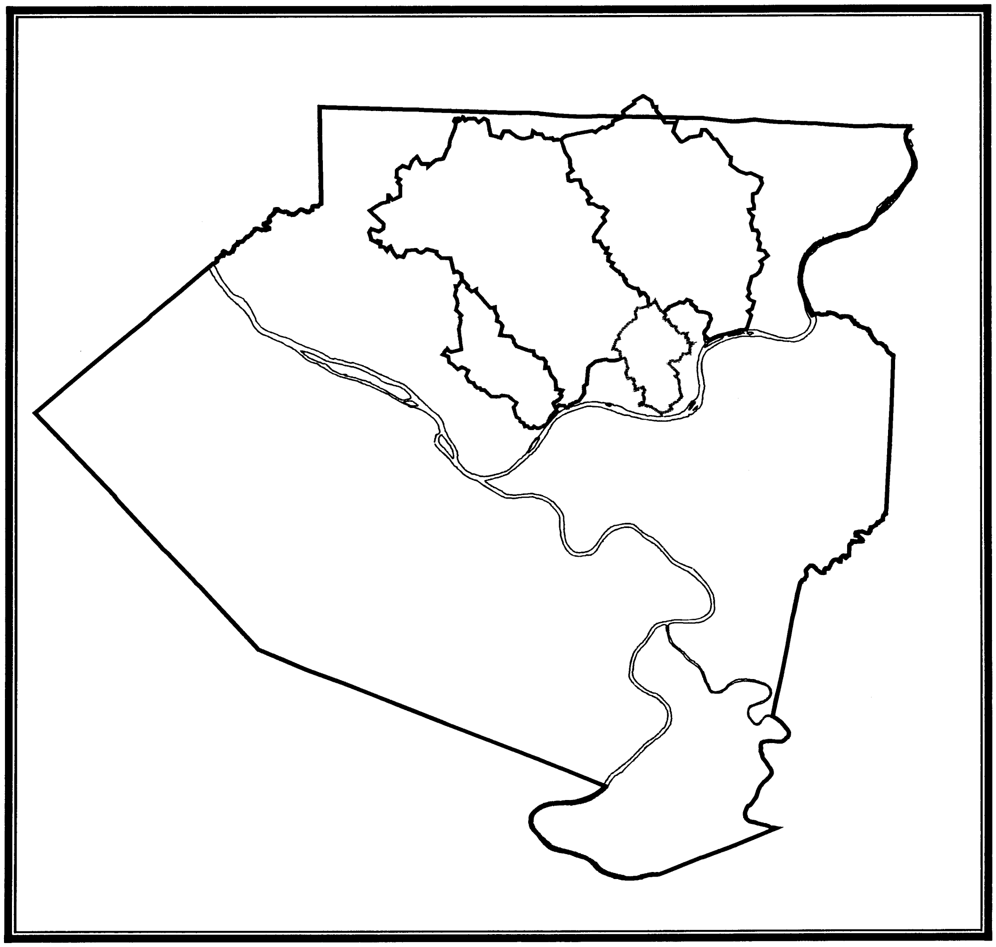
Act 167
Stormwater Management Plan Update Report



Act 167 Stormwater Management Plan Update
Girtys Runs, Pine Creek, Squaw Run and Deer Creek Watersheds
Allegheny County, Pennsylvania

Prepared for the
North Hills Council of Governments

Prepared by
Art Gazdik, P.E.

July 30, 2007

3/30/2007

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10.0 Draft Act 167 Stormwater Ordinance and Ordinance Appendices

(The Following is the Table of Contents for the Draft Act 167 Stormwater Ordinance)

Draft Ordinance Appendices

Report Appendices

Section 1.0 Introduction

1.1 Project Overview

This project is a multi-municipal effort to "Update" the Act 167 Stormwater Management Plan (SWM) for the Girtys Run, Pine Creek, Squaw Run and Deer Creek watersheds in Allegheny County, Pennsylvania. It is interesting to note that the original Act 167 Plan developed for these watersheds, adopted in 1981, served as the Pilot Act 167 Plan for the State of Pennsylvania.

The Update was brought about by the coordinated efforts of the municipalities in these watersheds, the North Hills Council of Governments, the PA DEP and the Allegheny County Department of Economic Development. All of the project partners wish to see a more comprehensive and coordinated approach to SWM throughout the area.

The development of the Update is being overseen by the Watershed Plan Advisory Committee (WPAC). The WPAC is made up of individuals from local environmental groups, PA DEP, the Allegheny County Conservation District, the Allegheny County Department of Economic Development, the North Hills Council of Governments and municipal managers, planners and engineers.

Pine Creek	Girtys Run	Deer Creek
Pine	McCandless	Richland
Richland	Ross	Hampton
Bradford Woods	Shaler	West Deer
Franklin Park	Reserve	Frazer
McCandless	Millvale (CSO)	Indiana
Marshall	West View (CSO)	Harmar
Hampton		
Ross	**Squaw Run**	
Shaler	Fox Chapel	
Indiana	O'Hara	
O'Hara	Indiana	
Fox Chapel		
Etna (CSO)		

Table 1.1 – Watersheds and Municipalities within the Study Area

1.2 Act 167 Phase I Findings

A Phase 1 questionnaire was developed to determine the effectiveness of the existing Act 167 Storm Water Management Ordinances.

A review of the questionnaires found that the Municipalities believe that the existing Act 167 stormwater management approach of requiring that the peak post-development runoff rate be reduced to less than that of the peak pre-development runoff rate is a useful approach that should be continued. There is also a consensus that the existing Act 167 modeling, used to produce the sub-basin release rate percentage maps and tables, is acceptable. Therefore, given the current available funding, no remodeling is proposed to be completed during the current Plan Update. Although several questionnaires noted that local pre-existing problem areas remain and that erosion and sedimentation complaints have occurred during land development, there were no reports of new watershed wide or local storm water problems surfacing since the Act 167 plan was implemented in the 1980s.

The Watershed Plan Advisory Committee (WPAC) met on September 16, 2003 at the North Hills Council of Governments office to discuss the project scope. The following findings were noted:

- The existing peak rate controls and sub-basin release rate mapping should continue to be utilized.
- Given the limited funding available the Phase 2 Act 167 Update should not remodel the watersheds.
- There is a need to update the existing SWM Ordinances to include "Best Management Practices" (BMP's) that are designed to improve the quality of runoff getting into our waterways.
- The Municipalities wish to obtain funds to update the plans to meet the obligations contained in their Municipal Separate Storm Sewer (MS4) Permits.
- There is a need to evaluate additional SWM methods and controls to better protect downstream communities and the water quality in or watersheds.

1.3 Scope of Work

The project has several goals and chief among them is the need to review the current stormwater management and land use ordinances to determine how they may be improved to further reduce the effects of urbanization on the watersheds.

The original Act 167 SWM Ordinance addresses the need to control peak runoff rates to reduce downstream flooding. Although past efforts have helped to reduce downstream flooding and will continue, there is also a need to control total runoff volume and water quality degradation due to runoff from land developments.

The coordination of the SWM Ordinance with other land development ordinances such as subdivision, zoning and grading is examined. It is important the developers and Municipalities begin to move toward planning that minimizes the impact on the watershed by using low impact development (LID) approaches. Municipal land use ordinances should encourage these practices and not conflict with the ideas proposed in the updated Act 167 SWM ordinance.

A discussion concerning the reduction or elimination of the No-Harm option contained in the current Act 167 ordinance is included. In addition, SWM standards for sites developed prior to the requirement for SWM controls are developed and proposed in the draft Act 167 SWM Ordinance.

Requirements and standards for stream buffers are developed and are recommended by the plan and proposed in the draft Act 167 SWM Ordinance.

The issue of proper management and maintenance of existing and proposed SWM facilities is explored. Recommendations for maintenance agreements and the enforcement of violations with respect to improper maintenance are provided.

A GIS database has been developed during the project so that the geographic information necessary to support the ordinance and to develop the stormwater planning is in place. The GIS product will be distributed to all of the Municipalities in the project area.

A web page has been created to provide much of the information developed during the Update to the stake holders, stormwater practitioners and the public.

The Update is timely in that many of the Municipalities in the study area have recently obtained Municipal Separate Storm Sewer (MS4) permits for their storm sewer collection system and also because of the recent efforts by the PA DEP to develop a Stormwater Best Management Practices (BMP) Manual and a model stormwater ordinance for the State.

As required by Act 167, all of the Municipalities in the study area will be required to adopt the SWM ordinance developed during this Update.

Section 2 Act 167 Stormwater Management Planning Girtys Run, Pine Creek, Squaw Run & Deer Creek Watersheds

2.1 Original Act 167 Planning

The original Act 167 Plan, developed for the Girtys Run, Pine Creek, Squaw Run and Deer Creek watersheds, was adopted in 1981. The SWM Plan for these watersheds served as the Pilot Act 167 Plan for the State of Pennsylvania.

This early watershed planning is still of great importance to the area and has been an effective tool to control flooding and establish watershed level post construction SWM for the watersheds.

Given the age of the original plan, it was becoming difficult for Municipalities and consultants to obtain copies of the plan documents. In order to make copies of the original planning and mapping available, we scanned the plan documents and map plates to convert them to Adobe PDF and or TIF format. The documents listed and hyperlinked below were then made available on our Act 167 Web Page.

Original Act 167 Study Reports for the Girtys Run, Pine Creek, Squaw Run and Deer Creek Watersheds

Original 167 Plan Girtys, Pine, Deer & Squaw Volume 1 Watershed Stormwater Plan (PDF)

Original 167 Plan Girtys, Pine, Deer & Squaw Volume 2 Background Data (PDF)

Original 167 Release Rate Percentage Tables

Original Act 167 Map Plates (tif format)

Plate 2.1 Girtys Run Release Rate Percentage

Plate 2.2 Pine Creek Release Rate Percentage

Plate 2.3 Deer Creek Release Rate Percentage

Plate 2.4 Squaw Run Release Rate Percentage

Plate 2.5 Girtys Run Obstructions Map

Plate 2.6 Pine Creek Obstructions Map

Plate 2.7 Deer Creek Obstructions Map

Plate 2.8 Squaw Run Obstructions Map

Original Act 167 Map Plates (pdf format)

Plate 2.1 Girtys Run Release Rate Percentage

Girtys Release Rate Table

Plate 2.2 Pine Creek Release Rate Percentage

Pine Release Rate Table

Plate 2.3 Deer Creek Release Rate Percentage

Deer Release Rate Table

Plate 2.4 Squaw Run Release Rate Percentage

Squaw Release Rate Table

Plate 2.5 Girtys Run Obstructions Map

Plate 2.6 Pine Creek Obstructions Map

Plate 2.7 Deer Creek Obstructions Map

Plate 2.8 Squaw Run Obstructions Map

So that they may be imported into GIS projects, the Sub-Basin Release Rate Percentage map plates were also converted into ERSI GIS shapefile format. The hyperlink for this shapefile is provided below. Note that the data is contained in a Winzip file that must be uncompressed (extracted) using Winzip software.

<u>Sub-Basin Release Rate Percentage Maps (shapefile's in Winzip folder)</u>

Section 3 Watersheds Characteristics

3.1 Study Area

The study area contains the Girtys Run, Pine Creek, Squaw Run and Deer Creek Watersheds.

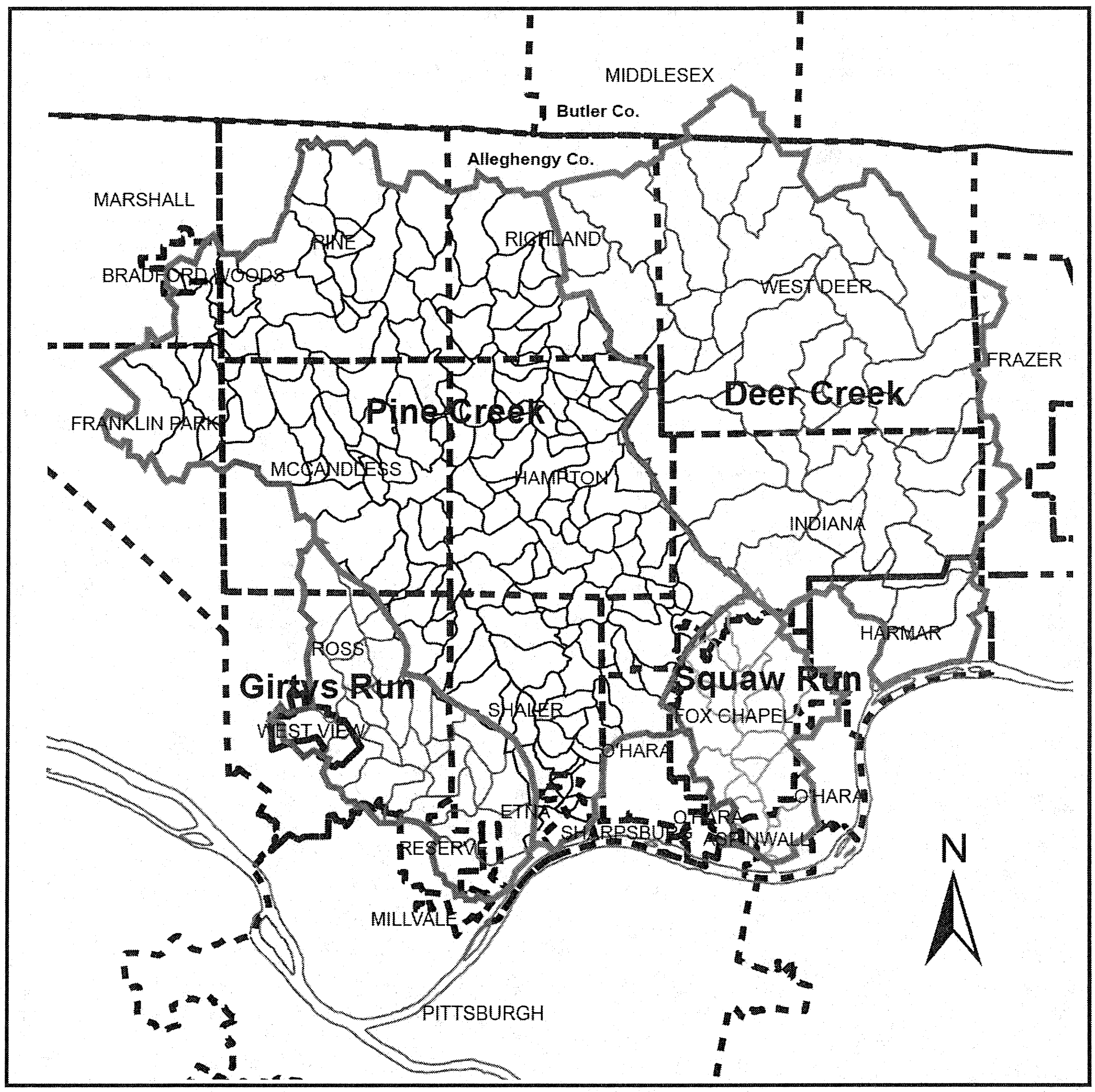


Figure 3.1 - Study Area Map Showing Municipalities, Sub-basin Boundaries and Watershed Boundaries

The total study area is approximately 140 square miles in area and contains a population of approximately 160,000 people. The total population within all of the municipalities involved in the study exceeds 200,000.

3.2 Impervious Cover

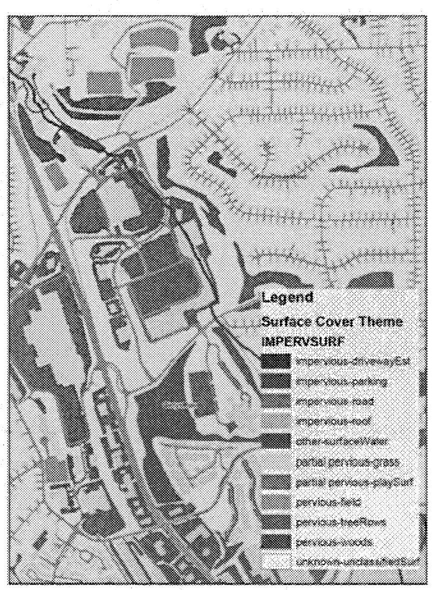
A fundamental measurement of the urbanization of a watershed is the amount of watershed area that has been covered by impervious cover (IC). Impervious cover is defined as a surface cover placed upon the land that does not allow water to pass through it to the existing soil. Impervious cover is all of the roof area and pavement in a watershed.

In order to determine an estimate of the impervious cover in the study area, we requested that the 3 Rivers Wet Weather Demonstration Program authorize their GIS consultant, Land Based Systems (LBS), to calculate a direct measurement of impervious cover and create a GIS IC layer for the plan. The existing Allegheny County GIS data was used and updated by LBS using recent USGS orthophotographs.

The Allegheny County GIS Database provided the following information need to develop the IC GIS layer;

- Building Foot Prints (2004)
- Road Pavement Edges (2004)
- Parking Lots (+/-1990)

LBS updated the older parking lot database by digitizing the boundaries of new parking areas added since the original parking layer was created. LBS also estimated (simulated) the area of driveway pavement in the watersheds by assuming that each home has a 10' wide driveway from the edge of the pavement to the front of the structure.



The following sections of the report provide characteristics for each of the watersheds, including; location, physical description, land use / land cover information, population trends, trends with respect to municipal housing units and water quality issues facing each of the watersheds.

All of the study area, with the exception of a 0.82 square mile portion of Middlesex Township, Butler County, is located within Allegheny County.

The study area makes up approximately 19% of the total area of Allegheny County.

3.3 Pine Creek

A. Project Location and Physical Description

Pine Creek is a 22.8 mile long stream in northern Allegheny County that begins in Pine Township and empties into the Allegheny River at the Borough of Etna. It's watershed is 67.3 square miles (43,072 acres) and covers parts of 14 Municipalities (see Table 3.1). There are 128 stream miles in the watershed.

Table 3.1 Pine Creek Municipalities

Municipality	Total Area (sq. mi)	Watershed Area within Municipality (sq. mi)	Watershed Area as % of Municipality	Watershed Area as % of Watershed
Bradford Woods	0.91	0.54	59.34	0.81
Etna	0.80	0.67	83.75	1.00
Fox Chapel	7.85	0.27	3.44	0.45
Franklin Park	13.46	3.95	29.35	5.74
Hampton	16.01	14.70	91.82	22.29
Indiana	17.49	3.38	19.33	4.83
Marshall	15.44	0.96	6.22	1.43
McCandless	16.54	13.03	78.78	19.32
O'Hara	7.21	1.35	18.72	2.08
Pine	16.85	12.20	72.40	18.30
Richland	14.70	6.58	44.76	9.90
Ross	14.45	1.41	9.76	2.14
Shaler	11.18	7.98	71.38	11.70
Sharpsburg	0.66	0.004	0.61	0.006

The watershed is comprised of hilly terrain. It has moderate to low relief and a dendritic stream pattern -- that is, the stream pattern is treelike, with trunk and branches at acute angles.

Soils in the watershed vary in thickness, composition, and porosity. Generally, most of the soil is well drained on the uplands and underlain by shale. However, the floodplains are typically poorly drained. Specific information about soils can be found in the Soil Survey of Allegheny County, Pennsylvania, published in 1981 by the U.S. Department of Agriculture Soil Conservation Service and in the 1972 publication Our Land: A Study of the Pine Creek Watershed, published by the North Area Environmental Council.

This area is highly susceptible to landslides. A combination of a humid temperate climate, locally steep and rugged topography, weak rock strata, springs, and a great diversity in the weathering and erosion characteristics of near surface sedimentary rocks makes this area one of the most slide-prone areas in the state. In addition, landslides can be triggered by the addition of fill, which increases the stress on underlying materials, changes in quantity or the direction of water flow, surface and subsurface excavations (including coal removal), and 'Red Beds'. Red Beds are bedrock in hillsides composed of claystones and shales that are 40-60' feet deep. This bedrock weathers easily, especially when wet, and causes unstable slopes. Stabilization and repair can cost thousands to millions of dollars.

Because steep slopes are more susceptible to landslides, they are often not developed; therefore, they are generally better suited for woodland and wildlife habitats.

B. Land Cover

The communities near the mid to lower section of Pine Creek as well as those near the West Branch of Little Pine Creek are the most developed in the watershed. While the headwaters section of the basin is the least developed, there is a significant transformation underway from rural communities and farmlands to suburban communities and commercial districts. This is illustrated in Tables 3.2 and 3.3.

Table 3.2 Change in Municipal Population

Municipality	1990 Population	2000 Population	% Change
Bradford Woods	1,329	1,149	-16.0
Etna	4,200	3,924	-0.1
Fox Chapel	5,319	5,436	2.0
Franklin Park	10,109	11,364	11.0
Hampton	15,568	17,526	11.0
Indiana	6,024	6,809	11.0
Marshall	4,010	5,996	33.0
McCandless	28,781	29,022	0.8
O'Hara	9,096	8,856	-3.0
Pine	4,048	7,683	47.0
Richland	8,600	9,231	7.0
Ross	33,482	32,551	-3.0
Shaler	30,533	29,757	-3.0
Sharpsburg	3,781	3,594	-5.0

Source: PA State Data Center, Penn State Harrisburg.
http://pasdc.hbg.psu.edu

Table 3.3 illustrates development through housing units (single or multiple units, mobile homes, etc.).

Table 3.3 Change in Municipal Housing Units			
Municipality	**1990 Units**	**2000 Units**	**% Change**
Bradford Woods	476	478	0.4
Etna	1,867	1,934	3.0
Fox Chapel	1,887	1,942	3.0
Franklin Park	3,420	3,973	14.0
Hampton	5,526	6,627	17.0
Indiana	2,208	2,457	10.0
Marshall	1,382	2,018	31.0
McCandless	10,933	11,697	6.0
O'Hara	3,377	3,381	0.1
Pine	1,514	2,500	39.0
Richland	3,201	3,508	9.0
Ross	14,124	14,422	2.0
Shaler	11,830	12,334	4.0
Sharpsburg	1,864	1,911	2.0
Source: PA State Data Center, Penn State Harrisburg. http://pasdc.hbg.psu.edu			

While six of the 14 communities saw declines in their population during a ten-year period, municipal housing units increased in all Municipalities.

Most of the commercial development in the watershed has been along the McKnight Road and Perry Highway (U.S. Route 19) corridor where enclosed malls and strip malls are common. More recent commercial development has and continues to occur near the Wexford interchange of Interstate 79. Future development is expected to occur along State Route 8, which currently has only pockets of development, primarily in Etna, Shaler, and part of Hampton. However, the recently developed Route 8 Economic Development Plan[1] seeks to strengthen the regional marketplace of the Rt. 8 Corridor to attract and diversify development. This is particularly significant to the lower portion of Pine Creek, which is adjacent to Rt. 8.

Along the lower part of Pine Creek is the CSX Railroad, which is currently leased to the Allegheny Valley Railroad until 2023. This line was heavily damaged due to flooding in 2004 and is in need of repair.

[1] Route 8 Economic Development Plan, July 2002, The Route 8 Partnership.

There are significant undeveloped or green areas (identified as forests, grasslands, crops) throughout the watershed. Some of this can be explained by steep forested slopes, which are unable to be developed, as well as managed recreation areas, such as North Park.

B.1. Important Areas

The Allegheny County Natural Heritage Inventory, published by the Western Pennsylvania Conservancy in 1994, listed several Pine Creek sites as significant natural heritage areas for the county. These sites either provide habitat for species of special concern or serve as an educational and scientific area with the potential for natural areas management. Sites listed are:

- Allegheny River
- Crouse Run
- Hemlock Grove, North Park
- Willow Run Slopes, North Park
- North Park
- Beechwood Farms Nature Reserve
- Cold Valley

North Park, at 3,010 acres, is the largest of the County Parks. It is mostly used for recreation and very little remains in its natural state. The U.S. Army Corps of Engineers is working on an aquatic ecosystem restoration project of North Park Lake, which has lost some of its depth due to growing silt deposits. Sediment from the Lake will be dredged and removed to an offsite location.

C. Water Quality

To control and regulate the amount and types of pollution entering our waterways and to help achieve designated uses and prevent water quality degradation, point sources of pollution must have proper permits to discharge wastes into the nation's waters. The National Pollutant Discharge Elimination System (NPDES) is a permitting system that targets point source dischargers, such as industrial facilities and wastewater treatment plants. Permitted facilities must meet stringent effluent limits and are responsible for monitoring and reporting to the Department of Environmental Protection (DEP).

While NPDES permits target only point source pollution, another approach to targeting all pollution sources, especially non-point, is through the use of Total Maximum Daily Loads (TMDLs). The Clean Water Act (CWA) calls for the development of TMDLs for all waterways that do not meet water quality standards.

Assessed waterways that do not meet their designated use, must be listed by the state every two years, in accordance with Section 303(d) of the CWA, which is the list of impaired streams and rivers. Waterways listed within Section 303(d) are prioritized for TMDL development based on the severity of impairment. The DEP is incorporating them on a watershed basis where local watershed groups actually implement the TMDL Plan and do testing with DEP's assistance.

According to the DEP, the TMDLs set an upper limit on the pollutant loads that can enter a water body, so that the water will meet water quality standards. The Clean Water Act requires states to list all waters that do not meet their water quality standards, even after required pollution controls are put into place. For streams on this list, the state calculates how much of a substance can be put into the stream without violating the standard and then distributes that quantity among all sources of the pollution on that water body. A TMDL plan includes waste load allocations for point sources, load allocations for non-point sources, and a margin of safety. States must submit TMDLs to the Environmental Protection Agency (EPA).

The Clean Water Act also requires a water quality assessment report (305(b)) on all impaired waters every two years along with the 303(d) list. "This report provides summaries of various water quality management programs including water quality standards, point source control, and non-point source control. It also includes descriptions of programs to protect lakes, wetlands, and groundwater quality."[2] Furthermore, the 305(b) report describes the extent to which waterways are supporting their designated uses. For example, if in a particular waterway all designated uses are achieved, the waterway is listed as "fully supporting." For 2004, DEP has combined the 303(d) report and 305(b) report into one document, the <u>2004 Pennsylvania Integrated Water Quality Monitoring and Assessment Report.</u>[3]

The 2004 report notes that segments of the following streams, and their unnamed tributaries, in the Pine Creek Watershed meet the standards for at least one use (that of aquatic life), but that the attainment status of remaining designations is unknown because of insufficient data:

- Gourdhead Run
- Montour Run
- Little Pine Creek (East and West branches)
- North Fork of Pine Creek
- Pine Creek
- Rinaman Run
- Willow Run

Waters with stream segments that are impaired for one or more designated uses and that require a TMDL appear in Table 3.4.

[2] PA DEP www.dep.state.pa.us

[3] <u>www.dep.state.pa.us</u>, Water Quality Assessments and Standards

Table 3.4 Impaired Streams Requiring a TMDL				
Stream	**303(d) list date**	**TMDL target date**	**Total stream miles impacted**	**Pollution Characterization**
Crouse Run (plus unnamed tributaries)	2002	2015	7.7	Urban Runoff/ Storm Sewers/Nutrients
Fish Run (plus unnamed tributaries)	2002	2017	4.8	Urban Runoff/ Storm Sewers/Nutrients Land Development/Siltation
Gourdhead Run (plus unnamed tributaries)	2002	2015	2.1	Urban Runoff/ Storm Sewers/Nutrients
West Little Pine Creek (plus unnamed tributaries)	2002	2015	1.1	Urban Runoff/ Storm Sewers/Nutrients
McCaslin Run	2002	2015	2.0	Urban Runoff/ Storm Sewers/Nutrients
Pine Creek (plus unnamed tributaries)	2002	2015	28.2	Land Development/ Siltation Small residential runoff/ Nutrients /Wastewater/ Organic Enrichment/ Low Dissolved Oxygen/ Urban Runoff/ Storm Sewers/Nutrients
Wexford Run (plus unnamed tributaries)	2002	2017	3.6	Urban Runoff/ Storm Sewers/Nutrients LandDevelopment/ Siltation

3.4 Girtys Run

A. Project Location and Physical Description

Girtys Run begins in McCandless Township and drains into the Allegheny River at the Borough of Millvale. Its watershed is 13.4 square miles, which covers parts of 7 Municipalities (see Table 3.5).

Table 3.5 Girtys Run Municipalities

Municipality	Total Area (sq. mi)	Watershed Area within Municipality (sq. mi)	Watershed Area as % of Municipality	Watershed Area as % of Watershed
McCandless	16.54	0.79	4.78	5.90
Millvale	0.70	0.55	78.57	4.10
Pittsburgh	58.37	0.03	0.05	0.22
Reserve	2.03	0.93	45.81	6.94
Ross	14.45	7.85	54.32	58.58
Shaler	11.18	2.58	23.08	19.25
West View	1.01	0.79	78.22	5.90

The physical description of this watershed is consistent with the rest of those in northern Allegheny County. See Pine Creek Section A.

B. Land Cover

The Girtys Run watershed is a small watershed situated in a very commercially and residentially developed area. Between 1990 and 2000, all but one of the Girtys Run communities lost population (see Table 3.6).

Table 3.6 Change in Municipal Population			
Municipality	**1990 Population**	**2000 Population**	**% Change**
McCandless	28,781	29,022	0.8
Millvale	4,341	4,028	-8.0
Pittsburgh	369,879	334,563	-11.0
Reserve	3,866	3,856	-0.3
Ross	33,482	32,551	-3.0
Shaler	30,533	29,757	-3.0
West View	7,734	7,277	-6.0
Source: PA State Data Center, Penn State Harrisburg. http://pasdc.hbg.psu.edu			

However most of those communities still experienced an increase in development as illustrated by the increase in housing units (single or multiple units, mobile homes, etc.) in Table 3.7.

Table 3.7 Change in Municipal Housing Units			
Municipality	**1990 Units**	**2000 Units**	**% Change**
McCandless	10,933	11,697	6.0
Millvale	2,078	2,085	0.3
Pittsburgh	170,159	163,366	-4.0
Reserve	1,489	1,605	7.0
Ross	14,124	14,422	2.0
Shaler	11,830	12,334	4.0
West View	3,352	3,304	-1.0
Source: PA State Data Center, Penn State Harrisburg. http://pasdc.hbg.psu.edu			

The significant corridors of development are located along U.S. Route 19 and Babcock Boulevard, which follows the stream for most of its length. Small shopping centers and residential dwellings abut Girtys Run. Some elevated structures have been built next to the waterway to help reduce the risk of flooding.

The watershed contains some undeveloped green space, primarily as steep forested slopes.

B.1. Important Areas

The Allegheny County Natural Heritage Inventory listed the Allegheny River as the only significant natural heritage area to touch the boundaries of the Girtys Run watershed. The Allegheny River is designated a Biological Diversity Area throughout Allegheny County since it serves as habitat for several sensitive fish species.

C. Water Quality

The 2004 Pennsylvania Integrated Water Quality Monitoring and Assessment Report does not list any streams in the Girtys Run watershed that were in attainment for meeting their designated use for aquatic life. Multiple segments of Girtys Run, totaling 2.9 miles of impacted streams, were listed as impaired in 2002. Pollution characterization included bank modification, other habitat modification, and removal of vegetation. These segments do not require a TMDL.

Impaired stream segments that require a TMDL appear in Table 3.8.

Table 3.8 Impaired Streams Requiring a TMDL

Stream	303(d) list date	TMDL target date	Total stream miles impacted	Pollution Characterization
Girtys Run (plus unnamed tributaries)	2002	2017	13.3	Urban runoff / Storm sewers / Nutrients / Road runoff / Oil and grease
Girtys Run	2002	2015	3.2	Urban runoff / Storm sewers / Organic enrichment / Low D.O.
Nelson Run (plus unnamed tributaries)	2002	2015	2.2	Urban runoff / Storm sewers / Nutrients,

3.5 Deer Creek

A. Project Location and Physical Description

Deer Creek begins in Middlesex Township, Butler County and drains into the Allegheny River at Harmar Township, Allegheny County. Its watershed is 51.50 square miles and covers parts of 8 municipalities (see Table 3.9).

Table 3.9 Deer Creek Municipalities

Municipality	Total Area (sq. mi)	Watershed Area within Municipality (sq. mi)	Watershed Area as % of Municipality	Watershed Area as % of Watershed
Fox Chapel	7.85	0.01	0.13	1.94
Frazer	9.38	0.93	9.91	1.81
Hampton	16.01	1.31	8.18	2.54
Harmar	6.36	2.52	39.62	4.90
Indiana	17.49	13.67	78.16	26.54
Richland	14.68	4.99	34.00	9.69
West Deer	28.76	24.77	86.13	48.10
Middlesex (Butler Co.)	23.39	0.82	3.51	1.59

The physical description of this watershed is consistent with the rest of those in northern Allegheny County. See Pine Creek Section A.

B. Land Cover

Deer Creek is the least developed of the four watersheds in the study area. However, much of the watershed is undergoing suburbanization. All but one of the communities experienced an increase in population (see Table 3.10). Two of the communities, Hampton and Indiana, saw a double digit growth in population in 10 years.

Table 3.10 Change in Municipal Population			
Municipality	**1990 Population**	**2000 Population**	**% Change**
Fox Chapel	5,319	5,436	2.0
Frazer	1,388	1,286	-8.0
Hampton	15,568	17,526	11.0
Harmar	3,144	3,242	3.0
Indiana	6,024	6,809	11.0
Richland	8,600	9,231	7.0
West Deer	11,371	11,563	2.0
Middlesex (Butler Co.)	5,578	5,586	0.1
Source: PA State Data Center, Penn State Harrisburg. http://pasdc.hbg.psu.edu			

Table 3.11 illustrates development through housing units (single or multiple units, mobile homes, etc.). Only Frazer Township, which had experienced a decline in population, saw a decline in housing units.

Table 3.11 Change in Municipal Housing Units			
Municipality	**1990 Units**	**2000 Units**	**% Change**
Fox Chapel	1,887	1,942	3.0
Frazer	576	569	-1.0
Hampton	5,526	6,627	17.0
Harmar	1,530	1,637	7.0
Indiana	2,208	2,457	10.0
Richland	3,201	3,508	9.0
West Deer	4,304	4,584	6.0
Middlesex	1,990	2,105	5.0
Source: PA State Data Center, Penn State Harrisburg. http://pasdc.hbg.psu.edu			

In addition to the increase in residential development, some commercial development is underway or proposed, including a large shopping complex at the mouth of Deer Creek.

Major transportation routes cross this watershed, including the Pennsylvania Turnpike and State Routes 28 and 910. Construction and maintenance of these roads have altered sections of Deer Creek, primarily in the southern reaches of the watershed. Further expansion and alteration of this transportation network is planned as part of the commercial development at the stream's mouth.

B.1 Important Areas

The Allegheny County Natural Heritage Inventory, lists the Deer Creek Valley Biodiversity Area as a High Diversity Area and Community/Ecosystem Conservation Area. Its significance is due to the fact that it contains parcels of natural land that have not been affected by past development in the general area. This location is at the mouth of the stream and will be affected by the proposed development mentioned above. Also listed as important areas are:

- Allegheny River
- Deer Lakes Park
- Blue Run Valley

C. Water Quality

The 2004 Pennsylvania Integrated Water Quality Monitoring and Assessment Report lists the following streams as attaining at least one designated use (for aquatic life), but all uses have not been assessed:

- Long Run
- Rawlins Run
- Shafers Run
- Cedar Run
- Cunningham Run
- Dawson Run
- Deer Creek
- Little Deer Creek

Table 3.12 lists the streams that did not meet the designated use of aquatic life, however, these do not require a TMDL.

Table 3.12 Impaired Streams Not Requiring a TMDL

Stream	303(d) list date	Total stream miles impacted	Pollution Characterization
Deer Creek (plus unnamed tributaries)	1998	10.4	Construction, flow alterations
Little Deer Creek (plus unnamed tributaries)	1998	7.8	Construction, flow alterations,
West Branch Deer Creek (plus unnamed tributaries)	1998	3.4	Construction other habitat alterations

Waters with stream segments that are impaired for one or more designated uses and that <u>require</u> a TMDL appear in Table 3.13.

Table 3.13 Impaired Streams Requiring a TMDL

Stream	303(d) list date	TMDL target date	Total stream miles impacted	Pollution Characterization
Blue Run (plus unnamed tributaries)	1998	2011	5.3	Road runoff / Nutrients Siltation / Small residential runoff
Cunningham Run	1998	NA	3.0	Abandoned mine drainage / Siltation / Construction
Dawson Run (plus unnamed tributaries)	1998	2011	8.3	Abandoned mine drainage / Salinity / TDS / Chlorides / Agriculture / Nutrients / Siltation Construction
Deer Creek (plus unnamed tributaries)	1998	2005	6.2	Abandoned mine drainage / Salinity / TDS Chlorides / Metals Construction / Turbidity Siltation / Source unknown / Nutrients Subsurface mining
Deer Creek (plus unnamed tributaries)	1998	2011	11.6	Construction / Suspended solids / Turbidity Siltation / Source unknown / Nutrients Removal of vegetation
Little Deer Creek (plus unnamed tributaries)	1998	2005	7.8	Abandoned mine drainage / Salinity / TDS Chlorides / Metals Construction / Siltation Turbidity / Subsurface mining / Metals
West Branch Deer Creek (plus unnamed tributaries)	1998	2011	7.3	Removal of vegetation Siltation / Nutrients Agriculture / Construction / Urban runoff / Storm sewers Turbidity

3.6 Squaw Run

A. Project Location and Physical Description

Squaw Run begins in Fox Chapel Borough and empties into the Allegheny River in O'Hara Township. Its watershed is small, only 8.56 square miles, and covers parts of three municipalities (see Table 3.14).

Table 3.14 Squaw Run Municipalities

Municipality	Total Area (sq. mi)	Watershed Area (sq. mi)	Watershed Area as % of Municipality	Watershed Area as % of Watershed
Fox Chapel	7.85	6.56	83.57	76.63
Indiana	17.49	0.44	2.52	5.14
O'Hara	7.21	1.44	19.97	16.82

The physical description of this watershed is consistent with the rest of those in northern Allegheny County. See Pine Creek Section A.

B. Land Cover

The majority of the watershed is in Fox Chapel Borough, which is primarily residential. The most developed area of this watershed is O'Hara Township at the stream's mouth. Population changes and housing development were most significant in Indiana Township, which experienced double digit growth in both measurements. This is illustrated in Tables 3.15 and 3.16.

Table 3.15 Change in Municipal Population

Municipality	1990 Population	2000 Population	% Change
Fox Chapel	5,319	5,436	2.0
Indiana	6,024	6,809	11.0
O'Hara	9,096	8,856	-3.0
Source: PA State Data Center, Penn State Harrisburg. http://pasdc.hbg.psu.edu			

Table 3.16 Change in Municipal Housing Units			
Municipality	**1990 Units**	**2000 Units**	**% Change**
Fox Chapel	1,887	1,942	3
Indiana	2,208	2,457	10
O'Hara	3,377	3,381	0.1
Source: PA State Data Center, Penn State Harrisburg. http://pasdc.hbg.psu.edu			

The mouth of Squaw Run is crossed by the largest transportation corridor in the watershed, State Route 28, and contains the largest residential and commercial development.

Much of the stream has been protected by the presence of several managed lands along its length. Some of these lands, managed by the Borough of Fox Chapel, are listed in Section C.1.

B.1 Important Areas

The Allegheny County Natural Heritage Inventory listed numerous Squaw Run sites as significant natural heritage areas for the county. Sites listed are:

- Allegheny River
- Trillium Trail
- Salamander Park
- Beechwood Farms Nature Reserve

C. Water Quality

The 2004 Pennsylvania Integrated Water Quality Monitoring and Assessment Report lists the following streams as attaining at least one designated use (for aquatic life), but all uses have not been assessed:

- Squaw Run
- Glade Run
- Stony Camp Run

Segments of Squaw Run and its unnamed tributaries were listed as impaired. These segments require a TMDL for the pollutants listed in Table 3.17.

Table 3.17 Impaired Streams Requiring a TMDL				
Stream	**303(d) list date**	**TMDL target date**	**Total stream miles impacted**	**Pollution Characterization**
Squaw Run (plus unnamed tributaries)	2002	2015	4.4	Golf courses, pesticides, organic enrichment, low DO, urban runoff, storm sewers, nutrients, siltation

Section 4.0 The Need For Stormwater Management

This section was abstracted from Volume 2, Section 1.1 of the Georgia Stormwater Management Manual, reformatted and revised for use in Pennsylvania.

4.1 Impacts of Development and Stormwater Runoff

Land development changes not only the physical, but also the chemical and biological conditions of Pennsylvania's waterways and water resources. This chapter describes the changes that occur due to development and the resulting stormwater runoff impacts.

A. How Development Changes Land and Runoff

When land is developed, the hydrology, or the natural cycle of water is disrupted and altered. Clearing removes the vegetation that intercepts, slows and returns rainfall to the air through evaporation and transpiration. Grading flattens hilly terrain and fills in natural depressions that slow and provide temporary storage for rainfall. The topsoil and sponge-like layers of humus are scraped and removed and the remaining subsoil is compacted. Rainfall that once seeped into the ground now runs off the surface. The addition of buildings, roadways, parking lots and other surfaces that are impervious to rainfall further reduces infiltration and increases runoff.

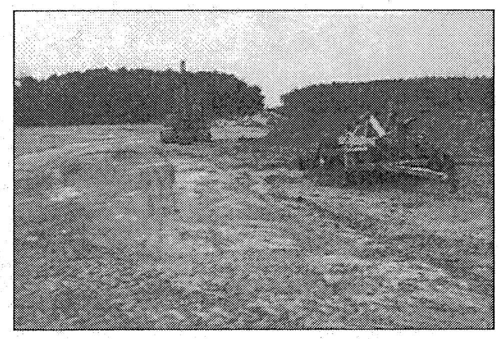


Figure 4.1 - Clearing and Grading Alter the Hydrology of the Land

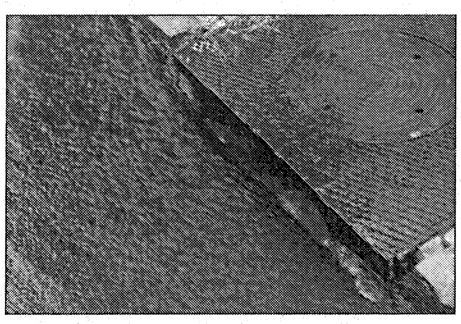


Figure 4.2 - Impervious Cover Increases Runoff Peak Flows and Volumes While Reducing Recharge

Depending on the magnitude of changes to the land surface, the total runoff volume can increase dramatically. These changes not only increase the total volume of runoff, but also accelerate the rate at which runoff flows across the land. This effect is further exacerbated by drainage systems such as gutters, storm sewers and lined channels that are designed to quickly carry runoff to rivers and streams.

Development and impervious surfaces also reduce the amount of water that infiltrates into the soil and groundwater, thus reducing the amount of water that can recharge aquifers and feed streamflow during periods of dry weather.

Finally, development and urbanization affect not only the quantity of stormwater runoff, but also its quality. Development increases both the concentration and types of pollutants carried by runoff. As it runs over rooftops and lawns, parking lots and industrial sites, stormwater picks up and transports a variety of contaminants and pollutants to downstream waterbodies. The loss of the original topsoil and vegetation removes a valuable filtering mechanism for stormwater runoff.

The cumulative impact of development and urban activities, and the resultant changes to both stormwater quantity and quality in the entire land area that drains to a stream, river, lake or estuary determines the conditions of the waterbody. This land area that drains to the waterbody is known as its watershed. Urban development within a watershed has a number of direct impacts on downstream waters and waterways. These impacts include:

- Changes to stream flow
- Changes to stream geometry
- Degradation of aquatic habitat
- Water quality impacts

The remainder of this section discusses these impacts and why effective stormwater management is needed to address and mitigate them.

B. Changes to Stream Flow

Urban development alters the hydrology of watersheds and streams by disrupting the natural water cycle. This results in:

- <u>Increased Runoff Volumes</u> – Land surface changes can dramatically increase the total volume of runoff generated in a developed watershed.
- <u>Increased Peak Runoff Discharges</u> – Increased peak discharges for a developed watershed can be two to five times higher than those for an undisturbed watershed.
- <u>Greater Runoff Velocities</u> – Impervious surfaces and compacted soils, as well as improvements to the drainage system such as storm drains, pipes and ditches, increase the speed at which rainfall runs off land surfaces within a watershed.
- <u>Timing</u> – As runoff velocities increase, it takes less time for water to run off the land and reach a stream or other waterbody.
- <u>Increased Frequency of Bankfull and Near Bankfull Events</u> – Increased runoff volumes and peak flows increase the frequency and duration of smaller bankfull and near bankfull events which are the primary channel forming events.
- <u>Increased Flooding</u> – Increased runoff volumes and peaks also increase the frequency, duration and severity of out-of-bank flooding.

- Lower Dry Weather Flows (Baseflow) – Reduced infiltration of stormwater runoff causes streams to have less baseflow during dry weather periods and reduces the amount of rainfall recharging groundwater aquifers.

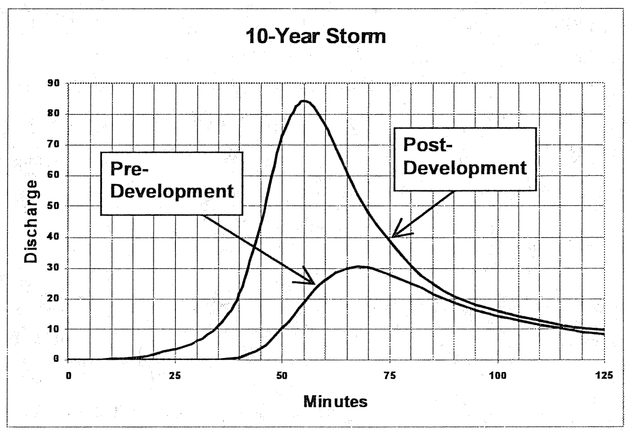


Figure 4.3 - Hydrograph under Pre- and Post Development Conditions

C. Changes to Stream Geometry

The changes in the rates and amounts of runoff from developed watersheds directly affect the morphology, or physical shape and character, of Pennsylvania's streams and rivers. Some of the impacts due to urban development include:

- Stream Widening and Bank Erosion – Stream channels widen to accommodate and convey the increased runoff and higher stream flows from developed areas. More frequent small and moderate runoff events undercut and scour the lower parts of the stream bank, causing the steeper banks to slump and collapse during larger storms. Higher flow velocities further increase stream bank erosion rates. A stream can widen many times its original size due to post-development runoff.
- Stream Downcutting – Another way that streams accommodate higher flows is by downcutting their streambed. This causes instability in the stream profile, or elevation along a stream's flow path, which increases velocity and triggers further channel erosion both upstream and downstream.
- Loss of Riparian Tree Canopy – As stream banks are gradually undercut and slump into the channel, the trees that had protected the banks are exposed at the roots. This leaves them more likely to be uprooted during major storms, further weakening bank structure.
- Changes in the Channel Bed Due to Sedimentation – Due to channel erosion and other sources upstream, sediments are

deposited in the stream as sandbars and other features, covering the channel bed, or substrate, with shifting deposits of mud, silt and sand.

- Increase in the Floodplain Elevation – To accommodate the higher peak flow rate, a stream's floodplain elevation typically increases following development in a watershed due to higher peak flows. This problem is compounded by building and filling in floodplain areas, which cause flood heights to rise even further. Property and structures that had not previously been subject to flooding may now be at risk.

D. Impacts to Aquatic Habitat

Along with changes in stream hydrology and morphology, the habitat value of streams diminishes due to development in a watershed. Impacts on habitat include:

- Degradation of Habitat Structure – Higher and faster flows due to development can scour channels and wash away entire biological communities. Stream bank erosion and the loss of riparian vegetation reduce habitat for many fish species and other aquatic life, while sediment deposits can smother bottom-dwelling organisms and aquatic habitat.
- Loss of Pool-Riffle Structure – Streams draining undeveloped watersheds often contain pools of deeper, more slowly flowing water that alternate with "riffles" or shoals of shallower, faster flowing water. These pools and riffles provide valuable habitat for fish and aquatic insects. As a result of the increased flows and sediment loads from urban watersheds, the pools and riffles disappear and are replaced with more uniform, and often shallower, streambeds that provide less varied aquatic habitat.
- Reduce Baseflows -- Reduced baseflows due to increased impervious cover in a watershed and the loss of rainfall infiltration into the soil and water table adversely affect in-stream habitats, especially during periods of drought.
- Increased Stream Temperature – Runoff from warm impervious areas, storage in impoundments, loss of riparian vegetation and shallow channels can all cause an increase in temperature in urban streams. Increased temperatures can reduce dissolved oxygen levels and disrupt the food chain. Certain aquatic species can only survive within a narrow temperature range. Thermal problems are especially critical for trout.
- Decline in Abundance and Biodiversity – When there is a reduction in various habitats and habitat quality, both the number and the variety, or diversity, of organisms (wetland plants, fish, macroinvertebrates, etc.) are also reduced. Sensitive fish species

and other life forms disappear and are replaced by those organisms that are better adapted to the poorer conditions. The diversity and composition of the streambed community have frequently been used to evaluate the quality of urban streams.

Aquatic insects are a useful environmental indicator as they form the base of the stream food chain. Fish and other aquatic organisms are impacted not only by the habitat changes brought on by increased stormwater runoff quantity, but are often also adversely affected by water quality changes due to development and resultant land use activities in a watershed.

D. Water Quality Impacts

Non-point source pollution, which is the primary cause of polluted stormwater runoff and water quality impairment, comes from many diffuse or scattered sources—many of which are the result of human activities within a watershed. Development concentrates and increases the amount of these non-point source pollutants. As stormwater runoff moves across the land surface, it picks up and carries away both natural and human-made pollutants, depositing them into Pennsylvania's streams, rivers, lakes, wetlands, marshes, and underground aquifers.

Water quality degradation in urbanizing watersheds starts when development begins. Erosion from construction sites and other disturbed areas contribute large amounts of sediment to streams. As construction and development proceed, impervious surfaces replace the natural land cover and pollutants from human activities begin to accumulate on these surfaces. During storm events, these pollutants are then washed off into the streams. Stormwater also causes discharges from sewer overflows and leaching from septic tanks. There are a number of other causes of non-point source pollution in urban areas that are not specifically related to wet weather events including leaking sewer pipes, sanitary sewage spills, and illicit discharge of commercial/industrial wastewater and wash waters to storm drains.

Due to the magnitude of the problem, it is important to understand the nature and sources of urban stormwater pollution. Table 4.1 summarizes the major stormwater pollutants and their effects.

Table 4.1 - Summary of Urban Stormwater Pollutants	
Constituents	**Effects**
Sediments—Suspended Solids, Dissolved Solids, Turbidity	Stream turbidity Habitat changes Recreation/aesthetic loss Contaminant transport Filling of lakes and reservoirs
Nutrients—Nitrate, Nitrite, Ammonia, Organic Nitrogen, Phosphate, Total Phosphorus	Algae blooms Eutrophication Ammonia and nitrate toxicity Recreation/aesthetic loss
Microbes—Total and Fecal Coliforms, Fecal Streptococci Viruses, E.Coli, Enterocci	Ear/Intestinal infections Shellfish bed closure Recreation/aesthetic loss
Organic Matter— Vegetation, Sewage, Other Oxygen Demanding Materials	Dissolved oxygen depletion Odors Fish kills
Toxic Pollutants—Heavy Metals (cadmium, copper, lead, zinc), Organics, Hydrocarbons, Pesticides/Herbicides	Human & aquatic toxicity Bioaccumulation in the food chain
Thermal Pollution	Dissolved oxygen depletion Habitat changes
Trash and debris	Recreation/aesthetic loss

Some of the most frequently occurring pollution impacts and their sources for urban streams are:

- <u>Reduced Oxygen in Streams</u> – The decomposition process of organic matter uses up dissolved oxygen (DO) in the water, which is essential to fish and other aquatic life. As organic matter is washed off by stormwater, dissolved oxygen levels in receiving waters can be rapidly depleted. If the DO deficit is severe enough, fish kills may occur and stream life can weaken and die. In addition, oxygen depletion can affect the release of toxic chemicals and nutrients from sediments deposited in a waterway. All forms of organic matter in urban stormwater runoff such as leaves, grass clippings and pet waste contribute to the problem. In addition, there are a number of non-stormwater discharges of organic matter to surface waters such as sanitary sewer leakage and septic tank leaching.

- Nutrient Enrichment – Runoff from urban watersheds contains increased nutrients such as nitrogen or phosphorus compounds. Increased nutrient levels are a problem as they promote weed and algae growth in lakes, streams and estuaries. Algae blooms block sunlight from reaching underwater grasses and deplete oxygen in bottom waters. In addition, nitrification of ammonia by microorganisms can consume dissolved oxygen, while nitrates can contaminate groundwater supplies. Sources of nutrients in the urban environment include wash-off of fertilizers and vegetative litter, animal wastes, sewer overflows and leaks, septic tank seepage, detergents, and the dry and wet fallout of materials in the atmosphere.

- Microbial Contamination – The level of bacteria, viruses and other microbes found in urban stormwater runoff often exceeds public health standards for water contact recreation such as swimming and wading. Microbes can also contaminate shellfish beds, preventing their harvesting and consumption, as well as increasing the cost of treating drinking water. The main sources of these contaminants are sewer overflows, septic tanks, pet waste, and urban wildlife such as pigeons, waterfowl, squirrels, and raccoons.

- Hydrocarbons – Oils, greases and gasoline contain a wide array of hydrocarbon compounds, some of which have shown to be carcinogenic, and mutagenic in certain species of fish. In addition, in large quantities, oil can impact drinking water supplies and affect recreational use of waters. Oils and other hydrocarbons are washed off roads and parking lots, primarily due to engine leakage from vehicles. Other sources include the improper disposal of motor oil in storm drains and streams, spills at fueling stations and restaurant grease traps.

- Toxic Materials – Besides oils and greases, urban stormwater runoff can contain a wide variety of other toxicants and compounds including heavy metals such as lead, zinc, copper, and cadmium, and organic pollutants such as pesticides, PCBs, and phenols. These contaminants are of concern because they are toxic to aquatic organisms and can bioaccumulate in the food chain. In addition, they also impair drinking water sources and human health. Many of these toxicants accumulate in the sediments of streams and lakes. Sources of these contaminants include industrial and commercial sites, urban surfaces such as rooftops and painted areas, vehicles and other machinery, improperly disposed household chemicals, landfills, hazardous waste sites and atmospheric deposition.

- Sedimentation – Eroded soils are a common component of urban stormwater and are a pollutant in their own right. Excessive sediment can be detrimental to aquatic life by interfering with photosynthesis, respiration, growth and reproduction. Sediment particles transport other pollutants that are attached to their surfaces including nutrients, trace metals and hydrocarbons. High turbidity due to sediment increases the cost of treating drinking water and reduces the value of surface waters for industrial and recreational use. Sediment also fills ditches and small streams and clogs storm sewers and pipes, causing flooding and property damage. Sedimentation can reduce the capacity of reservoirs and lakes, block navigation channels, fill harbors and silt estuaries. Erosion from construction sites, exposed soils, street runoff, and stream bank erosion are the primary sources of sediment in urban runoff.

- Higher Water Temperatures – As runoff flows over impervious surfaces such as asphalt and concrete, it increases in temperature before reaching a stream or pond. Water temperatures are also increased due to shallow ponds and impoundments along a watercourse as well as fewer trees along streams to shade the water. Since warm water can hold less dissolved oxygen than cold water, this "thermal pollution" further reduces oxygen levels in depleted urban streams. Temperature changes can severely disrupt certain aquatic species, such as trout and stoneflies, which can survive only within a narrow temperature range.
- Trash and Debris – Considerable quantities of trash and other debris are washed through storm drain systems and into streams and lakes. The primary impact is the creation of an aesthetic "eyesore" in waterways and a reduction in recreational value. In smaller streams, debris can cause blockage of the channel, which can result in localized flooding and erosion.

E. Stormwater Hotspots

Stormwater hotspots are areas of the urban landscape that often produce higher concentrations of certain pollutants, such as hydrocarbons or heavy metals, than are normally found in urban runoff. These areas merit special management and the use of specific pollution prevention activities and/or structural stormwater controls. Examples of stormwater hotspots include:

- Gas/fueling stations
- Vehicle maintenance areas
- Vehicle washing/steam cleaning
- Auto recycling facilities
- Outdoor material storage areas
- Loading and transfer areas
- Landfills
- Construction sites
- Industrial sites
- Industrial rooftops

F. Effects on Lakes and Reservoirs

Stormwater runoff into lakes and reservoirs can have some unique negative effects. A notable impact of urban runoff is the filling in of lakes with sediment. Another significant water quality impact on lakes related to stormwater runoff is nutrient enrichment. This can result in the undesirable growth of algae and aquatic plants. Lakes do not flush contaminants as quickly as streams and act as sinks for nutrients, metals and sediments. This means that lakes can take longer to recover if contaminated.

4.2 Addressing Stormwater Impacts

The focus of this Manual is how to effectively deal with the impacts of urban stormwater runoff through effective and comprehensive stormwater management. Stormwater management involves both the prevention and mitigation of stormwater runoff quantity and quality impacts as described in this chapter through a variety of methods and mechanisms.

This Manual deals with ways that developers in Pennsylvania can effectively implement stormwater management to address the impacts of new development and redevelopment, and both prevent and mitigate problems associated with stormwater runoff. This is accomplished by:

- Developing land in a way that minimizes its impact on a watershed, and reduces both the amount of runoff and pollutants generated
- Using the most current and effective erosion and sedimentation control practices during the construction phase of development
- Controlling stormwater runoff peaks, volumes and velocities to prevent both downstream flooding and stream bank channel erosion
- Treating post-construction stormwater runoff before it is discharged to a waterway
- Implementing pollution prevention practices to prevent stormwater from becoming contaminated in the first place
- Using various techniques to maintain groundwater recharge

5.1 Summary of Multi-State Stormwater Management Approaches

In order to evaluate how other States were approaching stormwater quality and quantity calculations, a literature search was undertaken and all or a portion of the Stormwater manuals were acquired from Pennsylvania, Maryland, Massachusetts, New York, Virginia and Georgia.

A summary of the approaches used by each of these States is provided in the following Table 5.1.

SW Calculation Approaches Used by Several States
AG 2/18/2007

	Pennsylvania	Maryland	Massachusetts	New York	Virginia	Georgia
Water Quality	A reduction of 85% of TSS and total Phosphorus; and a 50% reduction of post-development solute loads (represented by NO3-N)	WQv = (1"RvA)/12 Areas having no impervious cover or disturbance may be excluded from calculation	1" per impervious acre in critical areas, 0.5" per impervious acre in all other areas. Subtract roof area	WQv = (1"RvA)/12 Calculated using contributing areas. Percent impervious cover also based upon contributing area.	0.5" per impervious acre	WQv = (1.2"RvA)/12 Areas having no impervious cover or disturbance may be excluded from calculation
		A reduction of 80% of TSS & 40% TP	A reduction of 80% of TSS	A reduction of 80% of TSS & 40% TP		A reduction of 80% of TSS
		90th Percentile Storm = 1"		90th Percentile Storm = 1"		85th Percentile Storm = 1.2"
		Rv = 0.05 + 0.009 (I)		Rv = 0.05 + 0.009 (I)		Rv = 0.05 + 0.009 (I)
		A = Project Area (Ac)		A = Contributing Area (Ac)		A = Project Area (Ac)
		I = Percent Impervious Cover		I = Percent Impervious Cover		I = Percent Impervious Cover
		0.2"/Ac min required		0.2"/Ac min required		
Volume	CG-1 No increase in runoff volume for up to the 2 year, 24 hour storm CG-2 From impervious area, capture & remove runoff generated by 2" of rainfall, with 1" permanently removed of which 0.5" is infiltrated	See Channel Protection Volume		See Channel Protection Volume	See Channel Protection Volume	See Channel Protection Volume
Recharge Volume	See CG-2 above	Rev = (S Rv A)/12 Areas having no impervious cover or disturbance may be excluded from calculation **Note Rev and WQv are inclusive**	Hydrologic Soil Group A 0.4" x Impervious Area B 0.25" x Impervious Area C 0.10" x Impervious Area D waived		Limited requirements Infiltration from stormwater hot spots should be prohibited. Recommends protection of areas of natural recharge.	
		S = Soil Specific Recharge Factor for Hydrologic Soil Group A = 0.38, B = 0.26, C = 0.13, D = 0.07				
		See Rv Above				
		A = Project Area (Ac)				
Channel Protection Volume	**CG-2 Only** Cpv = 24 hour extended detention of 1Yr - 24 Storm	Cpv = 24 hour extended detention of 1Yr - 24 Storm. Note extended detention does not met the WQv requirements and is not inclusive		Cpv = 24 hour extended detention of 1Yr - 24 Storm Optional geomorphic assessment for sites over 50 acres	Cpv = 24 hour extended detention of 1Yr - 24 Storm	Cpv = 24 hour extended detention of 1Yr - 24 Storm
Peak Rate - Over Bank Protection	1, 2, 10, 25 & 100 year return periods. Note: Only peak rates for the 10, 25 & 100 will require evaluation due to the requirement for 24 hour retention of the 1 year event.	2, 10 & in some cases 100 year return periods	2, 10 & in some cases 100 year return periods	10 & 100 year return periods	10 year return period or higher with study or in problem areas	25 year return period & safely handle flows during 100 year event, 100 year control in flood prone areas

Table 5.1 – A Summary of SWM Approaches Used by Several States

As noted in Section 1.0 of this report, the existing Act 167 ordinance addresses peak rate control only. It is recommended that the Act 167 Ordinance be revised to include the following unified stormwater design approaches. This approach was developed by the State of Maryland and the Center for Watershed Protection and is the basis of many of the State Programs reviewed.

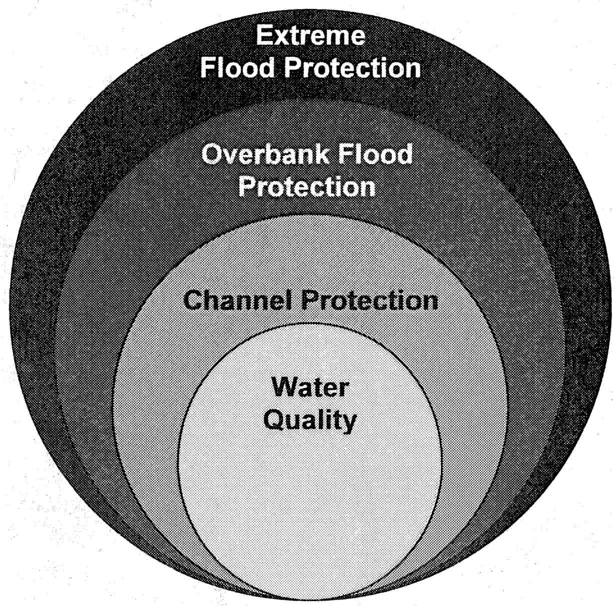


Figure 5.1 Representation of the Unified Stormwater Sizing Criteria
From the Georgia Stormwater Management Manual

Figure 5.2 below shows how these volumes would be stacked in a typical stormwater (wet) pond designed to handle all four criteria.

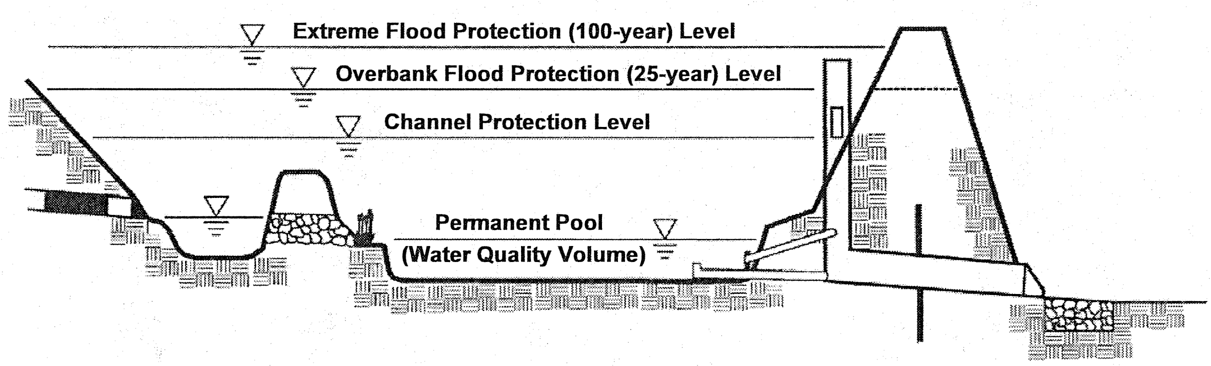


Figure 5.2 - Unified Sizing Criteria Water Surface Elevations in a Stormwater (Wet) Pond
From the Georgia Stormwater Management Manual

5.2 Description of Stormwater Sizing Criteria

It is recommended that the region adopt methods in use in other states that are easy to calculate and verify. A summary of the recommended methods are provided in Table 5.2.

<table>
<tr><th colspan="3">Table 5.2 A Summary of Recommended Methods of Calculations</th></tr>
<tr><th>Sizing Criteria</th><th colspan="2">Description of Stormwater Sizing Criteria</th></tr>
<tr><td>Water Quality Volume
(WQ_v) (acre-feet)</td><td colspan="2">$WQ = [\, P(R_v)(A)\,]/12$
Where; P= rainfall depth in inches and is equal to 1.0”
R_v = volumetric runoff coefficient = 0.05 + 0.009(I) where I is percent impervious cover
A = site area in acres</td></tr>
<tr><td rowspan="3">Recharge Volume
(Re_v) (acre-feet)</td><td colspan="2">Fraction of WQ_v, depending on soil hydrologic group.
$Re_v = \mathbf{(S)(A_i)}$
Where; S = soil specific recharge factor in inches
A_i = the measured impervious cover</td></tr>
<tr><td>Hydrologic Soil Group</td><td>Soil Specific Recharge Factor (S)</td></tr>
<tr><td>A
B
C
D</td><td>0.40 inches
0.25 inches of runoff
0.10 inches of runoff
waived</td></tr>
<tr><td>Channel Protection Storage Volume (extended detention)
(Cp_v)</td><td colspan="2">Cp_v = 24 hour extended detention
of post-developed one-year, 24 hour storm event.</td></tr>
<tr><td>Overbank Flood Protection Volume
(Q_p)</td><td colspan="2">Controlling the post development peak discharge rate from the ten-year storm event to the pre development rate (Q_{p10}), using the specified Act 167 release rate percentage for the sub-basin.</td></tr>
<tr><td>Extreme Flood Volume
(Q_f)</td><td colspan="2">Controlling the post development peak discharge rate from the ten-year storm event to the pre development rate (Q_{p100}), using the specified Act 167 release rate percentage for the sub-basin.</td></tr>
</table>

A. Water Quality - Treatment of First Flush Volume

The Georgia Manual states “Hydrologic studies show that small-sized, frequently occurring storms account for the majority of rainfall events that generate stormwater runoff. Consequently, the runoff from these storms also accounts for a major portion of the annual pollutant loadings. Therefore, by treating these frequently occurring smaller rainfall events and a portion of the stormwater runoff from larger events, it is possible to effectively mitigate the water quality impacts from a developed area."

A.1 Proposed Method to Calculate Water Quality Volume (WQ_v)

A water quality treatment volume is specified to size structural control facilities to treat these small storms up to a maximum runoff depth and the "first flush" of all larger storm events. This maximum depth was determined to be the runoff generated from the 90th percentile storm event (i.e., the storm event that is greater than 90% of the storms that occur within an average year).

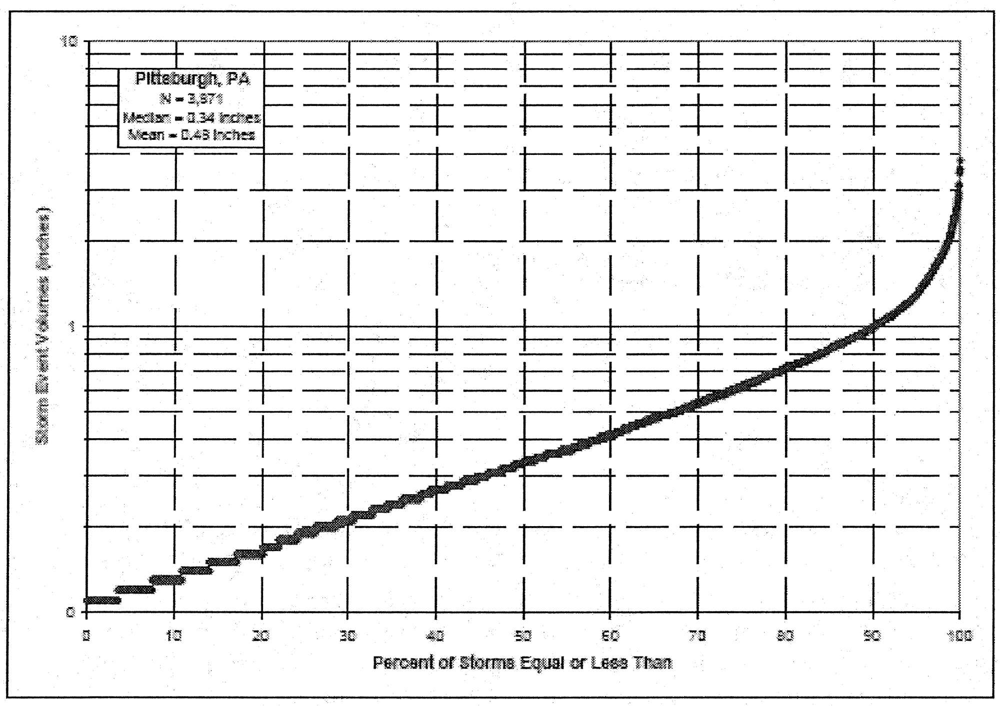


Figure 5.3 Synoptic Precipitation Analysis for the ALCOSAN Service Area

Based on a rainfall analysis performed by ALCOSAN (Synoptic Precipitation Analysis for the ALCOSAN Service Area, 2/2003), a value of one (1") inch for the 90th percentile storm was noted. A stormwater management system designed for the WQ_v will treat the runoff from all storm events of one (1") inch or less, as well as the first one (1") inch of runoff for all larger storm events. The Water Quality volume is directly related to the amount of impervious cover and is calculated using the formula in the following:

$$WQ_V = \frac{1'' R_V A}{12}$$

where: WQ_v = water quality volume (in acre-feet)
R_v = 0.05 + 0.009(I) where I is <u>percent</u> impervious cover
A = total area of site being developed in acres

Using the percent impervious area as the basis for calculating the water quality treatment volume promotes the use of straightforward volume calculations. The total impervious area of a site is determined based on final project site plans, not on pre-existing conditions.

The developer will have to indicate how the WQ_v will be achieved by the use of structural and non structural BMPs.

Where possible, it is recommended that a portion of the **total** WQ_v be infiltrated (see recharge volume section).

B. Recharge Volume (Infiltrated Volume)

In order to restore ground water recharge and stream base flows, the following criteria developed by the State of Massachusetts is recommended.

B.1 Recharge to Groundwater

The prescribed stormwater runoff volume to be recharged to groundwater should be determined using the existing (pre-development) soil conditions (from a U.S. Natural Resources Conservation Service (NRCS, formerly SCS) County Soils Survey, **(it should be noted that a Hydrologic Soils Group Map for the North Hills was developed during this project and is available in ArcGIS format**), onsite soil evaluation, or other geologic information) and these rates:

Hydrologic Group	Volume to Recharge (x Total Impervious Area)
A	0.40 inches of runoff
B	0.25 inches of runoff
C	0.10 inches of runoff
D	waived

Roof runoff (except for certain metal roofs) may be infiltrated, and any infiltrated volume may be subtracted from the total WQ_v.

Different recharge values may be used provided the proponent makes a clear showing demonstrating that the recharge rate differs from the listed values based upon soils, precipitation, and evapo-transpiration.

B.2 Recharge / Infiltration Design Considerations

- In general, roof areas should be considered for infiltration.

- Any infiltrated volume may be subtracted from the total WQ_v

- Infiltration should not be considered for sites or areas of sites that have activities that may allow pollution to be infiltrated. For example, the use of infiltration for the runoff of a service station paved lot would not be appropriate, although roof water from the service station may be infiltrated.

- Infiltration should only be used when, in the opinion of a Professional Engineer, it will not contribute to slope instability or cause seepage problems into basements or developed down gradient areas.

C. Credits for the Use of Nonstructural BMPs

The developer may obtain credits for the use of nonstructural BMPs using the procedures outlined below. It is recommended that the design of BMPs be as per the requirements contained in the Pennsylvania's Stormwater Best Management Practices Manual (PaBMP Manual).

The following methods of credits noted in the Georgia Stormwater Manual and further refined in the North Central Texas Council of Governments Stormwater Manual are recommended.

C.1 Volume Reduction Method #1: Natural Area Conservation

A water quality volume reduction can be taken when undisturbed natural areas are conserved on a site, thereby retaining their pre-development hydrologic and water quality characteristics. Under this method, a designer would be able to subtract the conservation areas from the total site area when computing the water quality protection volume. An added benefit is that the post-development peak discharges will be smaller, and hence, water quantity control volumes will be reduced due to lower post-development curve numbers or rational formula "C" values.

Rule: Subtract conservation areas from total site area when computing water quality protection volume requirements.

Criteria:

- Conservation area cannot be disturbed during project construction and must be protected from sediment deposition.

- Shall be protected by limits of disturbance clearly shown on all construction drawings.
- Shall be located within an acceptable conservation easement instrument that ensures perpetual protection of the proposed area. The easement must clearly specify how the natural area vegetation shall be managed and boundaries will be marked [Note: Managed turf (e.g., playgrounds, regularly maintained open areas) is not an acceptable form of vegetation management].
- Shall have a minimum contiguous area requirement of 10,000 square feet.
- R_v is kept constant when calculating WQ_v
- Must be forested or have a stable, natural ground cover.

<u>Example:</u>

Residential Subdivision
Area = 38 acres
Natural Conservation Area = 7 acres
Impervious Area = 13.8 acres
$R_v = 0.05 + 0.009\ (I) = 0.05 + 0.009\ (36.3\%) = 0.38$

Reduction:

7.0 acres in natural conservation area

New drainage area = 38 – 7 = 31 acres
Before reduction:
WQ_v = (1.5)(0.38)(38)/12 = 1.81 ac-ft

With reduction:
WQ_v = (1.5)(0.38)(31)/12 = 1.47 ac-ft
(19% reduction in water quality protection volume)

C.2 <u>Volume Reduction Method #2: Stream Buffers</u>

This reduction can be taken when a stream buffer effectively treats storm water runoff. Effective treatment constitutes treating runoff through overland flow in a naturally vegetated or forested buffer. Under the proposed method, a designer would be able to subtract areas draining via overland flow to the buffer from total site area when computing water quality protection volume requirements. In addition, the volume of runoff draining to the buffer can be subtracted from the stream bank protection volume. The design of the stream buffer treatment system must use appropriate methods for conveying flows above the annual recurrence (1-yr storm) event.

Rule: Subtract areas draining via overland flow to the buffer, from total site area when computing water quality protection volume requirements.

Criteria:

- The minimum undisturbed buffer width shall be 50 feet.
- The maximum contributing length shall be 150 feet for pervious surfaces and 75 feet for impervious surfaces.
- The average contributing slope shall be 3% maximum unless a flow spreader is used.
- Runoff shall enter the buffer as overland sheet flow. A flow spreader can be installed to ensure this.
- Buffers shall remain as naturally vegetated or forested areas and will require only routine debris removal or erosion repairs.
- R_v is kept constant when calculating WQ_v
- Not applicable if overland flow filtration/groundwater recharge reduction is already being taken.

Example:

Residential Subdivision
Area = 38 acres
Impervious Area = 13.8 acres
Area Draining to Buffer = 5 acres
R_v = 0.05 + 0.009 (I) = 0.05 + 0.009 (36.3%) = 0.38

Reduction:

5.0 acres draining to buffer

New drainage area = 38 – 5 = 33 acres
Before reduction:
WQ_v = (1.5)(0.38)(38)/12 = 1.81 ac-ft

With reduction:
WQ_v = (1.5)(0.38)(33)/12 = 1.57 ac-ft

(13% reduction in water quality protection volume)

C.3 Volume Reduction Method #3: Enhanced Swales

This reduction may be taken when enhanced swales are used for water quality protection. Under the proposed method, a designer would be able to subtract the areas draining to an enhanced swale from total site area, when computing water quality protection volume requirements. An enhanced swale can fully meet the water quality protection volume requirements for certain kinds of low-density residential development (see Volume Reduction Method #5). An added benefit is the post-development peak discharges will likely be lower due to a longer time of concentration for the site.

Rule: Subtract the areas draining to an enhanced swale from total site area when computing water quality protection volume requirements.

Criteria:

- This method is typically only applicable to moderate or low density residential land uses (3 dwelling units per acre maximum).
- The maximum flow velocity for water quality design storm shall be less than or equal to 1.0 feet per second.
- The minimum residence time for the water quality storm shall be 5 minutes.
- The bottom width shall be a maximum of 6 feet. If a larger channel is needed use of a compound cross section is required.
- The side slopes shall be 3:1 (horizontal:vertical) or flatter.
- The channel slope shall be 3 percent or less.
- R_v is kept constant when calculating WQ_v

Example:

Residential Subdivision
Area = 38 acres
Impervious Area = 13.8 acres
R_v = 0.05 + 0.009 (I) = 0.05 + 0.009 (36.3%) = 0.38

Reduction:

12.5 acres meet enhanced swale criteria

New drainage area = 38 – 12.5 = 25.5 acres
Before reduction:
WQ_v = (1.5)(0.38)(38)/12 = 1.81 ac-ft

With reduction:
WQ_v = (1.5)(0.38)(25.5)/12 = 1.21 ac-ft

(33% reduction in water quality protection volume)

C.4 Volume Reduction Method #4: Overland Flow Filtration/Groundwater Recharge Zones

This reduction can be taken when “overland flow filtration/infiltration zones” are incorporated into the site design to receive runoff from rooftops or other small impervious areas (e.g., driveways, small parking lots, etc). This can be achieved by grading the site to promote overland vegetative filtering or by providing infiltration or “rain garden” areas. If impervious areas are adequately disconnected, they can be deducted from total site area when computing the water quality protection volume requirements. An added benefit will be that the post-development peak discharges will likely be lower due to a longer time of concentration for the site.

Rule: If impervious areas are adequately disconnected, they can be deducted from total site area when computing the water quality protection volume requirements.

Criteria:

- Relatively permeable soils (hydrologic soil groups A and B) should be present.
- Runoff shall not come from a designated hotspot.
- The maximum contributing impervious flow path length shall be 75 feet.
- Downspouts shall be at least 10 feet away from the nearest impervious surface to discourage "re-connections".
- The disconnection shall drain continuously through a vegetated channel, swale, or filter strip to the property line or structural storm water control.
- The length of the "disconnection" shall be equal to or greater than the contributing length.
- The entire vegetative "disconnection" shall be on a slope less than or equal to 3%.
- The surface imperviousness area to any one discharge location shall not exceed 5,000 square feet.
- For those areas draining directly to a buffer, reduction can be obtained from either overland flow filtration *-or-* stream buffers (See Method #2).
- R_v is kept constant when calculating WQ_v

Example:

Site Area = 3.0 acres
Impervious Area = 1.9 acres (or 63.3% impervious cover)
"Disconnected" Impervious Area = 0.5 acres
R_v = 0.05 + 0.009 (I) = 0.05 + 0.009 (63.3%) = 0.62

Reduction:

0.5 acres of surface imperviousness hydrologically disconnected

New drainage area = 3 – 0.5 = 2.5 acres
Before reduction:
WQ_v = (1.5)(0.62)(3)/12 = 0.23 ac-ft

With reduction:

WQ_v = (1.5)(0.62)(2.5)/12 = 0.19 ac-ft

(17% reduction in water quality protection volume)

C.5 Volume Reduction Method #5: Environmentally Sensitive Large Lot Subdivisions

This reduction can be taken when a group of environmental site design techniques are applied to low and very low density residential development (e.g., 1 dwelling unit per 2 acres [du/ac] or lower). The use of this method can eliminate the need for structural storm water controls to treat water quality protection volume requirements. This method is targeted towards large lot subdivisions and will likely have limited application.

Rule: Targeted towards large lot subdivisions (e.g. 2 acre lots and greater). The requirement for structural practices to treat the water quality protection volume shall be waived.

Criteria:

For Single Lot Development:

- Total site impervious cover is less than 15%
- Lot size shall be at least two acres.
- Rooftop runoff is disconnected in accordance with the criteria in Method #4.
- Grass channels are used to convey runoff versus curb and gutter.

For Multiple Lots:

- Total impervious cover footprint shall be less than 15% of the area.
- Lot areas should be at least 2 acres, unless clustering is implemented. Open space developments should have a minimum of 25% of the site protected as natural conservation areas and shall be at least a half-acre average individual lot size.
- Grass channels should be used to convey runoff versus curb and gutter (see Method #3).
- Overland flow filtration/infiltration zones should be established (see Method #4).

D. Channel Protection Volume (CP_v)

The Georgia Stormwater Manual provides the following: "The increase in the frequency and duration of bankfull flow conditions in stream channels due to urban development is the primary cause of stream bank erosion and the widening and downcutting of stream channels. Therefore, channel erosion downstream of a development site can be significantly reduced by storing and releasing stormwater runoff from the channel-forming runoff events (which correspond approximately to the 1-year storm event) in a gradual manner to ensure that critical erosive velocities and flow volumes are not exceeded."

The Channel Protection sizing criterion specifies that 24 hours of extended detention be provided for runoff generated by the 1-year, 24-hour rainfall event to protect downstream channels. The required volume needed for 1-year extended detention, or Channel Protection Volume (denoted CP_v), is roughly equivalent to the required volume needed for peak discharge control of the 5-year to10-year storm.

The reduction in the frequency and duration of bankfull flows through the extended detention of the CP_v is presumed to reduce the bank scour rate and severity. Therefore, these criteria should be applied wherever upstream development can increase the natural flows to downstream feeder streams, channels, ditches and small streams. It might be waived by a community for sites that discharge directly into larger streams, rivers, wetlands or lakes where the reduction in the smaller flows will not have significant impact on stream bank or channel integrity.

This criterion should be paired with an effective stream bank inspection and restoration program designed to identify and protect any locations where erosion occurs, through the use of bio-engineering and other stream bank protection and stabilization techniques.

Section 6.0 Review of Existing Stormwater Management & Land Use Ordinances

In order to determine the current state of ordinance protection in our watersheds, the following land use ordinances, from all of the 23 Municipalities in the study area, were obtained in May and June of 2005.

- Stormwater Management (SWM)
- Subdivision
- Zoning
- Grading / Erosion & Sedimentation Control

Each of these land use ordinances was reviewed for requirements that may affect water quality, sedimentation, erosion control and flooding in the watershed. Of particular interest was the quality of the existing SWM ordinances and if all of the Municipalities properly referenced the original Act 167 Plans release rate percentage requirements. It should be noted that the result of this Act 167 Update will be a revised SWM Ordinance that must be adopted by all the located within the studied watersheds. Therefore, a review of the finding of the Municipal Stormwater Management (SWM) Ordinances will be discussed first.

6.1 Stormwater Management Ordinances

A. Adoption & Use of Stormwater Management Ordinances

All of the 23 Municipalities in the study area had adopted a Stormwater Management Ordinance. This was expected because of the requirement for the adoption of the Act 167 SWM ordinance produced during the original study.

B. Conformance with Existing Act 167 Release Rate Percentage Requirements

In order to determine if the existing Act 167 Plans are being followed, the existing SWM ordinances were reviewed to determine if the Act 167 release rate percentage requirements were properly cited. Of the 23 Municipalities, 11 did not appear to require the use of the Act 167 release rate percentages.

One of the most valuable actions of this review will be to insure that the updated SWM model ordinance will include a reference to the required use of the release rate percentage maps. As a part of this Update, we have converted the existing paper Release Rate Percentage Maps into digital formats, such as GIS shapefiles and Adobe PDF files, and have made them available on the Ross Township Web Site (www.ross.pa.us).

C. Design Storms

All of the Municipalities based the design of their SWM facilities on design storms having a return period of 2, 10 and 100 years. Several of the Municipalities also required that the 1, 5 and 25 year storms also be considered.

The precipitation amounts for the 2 and 10 year storms provided in the original Act 167 study were 2.14 inches and 3.23 inches respectively. For the 100 year storm, the rainfall amount cited in the original Act 167 Report was 4.59 inches. Some earlier versions of the original study listed a 100 year storm of 5.72 inches for the Pine Creek, Deer Creek and Squaw Run Watersheds.

A review of the current ordinances found the following range of required precipitation amounts for the design storms. The value in parenthesis is the recommended rainfall amount proposed by the original Act 167 plan.

1-year	–	2.3"
2-year (2.14")	–	2.13", 2.14", 2.50", or 2.6"
10-year (3.23")	–	3.23", 3.24", 3.8", 3.9" & 4.31"
25-year	–	4.3" or 4.4"
100-year (4.59"Girtys Run, 5.72"All others)	–	4.59", 5.0", 5.2", 5.71" & 5.72"

It is recommended that one set of design storms be used in the Updated 167 SWM Ordinance. The recommended approach would be to use the "Point Precipitation Frequency Estimates" from the current National Oceanic & Atmospheric Administration (NOAA) Atlas 14, as provided below. The value for the one (1) year return period storm was not provided in Atlas 14 and was taken from the Penn DOT Storm Intensity – Duration – Frequency Chart for Region 1.

Table 6.1
Recommended Design Storms

Return Period (Years)	24 Hour Storm (inches)
1	1.85
2	2.35
5	2.87
10	3.30
25	3.91
50	4.40
100	4.92

The current Act 167 Ordinance requires that storms having return periods of 2, 10, and 100 years be evaluated. It is recommended that the 25 year storm also be evaluated.

D. No Harm Evaluation

The existing Act 167 SWM Ordinance provides for a "No-Harm Option", whereby an applicant may attempt to demonstrate that the increased runoff from their site will not cause any harmful or adverse effects to downstream areas. If the applicant can show that there will be no adverse effects downstream, they are not required to reduce the peak flow rate (as reduced by the applicable release rate percentage) leaving their site to that of the predevelopment conditions.

Although, it may be shown that the increased runoff from a single new development may be negligible downstream, the aggregate effect of the increased runoff from many separate developments constructed over a period of years will certainly cause adverse effects in downstream areas. In other words, every little bit counts and proper SWM controls should be required for all new developments, with the possible exception of those on or very near to the Allegheny River. Sites along or near the Allegheny River should not be required to retain or detain stormwater, because the River peaks many hours later than the local tributary streams. Sites along the River should however be required to conform to all water quality BMP requirements established by the Updated SWM Ordinance.

The use of the No-Harm Option undermines the effectiveness of thorough, comprehensive SWM planning and enforcement. It is recommended that the No-Harm Option be restricted to only those properties located within 1500 to 2500 feet from the Allegheny River. It is also recommended that the distance from the river be measured along the path (travel time path) water would follow from the development site to the river.

6.2 <u>Stormwater Management Ordinance Review Matrices General Findings</u>

Sixteen (16) specific categories were summarized in the Stormwater Management (SWM) review matrix that is found in the Appendix D of this report. The focus of the Matrix was on the SWM ordinances that were provided by the communities in May and June of 2005.

Data gaps may be present on the Matrix for several reasons. For example, certain information may have been referenced within a SWM ordinance, but the supporting information was not provided by the communities at the time of this review, (i.e.; release rates are referenced in attachments or appendices that were not attached to the primary ordinance). In addition, this summary does not reflect information presented in every section of a Municipal ordinance, as often SWM-related specifics are located in the community's Zoning or Land and Subdivision Ordinances.

The following narrative reflects the general findings as documented on the SWM Matrix.

A. General Comments

- The SWM ordinances for the communities of Bradford Woods, Hampton, Shaler, Richland and Ross provide solid direction and good, basic stormwater-related information. The ordinances reviewed for the Borough of West View are not specific and do not provide basic SWM direction.

- Three communities, Middlesex, O'Hara, and Reserve provide strong encouragement, recommendations, and guidance for the use of infiltration practices within their boundaries.

- Approximately 70% of the 23 Municipalities mention or identify the watershed(s) located within their Municipal boundaries. The communities that do not appear to directly mention the watershed(s) within their Municipal boundaries include Aspinwall, Sharpsburg and West View Boroughs; and the Townships of Harmar, Middlesex, Reserve, and Shaler.

- Seven (7) do not have their own separate SWM ordinances but reference SWM-related information within their subdivision and land development, zoning, or grading ordinances. Where a cell is left without any information or marking, it is assumed that this information is either not included in a community's ordinances or it may be documented in ordinances other than the ones reviewed for the development of the SWM Matrix.

- Hampton Township provided a draft SWM ordinance.

- Nine (9) communities do not have individual Flood Plain Management Ordinances. Many communities currently reference Floodplain Management within other ordinances such as zoning.

- Ten (10) communities make some reference to State Water Quality Chapter 93.

B. Design Storm Criteria

- 2-year, 10-year, and 100-year design storm criteria for stormwater management (pre- and post-development standards) are specified for the majority of the 23 communities. Middlesex, O'Hara, Reserve and Ross also require consideration of the 25-year storm, in addition to the 2, 10 and 100-year design storms. Shaler Township requires the additional design of a 1 and 25-year storm event.

- The design storms to be considered within the City of Pittsburgh include the 2, 5, 10, 50, and 100-year storms within the limits of the Girtys Run basin; and the 2, 10, 25, and 100-year storms within the limits of the Monongahela River basin.

- Sharpsburg identifies minimum design criteria for the 100-year storm events.

- West View does not state specific stormwater design criteria.

- Aspinwall and Etna Boroughs specify 25-year storm criteria for storm drain system design. Aspinwall further defines their criteria with 50-year design storm consideration for culverts and 100-year design storm for open watercourses. O'Hara specifies the 100-year storm for their storm drain system design.

C. Release Rates

- 100% Release Rates are stated for Bradford Woods, Etna, Frazer (or "County provided rates"), Harmar and McCandless (Lowries Run).

- Indiana Township's Release Rates range from 65 to 100%, while Marshall Township notes an 80% Release Rate. The Release Rates for Pittsburgh range from 50 to 100%, while Richland's Release Rates range from 65 to 110%.

- Seven (7) Municipalities make reference to Release Rates (tables, maps, etc.) within attachments or appendices to their ordinances. Unfortunately, the referenced appendices were not "copied" or included with their basic (SWM, subdivision, etc.) ordinance.

- A general reference is readily noted concerning Act 167 Release Rates within the ordinances for 12 communities.

D. Rainfall Rates & Method of Design

- The following differences are identified for the rainfall (inches) specified for the 1-year, 2-year, 10-year, 25-year, and 100-year design storm events:

1-year	–	2.3"
2-year	–	2.13", 2.14", 2.50" or 2.6"
10-year	–	3.23", 3.24", 3.8", 3.9" or 4.31"
25-year	–	4.3" or 4.4"
100-year	–	4.59", 5.0", 5.2", 5.71" or 5.72"

1-year rainfall amounts are noted in the regulations for Middlesex, O'Hara, Reserve, Ross and Shaler. Only Shaler requires pre- and post-development consideration of the 1-year storm events.

- Rainfall rates are not readily noted within the ordinances reviewed for Aspinwall, Sharpsburg or West View Boroughs.

- TR-55 Methodology is noted as acceptable in all but one Municipality (West View).

- The Rational Method is noted as acceptable methodology in approximately 35% of the 23 communities.

E. Other Considerations

- The use of infiltration practices is discussed in the majority of the 23 Municipal stormwater (or SWM sections) ordinances. The discussions range in complexity from general language (Etna), to BMPs that encourage infiltration practices (Bradford Woods, Fox Chapel, Franklin Park, Hampton, Indiana, Marshall and Middlesex,). O'Hara Township includes extensive guidelines for infiltration calculations and site requirements.

- Maintenance references for stormwater management Best Management Practices (BMPs) includes:

  a. Identification of responsible party
  b. Maintenance schedules
  c. Identification of personnel and equipment maintenance requirements
  d. Criteria for maintenance securities (funds) for both public and private improvements
  e. Municipal access to stormwater facilities (easements or rights-of-way)
  f. Municipal authority to complete deficient maintenance and bill owner/developer for time/materials
  g. When fees for maintenance funds are required, they are to cover 18 months (Aspinwall Borough) to 10-years (Frazer Township) of maintenance consideration

- Wetlands (or protection of such) are noted in 17 of 23 Municipal ordinances.

- The most typical drainage easement width noted is 15 feet wide. Aspinwall notes a 20 foot minimum drainage width, while Hampton

Township specifies a 20 foot width for storm drains and a 25 foot width for detention/retention facilities.

- Although exceptions and Municipal-approved exemptions are noted in many of the ordinances, the typical acreage requirements where stormwater management design/plans are required is noted as:

  a. $\geq$ 3,000 sq. ft (often "of impervious surfaces/area")
  b. $\geq$ 5,000 sq. ft
  c. > 1 acre
  d. All disturbances (Bradford Woods)

F. SWM Review Recommendations and Conclusions:

It is recommended that the following items be included or addressed when developing the updated SWM ordinance.

1. Reference the use of the existing Act 167 release rate percentage requirements and make release rate mapping readily available on the internet and at Municipal offices.

2. The precipitation amounts for the proposed design storms should be consistent and based upon the most current data from NOAA ATLAS 14.

3. Additional design storms other than the 2, 10 and 100 should be evaluated. Specifically, it is recommended that the 25 year storm also be evaluated.

4. Water Quality and volume considerations should be addressed. Such concepts as the Water Quality Design Storm, Runoff Capture Design Storm, infiltration, stormwater BMPs and extended detention should be included.

5. The use of the "No Harm" approach should be reviewed and eliminated or be allowed only when a site discharges into or within a short distance of the Allegheny River.

6. A consistent standard of the area requirements where stormwater management design/plans are required should be provided. The standard should be based upon the area of disturbed area and or impervious cover.

7. Wetland protection and review should be discussed.

8. SWM "Retrofitting" of existing facilities that are being redeveloped should be reviewed and reasonable retrofit standards developed.

9. Make materials such as hydrologic soils group maps, release rate percentage maps, soils maps, SWM ordinance requirements, bmp requirements and other materials needed to successfully implement the SWM practices available on the internet, see www.ross.pa.us for listing of available online information.

10. Stream buffer and drainage easement requirements should be defined in the updated ordinance.

11. SWM facility maintenance and inspection agreements should be defined in the updated ordinance.

6.3 Review of Subdivision, Zoning & Grading Ordinances

A. Site Planning Model Development Principles

The following site planning and model development principles, developed by the Center for Watershed Protection were used as a guide to evaluate the existing land development ordinances in our study area.

The twenty-two model development principles provide design guidance for economically viable, yet environmentally sensitive development. Our objective is to provide planners, developers, and local officials with benchmarks to investigate where existing ordinances may be modified to reduce impervious cover, conserve natural areas, and prevent stormwater pollution. These development principles are not national design standards. Instead, they identify areas where existing codes and standards can be changed to better protect streams, lakes and wetlands at the local level. The development principles are divided into the three following areas:

- Residential Streets and Parking Lots (Habitat for Cars)
- Lot Development (Habitat for People)
- Conservation of Natural Areas (Habitat for Nature)

Each principle is presented as a simplified design objective. Actual techniques for achieving the principle should be based on local conditions. Please consult the Technical Support Document for more detailed rationale for each principle. Or click here to use our Codes and Ordinances Worksheet to evaluate your own community.

A.1 Residential Streets and Parking Lots (Habitat for Cars)

1. Design residential streets for the minimum required pavement width needed to support travel lanes; on-street parking; and emergency, maintenance, and service vehicle access. These widths should be based on traffic volume.

2. Reduce the total length of residential streets by examining alternative street layouts to determine the best option for increasing the number of homes per unit length.

3. Wherever possible, residential street right-of-way widths should reflect the minimum required to accommodate the travel-way, the sidewalk, and vegetated open channels. Utilities and storm drains should be located within the pavement section of the right-of-way wherever feasible.

4. Minimize the number of residential street cul-de-sacs and incorporate landscaped areas to reduce their impervious cover. The radius of cul-de-sacs should be the minimum required to accommodate emergency and maintenance vehicles. Alternative turnarounds should be considered.

5. Where density, topography, soils, and slope permit, vegetated open channels should be used in the street right-of-way to convey and treat stormwater runoff.

6. The required parking ratio governing a particular land use or activity should be enforced as both a maximum and a minimum in order to curb excess parking space construction. Existing parking ratios should be reviewed for conformance taking into account local and national experience to see if lower ratios are warranted and feasible.

7. Parking codes should be revised to lower parking requirements where mass transit is available or enforceable shared parking arrangements are made.

8. Reduce the overall imperviousness associated with parking lots by providing compact car spaces, minimizing stall dimensions, incorporating efficient parking lanes, and using pervious materials in spillover parking areas where possible.

9. Provide meaningful incentives to encourage structured and shared parking to make it more economically viable.

10. Wherever possible, provide stormwater treatment for parking lot runoff using bioretention areas, filter strips, and/or other practices that can be integrated into required landscaping areas and traffic islands.

A.2 Lot Development (Habitat for People)

11. Advocate open space design development incorporating smaller lot sizes to minimize total impervious area, reduce total construction costs, conserve natural areas, provide community recreational space, and promote watershed protection.

12. Relax side yard setbacks and allow narrower frontages to reduce total road length in the community and overall site imperviousness. Relax front setback requirements to minimize driveway lengths and reduce overall lot imperviousness.

13. Promote more flexible design standards for residential subdivision sidewalks. Where practical, consider locating sidewalks on only one side of the street and providing common walkways linking pedestrian areas.

14. Reduce overall lot imperviousness by promoting alternative driveway surfaces and shared driveways that connect two or more homes together.

15. Clearly specify how community open space will be managed and designate a sustainable legal entity responsible for managing both natural and recreational open space.

16. Direct rooftop runoff to pervious areas such as yards, open channels, or vegetated areas and avoid routing rooftop runoff to the roadway and the stormwater conveyance system.

A.3 Conservation of Natural Areas (Habitat for Nature)

17. Create a variable width, naturally vegetated buffer system along all perennial streams that also encompasses critical environmental features such as the 100-year floodplain, steep slopes and freshwater wetlands.

18. The riparian stream buffer should be preserved or restored with native vegetation. The buffer system should be maintained through the plan review delineation, construction, and post-development stages.

19. Clearing and grading of forests and native vegetation at a site should be limited to the minimum amount needed to build lots, allow access, and provide fire protection. A fixed portion of any community open space should be managed as protected green space in a consolidated manner.

20. Conserve trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native plants. Wherever practical, manage community open space, street rights-of-way, parking lot islands, and other landscaped areas.

21. Incentives and flexibility in the form of density compensation, buffer averaging, property tax reduction, stormwater credits, and by-right open space development should be encouraged to promote conservation of stream buffers, forests, meadows, and other areas of environmental value. In addition, off-site mitigation consistent with locally adopted watershed plans should be encouraged.

22. New stormwater outfalls should not discharge unmanaged stormwater into jurisdictional wetlands, sole-source aquifers, or sensitive areas.

B. PennDOT Liquid Fuels Requirements

In order for a Municipality to obtain annual PennDOT Liquid Fuels funding for new roadways adopted by the community, the following minimum standards are required. Obviously, Municipalities would not want to specify pavement or right of way widths that are less than these minimum requirements.

1. Road must have a minimum right-of-way of 33 feet.
2. Road must have a minimum cartway of 16 feet, paved or unpaved. (Necessary shoulder widths are excluded).
3. Cul-de-sacs must a 40' minimum pavement radius.
4. Road must be capable of being driven safely at 15 miles per hour.
5. All dead end roads must be at least 250 feet in length measured from the last intersection and have a cul-de-sac.

C. Subdivision Ordinance Review Matrices General Findings

The Subdivision and Land Development Ordinances were reviewed with respect to criteria that affect the quantity and quality of runoff. The ordinances were screened for development principles that reduce the amount of impervious area, reduce the amount of grading, conserve natural areas and require stream buffers and drainage easements.

The subdivision review matrix consisted of 23 items that are either directly or indirectly related to the important factors that affect stormwater quantity and water quality; the ordinance review identified these items and the following summaries those findings. A copy of the Subdivision Ordinance Review Matrix is provided in Appendix D.

<u>Reference Stormwater Management (SWM)</u>: With the exception of Indiana, Reserve, West View, Frazer and Shaler, all of the addressed the item of "Reference SWM". Millvale noted that they follow the guide lines of the Allegheny County Planning Commission.

<u>Buffer Zones</u>: The item "Buffer Zones" was addressed in 16 of the 23. The extent to which the item was addressed varied from referring to another section of the Municipal ordinances to a detailed description of requirements per zoning district. In general stream buffer zones requirements need to be improved in the majority of the

ordinances. The width of the buffer should be increased and the vegetation in the buffer zone should be allowed to grow in its natural state, trees should also be protected in the buffer zone and the buffer zone should be protected by easements. This item is also addressed in the zoning matrix.

Residential ROW and Roadway Widths: The item "Residential ROW & Roadway Widths" was addressed by 17 Municipalities. Of the 17 that addressed the item, better than 80 percent indicated that they required ROW widths of 50 feet and pavement widths of 20 to 36 feet. Each Municipality should review their existing pavement and right of way width requirements. In general, cartway widths for residential areas should not be more than 24 feet and right of way widths should be no more than 50 feet. Several of the Municipalities in the study area required pavement widths of over 30 feet. It should be noted that PennDOT Liquid Fuel requirements for cul-de-sacs require a minimum 40 foot pavement radius, which should not be exceeded.

Maximum Road Slope: Residential: Eighteen (18) of the 23 Municipalities addressed "Maximum Road Slope"; 66 percent that addressed the item, noted 12 percent as the maximum allowable slope. For residential: The allowance for steeper roadway slopes for short distances may reduce site grading and disturbance to land and waterways.

Maximum Vertical Curve: Residential: While 18 Municipalities addressed road slope, 14 addressed "Maximum Vertical Curve".

Curbs Required: Fourteen (14) Municipalities addressed "Are Curbs Required", with a majority indicating specific locations where curbs are required and the remainder noted "as deemed necessary" or "as required by the Planning Commission". Design standards should recommend curbs only in those areas where curbs are an essential part of the development and consideration should be given to their elimination. Eliminating the curbs would allow the drainage from roadway surfaces to flow across the pavement on to earthen areas and percolate into the soils, thus reducing the amount of stormwater that would need to be collected and transported.

Sidewalks Required/Sidewalk Widths: Seventeen (17) Municipalities addressed "Sidewalks Required" with a majority of the notations either noted "yes" or "as deemed necessary". One, Bradford Woods made a cross reference to another chapter of their subdivision ordinance. In regards to "Sidewalk Width", 13 Municipalities noted sidewalks with a minimum width of 4 feet, one Municipality noted 3 feet, while Bradford Woods, cross referenced another section of their subdivision ordinance.

Sidewalks are an important element in a community allowing for safe pedestrian traffic and more connected neighborhoods. It is recommended that sidewalk widths be no more than the minimum to meet ADA requirements and that they be required only on one side of the cartway to reduce impervious cover.

Reference E&S: Concerning the line item "Reference E&S", 15 Municipalities indicated a reference to the item, while few, if any, discussed it in length.

Drainage Easement Requirement: Thirteen (13) Municipalities addressed "Drainage Easement"; a majority noting 20 foot, another 15 foot or 15 foot minimum. The line item was defined and only required a yes/no response. The following is an example definition with language relating to drainage width.

> "Drainage easements" means the lands required for the installation of stormwater sewers or drainage ditches, or required along a natural stream or watercourse for preserving the channel and providing for the flow of water therein to safeguard the public against flood damage. (Ord. 668 §202. Passed 1-27-75.)

The width of stormwater drainage easements shall be established by the Municipality but in no case less than 15 feet in width. Drainage easements shall be constructed to follow property lines unless physically impossible to do so.

Drainage Standards: Eleven (11) Municipalities addressed "Drainage Standards"; primarily by cross referencing another section of their respective ordinance, but none clearly defined it. The following section was taken from the Hampton Township Subdivision Ordinance. It should be noted that requirements such as 613.5, the direct connection of stormwater to storm sewers and the piping of roof drains to the curb, are counter to the newer principles of disconnecting roof drains and distributing flows overland where possible, so that travel times are increased, infiltration may occur and the water quality may be improved.

SECTION 613 STORM SEWERS AND DRAINAGE FACILITIES
(From the Hampton Township Subdivision Ordinance)

613.1 Size and Grade. Storm drains shall be designed to accommodate the anticipated run-off from a twenty-five (25) year storm when the area is fully developed, subject to the additional requirements of Article 7 of this Ordinance. The minimum diameter of storm sewers shall be fifteen (15) inches, and the minimum grade shall be one percent (1%), unless approved by the Township Engineer.

613.2 Manholes. For pipe sizes of twenty-four (24) inches or less, manholes shall be spaced at a maximum of four hundred (400) feet and for larger pipe sizes, the maximum distances between manholes shall be six hundred (600) feet. In addition, manholes shall be installed at all points of abrupt changes in alignment and grade. Inlets may be substituted for manholes where practical.

613.3 Inlets. Inlets of the type shown in the Township Construction Standards shall be installed. Inlets at street intersections shall be placed on the tangent and not on the curved portions. If possible, inlets shall be placed at property lines to avoid conflicts with driveways. Inlets shall be spaced at a maximum of three hundred (300) feet, with exception made based on the preceding conditions.

613.4 Castings. Manholes and inlet castings shall be as indicated in the Township Construction Standards.

613.5 Stormwater Roof Drains. Stormwater roof drains shall extend to the paved gutter and, where accessible, shall connect to the storm drainage system. Where the runoff from the house is not directed to a stormwater management facility, sumps shall be installed in each lot for detention of the water from roof drains.

6.13.6 Unnatural Drainage. Whenever construction stops or concentrates the natural flow of storm drainage in such a way as to affect adjoining properties, approval of the owners shall be obtained in writing. Approval of plans by the Township does not authorize or sanction drainage affecting adjoining properties.

613.7 Water Courses. Open water courses will not be permitted within the rights of way of streets. The stopping, filling up, confining or other interference with, or changing the course of, drains, ditches, streams and water courses in the Township will not be permitted unless approval, in writing, is obtained from the Township Council. A permit must be obtained from the Pennsylvania Department of Environmental Protection (PADEP) for construction or change sin a watercourse which drains an area of more than one hundred (100) acres or any other cases where PADEP requires a permit.

613.8 Bridges and Culverts. All bridges and culverts shall be designed to support expected loads and to carry expected flows and shall be constructed to the full width of the right of way. They shall be designed to meet current standards of the Pennsylvania Department of Transportation and the Pennsylvania Department of Environmental Protection.

Storm Sewer Design (Storm Year): was addressed by 10 of the 23 Municipalities. A majority of the Municipalities noted 2-10-100 year storms, although one noted a 100 year storm and two noted 25 year storms. It was not always apparent if the design storm was related to detention or conveyance.

Wetland Delineation: Three (3) of the 23 Municipalities addressed "Wetland Delineations" and "Swales Allowed", although very little specific detail was provided. The following are examples taken from the Marshall and Pine Township ordinances. It is recommended that wetland delineations be required for all land development projects. Wetland areas provide important water quality and flood control benefits and should be carefully protected.

§ 174-28. Wetland, Lake and Stream Frontage Preservation.

The following requirements shall be met as set forth below:

a. Lake and Stream Frontage shall be preserved as open space whenever possible. (This area may be credited toward the open space requirement set forth below.)

b. Access points to the water and maintenance easement areas shall be provided at intervals of no more than one-half (1/2) mile. These access points shall be no less than 25 feet in width.

c. No cutting or filling is permissible within 25 feet of the edge of any flowing stream, lake or wetlands.

d. Wetlands and stream corridors: no clearing within 50 feet of designated wetlands as identified by the pre-application review required for subdivisions and land developments in Chapter 78 or Chapter 84 of the Pine Code or within 50 feet of a blue-lined stream as identified by United States Geological Survey mapping.

<u>Method of Stormwater Control</u>: This was addressed by 10 Municipalities. Most indicated they utilized TR-55, with the exception of O'Hara, which noted they follow the guidelines of the PA Department of Transportation. Pine Township noted multiple methods and Sharpsburg used the Rational Method.

<u>Landscape Requirements</u>: Fourteen (14) Municipalities addressed "Landscape Requirements" and 11 addressed "Tree Conservation". The Pine Township Subdivision Ordinance contains detailed guidance with respect to landscaping.

<u>Private Roads/Number of Lots</u>: Eleven (11) of the Municipalities addressed "Are Private Roads Allowed" and only 4 Municipalities addressed "How Many Lots May Be Served". With the exception of O'Hara and Richland, all of the Municipalities indicated that private roads were permissible. Concerning the item of how many lots, Hampton indicated 2 lots, Harmar and Pine both indicated 2 lots and some, while allowing "Private Road", discouraged the use.

The following defines private roads and the associated paragraphs address the issue relating to the design criteria. The information was taken from the Pine Township Subdivision Ordinance.

> STREET, PRIVATE – A strip of land or roadway intended for use as a means of vehicular and pedestrian circulation to provide access to more than one (1) lot. A "private street" is intended for use of only the lots served rather than the general public.

Every lot shall abut on at least one (1) public street, as such is defined in § 78-4 of this chapter (but not only on a service street as such is defined in said § 78-4 of this chapter); provided, however, that not more than three (3) dwelling units may be served by a private street (as defined in § 78-4 of this chapter) of not less than fifty (50) feet in width, provided that a modification is granted in accordance with the procedures of § 78-11 of this chapter. In addition to the requirements and conditions stated in § 78-11 of this chapter, the governing body may impose such additional requirements upon the allowance of a private street such as a modification to the terms of this chapter, including but not limited to the following:

a. Partial or full compliance with any or all of the requirements, standards or conditions for the approval of public roads, as set forth in this chapter, Township Ordinance No. 11636 and all other Pennsylvania and township laws, ordinances and regulations, now and as amended in the future, including but not limited to design, construction and maintenance standards and performance and maintenance bond requirements.

b. The execution of a formal agreement by the developer, approved by the Township Solicitor, whereby the developer agrees to the nondelegable duty of perpetual maintenance of the private road.

<u>Alternating Paving Methods</u>: This item was not addressed by any of the Municipalities.

<u>Parking Lot Landscaping</u>: Three (3) Municipalities addressed "Parking Lot Landscaping". Franklin Park, Indiana, and Pine all indicated that they had ordinances.

<u>Soils Maps Required</u>: None of the Municipalities indicated that they had requirements for "Soil Maps, Soil Types or Slide Prone Soils".

<u>Parking Lot BMPs</u>: Two (2) of the 23 Municipalities, Fox Chapel and Marshall Township, addressed "Parking Lot Best Management Practices (BMPs), but no reference was made to BMP use in parking lots. It should be noted, as is defined in the "Pennsylvania Handbook for BMP Design", besides compliance with local, state and federal laws and regulations, a well-planned, designed, and built project also can protect or improve water quality and other watershed resources. Some reasons for using BMPs that go beyond compliance with legal requirements are preservation of water quality and wildlife habitat, efficient use of space, and aesthetically pleasing design.

<u>Tree Conservation Requirements</u>: Eleven (11) of the 23 Municipalities addressed the item; four (4) noted "limited" protection for wooded areas. With respect to tree conservation, the following requirements from the Marshall Township Subdivision Ordinance are recommended.

§ 174-29. Tree preservation and planting.

The following requirements shall be met as set forth below:

a. Trees eight (8) inches or more in diameter [measured at a height of four and one- proposed cartway or SIDEWALK portion of a STREET right-of-way, within twenty-five (25') feet of the foundation area of a new building or within an area where regarding is necessary to achieve acceptable site development. Where possible, existing open space areas should be utilized for such facilities to minimize necessary disturbance of existing wooded areas. Areas in which trees are retained shall remain undisturbed and at the original grade level wherever possible. Registered Bicentennial Trees or older shall not be removed unless the APPLICANT provides the property is incapable of development without removal.

b. For all commercial, industrial, PRD, mobile home park and multifamily developments, a landscape plan shall be prepared. The plan shall show the plant cover which exists and, on the same or separate sheet, that which will exist when the landscaping is completed, including trees, shrubs and ground cover. A landscape plan shall be prepared and submitted prior to approval of a building permit. In the case of staged development or developments of individual parcels by separate owners, the landscape plan may be submitted in stages coinciding with the application for final plan approval for each stage.

D. Subdivision Ordinance Review Matrices General Comments

The following language from the Hampton Township SWM Ordinance provides a quality statement about the purpose and objectives of SWM.

The regulations in this Article are adopted and implemented to achieve the following general purposes and objectives:

a. To manage stormwater runoff resulting from land alteration and disturbance activities in accordance with the watershed stormwater management plans adopted by Allegheny County as required by the Pennsylvania Stormwater Management Act (Act 167 of 1978, as amended).

b. To utilize and preserve the desirable existing natural drainage systems and to preserve the flood-carrying capacity of streams.

c. To encourage natural infiltration of rainfall to preserve groundwater supplies and stream flows.

d. To provide for adequate maintenance of all permanent stormwater management structures in the Municipality.

D.1 General Comments

Swales: Swales are defined as "low-lying stretches of land which gather or carry surface water runoff". Beyond the aforementioned, there was no mention of any kind as to the use and/or construction of swales. It is recommended that the Municipalities give consideration to addressing where and how swales need to be incorporated into overall drainage design.

Stormwater Calculation Method: Reference Method of Stormwater Control: It is recommended that all of the Municipalities address this item, noting what method needs to be followed when calculating the stormwater runoff. The updated Act 167 SWM Ordinance will address this item.

E. Zoning Ordinance Review Matrices - General Comments and Recommendations

The purpose of the ordinance review was to outline specific findings and provide recommendations for improvements to each of the 23 Municipal Zoning Ordinances reviewed. The zoning matrix consisted of 22 items that are either directly or indirectly related to the important factors that effect stormwater quantity and water quality. The ordinance review identified these items and the following summarizes those findings. A copy of the Zoning Ordinance Review Matrix is provided in Appendix D.

General Lot Sizes: Information was provided in 21 of the 23 ordinances that were reviewed. There was nothing noted in either the McCandless or Sharpsburg ordinance. The lot sizes ranged from 1000 sq. ft. to 10 acres. With respect to minimum lot width, 19 of the 23 Municipalities noted minimum lot sizes. They ranged from 20 feet to 500 feet. The line item is quantitative in nature, thus no recommendation is noted.

As an observation, the range of lot sizes for each of the respective Municipalities appears to be in a range that is compatible to the location and size of the Municipality. The line item for minimum lot sizes is quantitative in nature, thus no recommendation is noted. The widths of the lots noted appear to be in line with what would be expected for the respective size of the Municipality.

Set Backs: Of the 23 Municipalities, only one, Sharpsburg, did not note front yard set backs, side yard set backs or rear yard set backs. In general, front set backs should be reduced to reduce site grading and driveway lengths.

Slopes: Six (6) Municipalities made some reference to "Slopes" in one way or another. The following is from the Township of Hampton: Steep slopes and very steep slopes shall be protected as follows:

a. Very steep slopes (over 25%) – no environmental disturbance of any kind shall be permitted on these areas.

b. Steep slopes (15 to 25%), where any portion of the steep slope contains soils identified on the Township Soils Maps as having a high landslide-prone risk; no environmental disturbance of any kind shall be permitted.

c. Steep Slopes (15 to 25%), where any portion of the steep slope contains soils identified on the Township Soils Map as having a moderate landslide-prone risk; disturbances not exceeding twenty-five percent (25%) of the steep slope areas containing the moderate-risk landslide-prone soils may be permitted provided the applicant demonstrates to the satisfaction of the Township Engineer and the Council that such disturbances will not adversely impact the stability of the soils.

d. Steep Slopes (15 to 25%), not involving any areas identified on the Township Soils Map as having landslide-prone soils; no more than fifty percent (50%) of the steep slope area may be environmentally disturbed.

e. In instances where it can be demonstrated to the satisfaction of the Township Council that no adverse environmental impacts will occur, the determination of the percent slope may be calculated using the "average percent slope" formula. Use of the "average percent slope" may be utilized provided that the following has been taken into consideration for making the judgment:

   1. The average percent slope has been calculated for the area of disturbance.

   2. If the average percent slope is between 15-25%, the total amount of disturbance of these slopes can be either 50% (if no sliding soils) or 25% (if moderate sliding soils), as in c. and d. above.

3. In the case of 15 to 25% slopes that have a high landslide risk, or the very steep slopes over 25%, council shall also look at the total area of the proposed disturbance in relation to the total area of the entire site and base their decision on the total amount of overall disturbance to the site, the least possible disturbance being the goal.

4. In case of 25% and over slopes which are also shown to have landslide prone soils, such a waiver should only be given in the instance of an extremely difficult site from the standpoint of environmental constraints, and then given only for the minimum amount of disturbance needed for the owner to realize a reasonable use and monetary return for his property.

f. Landslide-prone soils shall be further protected, and excavations, cuts, and fills shall be regulated, as per the Township's Grading and Excavating Ordinance.

Planned Residential Developments (PRD) Allowed/Requirements: Sixteen (16) Municipalities noted they allowed PRD's and all noted their respective requirements of the PRD. Recommended example: PRD's are an important tool for preserving environmentally critical lands and open spaces and reducing the impact of new development.

Accommodate Reasonable Community Growth: Eight (8) Municipalities addressed this matrix line item; typically with the following statement or something similar:

> "To accommodate reasonable overall community growth, including population and employment growth, and opportunities for development of a variety of residential dwelling types and non-residential uses".

Maintain Stability of Residential/Commercial and Industrial Areas: Sixteen (16) Municipalities made no reference to this particular item.

Establishment of Zoning Districts: All 23 Municipalities made reference to this item, with a range from 3 to 17 zoning districts. This item is quantitative in nature, thus no recommendation is noted.

Natural Features Analysis: Twenty (20) Municipalities made no reference to this item.

Preserve Natural Resources: This item was not noted by 16 Municipalities. Recommended example: "The preservation and improvement of the environment shall be pursued by:

a. The preservation of natural topography, environmentally critical areas, wetlands, and wooded areas, including the limiting of hillside development beyond a reasonable gradient, and the control of flood plains and stormwater.

b. The limitation of excess erosion, hazardous rock and soil slippage, sedimentation and other soil and water management problems

c. The regulation and control of the design, construction, quality of materials, use, location and maintenance of grading, excavation and fill.

d. The promotion and dedication of natural open space and wooded slope land in order to link the existing and proposed open spaces and to prevent ecological problems resulting from extensive cut and fill necessary to develop wooded slope land.

<u>Density/Area</u>: Eight (8) Municipalities responded favorably to this item. The range went from 2 to 20 units per acre.

<u>Is Percent Cover Restricted?</u>: Eleven (11) Municipalities made no reference to this item. Of the 12 that referenced this item, the coverage ranged from 10 to 90 percent. Restrictions on percent cover may allow increased infiltration and reduced peak runoff rates.

<u>Standards/Open Space & Common Ground</u>: Nine (9) Municipalities made some reference to Open Space & Common Ground. Recommended definition: "A parcel or parcels of land, or area of water, or a combination of land and water, within a development and designed and intended for the use or enjoyment of the residents of the development, not including streets, off-street parking areas, and areas set aside for public facilities. Open space must consist of a tract of land exceeding at least ½ acre in area, which has been designed to remain undeveloped permanently for resource protection or recreation or agricultural purposes. Open space does not include road right-of-way, yards around dwelling units, lots and/or dwelling units, parking units, or buffer yards unless the buffers are a minimum of forty (40) feet in width and are contiguous with other open space or part of a greenway corridor" Open space is further defined as follows:

a. Natural recreation area – open space which is left in its natural pre-development state with only passive recreation allowed, such as trails and/or areas for public off-street parking necessary for the residents and/or visitors of the development while they are using the recreation area.

b. Active recreation area – open space which accommodates such facilities as swimming pools, tennis courts, ball fields, etc

Protection / Watercourses & Wetlands: Sixteen (16) Municipalities made no reference to this item. The following example is taken from the Marshall Township Code, paragraph 208-162 :

> One of the principal factors that will influence the intensity of Development on a particular parcel of land is the requirement for protecting the designated environmental resources existing on the site. Specific natural resources that are sensitive to Development, such as forests, steep slopes, floodplains and streams, are protected under this chapter. All land area consisting of natural resources or natural features listed in the following table shall be mapped and quantified by the Developer as part of the Site Development Plan review process. The Resource Protection Land shall be calculated in the following manner.
>
> a) Calculate the total area (acreage) of each natural resource.
>
> b) Multiply the total area of each resource by the preservation Ratio for that resource to determine the amount of Resource Protection Land required to be kept in Open Space or conservation easement in order to protect the resource or feature.
>
> c) On that portion of the Site where two (2) or more resources overlap, only that natural resource which has the highest preservation Ratio shall be calculated.
>
> d) All Resource Protection Land must be preserved by either Open Space or conservation Easement. All Resource Protection Land for Mature Woodlands, Young Woodlands, Wetlands, and Floodplains must be located in Open Space and outside of Lot Areas.

Protection/Significant Natural Areas: Seventeen (17) Municipalities made no reference to this item. The Borough of Fox Chapel Health and Safety Ordinance provides excellent guidance.

Avoidance/Hazardous Development: Five (5) Municipalities noted some reference to Hazardous Development. For the most part, a review of the ordinances of the Municipalities that addressed this item referred to Floodplain Districts and/or Flood Prone areas. The apparent intent was to define "what was and what was not" allowed in those areas, i.e. Marshall Township Ordinance, Article XIV, paragraph 208-107 through 208-129.

Parking Ratio / Office: Four (4) Municipalities made no reference to this item.

Parking Ratio / Retail: Six (6) of the 23 Municipalities made no reference to retail parking ratios.

Parking Ratio (Office / Retail) per 1000 SF: Parking ratios and parking space sizes should be reviewed so that they are not overly conservative and require more spaces than needed to support the development. Developers should be encouraged to develop parking areas using pervious pavement materials.

F. Grading Ordinance Review Matrices General Comments

In June 2005, Grading Ordinances (or specific grading sections from other Municipal ordinances) were reviewed for 23 Pittsburgh-area Municipalities located in northern Allegheny County, Pennsylvania. This project was completed for the North Hills Council of Governments, as part of the Act 167 update. Nineteen (19) specific categories were outlined for the grading review. The information gathered during the Grading Ordinance review (on the ordinances provided at the time of the review) is provided in the Grading Matrix. The following summary reflects the general findings as documented on the Grading Matrix and overall recommendations. A copy of the Grading Ordinance Review Matrix is provided in Appendix D.

Data gaps may be present on the Grading Matrix for several reasons. For example, this summary does not reflect information presented in every section of a Municipal ordinance, as often grading-related specifics are located throughout other Municipal ordinances, such as Subdivision and Land Development, Zoning, etc.

- The majority of the Municipalities had a separate Grading Ordinance. Six of the communities (Etna Borough, Fox Chapel Borough, Franklin Park, Harmar Township, Millvale Borough and Sharpsburg Borough) did not appear to have a separate Grading Ordinance.

- Five of the six communities without a separate Grading Ordinance, had grading regulations referenced or documented in other ordinances. It appears that Etna Borough does not have grading requirements.

- It does not appear that any of the 23 communities had a separate Erosion and Sediment Control (E&SC) Ordinance. E&SC regulations are included in other Municipal ordinances.

F.1 Cut Slope Restrictions

The maximum allowable cut slopes documented in the grading regulations for the communities varied. They included 1H:1V, 1½ H:1V, 2H:1V, 2½H:1V, and 3H:1V. It appears that overall, the maximum cut slope of 2H:1V was most common. Some communities such as Harmar Township, Marshall Township, Pine Township, the City of Pittsburgh, Richland Township, Ross Township, and Sharpsburg Borough noted various exceptions to the maximum allowable cut slope.

As noted on the Grading Matrix, cut slope information was not found for Aspinwall Borough, Fox Chapel Borough, and Millvale Borough. It is assumed that this information is either not included in communities' ordinances or it may be documented in ordinances other than the ones reviewed for the development of the Grading Matrix.

F.2 Fill Slope Restrictions

The maximum allowable fill slopes documented in the grading regulations for the communities varied. They included 1½ H:1V, 2H:1V, 2½H:1V, and 3H:1V. It appears that overall, the maximum fill slope of 2H:1V was most common. Some communities, such as Frazer Township, Marshall Township, Pine Township, the City of Pittsburgh, and Ross Township noted exceptions to the maximum allowable fill slope.

As noted on the Grading Matrix, fill slope information was not found for Aspinwall Borough, Etna Borough, Fox Chapel Borough, Franklin Park Borough, Harmar Township, Millvale Borough, Richland Township and Sharpsburg Borough. It is assumed that this information is either not included in communities' ordinances or it may be documented in ordinances other than the ones reviewed for the development of the Grading Matrix.

F.3 Steep Slope Restrictions

Steep slope restrictions were noted in approximately 50 percent or less of the communities and were varied. Some restrictions stated that slopes greater than 25 percent shall not be graded (Hampton Township). The communities of O'Hara Township, Pine Township, the City of Pittsburgh, Ross Township and Shaler Township had restrictions based on ranges of slopes and/or percent of area permitted to be graded or soil type.

As noted on the Grading Matrix, steep slope information was not found for over half of the communities. It is assumed that this information is either not included in communities' ordinances or it may be documented in ordinances other than the ones reviewed for the development of the Grading Matrix.

F.4 Limiting Slopes

The limiting slope where development is not permitted in a community was identified in only a few communities' ordinances. Middlesex Township, Pine Township, and the City of Pittsburgh do not allow grading or construction on slopes greater than 40 percent. O'Hara Township does not allow earth disturbance on slopes greater than 40 percent without Council approval. Shaler Township does not allow disturbance on slopes greater than 25 percent. The limiting slope information was not found for most of the communities as noted on the Grading Matrix. It is assumed that this information is either not included in communities' ordinances or it may be documented in ordinances other than the ones reviewed for the development of the Grading Matrix.

F.5 Soil Considerations

As noted on the Grading Matrix, all of the communities required soil type maps. It was inconsistent, however, as to when they were needed and for what documents the soil maps were required, i.e. permit applications, etc.

Slide-prone soils were addressed in the majority of the communities' ordinances. It appears that most of the communities require special precautions and possibly soil testing when proposing to grade landslide-prone soils.

F.6 Stream Buffers

Stream buffer requirements were only noted in grading-related ordinances from approximately one-third of the communities. The stream buffer widths specified included 25 feet and 50 feet (Etna Borough, Marshall Township, and Pine Township). Middlesex Township, O'Hara Township, Richland Township, Ross Township, and Shaler Township require stream buffers, but did not specify a width. The stream buffer information was not found for most of the communities as noted on the Grading Matrix. It is assumed that this information is either not included in communities' ordinances or it may be documented in ordinances other than the ones reviewed for the development of the Grading Matrix. (See Section H for more detailed information on stream buffers.)

F.7 Development Buffer Requirements

Development buffer requirements were only noted in ordinances from less than 50 percent of the communities. The development buffer widths varied per community as follows:

Frazer Township	-	3' to 20'
Middlesex Township	-	5' to 20'
O'Hara Township	-	5' to 25'
City of Pittsburgh	-	5' Minimum
Pine Township	-	10' Minimum
Reserve Township	-	10' Minimum
Ross Township	-	15' to 50'

These buffer requirements generally are not stream buffers and typically are designed to provide a buffer between commercial and residential zoning districts. As noted on the Grading Matrix, the development buffer information was not found for most of the communities. It is assumed that this information is either not included in communities' ordinances or it may be documented in ordinances other than the ones reviewed for the development of the Grading Matrix.

F.8 Drainage Easements

Drainage easements were required in most of the communities, with the exception of Sharpsburg Borough and possibly Harmar Township. The easement widths were not specified in several of the communities like Etna Borough, Franklin Park Borough, Indiana Township, Marshall Township, Millvale Borough, Pine Township and the City of Pittsburgh. Specified easement widths varied, but included 10 feet, 15 feet, 20 feet and 25 feet. Of the widths specified, 15 feet was the most common.

F.9 Other Considerations

Deforestation regulations were noted in over half of the communities' grading-related ordinances. Some communities, such as Harmar Township, Middlesex Township, Reserve Township, and West View Borough require that whenever practical, large trees shall be preserved. Other communities state that no more than 50 percent of a forest may be cleared or developed (Frazer Township and O'Hara Township). Ross Township requires that no significant environmentally sensitive areas shall be physically disturbed. Shaler Township requires that development activities should minimize tree clearance and the regulations limit the tree size that may be removed. Pine Township provides fairly extensive guidance for tree preservation. Deforestation information was not found for several of the communities as noted on the Grading Matrix. It is assumed that this information is documented in ordinances other than the ones reviewed for the development of the Grading Matrix.

Vegetative mitigation requirements were noted in the grading-related ordinances from 21 of 23 of the communities. They were not identified in the ordinances reviewed for Sharpsburg or West View Boroughs. The requirements varied, but in general most of the communities required that permanent vegetation and erosion control structures be installed as soon as practical during construction activities.

Over half of the communities acknowledge that the County Conservation District' review is required. The minimum disturbed area requiring the agency's review varied as follows:

Aspinwall Borough	-	Greater than 5,000 SF
Bradford Woods Borough	-	Greater than 5,000 SF
Ross Township	-	Greater than or equal to 0.5 Acres
O'Hara Township	-	Greater than 1 Acre
Reserve Township	-	Greater than 1 Acre
Shaler Township	-	Greater than 1 Acre
Middlesex Township	-	All Disturbances
West Deer Township	-	All Disturbances

Some communities such as Millvale Borough, Frazer Township and Pine Township do not specify a minimum acreage. County Conservation District review information was not found for several of the communities as noted on the Grading Matrix. It is assumed that this information is either not included in communities' ordinances or it may be documented in ordinances other than the ones reviewed for the development of the Grading Matrix.

Wetlands (or protection of such) were noted in 17 of 23 Municipal ordinances.

The use of infiltration practices was discussed in the majority of the 23 Municipal ordinances. The discussions ranged in complexity from general language (Etna Borough), to BMPs that encourage infiltration practices (Bradford Woods, Fox Chapel, Franklin Park, Hampton, Indiana, Marshall, Middlesex, etc.). O'Hara Township included extensive guidelines for infiltration calculations and site requirements.

Approximately 80 percent of the 23 communities require post-construction BMPs. Many of the communities, such as Bradford Woods Borough, Hampton Township, Harmar Township, Indiana Township, Marshall Township, Middlesex Township, Pine Township, the City of Pittsburgh, Reserve Township, Richland Township, Ross Township, Shaler Township and West View Borough specified that the owner of any property on which an excavation or fill has been made shall maintain it in good condition and repair, including all retaining walls, cribbing, drainage structures, fences, ground cover, and other protective devices as required by permit.

Aspinwall and Sharpsburg Boroughs contained general language in their ordinances. Post-construction BMP requirements were not noted in the ordinances from Etna, Franklin Park and Millvale Boroughs and from Frazer Township. It is assumed that this information is either not included in these communities' ordinances or it may be documented in ordinances other than the ones reviewed for the development of the Grading Matrix.

Approximately half of the communities' ordinances specified an acreage requiring an Erosion and Sediment Control Plan (E&SC). Reserve, Richland, Ross and Shaler Townships, and West View Borough require a project site greater than or equal to 5,000 square feet. Middlesex, West Deer and Pine Townships, and Sharpsburg Borough require an E&SC plan regardless of site size. As noted on the Grading Matrix, E&SC plan size requirement information was not found for several of the communities. It is assumed that this information is either not included in communities' ordinances or it may be documented in ordinances other than the ones reviewed for the development of the Grading Matrix.

G. Grading Ordinance Review Recommendations and Conclusions

Grading and clearing land has significant impacts on runoff water and water quality. Each Municipality should review the grading ordinance for the following requirements that will reduce the impact of grading on our watershed(s).

1. Insure that all grading plans have an erosion and sedimentation control (E&S) plan and that it is implemented. Even small

disturbances such as the construction of a single home should be required to have proper E&S controls. In order to make E&S planning easier for individual builders each Municipality should provide a simple to follow general E&S control requirements with each building permit issued. The Municipal building inspector and engineers should insure that E&S plans are installed and properly maintained for all construction projects.

2. As per Pennsylvania Code Chapter 102, the grading ordinance should make clear that any earth disturbance activity will result in a total earth disturbance of 5,000 square feet (464.5 square meters) or more require that an E&S plan be prepared and implemented.

3. Maintenance agreements for permanent E&S controls should be required.

4. Ordinances should contain steep slope protection requirements that restrict the development of steep slopes.

5. Stream buffers should be established in the grading ordinance. The stream buffer requirements should conform to the stream buffer and drainage easement requirements established in other land development ordinances such as the SWM and subdivision ordinance

6. If possible the vegetation along waterways should be protected and allowed to remain in their natural state. In particular trees should be protected within the stream buffer zone.

7. Drainage easements should be established and recorded before a site is disturbed.

8. The ordinance should be clear that all State and Federal Permits needed should be received prior to issuance of the grading permit.

9. Wetlands should be protected. All wetland areas should be delineated and the proper State and Federal permits received prior to issuance of a grading permit.

10. Grading should not be allowed within the 100 Year Flood Plain without proper State and Federal approvals.

11. Reasonable deforestation regulations should be established.

H. Stream Buffers

For streams within the watershed that do not yet have highly developed storm sewer collection systems, stream buffers or aquatic buffers are an important element of protection. It is advisable to leave an area on both sides of the waterway undisturbed and covered by native vegetation. Allowing a wooded vegetated area along the waterways also provides shade and helps maintain cooler water temperatures.

Buffers in highly urbanized watersheds are less effective than in less disturbed watersheds because much of the runoff is collected in storm sewers and piped directly to the waterway.

It is anticipated that the adoption of stream buffers in the revised Act 167 SWM Ordinance will be an important element in the regions watershed protection plan, particularly for rural or lightly disturbed suburban areas that are currently being considered for development.

The following recommendations are found in the EPA's Aquatic Buffer Model Ordinance that is provided in Appendix E of this report. The EPA has indicated that buffers adjacent to stream systems provide numerous environmental protection and resource management benefits that include the following:

1. Restoring and maintaining the chemical, physical, and biological integrity of the water resources
2. Removing pollutants delivered from urban stormwater
3. Reducing erosion and sediment entering the stream
4. Stabilizing stream banks
5. Providing infiltration of stormwater runoff
6. Maintaining base flow of streams
7. Contributing the organic matter that is a source of food and energy for the aquatic ecosystem
8. Providing tree canopy to shade streams and promote desirable
9. Providing riparian wildlife habitat
10. Furnishing scenic value and recreational opportunity

In order to determine and classify stream buffer requirements, EPA recommends that "Stream Order", "Stream Zone", presence of wetlands, 100 year flood plains and the grade of the slopes abutting the Waterway be considered. These items are defined in more detail below.

H.1 <u>Stream Order</u>

Stream Order is a classification system based on stream hierarchy. The smaller the stream, the lower its numerical classification, for example, a first-order stream does not have tributaries and normally originates from springs and/or seeps.

Streams in a watershed are grouped by numbers based on size:

- Headwater streams are orders 1 - 3
- Medium sized streams are orders 4 - 6
- Large rivers are orders >6

Note: It takes 2 streams of the same order, coming together, to make the next larger order (i.e. Two 1st order streams make a 2nd order stream. A 2nd and 1st order is still a 2nd order.)

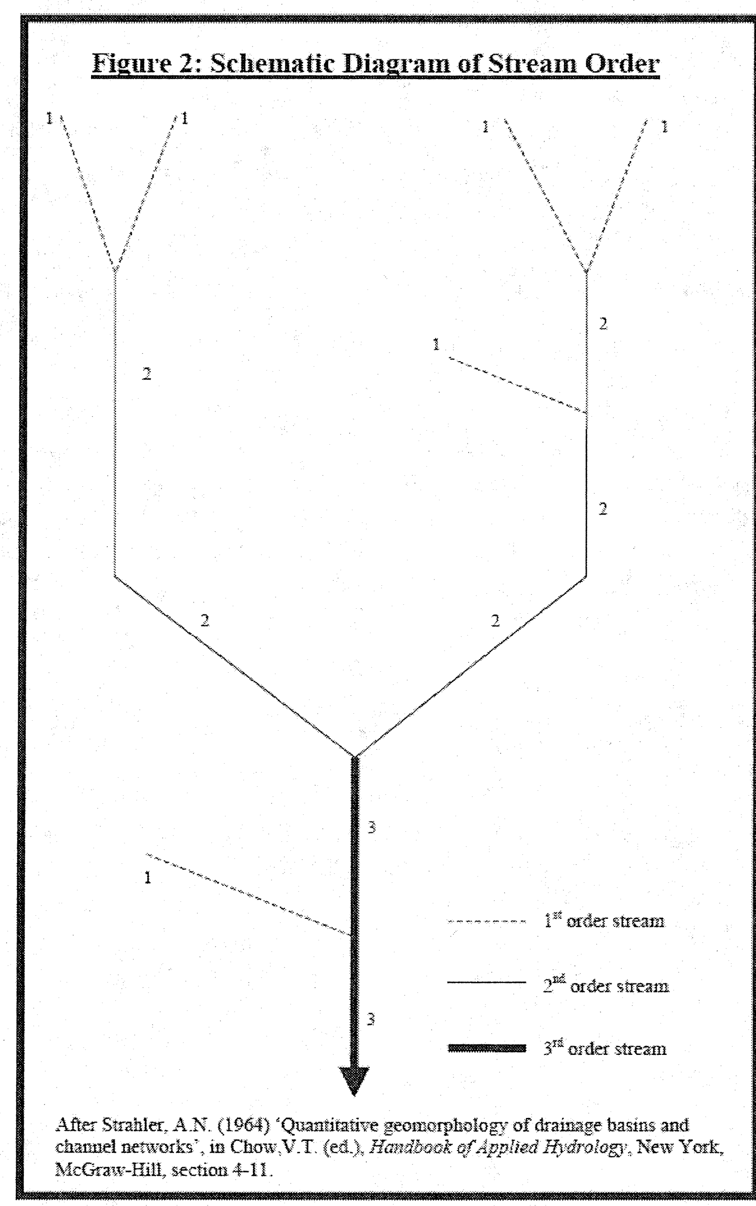


Figure 6.1 Stream Orders

H.2 Stream Zone and Recommended Buffer Widths

The stream zones are shown on the figure below. Each zone is defined by its relationship to the top of the stream bank.

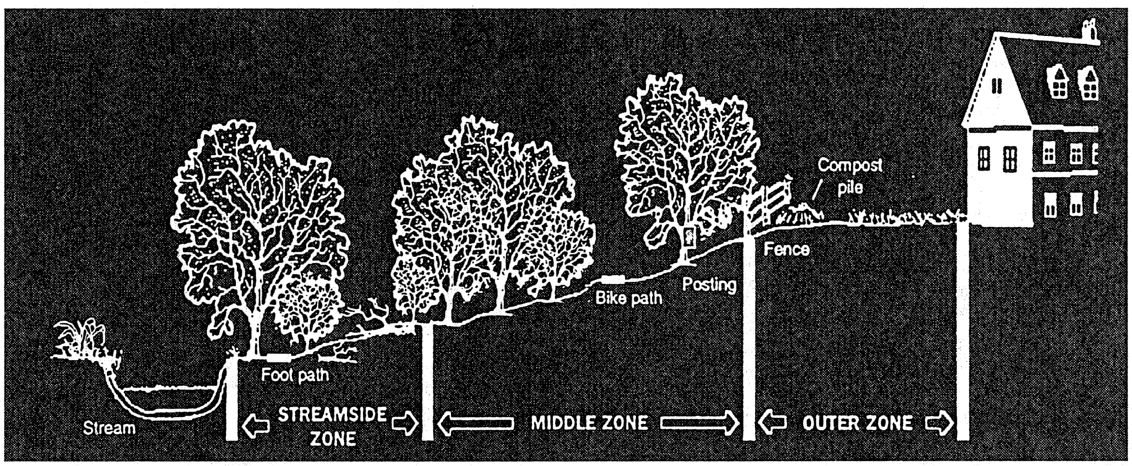


Figure 6.2 From EPA Model Aquatic Buffer Ordinance

The EPA recommends that the following stream zones be used to define stream buffer requirements. EPA guidance indicates that the width of the stream buffer varies from 20 feet to 200 feet in ordinances throughout the United States (Heraty, 1993). The width chosen by a jurisdiction will depend on the sensitivity and characteristics of the resource being protected and the political realities in the community. The proposed steam buffer widths should be reviewed by the WPAC Committee prior to being considered for inclusion in the revised SWM ordinance.

I) Zone 1, Streamside Zone
   a) Protects the physical and ecological integrity of the stream ecosystem.
   b) Begins at the edge of the stream bank of the active channel and extends a minimum of 25 feet from the top of the bank.
   c) Allowable uses within this zone are highly restricted to
      i) Flood control structures
      ii) Utility right of ways
      iii) Footpaths
      iv) Road crossings, where permitted
   d) Target for the streamside zone is undisturbed native vegetation.

2) Zone 2, Middle Zone
   a) Protects key components of the stream and provides distance between upland development and the streamside zone.
   b) Begins at the outer edge of the streamside zone and extends a minimum of 50 feet plus any additional buffer width as specified in this section.

c) Allowable uses within the middle zone are restricted to
    i) Biking or hiking paths
    ii) Stormwater management facilities, with the approval of (local agency responsible for stormwater).
    iii) Recreational uses as approved by (planning agency).
    iv) Limited tree clearing with approval from (forestry agency or planning agency).
d) Targets mature native vegetation adapted to the region.

3) Zone 3, Outer Zone
a) Prevents encroachment into the forest buffer and filters runoff from residential and commercial development.
b) Begins at the outward edge of the middle zone and provides a minimum width of 25 feet between Zone 2 and the nearest permanent structure.
c) Restricts septic systems, permanent structures, or impervious cover, with the exception of paths.
d) Encourages the planting of native vegetation to increase the total width of the buffer.

H.3 Wetlands

EPA guidance indicates wetlands should be contained in the buffer and that an additional buffer of 25' should be required around the perimeter of each wetland.

H.4 100 Year Flood Plain

It is recommended that the buffer zone include the area contained in the 100 Year Flood Plain. The EPA Model indicates:

- Forest buffers shall be extended to encompass the entire 100-year floodplain and a zone with a minimum width of 25 feet beyond the edge of the floodplain.

H.5 100 Year Floodway

The Floodway is an area delineated on the Federal Emergency Management Agencies (FEMA) Flood Insurance Rate (FIRM) Maps. If the Floodway is not delineated on the FIRM map, PA DEP generally considers the Floodway to be a fifty (50') foot setback from the top of bank. Flood Plain Ordinances typically consider the floodway to be a no build zone.

Flood Plain Management Ordinances should also require that there is no net change in the Floodway cross section due to development activities, unless the proper permits are obtained from PA DEP.

H.6 <u>Steep Slopes</u>

The EPA Model Stream Buffer Ordinance recommends that a buffer be extended in areas where steep slopes abut the waterway. Several methods may be used to adjust buffer widths for steep slopes. Two examples follow:

Table 6.2 Method A - Buffer Width Adjustment for Steep Slopes

Percent Slope	Width of Buffer
15%-17%	add 10 feet
18%-20%	add 30 feet
21%-23%	add 50 feet
24%-25%	add 60 feet

Table 6.3 Method B - Buffer Width Adjustment for Steep Slopes

Percent Slope	Type of Stream Use	
	Water Contact Recreational Use	Sensitive Stream Habitat
0% to 14%	no change	add 50 feet
15% to 25%	add 25 feet	add 75 feet
Greater than 25%	add 50 feet	add 100 feet

H.7 <u>Protections Under the National Flood Insurance Program & PA Act 166 Flood Plain Management Act & Local Ordinances</u>

It should be noted that the floodway is considered a <u>no build zone</u>. The floodway is defined on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) or if undefined, is considered by PA DEP to be the area within fifty (50') landward from the top of the stream bank on both sides of the stream.

It should be noted that any work that would alter the floodway must be reviewed and approved by the PA DEP.

The following summary of Flood Plain Management requirements was adapted for this study from an information sheet produced by the Susquehanna River Basin Commission entitled “Sound Flood Plain Management Practices within Pennsylvania”.

H.8 Why are Flood Plains Important?

Large-scale and localized flash floods cause significant property damage and result in the loss of lives. Flash floods, which usually affect smaller tributaries, can occur with little warning. Since the effects of flooding are mostly localized, Municipalities play an important role in protecting their communities through the use of sound flood plain management practices. Flood plains provide a natural form of flood protection. A naturally functioning flood plain has many benefits, including the storage and conveyance of floodwaters, recharging groundwater; and providing habitat for fish and wildlife. Vegetation on the flood plain absorbs water, collects debris, and reduces erosion, thus protecting surface water quality. A properly maintained flood plain protects the local community, as well as those downstream.

H.9 What is a Floodway?

FEMA defines a floodway as the land that contains the stream channel and that portion of the adjacent flood plain that must remain open to permit the passage of a 100-year flood. In the 1970s, the FIA conducted detailed analyses of many flood-prone waterways. The results of these studies were published in flood insurance studies. If a flood insurance study was conducted, the floodway is illustrated on the community's FEMA map. In the absence of a FEMA-defined floodway, the state defines a floodway as the area including the stream channel and 50 feet landward from the top of the stream bank on both sides of the stream channel. In addition to DCED regulations, floodways are under the jurisdiction of the DEP.

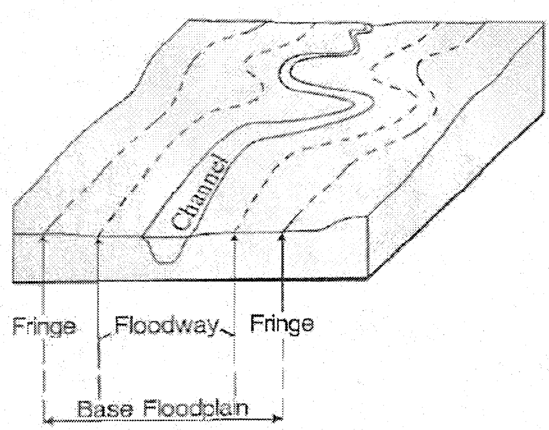


Figure 6.3 Floodway Section

H.10 Stream Buffer Survey Results

In order to assess the stream buffer requirements of the Municipalities within the study area, a stream buffer survey was prepared and forwarded to each of the Municipalities.

Table 6.4, summarizing the results of the survey, is provided below. Note that the typical stream buffer width is 50' from the top of the bank; therefore, the typical total stream buffer width is the 100' plus the width of the waterway. Most of the Municipalities requiring stream buffers required that the buffers be maintained in their natural state.

Table 6.4 Stream Buffer Survey Results

	Buffer Required?	Width from Bank	Stream Size Criteria	Shown on Subdivision	Grading Plans	Kept in Natural State	Drainage Easements used to protect waterways	Width	Shown on Subdivision	Grading Plans	Kept in Natural State
		(ft)						(ft)			
Municipality											
Fox Chapel	n						n				
Franklin Park	y	50-80		y	y	n	n	nr	y	y	n
Frazer Township	n						n				
Hampton Township	y	50	Drains over 100 Ac	n	y	y	n	50	y	n	n
Indiana Township	y	50	Has defined banks	n	n	y	y	as needed	n	n	y
McCandless	y	50	As per DEP	y	y	n	y	as needed	y	y	y
Millvale	n						y	as needed	y	y	n
O'Hara Township	y	50	Squaw Run only	y	y	y	y	20	y	n	n
Pine Township	y	50	Perennial Streams	y	y	y	y	as needed	y	y	y
Ross Township	n						y	20 Typ	y	y	y
Shaler Township	n						y	20 Typ	y	y	y
West Deer Township	y	50	Stream line on USGS	n	y	y	y	20	y	y	y

Many of the Municipalities also used drainage easements to protect waterways. The width of the protected area was typically only 20 feet.

It is important to note that stream buffer protections are not always recorded on subdivision plans and/or required for grading plans.

The criterion for when a stream buffer is required varies as noted below:

- Only for a specific stream in the Municipality
- Only for streams having a drainage area of over 100 acres (PA DEP permitting limit)
- Only for perennial streams (streams that flow all year long)
- Any waterway with defined banks
- Streams shown on USGS quad maps (as a blue line).

H.11 Stream Buffer Recommendations

In order to protect our waterways stream buffer requirements should be defined in the updated Act 167 Stormwater Ordinance. The following recommendations should be consider when drafting the ordinance.

- A minimum stream buffer width of 50’ landward in each direction from the top of stream banks should be considered for all waterways having a defined bank and having a contributing watershed area of greater than 100 acres.

- A minimum stream buffer width of 15’ landward in each direction from the centerline of the waterway should be considered for smaller waterways having a contributing watershed area of less than 100 acres and greater than 10 acres.
- The stream buffer area should be maintained in a natural state.

- Stream buffer averaging may be applied to account for encroachments such as road crossings.

- Stream buffer should be illustrated on all subdivision plans with notations requiring that they be maintained in a natural state.

- Stream buffers should be illustrated on all grading plans and properly recorded. The recording should provide a plan illustrating the stream buffer location and the requirement that it be maintained in a natural state.

Section 7.0 Priorities for Implementation of the Plan

The priorities for implementation of this plan are outlined below.

7.1 Adoption of the Plan Amendment

A. Preparation of the Draft Act 167 Plan Amendment (plan) and the corresponding Stormwater Management Ordinance (SWM ordinance) for the study area.

B. Develop a concurrence among the Municipal representatives and other stakeholders, represented by the Watershed Plan Advisory Committee, that the plan update is appropriate and will be an effective tool to further protect our watersheds.

C. Provide drafts of the plan to PA DEP so that they may provide comment prior to development of the final draft.

D. Insure that the final draft of the plan and ordinance are made available to all of the Municipalities and their Planning Commissions, so that they review and provide comments with respect to the plan and ordinance.

E. Insure that the final draft of the plan and ordinance are made available to the County and regional planning agency, so that they review and provide comments with respect to the plan and ordinance.

F. The County shall advertise and hold a public hearing on the plan prior to adoption of the plan amendment. Prior to amendment of a watershed stormwater plan, the County shall hold a public hearing pursuant to public notice of not less than two weeks. The notice shall contain a brief summary of the principle provisions of the plan, and a reference to the places within each affected Municipality where copies may be examined or purchased at cost.

G. Have the plan amendment approved by the County government. Amendment of the plan shall be by resolution carried by an affirmative vote of at least a majority of the members of the County governing body. The resolution shall refer expressly to the maps, charts, textual matter and other materials intended to form the whole or part of the official plan, or amendment thereto, and the action shall be recorded on the adopted plan, part or amendment.

H. Submit the plan as approved by the County to PA DEP for approval.

I. The adoption of the requirements contained in the approved SWM ordinance by each of the Municipalities within the study shall.

7.2 Publishing of Final Plan Documents

A. The plan and all attachments (plan) will be made available to all parties in Adobe PDF format on the plan update web page.

B. The plan will be distributed to all members of the WPAC in digital format on CD or DVD media.

7.3 Municipal Implementation of Ordinance Requirements

A. Implementation of the Water Quality Volume requirement and use of water quality BMPs.

B. Implementation of Infiltration requirements when appropriate.

C. Implementation of the Channel Protection Volume requirement through the use of extended detention.

D. Continued use of peak release rate controls to reduce post development peak runoff rates.

E. Encourage the use of non structural BMPs and low impact development methods.

F. Insure that the plan documents are made readily available to all parties; Municipalities, Municipal engineers, Municipal planners, consultants, developers and the general public.

G. Recommend that each Municipality insure that the SW reviewer understands and implements the new SWM requirements.

H. Recommend that Municipalities review their; Subdivision, Zoning, Grading, Flood Plain Management and Erosion and Sedimentation Control Ordinances, to insure they are consistent with and do not conflict with the requirements or goals of the SWM ordinance.

7.4 Maintenance of Plan Documents

A. Digital copies of all files, documents, including the GIS data base developed will be maintained by Ross Township and the North Hills Council of Governments (NHCOG), the Southwest PA Planning Commission (SPC) and the Allegheny County Department of Economic Development.

B. Digital copies of the final plan will be maintained by Ross Township and the North Hills Council of Governments (NHCOG), the Southwest PA Planning Commission (SPC) and the Allegheny County Department of Economic Development.

C. Copies of the final plan will be provided to PA DEP and made available on their web site.

Section 8.0 Review and Adoption Procedures

Act 167 contains the follow requirements with respect to the review and adoption of the Act 167 Plan Update. The following sections are reprinted from Act 167.

Section 6. Municipal and Public Participation in Watershed Planning

(a) The County shall establish, in conjunction with each watershed storm water planning program, a watershed plan advisory committee composed of at least one representative from each municipality within the watershed, the County soil and water conservation district and such other agencies or groups as are necessary and proper to carry out the purposes of the committee.

(b) Each committee shall be responsible for advising the County throughout the planning process, evaluating policy and project alternatives, coordinating the watershed storm water plans with other Municipal plans and programs, and reviewing the plan prior to adoption.

(c) Prior to adoption, each plan shall be reviewed by the official planning agency and governing body of each Municipality, the County planning commission and regional planning agencies for consistency with other plans and programs affecting the watershed. All such reviews shall be submitted to the department with the proposed plan.

Section 7. Joint Plans and Coordination of Planning.

Where a watershed includes land in more than one county, the department may require the affected counties to prepare, adopt and submit a joint plan for the entire watershed.

Section 8. Adoption and Amendment.

(a) Prior to adoption or amendment of a watershed stormwater plan, the County shall hold a public hearing pursuant to public notice of not less than two weeks. The notice shall contain a brief summary of the principle provisions of the plan, and a reference to the places within each affected Municipality where copies may be examined or purchased at cost.

(b) Adoption or amendment of the plan shall be by resolution carried by an affirmative vote of at least a majority of the members of the County governing body. The resolution shall refer expressly to the maps, charts, textual matter and other materials intended to form the whole or part of the official plan, or amendment thereto, and the action shall be recorded on the adopted plan, part or amendment.

Section 9. Review and Approval by the Department.

(a) The department shall, in consultation with the Department of Community Affairs, review all watershed storm water plans and revisions or amendments thereto. It shall approve the plan if it determines:

(1) that the plan is consistent with Municipal flood plain management plans, State programs which regulate dams, encroachments, and water obstructions, and State and Federal flood control programs; and

(2) that the plan is compatible with other watershed storm water plans for the basin in which the watershed is located, and is consistent with the policies and purposes of this act.

(b) Should the department neither approve nor disapprove a watershed plan or amendment or revision thereto within 90 days of its submission to the department, the plan or amendment or revision shall be deemed to be approved.

(c) Any person aggrieved by a final decision of the department approving or disapproving a watershed plan or amendment thereto, may appeal the decision to the Environmental Hearing Board in accordance with the provisions of section 1921>A of the act of April 9, 1929 (P.L.177, No.175), known as "The Administrative Code of 1929," and the "Administrative Agency Law." ((c) repealed in part Oct. 5, 1980, P.L.693, No.142)

Section 10. Failure to Submit Plan; Mandamus.

The department may institute an action in mandamus to compel counties to adopt and submit plans in accordance with this act. (10 repealed in part Oct. 5, 1980, P.L.693, No.!142 and repealed insofar as inconsistent Oct.!15, 1980, P.L.950, No.!164)

Section 11. Effect of Watershed Storm Water Plans.

(a) After adoption and approval of a watershed storm water plan in accordance with this act, the location, design and construction within the watershed of storm water management systems, obstructions, flood control projects, subdivisions and major land developments, highways and transportation facilities, facilities for the provision of public utility services and facilities owned or financed in whole or in part by funds from the Commonwealth shall be conducted in a manner consistent with the watershed storm water plan.

(b) 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.

Section 12. Failure of Municipalities to Adopt Implementing Ordinances.

(a) If the department finds that a municipality has failed to adopt or amend, and implement such ordinances and regulations as required by section 11, the department shall provide written notice of violation to the municipality.

(b) Within 60 days of receipt of the notice of violation, the Municipality shall report to the department the action which it is taking to comply with the requirement or regulation.

(c) If within 180 days of receipt of the notice of violation, the Municipality has failed to comply with such requirement or regulation, as determined by the department, the department shall notify the State Treasurer to withhold payment of all funds payable to the municipality from the General Fund. Provided, that prior to any withholding of funds, the department shall give both notice to the Municipality of its intention to notify the State Treasurer to withhold payment of funds and the right to appeal the decision of the department within the 180 day period following notification. The hearing shall be conducted before the Environmental Hearing Board in accordance with the provisions of the act of April 9, 1929 (P.L.177, No. 175), known as "The Administrative Code of 1929," and Chapters 5 and 7 of Title 2 (Administrative Law and Procedure), of the Pennsylvania Consolidated Statutes. If an appeal is filed within the 180 day period, funds shall not be withheld from the municipality until the appeal is decided.

(d) Any person, other than a municipality, aggrieved by an action of the department shall have the right within 30 days of receipt of notice of such action to appeal such action to the Environmental Hearing Board, pursuant to section 1921-A, act of April 9, 1929 (P.L.177, No. 175), known as "The Administrative Code of 1929," and the provisions of Chapters 5 and 7 of Title 2 (Administrative Law and Procedure) of the Pennsylvania Consolidated Statutes.

9.1 Municipal Separate Storm Sewer Systems (MS4s)

In response to the 1987 Clean Water Act Amendments, the U.S. Environmental Protection Agency (U.S. EPA) developed Phase I of the National Pollution Discharge Elimination System (NPDES) to address sources of storm water that might negatively impact water quality. Phase I required that construction sites that disturb more than 5 acres, certain industrial sites, and "medium" and "large" Municipal Separate Storm Sewer Systems (MS4s), located in incorporated places or counties with populations of 100,000, to obtain an NPDES permit.

The Storm Water Phase II final rule is the U.S. EPA's next step in protecting surface water against polluted storm water runoff. Phase II requires that construction sites that propose a land disturbance of greater than 1 acre and all MS4s located in urbanized areas that were not previously permitted now obtain an NPDES Permit.

The Pennsylvania Department of Environmental Protection (PADEP) is the permitting authority for the State. Its overall goals are that Phase II will provide a comprehensive program that designates and controls sources of storm water, addresses discharges of storm water not covered by Phase I, and promotes watershed planning to implement future water quality programs. Under the Phase II approach, operators of small MS4s will be allowed to select, when approved by the PADEP, to file a general permit, an individual permit, or a modified Phase I individual permit with a co-permittee option. The Phase II permit also requires Municipalities to submit an annual report to PADEP on the permit compliance status, monitoring data, and a summary of future activities.

Table 9.1
Summary of Initial MS4 Phase II Permit Measures and Goals

	Year 1	Year 2-5
Mapping	Complete map of all Municipal-owned outfalls	Establish priority areas for 25% of system
Ordinance	Adopt and enact	Implement and enforce
Program	*na*	Screen Priority Areas, Take corrective actions to remove illicit discharges, as needed
Education	Presentation on IDD & E Program and Ordinance during a published meeting, Distribute educational materials	Distribute educational materials

The program timeline, for the initial NPDES MS4 permit, may be extended by one year for Municipalities implementing an Act 167 Study. Since many of the components of the MS4 program fall within traditional, on-going Municipal operations, Act 167 funding reimbursement may be allowed for some of the associated MS4 program costs.

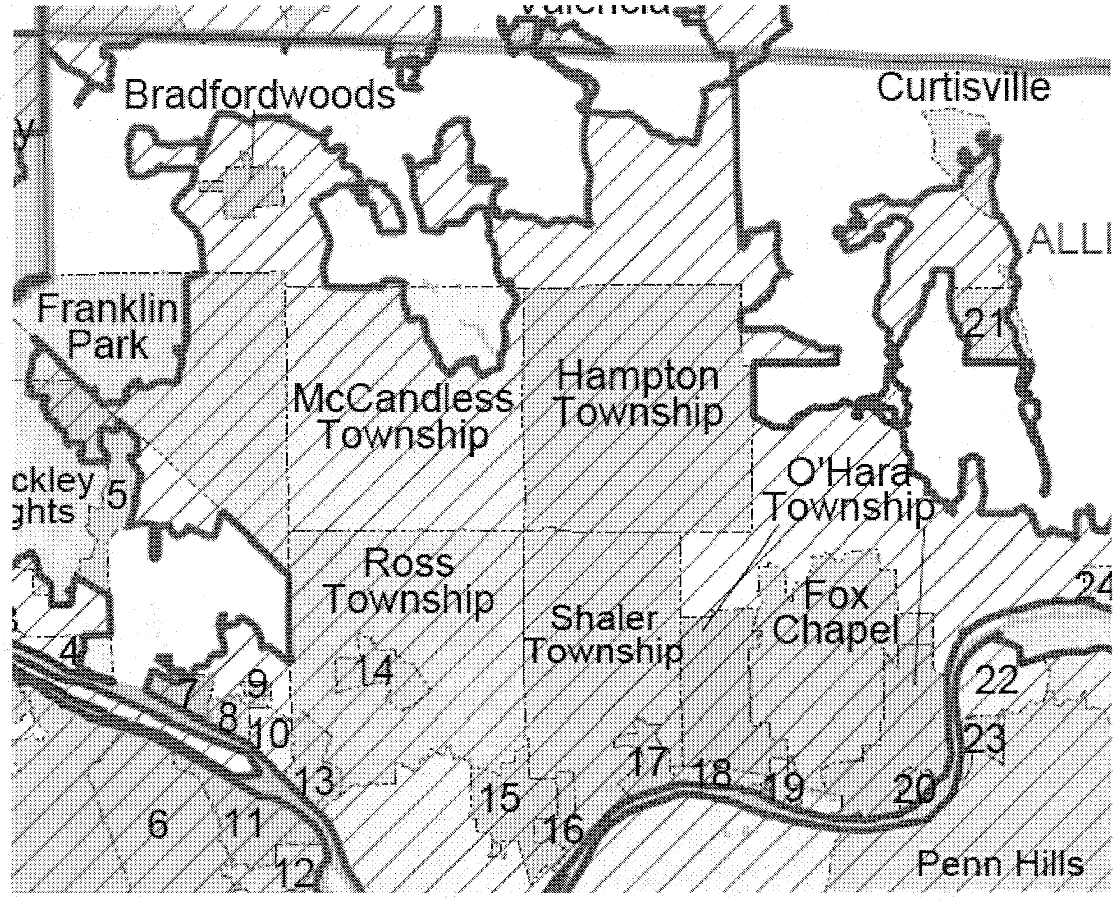


Figure 9.1 Urbanized Area Map (As Per the 2000 Census)

<u>Numbered Municipalities in Allegheny County</u>

1 - Sewickley	15 - Reserve Township	32 - Thornburg	47 - Swissvale	61 - Wall
2 - Osborne	16 - Millvale	33 - Crafton	48 - Edgewood	62 - Pitcairn
3 - Haysville	17 - Etna	34 - Rosslyn Farms	49 - Wilkinsburg	64 - Dravosburg
4 - Glenfield	18 - Sharpsburg	35 - Carnegie	50 - Rankin	65 - Glassport
5 - Sewickley Hills	19 - Aspinwall	36 - Green Tree	51 - Braddock Hills	66 - Port Vue
6 - Kennedy Township	20 - Blawnox	37 - Heidelberg	52 - Forest Hills	67 - McKeesport
7 - Emsworth	21 - Russellton	38 - Scott Township	53 - Churchill	68 - Duquesne
8 - Ben Avon	22 - Oakmont	39 - Dormont	54 - North Braddock	69 - Clairton
9 - Ben Avon Heights	23 - Verona	40 - Castle Shannon	55 - Chalfant	70 - West Elizabeth
10 - Avalon	24 - Cheswick	41 - Mount Oliver	56 - Wilkins Township	71 - Elizabeth
11 - Stowe Township	25 - Springdale	42 - Brentwood	57 - East Pittsburgh	72 - Versailles
12 - McKees Rocks	26 - Tarentum	43 - Baldwin	58 - Turtle Creek	
13 - Bellevue	27 - Brackenridge	44 - West Hollywood	59 - Wilmerding	
14 - West View	30 - Pennsbury Village	45 - Homestead	60 - East McKeesport	
15 - Reserve Township	31 - Ingram	46 - Munhall	61 - Wall	

Each of the Municipalities within the urbanized portion of Act 167 study area has chosen to meet the MS4 requirement by submitting a Notice of Intent (NOI) for the MS4 General Permit (PAG – 13) in March of 2003.

The Municipalities will be required to fulfill the terms of the PAG – 13 by following the protocols contained in the MS4 Stormwater Management Program Requirements (Protocol) provided in Appendix B. A brief overview of each of the program requirements is provided below.

Public Education and Outreach - Raise the awareness of homeowners, business owners, and developers and educate through such strategies as community websites, utility bill stuffers, or local newspapers. Several advertisements produced by the 3 Rivers Wet Weather Demonstration Program are provided in Appendix C.

Public Participation and Involvement - Involve the public with issues related to Municipal action, new ordinances, and planning projects through volunteer monitoring initiatives, engaging watershed associations, and establishing community events.

Illicit Discharge Detection and Elimination - Develop a storm sewer system map and identify all outfalls in the area. Implement a field screening program and procedures for removal of illicit discharges. The following list of test kits may be used to develop a field screening program.

- pH - Pocket Pal pH Tester Item No. 4435001
- Total Chlorine & #8209; Hach Test Strip item No. 2745050. The detection range is 0 ‑ 10mg/l.
- Total Chlorine & #8209; Hach Test Strip item No. 2793944. The detection range is 0 & #8209; 10mg/l.
- Total Copper & #8209; Hach Test Strip item No. 2745125. The detection range is 0 & #8209; mg/l.
- Phenol & #8209; Chemetrics Test Kit No. K & #8209; 8012. The detection range is 0 & #8209; 1 & 0 & #8209; 12 PPM.
- Detergents and Surfactants & #8209; Chemetrics Test Kit No. K & #8209; 9400. The detection range is 0 & #8209;3 PPM
- Or use the full Hach stormwater test kit, item No. 2481300: pH, Chlorine Total, Copper, Phenols, and Detergents (This kits includes the Pocket Pal tester)
- More specific information regarding each of these tests is available at the respective manufacturers' web site. For Hach products please visit http://www.hach.com/. For Chemetrics products please visit http://www.chemetrics.com.

Construction Site Storm Water Runoff Control - Review existing ordinances in the Municipality. Revise or enact an ordinance requiring the review and renewal of Erosion and Sediment Control Plans for any earth disturbance of one acre or more with runoff to the MS4, or five acres or more regardless of the planned runoff.

Post-construction Storm Water Management in New Development and Redevelopment - Review existing ordinances in the Municipality, including approved County watershed plans. Coordinate this review and approval with the review and approval of Construction Site Storm Water Runoff Control. Ensure long-term operation and maintenance of the BMPs.

Pollution Prevention/Good Housekeeping for Municipal Operations Maintenance - Review existing Operations and Maintenance Programs for the Municipality. Revise plans to include training and procedures related to vehicle maintenance, fueling and washing and maintenance of storm water facilities in relation to the MS4 runoff.

9.2 A Multi-Municipal Watershed Approach

Because watersheds cross municipal boundaries, in the future it would be beneficial for the urbanized Municipalities to consider a multi-municipal approach to MS4 permitting. A few of the advantages of a multi–municipal watershed approach are:

1. The DEP may allow additional time for the permit requirements to be completed.

2. The Municipalities may work with the County to apply for Act 167 funds to pay for eligible MS4 program costs.

3. A larger group could develop a more sophisticated approach to addressing the permit requirements. This may lead to the development of a customized set of protocols for the watershed that better address the permit requirements and the communities' interest.

4. The development of unified watershed progress reports as needed to address the regulatory requirements.

5. The Watershed Approach is a unified approach that brings together the stakeholders to develop a plan to address water quality problems. This approach places the focus on determining the sources of pollution in the waterways, so that solutions can be prioritized based upon their predicted ability to improve the water quality in streams and rivers. It is important to note that this approach would include and account for such things as upstream pollution, storm water runoff, and non-point source as well as CSO's and SSO's.

9.3 Act 167 - Storm Water Management Act & MS4 Compliance

(The Storm Water Management Act, Act of October 4, 1978 P.L. 864, No. 167, 32 P.S. Section 680.1 et.seq.)

The Storm Water Management (SWM) Act provides for the preparation of watershed stormwater plans by counties and implementation of such plans by municipalities. In order to provide financial assistance for the preparation and implementation of watershed stormwater plans, the General Assembly has authorized the payment of grants to counties and municipalities. Funding for such grants is limited to funds specifically appropriated for such purposes.

The Draft DEP Comprehensive Stormwater Management Policy (DEP document number 392-0300-022, 9/04/2002) recommends the integration of ACT 167 program into the NPDES MS4 permitting process.

The following Watersheds in the North Hills already have approved Act 167 SWM Plans.

- Pine Creek
- Girtys Run
- Deer Creek
- Squaw Run

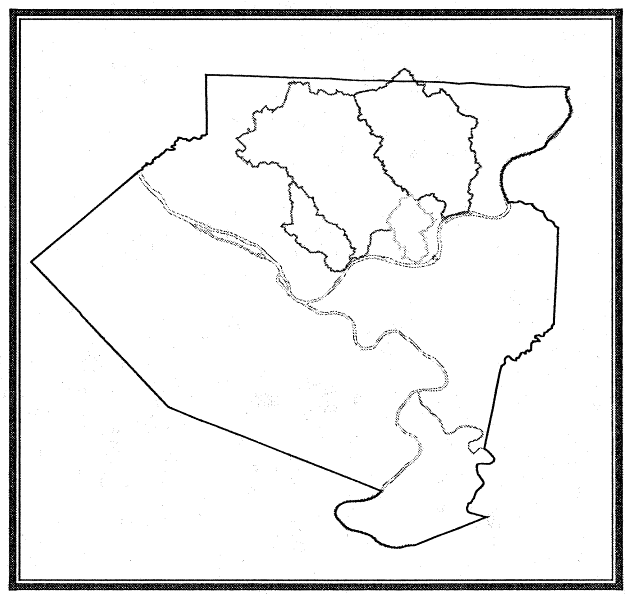
As per Act 167, these plans are to be updated every five (5) years. These plans were adopted in 1986 and were updated in 2007.

The NDPES MS4 Permits are also to be reapplied for, or administratively extended every five (5) years.

Section 10.0 Stormwater Ordinance

(See Separate PDF SW Ordinance & Ordinance Appendices Files)

Act 167 Stormwater Management Plan Update
Girtys Runs, Pine Creek, Squaw Run and Deer Creek Watersheds
Allegheny County, Pennsylvania



Report Appendices

Appendix A — **Synoptic Precipitation Analysis for the ALCOSAN Service Area**

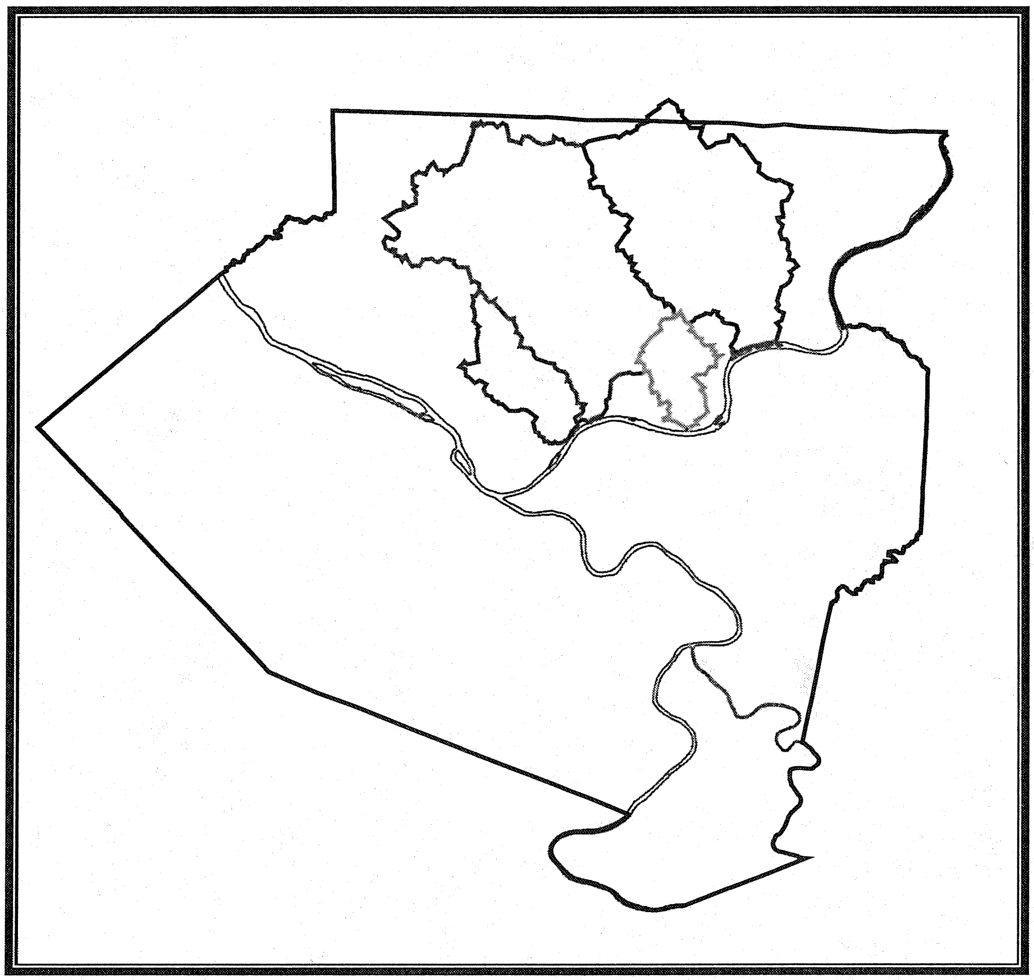
Appendix B — **MS4 PAG – 13 Stormwater Management Program Requirements**

Appendix C — **MS4 Public Education Advertisements**

Appendix D — **Matrices**
- Stormwater Management Ordinance Review Matrix
- Subdivision Ordinance Review Matrix
- Zoning Ordinance Review Matrix
- Grading Ordinance Review Matrix

Appendix E — **EPA's Aquatic Buffer Model Ordinance**

Chapter 10
Stormwater Ordinance



Act 167 Stormwater Management Plan Update
Girtys Runs, Pine Creek, Squaw Run and Deer Creek Watersheds
Allegheny County, Pennsylvania

Final Draft
June 23, 2007

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Appendices

STORMWATER MANAGEMENT

Section 1.0 Purpose

In order to protect the health, safety, and general welfare of the residents of the Municipality, as well as to protect, sustain, and enhance the surface and ground water resources of the Municipality, drainage and stormwater management practices shall be utilized as directed herein to achieve the following goals and objectives:

1.1 Accommodate site development and redevelopment in a manner that protects public safety and that is consistent with (or re-establishes) the natural hydrologic characteristics of each watershed and sustains ground water recharge, stream baseflows, stable stream channel (geomorphology) conditions, the carrying capacity of streams and their floodplains, ground water and surface water quality, and aquatic living resources and their habitats.

1.2 Reduce and minimize the volume of stormwater generated.

1.3 Protect natural infiltration and ground water recharge rates in order to sustain ground water supplies and stream baseflows.

1.4 Maintain runoff characteristics of the site after completion of development that are consistent with the carrying capacity and stable channel conditions of the receiving streams.

1.5 Protect water quality by removing and/or treating pollutants prior to discharge to ground and surface waters throughout the Municipality, and to protect, restore, and maintain the chemical, physical, and biological quality of ground and surface waters.

1.6 Protect instream channels and geomorphology conditions of the receiving streams; protect their flood carrying capacity and aquatic habitats and to reduce instream erosion and sedimentation.

1.7 Reduce flooding impacts and prevent a significant increase in surface runoff rates and volumes, predevelopment to post-development, which could worsen flooding downstream in the watershed, enlarge floodplains, erode stream banks and create other flood-related health-welfare-property losses; in general, to preserve and restore the natural flood-carrying capacity of streams and their floodplains.

1.8 Protect adjacent lands from adverse impacts of direct stormwater discharges.

1.9 Ensure effective long-term operation and maintenance of all permanent stormwater management facilities.

1.10 Maintain natural drainage patterns and encourage the use of natural drainage systems.

1.11 Treat and release stormwater as close to the source of runoff as possible using a minimum of structures and maximizing reliance on natural processes.

1.12 Maintain the existing water balance in all watersheds, subwatersheds, and streams in the Municipality, and protect and/or restore natural hydrologic characteristics and habitats wherever possible throughout the watershed systems.

1.13 Address certain requirements of the Municipal Separate Storm Sewer System (MS4) National Pollution Discharge Elimination System (NPDES) Phase II Stormwater Regulations.

1.14 Reduce the impacts of runoff from existing developed sites undergoing redevelopment while encouraging development and redevelopment in urban areas and areas designated for growth.

1.15 Meet legal water quality requirements under State law, including regulations at 25 Pa. Code Chapter 93.4a to protect and maintain "existing uses" and maintain the level of water quality to support those uses in all streams, and to protect and maintain water quality in "special protection" streams.

Section 2.0 General Provisions

2.1 Statutory Authority

Note: The applicable statutory authority in any given jurisdiction may vary. Municipalities should consult with their attorney or solicitor and edit or amend Section 2.1 Statutory Authority as deemed appropriate.

The Municipality is empowered to regulate land use activities that affect stormwater runoff by the authority of the Pennsylvania Municipalities Planning Code, Act 247, as amended, and Pennsylvania's Stormwater Management Act, Act 167, as amended. The Municipality, as a Municipal Separate Storm Sewer System under Phase II of the National Pollution Discharge Elimination System (NPDES) Storm Water Program of the Environmental Protection Agency (EPA), is empowered to regulate stormwater by the authority of the Clean Streams Law, 35 P.S.§691.1, et seq. and The Clean Water Act, 33 U.S.C.§1251, et seq.

Note: Only municipalities regulated under the PA NPDES Phase II stormwater regulations should include the references to NPDES related statutes.

2.2 Applicability

The standards contained herein shall apply to all Regulated Activities within the municipality. All local, county and State erosion and sedimentation control approvals must be in place to proceed with the Regulated Activities covered under this Ordinance.

Note: Municipalities should review their current ordinances for E&S related standards and cross-reference or incorporate those that still apply into this model. Section 2.9 contains E&S requirements for regulated earth disturbance activities.

Local stormwater management design criteria (e.g., inlet spacing, inlet type, collection system design and details, outlet structure design, culvert design and capacity, material specifications etc.) should be coordinated with the applicable Municipal Ordinances.

Note: Municipalities should review their current ordinances for stormwater related standards and cross-reference or incorporate those that still apply into this model. Section 4.3.6 contains standards for conveyance systems.

2.2.1 The following activities (Regulated Activities) shall be regulated by this Ordinance.

A. Land development and redevelopment.

B. Subdivision

C. Construction of new or additional impervious or semi-pervious surfaces (driveways, parking lots, etc.).

D. Construction of new buildings or additions to existing buildings.

E. Diversion or piping of any natural or man-made stream channel.

F. Installation of stormwater management facilities or appurtenances thereto.

G. Any Earth Disturbances or any activities that involve the alteration or development of land or removal of tree and vegetation in a manner that may affect post construction stormwater runoff.

2.2.2 Redevelopments shall conform to the requirements contained in Section 4.1.3.C, when more than a two thousand (2,000) square feet area of an existing facility is reconstructed, following the demolition, or partially demolition of the existing facility. The area determination shall be made using the footprint of the area being reconstructed, including all impervious surfaces proposed in the reconstructed area and the area of the parking lot required to support the reconstructed facility. The area of the parking lot required to support the reconstructed facility shall be determined using the Municipal Zoning Ordinance requirements for parking.

2.3 Exemptions

2.3.1 With the approval of Municipality's governing body, the following activities may be exempted from on-site stormwater runoff control. An exemption shall apply only to the requirement for on-site stormwater facilities and the preparation of a Stormwater Management Plan. All other stormwater management design elements, such as a storm sewer system, road culverts, erosion and sedimentation control, and runoff quality, shall be required. All exemption requests must be filed with the Municipal zoning officer and approved by the Municipal Engineer.

A. Activities having a Disturbed Area of less than 400 sq. ft. are exempt from the requirements of this Ordinance to implement SWM BMPs, unless the activity is found to be a significant contributor to pollution of the Waters of this Commonwealth.

B. <u>Small Project Improvement Exemption.</u> Activities having a Disturbed Area of less than five thousand (5000) square feet are exempt from the Peak Rate Control requirements of this Ordinance. These projects shall comply with the Water Quality Volume standards contained in Section 4.1.3.A and the Extended Detention requirement contained in Section 4.3.1.A. The "Single Residential Lot Standardized SWM Guidance" document provided in Appendix F was prepared to assist Applicants in meeting this requirement **for individual lots only**. The reduced site plan requirements contained in the "Single Residential Lot Standardized SWM Guidance" document shall apply.

C. Emergency Exemption. Emergency maintenance work performed for the protection of public health, safety and welfare may be exempted from the requirements of this Ordinance. A written description of the scope and extent of any emergency work performed shall be submitted to the Municipality within two (2) calendar days of the commencement of the activity. If the Municipality finds that the work is not an emergency, then the work shall cease immediately and the requirements of this Ordinance shall be addressed as applicable.

D. Maintenance Exemption. Any maintenance to an existing stormwater management system made in accordance with plans and specifications approved by the Municipal Engineer or Municipality.

E. Gardening. Use of land for gardening for home consumption.

F. Agricultural Activities. Agriculture when operated in accordance with a conservation plan, nutrient management plan or erosion and sedimentation control plan approved by the Allegheny County Conservation District, including activities such as growing crops, rotating crops, tilling of soil and grazing animals. Installation of new or expansion of existing farmsteads, animal housing, waste storage and production areas having impervious surfaces that result in a net increase in impervious surface of greater than one thousand (1,000) square feet shall be subject to the provisions of this Ordinance.

G. Forest Management. Forest management operations, which are consistent with a sound forest management plan as filed with the Municipal zoning officer and which follow the Pennsylvania Department of Environmental Protection's management practices contained in its publication "Soil Erosion and Sedimentation Control Guidelines for Forestry." Such operations are required to have an erosion and sedimentation control plan.

2.3.2 Waivers

A. The provisions of this Ordinance are the minimum standards for the protection of the public welfare.

B. If an Applicant demonstrates to the satisfaction of the County or its designee that any mandatory provision of this Ordinance is unreasonable or causes unique or undue unreasonableness or hardship as it applies to the proposed Project, or that an alternate design may result in a superior result within the context of Section 1.0, 4.1.1 and 4.1.2 of this Ordinance, the County or its designee upon obtaining the comments and recommendations of the Municipality and the Allegheny County Conservation District may grant a waiver or relief so that substantial justice may be done and the public interest is secured; provided that such waiver will not have the effect of nullifying the intent and purpose of this Ordinance.

C. The Applicant shall submit all requests for waivers in writing and shall include such requests as a part of the Application for Development, or during the plan review and approval process. The Applicant shall state in full the facts of unreasonableness or hardship on which the request is based, the provision or provisions of the Ordinance that are involved, and the minimum waiver or relief that is necessary. The Applicant shall state how the requested waiver and how the Applicant's proposal shall result in an equal or better means of complying with the intent of Section 1.0 "Purpose", 4.1.1 "Design Goals" and 4.1.2 "General Principles" of this Ordinance.

D. The Applicant shall submit all waiver requests to Allegheny County or its designee for review and approval. Copies of the waiver request shall also be submitted to the Municipality.

E. The Governing Body shall keep a written record of all actions on waiver requests.

F. The Governing Body may charge a fee for each waiver request, which shall be used to offset the administrative costs of reviewing the waiver request. The Applicant shall also agree to reimburse the Municipality, the County and the Allegheny County Conservation District for reasonable and necessary fees that may be incurred in any review of a waiver request.

G. In granting waivers, the County or its designee may impose reasonable conditions that will, in its judgment, secure substantially the objectives of the standards or requirements that are to be modified.

H. The County or its designee may grant applications for waivers when the following findings are made:

1. That the waiver shall result in an equal or better means of complying with the intent of Section 1.0, 4.1.1 and 4.1.2 of this Ordinance.
2. That the waiver is the minimum necessary to provide relief.
3. That the Applicant is not requesting a waiver based solely on cost considerations.
4. That existing off-site stormwater problems will not be exacerbated.
5. That runoff is not being diverted to a different drainage area.
6. That increased flooding or ponding on off-site properties or roadways will not occur.
7. That potential icing conditions will not occur.
8. That increase of post-development peak flow from the site will not occur and will, in fact, be reduced by the appropriate amount if the site is in a subbasin having a release rate of less than 100%.
9. There will be no increase in the of the post-development total runoff volume for all storms equal to or less than the 2 year / 24 hour storm event.
10. That adverse impact to water quality will not result.
11. That increased 100-Year Floodplain levels will not result.
12. That increased or unusual municipal maintenance expenses will not result from the waiver.
13. That the amount of stormwater generated has been minimized to the greatest extent allowed.
14. That infiltration of runoff throughout the proposed site has been provided where practicable and pre-development ground water recharge protected at a minimum.
15. That peak flow attenuation of runoff has been provided.
16. That long term operation and maintenance activities are established.
17. That no receiving streams and/or water bodies within 2000 feet downstream will be adversely impacted in flood carrying capacity, aquatic habitat, channel stability or erosion and sedimentation.

2.4 General Requirements

2.4.1 The management of stormwater on site, both during and upon completion of the disturbances associated with activities permitted under Section 2.2, shall be accomplished in accordance with the standards and criteria of this Ordinance. The design of any temporary or permanent facilities and structures and the utilization of any natural drainage systems shall be in full compliance with this article.

The intent of these design standards is to encourage environmentally sound stormwater management practices that provide necessary drainage facilities while protecting the hydrologic characteristics and water quality of the site and watershed. Developments shall be required to incorporate stormwater management controls. Stormwater management design shall blend into the natural environment and be aesthetically integrated into the site design.

2.4.2 Applicants shall refer to the Pennsylvania Storm Water Best Management Practices Manual, as amended, Pennsylvania Handbook of Best Management Practices for Developing Areas (PACD, 1998), the 2000 Maryland Stormwater Design Manual (MDE, 2000) or other appropriate references for guidance in the design of stormwater management facilities most appropriate to individual site conditions. Objectives for design are to reduce the volume of stormwater generated, infiltrate runoff at its source to the maximum extent possible, achieve water quality improvement at the source or during conveyance, and provide for peak flow attenuation. Applicants shall examine design alternatives by viewing them in a series. In addition, Applicants are strongly encouraged to use structural and nonstructural stormwater management practices that reduce or eliminate the need for detention basins.

2.4.3 All SWM design work must be completed by a Qualified Design Professional. All designs proposing the use of a SWM retention or detention facility with outlet structure(s) shall be completed by a professional engineer licensed in the state of Pennsylvania.

2.4.4 All development activity within a Special Flood Hazard Area designated by the Federal Emergency Management Agency (FEMA) shall comply with Chapter [*reference applicable local ordinance*] of the Zoning Ordinance [*i.e., local floodplain ordinance*] and this paragraph. All development shall be designed to maintain the flood carrying capacity of the floodway such that the base flood elevations are not increased, either upstream or downstream, unless an approval is received from PA DEP. The natural conveyance characteristics of the site and the receiving floodplain shall be incorporated into the stormwater management practices proposed for the site.

2.4.5 The stormwater management system shall not create an adverse impact on stormwater quantity or quality in either upstream or downstream areas. Offsite areas which discharge to or across a site proposed for development shall be addressed in the stormwater management plan prepared for the development. No stormwater management plan shall be approved until it is demonstrated that the runoff from the project shall not adversely impact downstream areas.

2.4.6 Wetlands shall not be used to meet the minimum design requirements for stormwater management or stormwater runoff quality treatment, except when used as part of a treatment train that incorporates a portion of the outer zone (filter strip) of the wetland's riparian buffer as a stormwater outfall.

2.4.7 All proposed stormwater management systems shall be designed to prevent the pollution of ground water resources by stormwater, promote safety, minimize health hazards, preserve natural features and provide infiltration and ground water recharge where appropriate. Neither submission of a plan under the provision herein nor compliance with the provisions of these Regulations shall relieve any person from responsibility for damage to any person or property otherwise imposed by law.

2.4.8 Where deemed necessary by the Municipal Engineer, or as addressed in an approved Act 167 stormwater management plan, the Applicant shall construct storm drains to handle on-site runoff; to the maximum extent permitted under the Municipalities Planning Code and Act 167, or any amendments thereto, provide on-site/off-site drainage easements; and provide for the conveyance of off-site runoff to an acceptable outlet in the same watershed.

2.4.9 Where watercourses traverse a development site, drainage easements shall be provided conforming to the line of such watercourses. The terms of the easements shall prohibit excavation, the placing of fill or structures, except as needed for roadways, driveways and walkways, or any alterations that may adversely affect the flow of stormwater within any portions of the easement, and require the establishment and protection of riparian buffers.

2.4.10 Any stormwater management facilities regulated by this Ordinance that would be located in or adjacent to Waters of the Commonwealth or wetlands shall be subject to approval by the PADEP through the Joint Permit Application process, or the General Permit Process, as required by PADEP regulations. When there is a question whether wetlands may be involved, it is the responsibility of the Applicant or his agent to demonstrate that the land in question is not classified as wetlands. Otherwise approval to work in the area shall be obtained from PADEP as determined through the jurisdictional determination process.

2.4.11 Any stormwater management facility or part thereof regulated by this Ordinance that will be located in a State or County highway right-of-way shall be subject to approval by the Pennsylvania Department of Transportation (PennDOT) or Allegheny County, as the case may be.

2.4.12 At the time of application for a building permit for any approved lot created by a subdivision and/or improved as a land development project, issuance of the permit shall be conditioned upon adherence to the terms of this Ordinance.

2.4.13 Stormwater discharges to critical areas with sensitive resources (e.g., special protection waters, cold water fisheries, recharge areas, water supply reservoirs, etc.) may be subject to additional performance criteria or may need to utilize or restrict certain stormwater management practices.

2.4.14 All regulated earth disturbance activities within the Municipality shall be designed, implemented, operated and maintained to meet the purposes of this Ordinance, through these two elements:

A. Erosion and Sediment control during the earth disturbance activities (e.g., during construction), and

B. Water quality protection measures after completion of earth disturbance activities (i.e. after construction), including operation and maintenance.

2.4.15 No regulated earth disturbance activities within the Municipality shall commence until the requirements of this Ordinance are met.

2.4.16 Post-construction water quality protection shall be addressed as required by the Stormwater Management requirements contained in this Ordinance.

2.4.17 Operations and maintenance of permanent stormwater BMPs shall be addressed as required by Section 5.0.

2.4.18 All best management practices (BMPs) used to meet the requirements of this Ordinance shall conform to the State Water Quality Requirements, and any more stringent requirements as required by the Municipality.

2.4.19 Techniques described in Appendix B (Non-Structural Stormwater Management Practices) of this Ordinance are encouraged, because they reduce the costs of complying with the requirements of this Ordinance and the State Water Quality Requirements.

2.4.20 In selecting the appropriate BMPs or combinations thereof, the Applicant shall consider the following:

A. Total contributing area.
B. Permeability and infiltration rate of the site soils.
C. Slope and depth to bedrock.
D. Seasonal high water table.
E. Proximity to building foundations and wellheads.
F. Erodibility of soils.
G. Land availability and configuration of the topography
H. Peak discharge and required volume control.
I. Stream bank erosion.
J. Efficiency of the BMPs to mitigate potential water quality problems.
K. The volume of runoff that will be effectively treated.
L. The nature of the pollutant being removed.
M. Maintenance requirements.
N. Creation/protection of aquatic and wildlife habitat.

2.4.20 Transference of runoff from one DEP designated Act 167 watershed to another shall be prohibited unless approved by the municipality.

2.5 Repealer

Any Ordinance or Ordinance provision of the Municipality inconsistent with any of the provisions of this Ordinance is hereby repealed to the extent of the inconsistency only; provided, however, that this repeal shall in no manner be construed as a waiver, release or relinquishment of the right to initiate, pursue or prosecute, as the case may be, any proceeding at law or in equity pertaining to any act done which would have constituted a violation of such prior ordinance or ordinance provision. All of said ordinance or ordinance provisions shall remain in full force and effect and are not repealed hereby as they pertain to such acts and to the processing of such plans filed prior to the effective date of this Ordinance, which are protected from the effect of intervening ordinances by Section 508(4) of the Pennsylvania Municipalities Planning Code.

2.6 Severability

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

2.7 Compatibility with Other Ordinance Requirements

Permits and approvals issued pursuant to this Ordinance shall not relieve the Applicant of the responsibility to comply with or to secure other required permits or approvals for activities regulated by any other applicable code, rule, act, statute or ordinance. This Ordinance shall not preclude the inclusion in such other permit of more stringent requirements concerning regulation of stormwater and erosion. Where a conflict exists between a provision within this Ordinance and that of the PADEP Phase II NPDES regulations, as amended, or any other ordinance of the Municipality, the more stringent requirements shall govern.

2.8 Permit Requirements by Other Government Entities

2.8.1 All regulated earth disturbance activities subject to permit requirements by DEP under regulations at 25 Pa. Code Chapter 102.

2.8.2 Work within natural drainage ways subject to permit by DEP under 25 Pa. Code Chapter 105.

2.8.3 Any stormwater management facility that would be located in or adjacent to surface waters of the Commonwealth, including wetlands, subject to permit by DEP under 25 Pa. Code Chapter 105.

2.8.4 Any stormwater management facility that would be located on a State highway right-of-way, or require access from a State highway, shall be subject to approval by the Pennsylvania Department of Transportation (PennDOT).

2.8.5 Culverts, bridges, storm sewers or any other facilities which must pass or convey flows from the tributary area and any facility which may constitute a dam subject to permit by DEP under 25 Pa. Code Chapter 105.

2.9 Erosion and Sediment Control During Regulated Earth Disturbance Activities

2.9.1 No Regulated Earth Disturbance activities within the Municipality shall commence until the Municipality receives an approval from the Conservation District of an Erosion and Sediment Control Plan for construction activities.

2.9.2 DEP has regulations that require an Erosion and Sediment Control Plan for any earth disturbance activity of 5,000 square feet or more, under 25 Pa. Code § 102.4(b).

2.9.3 In addition, under 25 Pa. Code Chapter 92, a DEP "NPDES Construction Activities" permit is required for Regulated Earth Disturbance activities.

2.9.4 Evidence of any necessary permit(s) for Regulated Earth Disturbance activities from the appropriate DEP regional office or County Conservation District must be provided to the Municipality.

2.9.5 A copy of the Erosion and Sediment Control plan and any required permits, as required by DEP regulations, shall be available at the project site at all times.

2.9.6 Additional erosion and sediment control design standards and criteria are recommended to be applied where infiltration BMPs are proposed and shall include the following.

A. Areas proposed for infiltration BMPs shall be protected from sedimentation and compaction during the construction phase to maintain maximum infiltration capacity.

B. Infiltration BMPs shall not be constructed nor receive runoff until the entire contributory drainage area to the infiltration BMP has achieved final stabilization

2.10 Prohibited Discharges and Connections

2.10.1 No person in the Municipality shall allow, or cause to allow, stormwater discharges into the Municipality's separate storm sewer system which are not composed entirely of stormwater, except (1) as provided in Subsection 2.10.5 B. below, and (2) discharges allowed under a State or Federal permit.

2.10.2 The following discharges are authorized unless they are determined to be significant contributors to pollution to the Waters of this Commonwealth:

- Discharges from fire fighting activities
- Potable water sources including dechlorinated water line and fire hydrant flushings
- Irrigation drainage
- Routine external building washdown (which does not use detergents or other compounds)
- Air conditioning condensate
- Water from individual residential car washing
- Spring water from crawl space pumps
- Uncontaminated water from foundation or from footing drains
- Flows from riparian habitats and wetlands
- Lawn watering
- Pavement wash waters where spills or leaks of toxic or hazardous materials have not occurred (unless all spill material has been removed) and where detergents are not used
- Dechlorinated swimming pool discharges
- Uncontaminated groundwater

2.10.3 In the event that the Municipality determines that any of the discharges identified in Section 2.10.2 significantly contribute to pollution of waters of the Commonwealth, or is so notified by DEP, the Municipality or PADEP will notify the responsible person to cease the discharge.

2.10.4 Nothing in this Section shall affect a discharger's responsibilities under State law.

2.10.5 The following discharges or connections are prohibited, except as provided in Section 2.10.2 above:

A. Any drain or conveyance, whether on the surface or subsurface, which allows any non-stormwater discharge including sewage, process wastewater, and wash water, to enter the separate storm sewer system, and any connections to the storm drain system from indoor drains and sinks; and

B. Any drain or conveyance connected from a commercial or industrial land use to the separate storm sewer system which has not been documented in plans, maps, or equivalent records, and approved by the Municipality.

2.10.6 Existing roof drain, underdrain and sump pump discharge should be directed to lawn area or other pervious areas. If required by the Municipality, the discharge shall be directed to a stone sump or infiltration BMP. If approved by the Municipality the discharge may also be directly connected to the storm sewer system.

2.11 Enforcement and Penalties

2.11.1 Right-of-Entry

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

2.11.2 Inspection

SWM BMPs should be inspected by the land owner/developer (including Municipality for dedicated facilities) according to the following list of frequencies:

A. Annually for the first 5 years.

B. Once every 3 years thereafter,

C. During or immediately after the cessation of a 10-year or greater storm.

2.11.3 Enforcement

A. It shall be unlawful for a person to undertake any Regulated Activity except as provided in an approved SWM Site Plan.

B. It shall be unlawful to alter or remove any control structure required by the SWM Site Plan.

C. Inspections regarding compliance with the SWM Site Plan are a responsibility of the Municipality.

2.11.4 Suspension and Revocation

A. Any approval for a Regulated Activity issued may be suspended or revoked by the Municipality for:

1. Non-compliance with or failure to implement any provision of the approval.

2. A violation of any provision of this Ordinance or any other applicable law, Ordinance, rule or regulation relating to the Regulated Activity.

3. The creation of any condition or the commission of any act during the Regulated Activity which constitutes or creates a hazard or nuisance, pollution, or which endangers the life or property of others.

B. A suspended approval may be reinstated by the Municipality when:

1. The Municipality has inspected and approved the corrections to the violations that caused the suspension.

2. The Municipality is satisfied that the violation has been corrected.

C. An approval that has been revoked by the Municipality cannot be reinstated. The Applicant may apply for a new approval under the provisions of this Ordinance.

D. Prior to revocation or suspension of a permit, if there is no immediate danger to life, public health, or property the Municipality may notify the land owner/ developer to discuss the non-compliance.

2.11.5 Penalties

A. Anyone violating the provisions of this Ordinance shall be guilty of a summary offense, and upon conviction shall be subject to a fine of not more than $1000.00 for each violation, recoverable with costs. Each day that the violation continues shall be a separate offense and penalties shall be cumulative.

B. In addition, the 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.

2.11.6 Appeals

A. Any person aggrieved by any decision of the Municipality, relevant to the provisions of this Ordinance, may appeal to the County Court Of Common Pleas in the county where the activity has taken place within thirty (30) days of the Municipality's decision.

Section 3.0 Stormwater Management Plan

For all stormwater management activities regulated by this Ordinance, the Applicant shall submit a stormwater management plan and report prepared by a Professional Engineer licensed in the Commonwealth of Pennsylvania, which shall contain, but not be limited to, the following. Final copies of all plans, specifications and reports shall also be submitted to the municipality in Adobe PDF format.

3.1 A suitable map of the watershed for any and all named streams within which the project is proposed (a United States Geological Survey quadrangle map is usually sufficient) with existing and proposed development areas presented on the map.

3.2 Suitable maps and drawings showing all existing natural and constructed drainage facilities affecting the subject property.

3.3 Hydrologic (watershed) and water feature boundaries, including all areas flowing to the proposed project, existing streams (including first order and intermittent streams), springs, lakes, ponds, or other bodies of water within the project area.

3.4 Sufficient topographical information with elevations to verify the location of all ridges, streams, etc. (two-foot contour intervals within the project's boundaries and for proposed offsite improvements; for slopes greater than fifteen percent (15%), five (5)-foot contours are acceptable).

3.5 Notes pertaining to and locations of existing standing water, areas of heavy seepage, springs, wetlands, streams, and hydrologically sensitive areas. The Chapter 93 Water Quality Standards use designation must also be provided on the plan.

3.6 General type of soils with Hydrologic Soil Group noted, estimated permeabilities in inches per hour, and location and results of all soil tests and borings (if needed).

3.7 100-year flood elevations for any Special Flood Hazard Areas on or within one hundred (100) feet of the property. For redevelopment sites, also show the ten (10) and twenty-five (25)–year flood elevations for any Special Flood Hazard Areas on or within one hundred (100) feet of the property. The source of these elevations shall also be shown on the plans.

3.8 Description of current and proposed ground cover and land use. The total area and percent impervious cover shall be noted.

3.9 A wetland delineation report for the project site with a location map identifying wetland areas if any were found.

3.10 A plan of the proposed stormwater drainage system attributable to the activity proposed, including runoff calculations, stormwater management practices to be applied both during and after development, and the expected project time schedule.

3.11 The design computations for all proposed stormwater drainage systems, including storm-drain pipes, inlets, runoff control measures and culverts, drainage channels, and other features, facilities, and stormwater management practices.

3.12 A grading plan, including all areas of disturbance of the subject activity. The total area of disturbance shall be noted in square feet and acres. Topographic contours showing the existing and proposed final contours at an interval of two (2') feet; in areas having slope of greater than 15% a five (5') contour interval may be used.

3.13 A plan of the erosion and sedimentation procedures to be utilized as required by local ordinance and State Regulations.

3.14 The effect of the project (in terms of runoff volumes and peak flows) on adjacent properties and on any other stormwater collection system that may receive runoff from the project site and specifics of how erosion and flooding impacts to adjacent properties will be avoided or otherwise mitigated.

3.15 An operation and maintenance plan consistent with the requirements of Section 5.0. Such a plan should clearly explain how the proposed facilities operate and the functions they serve.

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

3.17 A north arrow, submission date, graphic scale and revision dates as applicable shall be included on each page of all plans submitted.

3.18 Complete delineation of the flow paths used for calculating the time of concentration for the pre-developed and post-developed conditions.

3.19 Construction details sufficient to completely express the intended stormwater design components consistent with this Ordinance.

3.20 A listing of all permits required for the site providing the status of the permit application(s) and approval(s).

Section 4.0 Permanent Stormwater Management Design Standards

4.1 Design Goals, Principles and Standards

4.1.1 Design Goals

Applicants shall adhere to a holistic design process incorporating the goals listed below. The objective is to achieve post-development hydrologic conditions that are consistent with the predevelopment ground cover assumption for new development (refer to Section 4.2.2) and improve the runoff conditions for redevelopment (refer to Section 4.1.3.C). The design goals are:

A. Minimize the volume of runoff that must be collected, conveyed, treated and released by stormwater management facilities;

> *Note: Minimization of runoff generated by a proposed site is directly related to the various land use and design standards for site improvements required under the municipal zoning, and subdivision and land development ordinances. The affect that these requirements have on generating stormwater should be taken into consideration. Site design should implement runoff reduction techniques such as those described in Appendix B.*

B. Maintain the natural infiltration process and rate, and infiltrate runoff at its source when appropriate;

C. Remove and/or treat pollutants at the source or during conveyance;

D. Provide for peak flow attenuation, as needed; and

E. Attenuate runoff to protect the instream channel of the receiving stream.

4.1.2 General Principles

The following general principles apply to all applicable activities pursuant to Section 2.2.

A. Incorporate Conservation Design practices to minimize the amount of stormwater generated on a site, encourage the disconnection of impervious land cover, and maximize the use of pervious areas for stormwater treatment and on-site rainfall infiltration.

> *Note: Design standards in other sections of the municipal subdivision and land development ordinance should be evaluated for their impact on generating stormwater runoff. For example, standards for parking stall sizes, quantity of parking, roadway widths, yard and bulk area requirements for each zoning district can inadvertently work against the minimization of stormwater generated. Also, pervious areas such as recreation fields may be available for the installation of stormwater facilities thereby maximizing the use of pervious areas. A brief description of suggested site design practices is provided in Appendix B.*

B. Infiltration of surface water runoff at its source is to be a mechanism for stormwater management based on hydrologic soil group (or infiltration testing). Infiltration practices include, but are not limited to, those referenced in Section 4.3.2.A and as outlined in the publications listed in Section 4.3. Infiltration practices shall adhere to the following criteria:

1. In choosing methods of infiltration, preference shall be given to a combination of surface and subsurface infiltration methods.

2. Applicants shall first consider minimum disturbance/minimum maintenance techniques combined with site grading that distributes runoff to reduce concentration. Next, Applicants shall consider depression areas combined with subsurface infiltration practices followed by other subsurface measures, including, but not limited to, porous paving and perforated pipe storage.

3. The use of multiple infiltration features and facilities that provide for the following is encouraged:
    a. Discourage concentration of flows,
    b. Encourage disconnection of flows,
    c. Infiltrate as close to the source of runoff as possible, and
    d. Reduce visual impact.

> *Note: An example of promoting the concepts listed in 4.1.2.B.3 is choosing a design method to address runoff collected from rooftops and conveyed to the surface by downspouts. The "disconnection of flows" can be accomplished by directing the downspouts over pervious surfaces rather than impervious surfaces. This can be taken one step further by directing the downspouts into infiltration facilities close to the source of the runoff. This promotes the idea of infiltrating as close to the source of runoff as possible and discourages the concentration of flows.*

4. Where high water tables, subsurface contamination, slope stability concerns, or other site constraints preclude achieving the required infiltration volume, additional Conservation Design practices and alternative stormwater management practices should be implemented to reduce to the maximum extent practicable the total volume of stormwater released to streams. Applicant shall follow the stormwater runoff hierarchy of Section 4.3.1.A.

5. Infiltration areas should be designed to maintain any broad and even infiltration pattern which existed prior to development. Such facilities should use the natural topography and vegetation in order to blend in with the site. Infiltration designs, which do not provide this may be used if the Applicant demonstrates to the Municipality's satisfaction that alternative approaches would be more effective, more harmonious with their existing environment and as easily maintained.

6. Aboveground stormwater infiltration facilities should be as shallow as possible while still achieving the requirements of this Ordinance.

C. Water quality improvement shall be achieved in conjunction with or as part of infiltration practices. Water quality improvements shall also be provided for drainage areas not otherwise addressed by infiltration practices either at the source of runoff and/or during conveyance away from the source of runoff.

D. To reduce the need for large retention and/or detention basins designed to satisfy the peak flow attenuation and extended detention requirements, other innovative stormwater management practices located close to the source of runoff generation shall be considered, including a combination of practices (e.g., rooftop storage, open vegetated channels, bioretention, pervious pavement systems and infiltration trenches).

E. When designing stormwater management facilities to satisfy the peak flow attenuation and extended detention requirements (refer to Section 4.1.3.B.2), the effect of structural and non-structural stormwater management practices implemented as part of the overall site design may be taken into consideration when calculating total storage volume and release rates.

F. Site hydrology and natural infiltration patterns shall guide site design, construction and vegetation decisions. All channels, drainage ways, swales, natural streams and other surface water concentrations shall be considered and where possible incorporated into design decisions.

4.1.3 Minimum Performance Criteria

A. The following minimum performance standards shall apply to all applicable activities, **whether they are new development or redevelopment**, pursuant to Section 2.2.1.

1. Water quality treatment of stormwater runoff shall be provided for all discharges prior to release to a receiving water body. If a stormwater management practice does not provide water quality treatment, then water quality best management practices shall be utilized prior to the runoff entering the stormwater management practice.

2. Water quality management shall be provided through the use of structural and/or non-structural stormwater management practices. Water quality stormwater management practices shall be designed to reduce or eliminate solids, sediment, nutrients, and other potential pollutants from the site. It is presumed that a stormwater management practice complies with this requirement if it is:

    a. Designed according to the specific performance criteria outlined in the Pennsylvania Stormwater Best Management Practices Manual , or the 2000 Maryland Stormwater Design Manual (MDE, 2000), or other handbooks or manuals approved by the municipality.

    b. Constructed in accordance with all permits and approved plans and specifications; and

    c. Maintained per an approved operation and maintenance plan or agreement or, in lieu of that, in accordance with customary practices.

3. Stormwater discharges from land uses or activities with higher potential for pollutant loadings (hotspots) may require the use of specific structural stormwater management practices and pollution prevention practices. In addition, stormwater from a hotspot land use shall be provided with proper pretreatment prior to infiltration. For the purpose of this Ordinance, the sites/facilities listed in Section 4.1.3.A.4, below, are considered hotspots.

4. Certain industrial sites may be required to prepare and implement a stormwater pollution prevention plan and file notice of intent as required under the provision of the EPA Industrial Stormwater NPDES Permit Requirements. Other industrial sites storing significant quantities of chemicals/wastes should also prepare a prevention plan. Sites that are required by EPA to prepare a plan include, but are not limited to:

   a. Vehicle salvage yards and recycling facilities;
   b. Vehicle and equipment cleaning facilities;
   c. Fleet storage areas for buses, trucks etc.;
   d. Marinas (service and maintenance);
   e. Facilities that generate or store hazardous materials.

> *Note: Municipalities may add more quantifiable standards regarding the meaning of "significant quantities of chemicals/waste." For example, the 2000 International Building Code table 307.7(1) gives maximum allowable chemicals regarding hazardous materials posing a physical hazard. The PADEP spill prevention control program may also provide guidance. Additional categories of land use could be added to this list as warranted.*

5. Conveyance structures/channels shall be designed and adequately sized so as to protect the properties receiving runoff from impacts of flooding and erosion. Where necessary, and to the maximum extent permitted under the Municipalities Planning Code and Act 167, or any amendments thereto drainage easement from adjoining properties shall be obtained to ensure the drainage way and the property and shall also establish the operation and maintenance requirements for the drainage way.

6. All stormwater management practices shall have an Operation and Maintenance Plan pursuant to Section 5.3 of this Ordinance, and if to be privately owned, an enforceable Operation and Maintenance Agreement per Section 5.4 of this Ordinance to ensure the system functions as designed and to provide remedies for system failure.

> *Note: This model ordinance includes a sample operation and maintenance agreement document (refer to Appendix C). Municipalities should consult with their legal counsel on contents of any agreement prepared for operation and maintenance of stormwater management facilities. The PADEP document titled <u>Guidance on MS4 Ordinance Provisions</u>, document number 392-0300-003, dated August 2, 2003 should be consulted for further guidance.*

7. Stormwater runoff generated from development and discharged directly into a jurisdictional wetland or waters of the United States and their adjacent wetlands shall be treated by an approved stormwater management practice prior to release into a natural wetlands and shall not be used to meet the minimum design requirements for stormwater management or stormwater runoff quality treatment, except when used as part of a treatment train that incorporates a portion of the outer zone (filter strip) of the wetland's riparian buffer as a stormwater outfall. In such instances, the discharge velocity from the terminal end of a pipe or associated energy dissipation practice shall not exceed two feet per second for the two-year frequency storm event. Where

such a management strategy is used, all feasible methods shall be used to convert concentrated flow to uniform, shallow sheet flow before entering the outer zone of the wetland's riparian buffer. In addition, it shall be demonstrated that such an approach will not cause erosion.

B. The following minimum performance standards shall apply to all applicable **new development** activities, pursuant to Section 2.2.1.

1. Water quality improvement shall be achieved in conjunction with or as part of infiltration practices (if used). Water quality improvements shall also be provided for drainage areas not otherwise addressed by infiltration practices either at the source of runoff and/or during conveyance away from the source of runoff. Stormwater quality management practices shall be designed to capture and treat stormwater runoff generated by the one-inch rainfall event. Refer to Section 4.3.1.B for Water Quality Volume design standards and assumptions. Stormwater quality management practice selection, design and implementation shall be based upon appropriate reference materials, including the <u>Pennsylvania Handbook of Best Management Practices for Developing Areas</u> (PACD, 1998), (latest edition or the PA stormwater management design manual when published), or the <u>2000 Maryland Stormwater Design Manual</u> (MDE, 2000), and may include constructed wetlands, grass channels, dry swales, wet swales, filter strips, bioretention and other stormwater management practices.

2. The post development peak discharge rate shall not exceed the predevelopment peak discharge rate multiplied by the "subbasin release rate percentage" (where determined in Act 167 watersheds) for the 2-year, 10-year, 25-year, and 100-year 24-hour storm events pursuant to the predevelopment cover assumption described in Section 4.2.2. Refer to Appendix A for release rate percentages information.

3. Facilities capable of attenuating rainfall runoff shall be provided and be designed to attenuate the runoff volume from the 1-year 24-hour storm event for at least 24 hours.

4. Stormwater shall be infiltrated and/or discharged within the same drainage area of the stream receiving the runoff from the development site prior to development.

5. Structural and non-structural stormwater management practices that make best possible use of infiltration on-site shall be considered in all site designs, when appropriate.

C. The following minimum performance standards shall apply to all applicable **redevelopment** activities, pursuant to Section 2.2.2.

> *Note: The intent of Section 4.1.3.C is to accommodate redevelopment that is designed to provide improved stormwater management while recognizing that redevelopment sites have inherent physical constraints, which may make the application of the new development stormwater design parameters difficult to achieve.*

1. One of the following minimum performance standards shall be accomplished. Selection of the performance standard shall be whichever is most appropriate for the given site conditions:

    a. Reduce the total impervious cover on the site (e.g., by using pervious pavement, replacement of pavement with pervious planting areas or green roof systems) by at least twenty five percent (25%), based on a comparison of existing impervious cover to proposed impervious cover**, or**

    b. Provide facilities designed to attenuate the runoff volume from the one (1) year 24-hour post development storm event for at least 24 hours, or

    c. Provide facilities to insure that the post development peak discharge rate shall not exceed the predevelopment peak discharge rate multiplied by the "subbasin release rate percentage" (where determined in Act 167 watersheds) for the 2-year and 10-year 24-hour storm events. A predevelopment cover CN of 71 shall be assumed.

2. In addition to the minimum performance standards for redevelopment areas in Section 4.1.3.C above, water quality improvements shall be provided for drainage areas not otherwise addressed by infiltration practices either at the source of runoff and/or during conveyance away from the source of runoff. Stormwater quality management facilities shall be designed to capture and treat stormwater runoff generated by one quarter of one inch (0.25") on all pavement area (i.e. parking lots, pavements and non-covered sidewalks). Roof area may be excluded from the calculation.

4.2 Stormwater Runoff Calculation Criteria

In addition to the infiltration and water quality requirements of this Ordinance, peak flow from those activities resulting in increases in impervious surface and/or regrading and compaction shall be attenuated consistent with the following stormwater calculation methods:

4.2.1 The following design storms shall be used for analysis of the pre and post development conditions. These values are applicable to the Soil-Cover-Complex Method:

Return Period (years)	24 Hour Storm (inches)
1	1.85
2	2.35
10	3.30
25	3.91
100	4.92

The precipitation values for each frequency storm listed above (with the exception of the one-year storm) were abstracted from the precipitation frequency estimates developed by the National Oceanic and Atmospheric Administration as set forth in <u>NOAA Atlas 14, Volume 2</u> (NOAA June 2004). The NOAA data are available from the

Hydrometeorological Design Studies Center of the National Weather Service. The value for the one (1) year return period storm was not provided in Atlas 14 and was taken from the PennDOT Storm Intensity – Duration – Frequency Chart for Region 1.

The NOAA Atlas 14, volume 2 report can be accessed from the NOAA website at http://hdsc.nws.noaa.gov/hdsc/pfds/.

4.2.2 The following assumptions shall be used for runoff calculations:

A. For new development sites, the ground cover used as the **predevelopment** assumption for runoff calculations shall be as follows;

1. Wooded sites shall use a ground cover of woodland in good condition. Portions of a site having more than one viable tree of a DBH (Diameter at breast height (**DBH**) is the diameter of the tree stem 4 1/2 feet above the ground) of six (6) inches or greater per fifteen-hundred (1,500) square feet shall be considered wooded where such trees existed within ten (10) years of application. If there is evidence of logging within the ten (10) year period logged area shall be consider as woodland in good condition.

Note: The intent of Section 4.2.2.A.1 is to recognize woodland conditions and not inadvertently encourage tree harvesting.

2. Agricultural sites shall use a ground cover of pasture in good condition.

3. All other portions of a site shall use a ground cover of meadow in good condition.

4. All watershed area(s) contributing to the point of interest including off-site area shall be considered.

5. For redevelopment sites, see Section 4.1.3.C.

B. The runoff curve numbers listed in the table below shall be used in developing the runoff calculations for the ground covers noted in Section 4.2.2.A. These values are referenced from the Urban Hydrology for Small Watersheds Technical Release No. 55 (USDA, 1986). Coefficients for equivalent ground cover conditions shall be used if a runoff method other than the Soil Cover Complex Method is used.

Ground Cover	Hydrologic Soil Group Curve Numbers			
	A	B	C	D
Woodland	30	55	70	77
Meadow	30	58	71	78
Grass	39	61	74	80

C. Impervious cover shall have a curve number of 98.

D. Gravel pavement shall have a curve number of 89.

E. Average antecedent moisture conditions, or AMC II, shall be used (for the Soil Cover Complex Method only for example, TR-55, TR-20).

F. A type II distribution storm (for the Soil Cover Complex Method only for example, TR-55, TR-20).

G. For time of concentration calculations, sheet flow lengths shall not exceed 100 feet and shallow concentrated flow lengths shall not exceed 1000 feet.

F. The kinematic "n" value in the sheet flow equation should be applied as per the following table. (Values taken from TR-55)

Impervious Surfaces	0.011
Agricultural Lands	0.17
Grass, Lawn, or Open Space	0.24
Wooded Areas	0.40

4.2.3 In all plans and designs for stormwater management systems and facilities submitted to the Municipal Engineer for approval, stormwater peak discharge and runoff shall be determined through the use of the NRCS Soil Cover Complex Method as set forth in Urban Hydrology for Small Watersheds, Technical Release No. 55 (USDA, 1986), with specific attention given to antecedent moisture conditions, flood routing, time of concentration, and peak discharge specifications included therein and in Hydrology National Engineering Handbook, Section 4, (USDA, 1985) both by the U.S. Department of Agriculture, Natural Resources Conservation Service. Note that when TR-55 is used for natural system-based approaches and practices encouraged herein, calculations must be performed on a detailed small sub-area basis. Use of Technical Release No. 20 and other methods listed in Table 1 are also acceptable. The design professional's selection of a specific method shall be based on the suitability of the method for the given project site conditions with due consideration to the limitations of the method chosen. Table 1 herein summarizes the computational methods available.

Table 1
ACCEPTABLE COMPUTATION METHODOLOGIES FOR STORMWATER MANAGEMENT PLANS

METHOD	SOURCE	APPLICABILITY
TR-20 or commercial Package Based on TR-20	USDA – NRCS	When use of full model is desirable or necessary
TR-55 or Commercial Package Based on TR-55	USDA – NRCS	Applicable for plans within the model's limitations
HEC – HMS	U.S. Army Corps of Engineers	When full model is desirable or necessary
PSRM	Penn State University	When full model is desirable or necessary
VT/PSUHM	Virginia Polytechnic Institute & Penn State University	When full model is desirable or necessary
Modified Rational Method or Commercial package based on this Method	Emil Kuiching (1889)	For sites less than 20 acres
SWMM or commercial package based on SWMM	U.S. EPA	Most applicable in urban areas
Small Storm Hydrology Method (as included in SLAMM)	PV & Associates, or the website www.winslamm.com	Calculation of runoff volume from urban and suburban areas

4.2.4 A Modified Rational Method analysis may be used for drainage areas smaller than two (2) acres when permitted by the Municipal Engineer. The term "Modified Rational Method" used herein refers to a procedure for manipulation of the basic rational method techniques to reflect the fact that storms with a duration greater than the normal time of concentration for a basin will result in a larger volume of runoff even though the peak discharge is reduced. The methodology and model chosen for use shall be well documented as being appropriate for use in this region, and all relevant assumptions, methodologies, calculations and data used shall be provided to the Municipal Engineer for review. Information on the Modified Rational Method is presented in the Recommended Hydrologic Procedures for Computing Urban Runoff from Small Watersheds in Pennsylvania (PADEP, 1982).

4.2.5 Rainfall intensities used for the Modified Rational Method shall be based on the current PennDOT Storm Intensity-Duration-Frequency chart appropriate to the specific site.

4.2.6 The Rational Method (that is, Q = CIA) shall be used for calculations of the peak rate of runoff for the design of storm sewers and drainage swales but **not** for the design of stormwater management facilities where a full hydrograph is needed. The equation representing the Rational Method is comprised of the following (in English units):

Q = Peak flow rate, cubic feet per second (CFS)
C = Runoff coefficient, dependent on land use/cover
I = Design rainfall intensity, inches per hour
A = Drainage area, acres.

4.2.7 Runoff characteristics of off-site areas that drain through a proposed development shall be considered and be based on the existing conditions in the off-site area.

4.3 Standards for Stormwater Management Practices

The Pennsylvania Stormwater Best Management Practices Manual shall serve as a guide for the design of stormwater management practices. Additional design guidance may also be obtained from other related sources, including the 2000 Maryland Stormwater Design Manual, Volumes I and II (MDE, 2000), Design of Stormwater Filtering Systems (CWP, 1996), and the American Society of Civil Engineers Manual and Report on Engineering Practice, No. 87, Urban Runoff Quality Management (ASCE, 1998) for the design of stormwater runoff quality control features for site development. A list of references is provided with this Ordinance. The Water Quality Volume design measures used herein are partially based on the methodology expressed in the Maryland manual referenced above. Water Quality Volume (WQv) represents the storage needed to capture and treat the runoff from ninety percent (90%) of the average annual rainfall. Applicants are encouraged to refer to the Maryland manual for additional guidance.

Pursuant to the design options recommended in the above documents, the following standards shall be adhered to:

4.3.1 Extended Detention, Water Quality Volume, Infiltration & Nonstructural BMP Credits Criteria

The following sizing criteria shall be followed at all sites required to meet the standards of this Ordinance.

A. Extended Detention

1. Detain the 1-year, 24-hour design storm using the SCS Type II distribution. Provisions shall be made so that the 1-year storm takes a minimum of 24 hours to drain from the facility from a point where the maximum volume of water from the 1-year storm is captured. (i.e., the maximum water surface elevation is achieved in the facility). Release of water can begin at the start of the storm (i.e., the invert of the water quality orifice is at the invert of the facility). The design of the facility shall consider and minimize the chances of clogging and sedimentation potential.

2. Detention ponds shall detain the 1-year storm event and allow it to naturally infiltrate and recharge the groundwater table. All subsequent orifices for the 2, 10, 25, and 100-year storm events shall be placed above the maximum water surface elevation of the 1-year storm.

3. Flow from off-site areas must be considered as pass-through flow if it is conveyed through the BMP and should be modeled as "present condition" for the one year storm event.

4. The length of overland flow used in time of concentration (t_c) calculations is limited to no more than 100 feet for post development conditions.

5. The models TR-55 and TR-20 (or approved equivalent) can be used for determining peak discharge rates.

B. Water Quality Volume

1. Treatment of the Water Quality Volume (WQv) of stormwater prior to its release to receiving waters or water bodies shall be provided at all developments where stormwater management is required. The WQv equals the storage volume needed to capture and treat the runoff from storms of one (1) inch or less. Runoff from the first one (1) inch of rainfall transports most of the total pollutant load. The one (1) inch storm event represents 80% of the total volume of rainfall and 95% of all rainfall events that occur in a typical year in Allegheny County. Thus, capture of a one (1) inch storm is established as the criteria for calculating the WQv.

   The WQv is based on the following equation:

   $$WQv = [(P)(Rv)(A)]/12 \text{ (acre-feet)}$$

   Where:

   P = rainfall depth in inches (set to 1 inch)

Rv = volumetric runoff coefficient, 0.05 + 0.009(I) where I is percent impervious cover

A = site area (acres).

2. The formula assumes approximately five percent (5%) runoff from pervious surfaces, and ninety percent (90%) runoff from impervious surfaces. A minimum of 0.2 inches per acre of runoff volume shall be met at sites or in drainage areas that have less than fifteen percent (15%) impervious cover.

3. Drainage areas having no impervious cover and no proposed disturbance during development may be excluded from the WQv calculations. However, designers are encouraged to incorporate water quality treatment practices for these areas.

4. Stormwater Quality Treatment: The final WQv shall be treated by an acceptable stormwater management practice(s) from those described in this Section or as approved by the Municipality.

5. For new developments and redevelopments, infiltration is considered an acceptable method of satisfying part or all of the Water Quality Volume.

6. For new developments, the WQv requirements of this section shall be sized and designed in conjunction with the standards under Section 4.3.1.A.

7. As a basis for design, the following assumptions may be made:

   a. Multiple Drainage Areas: When a project contains or is divided by multiple drainage areas, the WQv volume shall be addressed for each drainage area.

   b. Offsite Drainage Areas: The WQv shall be based on the impervious cover of the proposed site. Offsite existing impervious areas may be excluded from the calculation of the water quality volume requirements.

C. Infiltration Volume

Where possible, all of the Water Quality Volume should be treated using infiltration BMPs. The following calculation shall be used to determine the minimum recharge goal for the site.

Recharge Volume (Re_v), (acre-feet) Fraction of WQ_v, depending on soil hydrologic group. $Re_v = (S)(A_i)$ Where; S = soil specific recharge factor in inches A_i = the measured impervious cover	
Hydrologic Soil Group	Soil Specific Recharge Factor (*S*)
A	*0.40 inches*
B	*0.25 inches of runoff*
C	*0.10 inches of runoff*
D	*0.05 inches of runoff*

1. Infiltrated volume may be subtracted from the total site WQ_v

2. Infiltration should not be considered for sites or areas of sites that have activities that may allow pollution to be infiltrated. For example the use of infiltration for the runoff of a service stations paved lot would not be appropriate, although roof water from the service station may be infiltrated.

3. Infiltration should only be used when in the opinion of a professional engineer it will not contribute to slope instability or cause seepage problems into basements or developed down-gradient areas.

4. If more than one hydrologic soil group is present at a site, a composite recharge volume shall be computed based upon the proportion of total site area within each hydrologic soil group.

5. All infiltration facilities shall be set back at least fifteen (15) feet from all structures with sub-grade elements (e.g., basements, foundation walls).

D. Credits for Use of Nonstructural BMPs

The developer may obtain credits for the use of nonstructural BMPs using the procedures outlined below. Examples of nonstructural credit calculations are provided in Appendix E.

<u>Volume Reduction Method #1: Natural Area Conservation</u>

A water quality volume reduction can be taken when undisturbed natural areas are conserved on a site, thereby retaining their pre-development hydrologic and water quality characteristics. Under this method, a designer would be able to subtract the conservation areas from the total site area when computing the water quality protection volume. An added benefit is that the post-development peak discharges will be smaller, and hence, water quantity control volumes will be reduced due to lower post-development curve numbers or rational formula “C” values.

Rule: Subtract conservation areas from total site area when computing water quality protection volume requirements.

<u>Criteria:</u>

• Conservation area cannot be disturbed during project construction and must be protected from sediment deposition. The conservation area shall be protected with a safety fence until construction has been completed. After construction the area shall be posted with signage indicating that it is a conservation area.

• Shall be protected by limits of disturbance clearly shown on all construction drawings

• Shall be located within an acceptable conservation easement instrument that ensures perpetual protection of the proposed area. The easement must clearly specify how the natural area vegetation shall be managed and boundaries will be marked [Note: managed turf (e.g., playgrounds, regularly maintained open areas) is not an acceptable form of vegetation management]

• Shall have a minimum contiguous area requirement of 10,000 square feet

• R_v is kept constant when calculating WQ_v

• Must be forested or have a stable, natural ground cover.

Volume Reduction Method #2: Stream Buffers

This reduction can be taken when a stream buffer effectively treats storm water runoff. Effective treatment constitutes treating runoff through overland flow in a naturally vegetated or forested buffer. Under the proposed method, a designer would be able to subtract areas draining via overland flow to the buffer from total site area when computing water quality protection volume requirements. The design of the stream buffer treatment system must use appropriate methods for conveying flows above the annual recurrence (1-yr storm) event.

Rule: Subtract areas draining via overland flow to the buffer from total site area when computing water quality protection volume requirements.

Criteria:

- The minimum undisturbed buffer width shall be 50 feet from top of bank
- The maximum contributing length shall be 150 feet for pervious surfaces and 75 feet for impervious surfaces
- The average contributing slope shall be 3% maximum unless a flow spreader is used. In no case shall the average contributing slope be greater than 10%.
- Runoff shall enter the buffer as overland sheet flow. A flow spreader can be installed to ensure this
- Buffers shall remain as naturally vegetated or forested areas and will require only routine debris removal or erosion repairs
- R_v is kept constant when calculating WQ_v
- Not applicable if overland flow filtration/groundwater recharge reduction is already being taken

Volume Reduction Method #3: Enhanced Swales

This reduction may be taken when enhanced swales are used for water quality protection. Under the proposed method, a designer would be able to subtract the areas draining to an enhanced swale from total site area when computing water quality protection volume requirements. An enhanced swale can fully meet the water quality protection volume requirements for certain kinds of low-density residential development (see Volume Reduction Method #5). An added benefit is the post-development peak discharges will likely be lower due to a longer time of concentration for the site.

Rule: Subtract the areas draining to an enhanced swale from total site area when computing water quality protection volume requirements.

<u>Criteria:</u>

- This method is typically only applicable to moderate or low density residential land uses (3 dwelling units per acre maximum)
- The maximum flow velocity for water quality design storm shall be less than or equal to 1.0 feet per second
- The minimum residence time for the water quality storm shall be 5 minutes
- The bottom width shall be a maximum of 6 feet. If a larger channel is needed use of a compound cross section is required
- The side slopes shall be 3:1 (horizontal:vertical) or flatter
- The channel slope shall be 3 percent or less
- R_v is kept constant when calculating WQ_v

<u>Volume Reduction Method #4: Overland Flow Filtration/Groundwater Recharge Zones</u>

This reduction can be taken when "overland flow filtration/infiltration zones" are incorporated into the site design to receive runoff from rooftops or other small impervious areas (e.g., driveways, small parking lots, etc). This can be achieved by grading the site to promote overland vegetative filtering or by providing infiltration or "rain garden" areas. If impervious areas are adequately disconnected, they can be deducted from total site area when computing the water quality protection volume requirements. An added benefit will be that the post-development peak discharges will likely be lower due to a longer time of concentration for the site.

Rule: If impervious areas are adequately disconnected, they can be deducted from total site area when computing the water quality protection volume requirements.

<u>Criteria:</u>

- Relatively permeable soils (hydrologic soil groups A and B) should be present
- Runoff shall not come from a designated hotspot
- The maximum contributing impervious flow path length shall be 75 feet
- Downspouts shall be at least 10 feet away from the nearest impervious surface to discourage "re-connections"
- The disconnection shall drain continuously through a vegetated channel, swale, or filter strip to the property line or structural storm water control
- The length of the "disconnection" shall be equal to or greater than the contributing length

- The entire vegetative "disconnection" shall be on a slope less than or equal to 3 percent
- The surface impervious area tributary to any one discharge location shall not exceed 5,000 square feet
- For those areas draining directly to a buffer, reduction can be obtained from either overland flow filtration *-or-* stream buffers (See Method #2)
- R_v is kept constant when calculating WQ_v

Volume Reduction Method #5: Environmentally Sensitive Large Lot Subdivisions

This reduction can be taken when a group of environmental site design techniques are applied to low and very low density residential development (e.g., 1 dwelling unit per 2 acres [du/ac] or lower). The use of this method can eliminate the need for structural storm water controls to treat water quality protection volume requirements. This method is targeted towards large lot subdivisions and will likely have limited application.

Rule: Targeted towards large lot subdivisions (e.g. 2 acre lots and greater). The requirement for structural facilities to treat the water quality protection volume may be waived.

Criteria:

For Single Lot Development:

- Total site impervious cover is less than 15%
- Lot size shall be at least two acres
- Rooftop runoff is disconnected in accordance with the criteria in Method #4
- Grass channels are used to convey runoff versus curb and gutter

For Multiple Lots:

- Total impervious cover footprint shall be less than 15% of the area
- Lot areas should be at least 2 acres, unless clustering is implemented. Open space developments should have a minimum of 25% of the site protected as natural conservation areas and shall be at least a half-acre average individual lot size
- Grass channels should be used to convey runoff versus curb and gutter (see Method #3)
- Overland flow filtration/infiltration zones should be established (see Method #4)

Note: The following sections provide minimum design standards for Stormwater Management Facilities.

4.3.2 Stormwater Infiltration Practices

A. In selecting the appropriate infiltration BMPs, the Applicant shall consider the following:

1. Permeability and infiltration rate of the site soils.
2. Slope and depth to bedrock.
3. Seasonal high water table.
4. Proximity to building foundations and well heads.
5. Erodibility of soils.
6. Land availability and topography.
7. Slope stability.
8. Effects on nearby properties and structures.

B. A detailed soils evaluation of the project site shall be performed to determine the suitability of infiltration BMPs. The evaluation shall be performed by a qualified professional, and at a minimum, address soil permeability, depth to bedrock and slope stability. The general process for designing the infiltration BMP shall be:

1. Analyze hydrologic soil groups as well as natural and man-made features within the watershed to determine general areas of suitability for infiltration BMPs.

2. Provide field testing data to determine appropriate percolation rate and/or hydraulic connectivity.

3. Design infiltration BMPs for required stormwater volume based on field-determined capacity at the level of the proposed infiltration surface.

C. Soil characteristics, as subject to the specific considerations below:

1. Infiltration BMPs are particularly appropriate in hydrologic soil groups A and B, as described in the Natural Resources Conservation Manual TR-55.

2. Low-erodibility factors ("K" factors) are preferred for the construction of basins.

3. There must be a minimum depth of 48 inches between the bottom of any facility and the seasonal high water table and/or bedrock (limiting zones), except for infiltration BMPs receiving only roof runoff which shall be placed in soils having a minimum depth of 24 inches between the bottom of the facility and the limiting zone.

4. There must be an infiltration and/or percolation rate sufficient to accept the additional stormwater load, and to drain completely as determined by field tests.

5. The infiltration system shall have positive overflow controls to prevent storage within 1 foot of the finished surface or grade.

6. Infiltration rates shall not be used the computing the storage volume of the infiltration system.

7. Surface inflows shall be designed to prevent direct discharge of sediment into the infiltration system.

D. The recharge volume provided at the site shall be directed to the most permeable hydrologic soil group available, except where other considerations apply such as in limestone geology.

E. Any infiltration BMP shall be capable of completely infiltrating the impounded water within 48 hours.

F. Extreme caution shall be exercised where infiltration is proposed in susceptible areas such as:

1. Strip mines

2. Areas where salt or chloride may be applied in deicing and other winter applications, causing groundwater pollution, since soils do little to filter these pollutants.

3. Unstable Slopes - The Applicant shall consider the effect of the proposed stormwater management techniques on any special soil conditions or geological hazards that may exist on the development site. In the event such conditions are identified on the site, the Municipal Engineer may require in-depth studies by a competent geotechnical Engineer.

G. During the period of land disturbance, runoff shall be controlled prior to entering any proposed infiltration area. Areas proposed for infiltration BMP's shall be protected from sedimentation and compaction during the construction phase, so as to maintain their maximum infiltration capacity.

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

I. Infiltration facilities shall be selected based on suitability of soils and site conditions. Acceptable infiltration facilities include, but are not limited to: filter strips or stormwater filtering systems (for example bioretention facilities, sand filters), open vegetated channels (that is, dry swales and wet swales), infiltration trenches, dry wells, infiltration basins, porous paving systems, retention basins, wet extended detention ponds, riparian corridor management, riparian forested buffers, rooftop runoff management systems, and sand filters (closed or open).

J. Where sediment transport in the stormwater runoff is anticipated to reach the infiltration system, appropriate permanent measures to prevent or collect sediment shall be installed prior to discharge to the infiltration system

K. All infiltration facilities shall be set back at least fifteen (15) feet from all structures with sub-grade elements (e.g., basements, foundation walls).

L. All infiltration facilities that serve more than one (1) lot and are considered a common facility shall have a drainage easement. The easement shall provide to the Municipality the right of access.

M. If detailed infiltration study is required, the following guidance shall be followed:

Soil evaluations shall be performed to determine the feasibility and extent to which infiltration systems can be used. The evaluation shall be performed by a qualified, licensed geologist, geotechnical/civil engineer or soil scientist and, at a minimum, address soil types, soil permeability, depth to bedrock, limitations of soils, presence/absence of carbonate geology susceptibility to subsidence and/or sinkhole formation and subgrade stability. The testing and evaluation should be completed at the preliminary design stage.

Infiltration requirements shall be based on the portions of the site that are permeable prior to disturbance and the degree to which development will reduce the permeability of the site. Permeability of the site shall be determined based on the detailed evaluations described herein. Use of stormwater management facilities to retain stormwater for infiltration should be applied to all areas where the soils evaluation indicates favorable conditions. Areas generally not favorable for infiltration shall still be provided with an appropriate water quality practice.

Soil infiltration tests shall be performed to an equivalent depth or elevation of the bottom of the proposed infiltration areas. These tests shall follow the procedures of percolation test holes as established by the Allegheny County Health Department (ACHD) for on-lot septic systems. The testing shall include a test pit and percolation test holes. The test hole shall be excavated to a depth so that the presence or absence of bedrock and/or seasonal high water table can be determined. A soil log describing the soils present in each test pit shall be performed. All test holes used for evaluating the percolation rate shall be pre-soaked in accordance with the procedures established by the ACHD. The location and number of test pits and percolation holes shall be determined based on the type(s) of stormwater management facilities being designed. Acceptability of infiltration rates shall be based on sound engineering judgment and recommended design considerations described in the design manuals listed in the references or other source material acceptable to the Municipal Engineer.

N. The following design and construction standards shall be followed when planning and constructing infiltration BMPs.

1. The lowest elevation of the infiltration area shall be at least two (2) feet above the Seasonal High Water Table and bedrock.

2. Where roof drains are designed to discharge to infiltration facilities, they shall have appropriate measures to prevent clogging by unwanted debris (for example, silt, leaves and vegetation). Such measures shall include, but are not limited to, leaf traps, gutter guards and cleanouts.

3. All infiltration facilities shall have appropriate positive overflow controls to prevent storage within one (1) foot of the finished surface or grade, unless a specific amount of surface storage away from pedestrian and vehicular traffic is provided and such areas infiltrate the stored volume within forty-eight (48) hours.

4. All infiltration facilities shall be designed to infiltrate the stored volume within forty-eight (48) hours.

5. All surface inflows shall be treated to prevent the direct discharge of sediment into the infiltration practice; accumulated sediment reduces stormwater storage capacity and ultimately clogs the infiltration mechanism.

No sand, salt or other particulate matter may be applied to a porous (pervious) surface for winter ice conditions.

6. During site construction, all infiltration practice components shall be protected from compaction due to heavy equipment operation or storage of fill or construction material. Infiltration areas shall also be protected from sedimentation. Areas that are accidentally compacted or graded shall be remediated to restore soil composition and porosity. Adequate documentation to this effect shall be submitted for review by the Municipal Engineer. All areas designated for infiltration shall not receive runoff until the contributory drainage area has achieved final stabilization.

7. The following procedures and materials shall be required during the construction of all subsurface facilities:

    a. Excavation for the infiltration facility shall be performed with equipment that will not compact the bottom of the seepage bed/trench or like facility.

    b. The bottom of the bed and/or trench shall be scarified prior to the placement of aggregate.

    c. Only clean aggregate with documented porosity, free of fines, shall be allowed.

    d. The tops and sides of all seepage beds, trenches, or like facilities shall be covered with drainage fabric. Fabric shall meet the specifications of PennDOT Publication 408, Section 735, Construction Class 1.

    e. Perforated distribution pipes connected to centralized catch basins and/or manholes with the provision for the collection of debris shall be provided in all facilities. Where perforated pipes are used to distribute stormwater to the infiltration practice, stormwater shall be distributed uniformly throughout the entire seepage bed/trench or like facility.

4.3.3 Open Vegetated Channels

A. Open Vegetated Channels are conveyance systems that are engineered to also perform as water quality and infiltration facilities. Such systems can be used for the conveyance, retention, infiltration and filtration of stormwater runoff.

B. Open Vegetated Channels primarily serve a water quality function (WQv), they also have the potential to augment infiltration. Examples of such systems include, but are not limited to: dry swales, wet swales, grass channels, and biofilters. Open Vegetated Channels are primarily applicable for land uses such as roads, highways, residential developments (dry swales only) and pervious areas.

C. Open Vegetated Channels shall be designed to meet the following minimum standards:

    1. The channel shall be designed to safely convey the ten-year frequency storm event with a freeboard of at least twelve (12) inches. Freeboard is the

difference between the elevation of the design flow in the channel and the top elevation of the channel.

2. The peak velocity of the runoff from the ten-year storm shall be non-erosive for the soil and ground cover provided in the channel.

3. The longitudinal slope shall be no greater than four percent (4%).

4. Channels shall be trapezoidal in cross section. The minimum bottom width shall be two (2) feet. The maximum bottom width shall be eight (8) feet.

5. Channels shall be designed with moderate side slopes of four (4) horizontal to one (1) vertical. Flatter side slopes may be necessary under certain circumstances.

6. The maximum allowable ponding time in the channel shall be less than 48 hours.

7. Channels (for example, dry swales) may require an underdrain in order to function and dewater.

8. Channels shall be designed to temporarily store the WQv within the system for a maximum period of 48 hours and a minimum period of one (1) hour.

9. Landscape specifications shall address the grass species, wetland plantings (if applicable), soil amendment and hydric conditions present along the channel.

10. Accumulated sediment within the channel bottom shall be removed when twenty-five (25%) of the original WQv volume has been exceeded. The channel shall be provided with a permanent concrete cleanout marker that indicates the 25% loss level.

11. Check dams along the channel length may be warranted.

12. The bottom of dry swales shall be situated at least two (2) feet above the seasonal high water table.

D. Additional design information for Open Vegetated Channels is available in Design of Stormwater Filtering Systems (CWP, 1996).

4.3.4 Retention Basins

A. Retention basins shall be designed to create a healthy ecological community with sufficient circulation of water to prevent the growth of unwanted vegetation and mosquitoes or other vectors. If circulation cannot be provided via natural means, then artificial aeration and circulation shall be provided. Care shall be taken to landscape retention basins in accordance with Section 4.4.

B. The retention basin shall be of sufficient size to allow the appropriate aquatic community needed to maintain healthy pond ecology and avoid mosquitoes capable of carrying West Nile Virus and other diseases. The Allegheny County Health Department, Pennsylvania Fish and Boat Commission, the Natural Resource Conservation Service, the Pennsylvania Extension Service, or other qualified professional consultant shall be consulted during the design of these facilities in order to ensure the health of aquatic communities and minimize the risk of creating mosquito breeding areas.

C. An outlet structure shall be designed to allow complete drainage of the pond for maintenance.

D. The design of a retention basin shall include the determination of the proposed site's ability to support a viable permanent pool. The design shall take into account such factors as the available and required rate and quality of dry weather inflow, the stormwater inflow, seasonal and longer-term variations in ground water table, and impacts of potential pollutant loadings.

E. Sediment storage volume equal to at least twenty percent (20%) of the volume of the permanent pool shall be provided.

F. A sediment forebay with a hardened bottom shall be provided at each inlet into the retention basin. The forebay storage capacity shall at minimum be ten percent (10%) of the permanent pool storage. The forebay shall be designed to allow for access by maintenance equipment for periodic cleaning. A permanent concrete cleanout maker shall be installed in the forebay to indicate the level where 25% for the forebay storage has been used.

G. Emergency spillways shall be sized and located to permit the safe passage of stormwater flows from an unattenuated 100-year post-development storm with 1 foot of freeboard. The maximum velocities in vegetated spillways excavated in otherwise undisturbed soil shall be analyzed based upon the velocity of peak flow in the emergency spillway during an assumed clogged primary outlet condition. Where maximum velocities exceed design standards contained in the Engineering Field Manual for Conservation Practices (USDA, SCS, July 1984) suitable lining shall be provided. All emergency spillways placed on fill materials shall be lined. Lining for emergency spillways shall incorporate native colors and materials where possible including mono slab revetments, grass pavers, rip rap and native stone.

H. Basin and pond embankments must be designed by a professional engineer registered in the State of Pennsylvania. The design must include an investigation of the subsurface conditions at the proposed embankment location to evaluate settlement potential, groundwater impacts, and the need for seepage controls. The submittal of a geotechnical report from a geotechnical engineer for any embankment over 10 feet in effective height or posing a significant hazard to downstream property or life is required. The selection of fill materials must be subject to approval of the design engineer. Fill must be free of frozen soil, rocks over six inches, sod, brush, stumps, tree roots, wood, or other perishable materials. Embankment fills less than 10 feet in fill height must be compacted using compaction methods that would reasonably guarantee that the fill density is at least 90% of the maximum density as determined by standard proctor (ASTM-698). All embankment fills more than 10 feet in fill height must be compacted to at least 90% of the maximum density as determined by standard proctor (ASTM-698) and must have their density verified by field density testing. A PADEP Dam permit is required for embankments having; a maximum depth of water, measured from the upstream toe of the dam to the top of the dam at maximum storage elevation, of greater than 15 feet; and or for ponds having contributory drainage area of greater than 100 acres; and or for impoundments of greater than 50 acre-feet.

I. The embankment's interior slope may not be steeper than 3:1 (3 horizontal to 1 vertical). The exterior slope of the embankment may not exceed 2:1 (2 horizontal to 1 vertical).

J. The minimum embankment width shall be 4' for embankments less than 6' in height, 6' if the embankment is between 6.1' and 9.9' in height and 8' if the embankment is between 10' and 15' in height.

K. Existing ponds or permanent pool basins can be used for stormwater management provided that it can be demonstrated that the ponds are structurally sound and meet the design requirements herein.

L. Inlet structures and outlet structures shall be separated to the greatest extent possible in order to maximize the flow path through the retention basin.

M. Retention basins shall be designed to provide a length-to-width ratio of at least 3L:1W as measured in plan view (for example, a ratio of 4L:1W is too narrow).

N. The retention basin depth shall average three (3) to six (6) feet.

O. Fencing of the facility is not required if the interior slope of the pond is 4H:1V or flatter and the design also includes a five (5') wide bench around the pond perimeter at an elevation 1' below the permanent water surface elevation.

P. Any side slopes below the permanent water surface level shall not exceed 3H:1V. Interior side slopes above the permanent water surface level shall not exceed 3H:1V.

Q. Stabilization. Proper stabilization structures, including stilling basins, energy dissipaters, and channel lining shall be constructed at the outlets of all retention basins and emergency spillways. The stabilization structures shall control water to: avoid erosion; reduce velocities of released water and direct water so that it does not interfere with downstream activities.

R. Energy dissipaters and/or level spreaders shall be installed to prevent erosion and/or initiate sheet flow at points where pipes or drainage ways discharge to or from basins. Level Spreaders shall be used only where the maximum slope between the discharge point and the waterway does not exceed five (5%) percent. Energy dissipaters shall comply with criteria in <u>Hydraulic Engineering Circular No. 15- Design for Stable Channels with Flexible Linings</u> (USDOT, FHWA, 1986) or the <u>Engineering Field Manual for Conservation Practices</u> (USDA, SCS, July 1984). Such facilities shall be both functional and harmonious with the surrounding environment; for example, native rock shall be used in constructing dissipaters where practical.

S. Discharge Points. The minimum distance between a proposed basin discharge point (including the energy dissipater, etc.) and a downstream property boundary shall in no case be less than fifteen (15) feet. Where there is discharge onto or through adjacent properties prior to release to a stream, designers shall demonstrate how downstream properties are to be protected. The Municipal Engineer may require that the setback distance be increased based upon factors such as topography, soil conditions, the size of structures, the location of structures, and discharge rates. A drainage easement may also be required.

T. Outlet Structures. Outlet structures shall meet the following specifications:

1. To minimize clogging and to facilitate cleaning and inspecting, outlet pipes shall have an internal diameter of at least fifteen (15) inches and a minimum grade of one percent (1%).

2. Anti-seep collars shall be provided on all outlet pipes within a constructed berm.

3. All principal outlet structures shall be built using reinforced concrete with watertight construction joints.

4. The use of architecturally treated concrete, stucco, painted surface or stone facade treatment shall be considered for enhancing the outlet structure. Such facilities shall be both functional and harmonious in design with the surrounding environment. .

5. Outlet pipes shall be constructed of reinforced concrete with rubber gaskets in conformance with AASHTO M170, M198 and M207, or smooth interior HDPE pipe in conformance with AASHTO M252 or M294.

6. Basin outlet structures shall have childproof non-clogging trash racks over all design openings exceeding twelve (12) inches in diameter except those openings designed to carry perennial stream flows. Periodic cleaning of debris from trash racks shall be included in the operation and maintenance plan.

7. Anti-vortex devices, consisting of a thin vertical plate normal to the basin berm, shall be provided at the top of all circular risers or standpipes.

4.3.5 Detention Basins

A. The landscape standards of Section 4.4 shall apply.

B. The maximum inside side slopes shall not exceed three (3) horizontal to one (1) vertical (3H:1V). The minimum required slope for the basin bottom is two percent (2%). A level bottom is acceptable, provided the designer demonstrates to the *Municipality's* satisfaction that the basin bottom will be landscaped with appropriate wetland vegetation pursuant to Section 4.4. In addition, Detention Basins of sufficient size and slope may serve other functions as well, including recreational uses which do not hinder or conflict with the function of the detention basin.

C. Inlet Structures. The inlet pipe invert into a basin shall be six (6) inches above the basin floor or lining so that the pipe can adequately drain after rainstorms. Inlets shall discharge into areas of the basin that slope toward the outlet structure.

D. Inlet structures and outlet structures shall be separated to the greatest extent possible in order to maximize the flow path through the retention basin.

E. Low Flow Channels. Low flow channels constructed of concrete or asphalt are not permitted. Where low flow channels are necessary, they shall be composed of a natural or bioengineered material. Low flow channels shall be designed to promote water quality and slow the rate of flow through the basin. Low flow channels may also be designed to infiltrate where practical.

F. Outlet Structures. Outlet structures shall meet the following specifications:

1. To minimize clogging and to facilitate cleaning and inspection, outlet pipes shall have an internal diameter of at least fifteen (15) inches and a minimum grade of one percent (1%).

2. Anti-seep collars shall be provided on all outlet pipes within a constructed berm.

3. All principal outlet structures shall be built using reinforced concrete with watertight construction joints.

4. The use of architecturally treated concrete, stucco, painted surface or stone facade treatment shall be considered for enhancing the outlet structure. Such facilities shall be both functional and harmonious in design with the surrounding environment.

5. Outlet pipes shall be constructed of reinforced concrete with rubber gaskets in conformance with AASHTO M170, M198 and M207, or smooth interior HDPE pipe in conformance with AASHTO M252 or M294.

6. Energy dissipation facilities that convert concentrated flow to uniform shallow sheet flow shall be used where appropriate.

7. Basin outlet structures shall have childproof non-clogging trash racks over all design opening exceeding twelve (12) inches in diameter except those openings designed to carry perennial stream flows.

8. Anti-vortex devices, consisting of a thin vertical plate normal to the basin berm, shall be provided at the top of all circular risers or standpipes.

G. Emergency spillways shall be sized and located to permit the safe passage of stormwater flows from an unattenuated 100-year post-development storm with 1 foot of freeboard. The maximum velocities in vegetated spillways excavated in otherwise undisturbed soil shall be analyzed based upon the velocity of peak flow in the emergency spillway during an assumed clogged primary outlet condition. Where maximum velocities exceed design standards contained in the <u>Engineering Field Manual for Conservation Practices</u> (USDA, SCS, July 1984) suitable lining shall be provided. In general, emergency spillways should not be located in fill areas; all such facilities placed on fill materials shall be lined. Lining for emergency spillways shall incorporate native colors and materials where possible, including mono slab revetments, grass pavers, rip rap and native stone.

H. Basin and pond embankments must be designed by a professional engineer registered in the State of Pennsylvania. The design must include an investigation of the subsurface conditions at the proposed embankment location to evaluate settlement potential, groundwater impacts, and the need for seepage controls. The submittal of a geotechnical report from a geotechnical engineer for any embankment over 10 feet in effective height or posing a significant hazard to downstream property or life is required. The selection of fill materials must be subject to approval of the design engineer. Fill must be free of frozen soil, rocks over six inches, sod, brush, stumps, tree roots, wood, or other perishable materials. Embankment fills less than 10 feet in fill height must be compacted using compaction methods that would reasonably guarantee that the fill density is at least 90% of the maximum density as determined by standard proctor (ASTM-698). All embankment fills more than 10 feet in fill height must be compacted to at least 90% of the maximum density as determined by standard proctor (ASTM-698) and must have their density verified by field density testing. A PADEP Dam permit is required for embankments having; a maximum depth of water, measured from the upstream toe of the dam to the top of the dam at maximum storage elevation, of greater than 15 feet; and or for ponds having contributory drainage area of greater than 100 acres; and or for impoundments of greater than 50 acre-feet.

I. The embankment's interior slope may not be steeper than 3:1 (3 horizontal to 1 vertical). The exterior slope of the embankment may not exceed 2:1 (2 horizontal to 1 vertical).

J. The minimum embankment width shall be 4' for embankments less than 6' in height, 6' if the embankment is between 6.1' and 9.9' in height and 8' if the embankment is between 10' and 15' in height.

K. Fencing of the facility is not required if the interior slope of the pond is 4:1 or flatter.

L. Freeboard. Freeboard is the difference between the elevation of the design flow in the emergency spillway (usually the 100 year peak elevation) and the top elevation of the settled basin embankment (that is, top of berm). The minimum freeboard shall be one (1) foot.

M. Energy dissipaters and/or level spreaders shall be installed to prevent erosion and/or initiate sheet flow at points where pipes or drainage ways discharge to or from basins. Level Spreaders shall be used only where the maximum slope between the discharge point and the waterway does not exceed five (5%) percent. Energy dissipaters shall comply with criteria in <u>Hydraulic Engineering Circular No. 15- Design for Stable Channels with Flexible Linings</u> (USDOT, FHWA, 1986) or the <u>Engineering Field Manual for Conservation Practices</u> (USDA, SCS, July 1984). Such facilities shall be both functional and attractive; for example, native rock shall be used in constructing dissipaters where practical.

N. Stabilization. Proper stabilization structures, including stilling basins, energy dissipaters, and channel lining, shall be constructed at the outlets of all basins and emergency spillways. The stabilization structures shall control water to avoid erosion, reduce velocities of released water and direct water so that it does not interfere with downstream activities.

O. Discharge Points. The minimum distance between a proposed basin discharge point (including the energy dissipater, etc.) and a downstream property boundary shall in no case be less than fifteen (15) feet. Where there is discharge onto or through adjacent properties prior to release to a stream, designers shall demonstrate how downstream properties are to be protected. The Municipal Engineer may require that the setback distance be increased based upon factors such as topography, soil conditions, the size of structures, the location of structures, and discharge rates. A drainage easement may also be required.

P. A sediment forebay with a hardened bottom shall be provided at each inlet into the detention basin. The forebay storage capacity shall at minimum be ten (10) percent of the permanent pool storage. The forebay shall be designed to allow for access by maintenance equipment for periodic cleaning.

4.3.6 Conveyance Systems (Open Channels, Drainageways, and Storm Sewers)

A. Applicants are encouraged to design conveyance systems that encourage infiltration and improve water quality wherever practicable.

B. Wherever conveyance channels are necessary, drainage shall be maintained by an open channel with landscaped banks designed to carry the 10-year, 24-hour stormwater runoff from upstream contributory areas. The Municipal Engineer may increase the design storm, as conditions require. All open channels shall be designed with one (1) foot of freeboard above the design water surface elevation of the design runoff condition.

C. Flood relief channels shall be provided and designed to convey the runoff from the 100-year, 24-hour storm, such that a positive discharge of this runoff to an adequate receiving stream or conveyance system occurs without allowing this runoff to encroach upon other properties.

D. Manholes and/or inlets shall not be spaced more than three hundred (300) feet apart for pipe sizes up to twenty-four (24) inches in diameter and not more than four hundred fifty (450) feet apart for larger pipe sizes.

E. Where drainage swales are used in lieu of or in addition to storm sewers, they shall be designed to carry the required runoff without erosion and in a manner not detrimental to the properties they cross. Drainage swales shall provide a minimum grade of two percent (2%) but shall not exceed a grade of nine percent (9%). Drainage swales used strictly for conveyance are not the same as Open Vegetated Channels. Design standards for Open Vegetated Channels are provided under Section 4.3.3 of this Ordinance.

F. Street curbing for the purpose of stormwater conveyance is discouraged. On streets that must contain curbing, storm sewers shall be placed in front of the curbing. To the greatest extent possible, storm sewers shall not be placed directly under curbing. At curbed street intersections, storm inlets shall be placed in the tangent section of the road.

G. Use of grassed swales or open vegetated swales in lieu of curbing to convey, infiltrate and/or treat stormwater runoff from roadways is encouraged. Inlets shall be placed at the center of the shoulder swale draining the street and shall be located no closer than four (4) feet from the edge of the cartway.

H. [When requested by the municipality] the developers shall obtain or grant a minimum twenty (20)-foot-wide drainage easement over all storm sewers, drainage swales, channels, etc., that are a component of the stormwater management system when located within undedicated land. All permanent detention basins and/or other stormwater management facilities providing stormwater control for other than a single residential lot shall be located within a defined drainage easement that allows proper legal access and maintenance vehicle access.

I. No property owner shall obstruct or alter the flow, location or carrying capacity of a stream, channel or drainage swale to the detriment of any other property owner, whether upstream or downstream. All subdivision and/or land development plans containing streams, channels, drainage swales, storm sewers or other conveyance systems that cross property boundaries, existing or proposed, or whose discharge crosses such boundaries shall contain a note stating the above.

J. Water Quality Inlets. Storm drainage systems that collect runoff from parking areas and/or loading areas exceeding 10,000 square feet of impervious coverage and discharge to stormwater management systems, including surface or subsurface infiltration systems, shall have a minimum of one (1) water quality inlet per each acre of drainage area. The purpose of water quality inlets is to remove oil, grease, and heavy particulates or total suspended solids, hydrocarbons and other floating substances from stormwater runoff. Methods other than water quality inlets may be permitted if the Applicant demonstrates to the Municipality's satisfaction that any such alternative will be as effective and as easily maintained. Periodic cleaning of these systems shall be addressed in the Operation and Maintenance Plan submitted to the Municipality.

Note: Municipalities may wish to expand on the types of stormwater practices listed above (only the general categories of stormwater management practices are covered in this ordinance). For example, it is recommended that sections be added on porous paving, water quality inlets, bioretention, rain barrels, and sand filters, to name a few. On the other hand, the design and construction of many stormwater management practices evolves over time and some municipalities may wish to list only the general categories for that purpose (but provide for other techniques in accordance with new design manuals, etc.). Also, riparian corridors and other native plant landscaping can provide a valuable stormwater management benefit and should be addressed but may best be implemented through a separate ordinance.

4.4 Landscaping of Stormwater Management Facilities

Stormwater management facilities shall be landscaped in accordance with the following standards.

Note: Many municipalities require that stormwater management facilities be landscaped in order to create more natural facilities that blend into the landscape. Accordingly, such landscaping can contribute to the effectiveness of the facility to hold and filter water as well. The standards listed below are an example of the type of landscaping practices that might be required. Also note that these standards relate specifically to structural facilities; other types of management strategies, including riparian buffers, constructed wetlands, etc., may need landscaping and enhancement standards as well.

4.4.1 Landscaping shall be required in and around all constructed stormwater management facilities with a minimum surface area of one thousand (1,000) square feet for the purposes of:

A. Assisting in the management of stormwater;

B. Stabilizing the soil within such facilities to minimize and control erosion;

C. Enhancing the visual appearance of such facilities; and

D. Mitigating maintenance problems commonly associated with the creation of such facilities.

4.4.2. A planting plan and planting schedule shall be submitted in accordance with the following:

A. Wet meadows including floors of stormwater management facilities.

1. Wet meadows and floors of stormwater management facilities shall be planted with non-invasive plants native to western Pennsylvania such as wildflowers and non-invasive grasses, the intent being to create a mixed meadow of such plantings, where appropriate. Selection of plantings shall be based on whether the area in question is usually well drained or permanently wet and whether the area will be used for recreation purposes. No woody plants shall be planted within the saturated zone (phreatic line) of a stormwater management practice or on a berm constructed for impounded water.

2. Seeding by drills, corrugated rollers, cyclone or drop seeders or hand seeding of such areas is preferred; however, hydroseeding followed by hydromulching can be used on wet ground and steep slopes.

3. Fertilizers, as a nutrient supplement, shall not be used unless it is documented that soil conditions warrant such use and nutrient applied does not exceed plant uptake. Soil for planting of wildflowers shall contain not less than three percent (3%) or more than ten percent (10%) organic matter, as determined by an agricultural chemist, with certification of the test before planting.

4. Seeding shall take place either between April 1 and May 15 or between September 1 and October 15. Planting areas shall be soaked to maintain a consistent level of moisture for at least four (4) to six (6) weeks after planting.

5. Once established, a single annual mowing when plants are dormant should be sufficient to maintain a wet meadow and/or floor of a stormwater management practice.

B. Wet edges that remain wet all or most of the year shall be planted with wildflowers, grasses and shrubs. Plants to be located on rims or banks, which remain dry most of the year, shall be planted with species tolerant of dry soil conditions.

C. Wooded areas

1. Where stormwater management facilities adjoin wooded areas, trees and shrubs shall be selected and planted outside the practice so as to blend with existing surroundings.

2. Plantings in such areas shall be of sufficient density to eliminate the need for mowing.

3. It is recommended that clusters of trees and shrubs be planted around stormwater management facilities but well away from outfalls and any constructed berms, where applicable, to provide for wildlife habitat, wind control and buffering and screening.

4. Vegetation shall be planted during appropriate times of the year, predominantly between late March and mid May or from early October until evidence of ground freezing, depending upon the species selected. Most deciduous trees and shrubs can be planted in either spring or fall. Evergreens are best planted in late summer or early fall.

D. Slopes

1. Where slopes are gentle, a mixture of meadow grasses and wildflowers (for wet meadows) shall be planted.

2. On steep slopes as defined by the Municipality's code of ordinances, dense spreading shrubs (shrubs tolerant of dry soils) shall be planted. Heavy mat mulch shall be used during the period of establishment.

3. No woody plant materials or trees shall be located on a constructed or natural berm acting as the impoundment structure of a stormwater management practice. Trees shall be located downstream of an impoundment berm a sufficient distance from the toe of the constructed slope to assure that the toe of the slope is outside the dripline of the species planted at maturity but in no case less than fifteen (15) feet.

E. In cases where stormwater management facilities are to be located in proximity to wetlands or waterways, the Applicant's planting plan and schedule shall consider the sensitive conditions existing therein and be modified accordingly to reflect existing flora.

F. Stormwater management facilities shall be screened in a manner which complements the existing landscape and provides sufficient access for maintenance.

4.5 Stream Buffer Requirements

Stream buffers shall be provided for new development sites as per the following requirements:

4.5.1 A minimum stream buffer width of 50 feet landward in each direction from the top of stream banks is required for all waterways having both a defined bank and a contributing watershed area of greater than 100 acres.

4.5.2 A minimum stream buffer width of 15 feet landward in each direction from the centerline of the waterway is required for smaller waterways having a contributing watershed area of less than 100 acres and greater than 10 acres.

4.5.3 The stream buffer area should be maintained in a natural state.

4.5.4 When wetland(s) extend beyond the edge of the required buffer width, the buffer shall be adjusted so that the buffer consists of the extent of the wetland plus a 25-foot zone extending beyond the wetland edge.

4.5.5 Stream buffer averaging may be applied to account for encroachments such as road crossings. The following criteria must be met in order to utilize buffer averaging on a development site:

1. Buffer averaging is required for water quality buffers that have stream crossings.

2. An overall average buffer width of at least 50 feet must be achieved within the boundaries of the property to be developed. Stream buffer corridors on adjoining properties cannot be included with buffer averaging on a separate property, even if owned by the same property owner.

3. The average width must be calculated based upon the entire length of stream bank that is located within the boundaries of the property to be developed. When calculating the buffer length, the natural stream channel should be followed.

4. Stream buffer averaging shall be applied to each side of a stream independently. If the property being developed encompasses both sides of a stream, buffer averaging can be applied to both sides of the stream, but must be applied to both sides of the stream independently.

5. The total width of the buffer shall not be less than 25 feet at any location, except at approved stream crossings. Those areas of the buffer having a minimum width of 25 feet (or less at approved stream crossings) can comprise no more than 50 percent of the buffer length.

4.5.6 Stream buffer locations and widths should be illustrated on all subdivision plans with notations requiring that they be maintained in a natural state.

4.5.7 Stream buffers should be illustrated on all grading and erosion and sedimentation control plans. The defined stream buffer location should be properly recorded. The recording should provide a plan illustrating the stream buffer location, width and the requirement that it be maintained in a natural state.

Section 5.0 Operation and Maintenance Responsibilities

5.1 General Responsibilities

5.1.1 The owner of stormwater management facilities shall be responsible for the proper operation and maintenance of those facilities during and after construction. An Operation and Maintenance Plan consistent with the requirements of Section 5.3 shall be prepared for review and approval by the Municipal Engineer and shall be executed and signed by the Municipal Engineer and Applicant.

5.1.2 The Owner of the stormwater management facilities for a tract shall be responsible for the proper installation and function of those facilities in accordance with the approved Stormwater Management Plan. All temporary soil erosion and sedimentation control measures shall be removed or converted to their permanent configuration in accordance with an approved erosion control plan. This requirement in no way precludes the authority of the Allegheny County Conservation District to determine when sufficient stabilization has occurred on a site in order to convert to the permanent stormwater management facilities.

5.1.3 Dedication and Acceptance of Stormwater Management Facilities.

A. Upon completion of construction of stormwater management facilities shown on an approved subdivision or land development plan and within ninety (90) days after approval of such construction, the Applicant shall submit a written offer of such stormwater management facilities for dedication to the Municipality. Said offer shall include a deed of dedication covering said facilities together with satisfactory proof establishing an Applicant's clear title to said property. Such documents are to be filed with the Municipal Secretary for review by the Municipal Solicitor. Deeds of dedication for stormwater management facilities may be accepted by resolution of the Municipality at a regular meeting thereof.

B. Municipality may require that stormwater management facilities remain undedicated, with operation and maintenance the responsibility of individual lot owners or a homeowners association or similar entity, or an organization capable of carrying out maintenance responsibilities.

C. Regardless of ownership, the Applicant shall submit a written offer deeding an access and/or drainage easement to Municipality pursuant to Section 5.2. Such easement shall cover the stormwater management facilities, any drainage to and from such facilities, and shall clearly permit municipal entry for inspection and/or maintenance purposes.

D. Regardless of ownership, the Applicant shall submit an actual "as built" plan to Municipality for the stormwater management facilities required per the approved Stormwater Management Plan. The "as built" plan shall show all final design specifications for all permanent stormwater management facilities including, but not limited to, pipe material and diameter, inlet, outlet and overflow elevations, 2' contours for all detention/retention basins and drainage swales and a comparison of "as-built" capacities compared to the capacities of the approved design facilities and shall be prepared and certified by a licensed professional engineer. The "as built" plan shall be based on an actual field survey performed by a licensed professional land surveyor. The surveyor shall certify as to the accuracy of the plan. The "as built" plan shall be submitted to Municipality for review by the Municipal Engineer. Any performance and/or financial securities established for the project shall include requirements for submittal of "as built" plans.

E. The "as-built" plan(s) shall be submitted to the Municipality in a digital format or formats approved by the Municipality

5.2 Ownership and Maintenance

All stormwater management facilities identified within an approved Stormwater Management Plan shall be owned and maintained by one, or a combination of, the following entities:

5.2.1 Private Ownership

A. Where individual on-lot stormwater management facilities are proposed, the subdivision and/or land development plan shall contain a note in a form satisfactory to the Municipal Solicitor designating the entity responsible for operation and maintenance of the on-lot facilities consistent with an approved Operation and Maintenance Plan and, in the event that the responsible person or entity fails to do so, granting to the Municipality the right but not the duty to enter upon the premises to repair or restore said facilities, to charge and assess the costs thereof to the owner, including a reasonable allowance for overhead, and to enforce said charges and assessments by lien upon the property. In addition, the deed for each lot shall contain a perpetual covenant binding the grantee and all successors in interest designating the responsibility for operation and maintenance of the on-lot facilities essentially in the following form:

"UNDER AND SUBJECT, nevertheless, to the following conditions and restrictions: Prior to any Earth Disturbance for which stormwater management facilities are required by the Municipality, Grantee shall construct the permanent stormwater management facilities as shown on the stormwater management plan (the "Plan") prepared by <NAME>, P.E., dated <DATE> and last revised <DATE> and approved by Municipality; thereafter, the Grantee, his heirs, executors, administrators, successors and assigns ("Owner"), at his sole cost and expense, shall operate, maintain and repair said stormwater management facilities on the lot in accordance with said Plan, so that the facilities shall at all times continue to operate and function in the same manner and capacity as they were designed. In the event of the failure of the Owner to comply with these conditions and restrictions, Municipality shall have said stormwater management facilities repaired or restored as required, and the costs thereof plus a reasonable allowance for overhead shall be assessed to the Owner; said assessment shall be a charge and a continuing lien upon the property herein. The Municipality, before it may exercise this right, shall notify the Owner by certified mail of its intention to take the aforesaid action. The notice shall set forth in what manner the Owner has neglected the operation and maintenance of or repair to the stormwater management facilities, and if the Owner fails to correct or repair the items listed in the notice from the Municipality, then and only then, may the Municipality exercise this right."

B. In addition to the above, developers of parcels with more than one (1) dwelling unit shall record in the Office of Recorder of Deeds for Allegheny County a declaration of covenants and restrictions in a form satisfactory to the Municipal Solicitor describing the responsibility for operation and maintenance of the on-lot facilities, consistent with an approved Operation and Maintenance Plan, prior to the sale of any individual lots. The terms of this covenant and restriction shall run with the land and be binding upon the initial grantees of each lot within the subdivision, his, her or their heirs, administrators, successors or assigns.

5.2.2 Homeowners or Condominium Association Ownership

Where a homeowners' association is created to own and manage common facilities, the subdivision and/or land development plan shall contain a note in a form satisfactory to the Municipal Solicitor designating the entity responsible for construction and/or maintenance of the stormwater management facilities consistent with an approved Operation and Maintenance Plan and, in the event that the responsible entity fails to do so, granting to the Municipality the right but not the duty to enter upon the premises to repair or restore said facilities, to charge and assess the costs thereof plus a reasonable allowance for overhead to each owner of property within the development and to enforce said charges and assessments by lien upon each property within the development. In addition, the developer shall record in the office of Recorder of Deeds for Allegheny County a declaration of covenants in a form satisfactory to the Municipal Solicitor setting forth the rights and responsibilities of the homeowners' association for operation and maintenance of the stormwater management facilities, prior to the sale of individual lots. The terms of this covenant and restriction shall run with the land and be binding upon the initial grantees of each lot within the subdivision, his, her or their heirs, administrators, successors and assigns.

5.2.3 Municipal Ownership

Where the Municipality has accepted an offer of dedication of the permanent stormwater management facilities, the Municipality shall be responsible for operation and maintenance. Municipal ownership notwithstanding, the Applicant is required to prepare a Stormwater Management Plan and an Operation and Maintenance Plan, as defined herein. Upon approval of the stormwater management facilities by the Municipality, the Applicant shall provide a lump sum long-term maintenance payment to the Municipality, to be reserved and used at all times by the Municipality only for costs of operation and maintenance of the dedicated facilities, as follows:

A. Long-term Maintenance Payment – the long-term maintenance payment shall be in an amount equal to the present value of operation and maintenance costs for the facilities for a ten-year period. The long-term maintenance payment shall be based on a ten-year cost estimate prepared by the Applicant's engineer and reviewed and approved by the Municipal Engineer. The amount of the payment shall include all costs of operation and maintenance which shall include but not be limited to, typical operation and maintenance costs as well as costs such as landscaping and planting, tax payments required and construction of any kind associated with the use, benefit and enjoyment of the facilities by the owners. In particular, a description of routine facility operation and day-to-day management requirements and a description of projected maintenance actions and schedules necessary to ensure proper operation of stormwater management facilities shall be submitted for review and approval to the Municipal Engineer.

B. Documentation. The terms of the long-term maintenance payment shall be documented as part of the Stormwater Management Plan and the Operation and Maintenance Plan.

5.3 Operation and Maintenance Plan

An Operation and Maintenance Plan shall be prepared by an engineer licensed to practice in the Commonwealth of Pennsylvania that identifies the ownership, operation and maintenance responsibilities and as-built conditions for all stormwater management facilities. At a minimum, the Operation and Maintenance Plan shall include the following:

5.3.1. Any obligations concerning perpetuation and/or maintenance of natural drainage or infiltration facilities, and other facilities identified within the Stormwater Management Plan. Ownership of and responsibility for operation and maintenance of stormwater management facilities, including names and contact information, shall be required.

5.3.2. A description of the permanent stormwater management facilities on the site, explaining how each facility is intended to function and operate over time. All drainage and access easements shall be depicted and any site restrictions to be recorded against the property shall be identified on the recorded plan. All such easements and restrictions shall be perfected to run with the land and be binding upon the landowner and any successors in interest.

5.3.3. A description of the actions, budget and schedule for operating and maintaining the stormwater management facilities. This description should be written in a clear manner, consistent with the knowledge and understanding of the intended user.

5.3.4. A general description of operation and maintenance activities and responsibilities for facilities held in common or on-lot, including but not limited to, lawn care, vegetation maintenance, clean out of accumulated debris and sediment (including from grates, trash racks, inlets, etc.), liability insurance, maintenance and repair of stormwater management facilities, landscaping and planting, payment of taxes and construction of any kind associated with the use, benefit and enjoyment of the facilities by the owners. In particular, a description of routine facility operation and day-to-day management requirements (as needed) and a description of routine maintenance actions and schedules necessary to ensure proper operation of stormwater management facilities shall be submitted.

5.3.5. Assurances that no action will be taken by any lot owner to disrupt or in any way impair the effectiveness of any stormwater management system, setting forth in deed restrictions the ability of the Municipality to take corrective measures if it is determined at any time that stipulated permanent stormwater management facilities have been eliminated, altered, or improperly maintained, including the ability of the Municipality to cause the work to be done and lien all costs plus a reasonable overhead allowance against the property should the required corrective measures not be taken by the lot owner, following written notification, within a period of time set by Municipal Engineer.

5.3.6 Parties responsible for the long term operation and maintenance of stormwater management facilities shall make records of the installation and of all maintenance and repairs, and shall retain the records for at least ten (10) years. These records shall be submitted to the Municipality as established by the Operation and Maintenance Plan or if otherwise required by the Municipality.

5.4 Operations and Maintenance Agreement

5.4.1 The owner of any land upon which permanent stormwater management facilities and/or BMPs will be placed, constructed or implemented, as described in an approved Stormwater Management Plan and the Operations and Maintenance Plan, shall record the following documents in the Office of the Recorder of Deeds for Allegheny County, within 15 days of approval of the Operations and Maintenance Plan by the Municipality:

A. The Operations and Maintenance Plan, or a summary thereof,

B. Operations and Maintenance Agreement, and

C. Access and/or drainage Easements.

5.4.2 The Operation and Maintenance Agreement shall be substantially the same as the sample agreement in Appendix C of this Ordinance.

5.4.3 Other items or conditions may be included in the Operation and Maintenance Agreement where determined necessary to guarantee the satisfactory operation and maintenance of all permanent stormwater facilities and BMPs. The agreement shall be subject to the review and approval of the Municipality.

5.4.4 The Municipality may suspend or revoke any approvals granted for the project site upon discovery of the failure of the owner to comply with Section 5 of this Ordinance.

The following Section 5.5 the Special Stormwater Facility Maintenance Fund is optional.

Several municipalities in the study area currently use this type of fund and requested that the Stormwater Facilities Fund language from the existing Act 167 SWM Ordinance be considered for inclusion in the model ordinance. The pervious sections of this ordinance have already stated that one of the options for maintaining private BMPs is to require that they be maintained by the facility owner with the municipality having the right to complete repairs and receive compensation if the facility owner fails to do so. Additionally, this section as currently written would require ***every*** *homeowner who installs an on-lot BMP to pay into the fund. It is recommended that significant review be done to revise this language if this Section is to be included in the local SWM ordinance. Alternately, municipalities may choose to delete Section 5.5.*

5.5 Special Stormwater Facility Maintenance Fund (Optional)

5.5.1 Persons installing storm water storage facilities will be required to pay a specified amount to the Municipal Stormwater Facility Maintenance Fund if one exists to help defray costs of periodic inspections and annual maintenance expenses. The amount of the deposit shall be determined as follows:

5.5.1.1 If the storage facilities are to be privately owned and maintained, the deposit shall cover the cost of periodic inspections performed by the Municipality for a period of ten (10) years, as estimated by the Municipal Engineer. After that period of time, inspections will be performed at the expense of the Municipality.

5.5.1.2 If the storage facilities are to be owned and maintained by the Municipality, the deposit shall cover the estimated annual costs for maintenance and inspections for ten (10) years. The Municipal Engineer will establish the estimated annual maintenance costs utilizing information submitted by the applicant.

5.5.1.3 The amount of the deposit to Maintenance Fund, covering annual inspection and maintenance costs, shall be converted to present worth of the annual series values.

The Municipal Engineer or Manager shall determine the present worth equivalents which shall be subject to the final approval of the Governing Body.

5.5.1.4 If a storage facility is proposed, which also serves as a recreation facility such as a lake or ballfield, the Municipality may reduce or waive the amount of the maintenance fund deposit based on the value of the land for public recreational purposes.

5.5.2 If any storage facility (whether publicly or privately owned) is subsequently eliminated due to the installation of storm sewers or another storage facility (e.g., a distributed storage facility), the unused portion of Maintenance Fund may be applied to the cost of abandoning the facility and connecting to the storm sewer system or other facility. Any amount of the deposit remaining after the costs of abandonment are paid will be returned to the depositor.

Section 6 Plan Submission, Review and Review Fees

6.1 Plan Submission- the Municipality shall require receipt of a complete plan, as specified in this Ordinance.

6.1.1 Six (6) copies of the Stormwater Management Plan shall be submitted and distributed as follows:

B. Two (2) copies to the Municipality accompanied by the requisite Municipal Review Fee as established by the Municipality.

C. Two (2) copies to the County Conservation District.

D. One (1) copy to the Municipal Engineer.

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

6.2 Review

6.2.1 The Municipal Engineer shall review the Stormwater Management Plan for consistency with the Stormwater Ordinance. Any Stormwater Management Plan found incomplete shall not be accepted for review and shall be returned to the Applicant.

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

6.2.3 When required by regulation, the County Conservation District shall review and approve the Erosion & Sedimentation Control Plan for consistency with PADEP's Chapter 102 regulations.

6.2.4 For activities regulated by this Ordinance, the Municipal Engineer shall notify the Applicant and the Municipality, whether the Stormwater Management Plan is consistent with the Ordinance.

B. Should the Stormwater Management Plan be determined to be consistent with the Stormwater Management Plan, the Municipal Engineer shall forward an approval letter to the Municipal Secretary who will then forward a copy to the Applicant.

C. Should the Stormwater Management Plan be determined to be inconsistent with the Stormwater Management Plan, the Municipal Engineer shall forward a disapproval letter to the Municipal Secretary who will then forward a copy to the Applicant. The disapproval letter shall cite the reason(s) and specific Ordinance sections for the disapproval. Disapproval may be due to inadequate information to make a reasonable judgment as to compliance with the stormwater management plan. Any disapproved Stormwater Management Plans may be revised by the Applicant and resubmitted consistent with this Ordinance.

6.2.5 For Regulated Activities specified in Section 2.0 of this Ordinance, which require a building permit, the Municipal Engineer shall notify the Municipal Building Permit Officer in writing, within a time frame consistent with the Municipal Building Code and/or Municipal Subdivision Ordinance, whether the Stormwater Management Plan is consistent with the Stormwater Management Plan and forward a copy of the approval/disapproval letter to the Applicant. Any disapproved Stormwater Management plan may be revised by the Applicant and resubmitted consistent with this Ordinance.

6.2.6 For regulated activities under this Ordinance that require an NPDES Permit Application, the Applicant shall forward a copy of the Municipal Engineer's letter stating that the Stormwater Management Plan is consistent with the stormwater management plan to the County Conservation District. PADEP and the County Conservation District may consider the Municipal Engineer's review comments in determining whether to issue a permit.

6.2.7 The Municipality shall not grant preliminary or final approval to any subdivision or land development for Regulated Activities specified in Section 2.0 of this Ordinance if the Stormwater Management Plan has been found to be inconsistent with the Stormwater Management Plan, as determined by the Municipal Engineer. All required permits from PADEP must be obtained prior to approval of any subdivision or land development.

6.2.8 No building permits shall be issued for any Regulated Activity specified in Section 2.0 of this Ordinance if the Stormwater Management Plan has been found to be inconsistent with the Stormwater Management Plan, as determined by the Municipal Engineer, or without considering the comments of the Municipal Engineer. All required permits from PADEP must be obtained prior to issuance of a building permit.

6.2.9 The Applicant shall be responsible for completing record drawings of all stormwater management facilities included in the approved Stormwater Management Plan. The record drawings and an explanation of any discrepancies with the design plans shall be submitted to the Municipal Engineer for final approval. In no case shall the Municipality approve the record drawings until the Municipality receives a copy of an approved Declaration of Adequacy and/or Highway Occupancy Permit from the PennDOT District Office, NPDES Permit, and any other applicable permits or approvals, from PADEP or the County Conservation District. The above permits and approvals must be based on the record drawings.

6.2.10 The Municipality's approval of a Stormwater Management Plan shall be valid for a period not to exceed five (5) years commencing on the date that the Municipality approves the Stormwater Management Plan. If stormwater management facilities included in the approved Stormwater Management plan have not been constructed, or if constructed and record drawings of these facilities have not been approved within this time period, then the Municipality may consider the Stormwater Management Plan disapproved and may revoke any and all permits. Stormwater Management Plans that are considered disapproved by the Municipality shall be resubmitted in accordance with Section 6.4 of this Ordinance.

6.3 Modification of Plans

6.3.1 A modification to a Stormwater Management Plan under review by the municipality for a development site that involves a change in stormwater management facilities or techniques, or that involves the relocation or re-design of stormwater management facilities, or that is necessary because soil or other conditions are not as stated on the Stormwater Management Plan as determined by the Municipal Engineer, shall require a resubmission of a modified Stormwater Management Plan consistent with this Ordinance and shall be subject to review as specified in Section 6 of this Ordinance.

6.4 Resubmission of Disapproved Stormwater Plans

6.4.1 A disapproved Stormwater Management Plan may be resubmitted; with the revisions addressing the Municipal Engineer's concerns documented in writing, and addressed to the Municipal Secretary in accordance with Section 6 of this Ordinance and distributed accordingly and shall be subject to review as specified in Section 6 of this Ordinance. Any applicable Municipal Review and Inspection Fee must accompany a resubmission of a disapproved Stormwater Management Plan.

6.5 Municipal Stormwater Plan Review and Inspection Fees

6.5.1 Fees may be established from time-to-time by the Municipality in accordance with applicable laws to defray plan review and construction inspection costs incurred by the Municipality. All fees shall be paid by the Applicant at the time of Stormwater Management Plan submission.

6.5.2 Any fees established pursuant to this Ordinance may include, but not necessarily be limited to, any of the following:

A. Administrative costs.
B. The review of the Stormwater Management Plan by the Municipality, County (if applicable), Allegheny County Conservation District (if applicable) and the Municipal Engineer.
C. The site inspections.
D. The inspection of stormwater management facilities and Stormwater Management improvements during construction.
E. The final inspection upon completion of the stormwater management facilities.
F. Any additional work required to enforce any permit provisions regulated by this Ordinance, correct violations, and assure proper completion of stipulated remedial actions.

Section 7.0 Definitions

Note: The following definitions are absolutely necessary in supporting this model ordinance. Municipalities may have some of these terms already defined in current ordinances for other purposes outside the scope of this model ordinance. Overlapping of defined terms must be addressed so there is no ambiguity in how a term is defined.

Additional terms, which are typically defined in most municipal ordinances, (for example, land development, subdivision, Applicant, owner, floodplain, riparian buffer) are not included here but are still applicable to this model ordinance. The municipality and their solicitor should review this model ordinance in the context of the other local ordinances for applicability and cross-referencing. Modifications to those existing definitions may be appropriate.

AASHTO - American Association of State Highway & Transportation Officials. The web site home page for ASHTO is http://transportation1.org/aashtonew/

ACT 167 - The Storm Water Management Act (Act of October 4, 1978, P.L. 864 No. 167; 32 P.S. §680.1-680.17, as amended).

ACT 167 Plan (or watershed plan) - The plan for managing stormwater runoff throughout a designated watershed adopted by Allegheny County as required by the Pennsylvania Storm Water Management Act.

Agricultural Activity - The work of producing crops including tillage, land clearing, plowing, disking, harrowing, planting, harvesting crops, or pasturing and raising of livestock and installation of conservation measures. Construction of new buildings or impervious area is not considered an Agricultural Activity.

Applicant - A landowner, developer or other person who has filed an application for approval to engage in any Regulated Earth Disturbance activity at a project site in the Municipality.

Attenuate – To reduce the magnitude of the flow rate by increasing the time it takes to release a specified volume of runoff (for example the 1 year, 24 hour storm event). Attenuation is a method of reducing the peak flow rates for post development compared to the peak flow rates in predevelopment.

Aquifer - A geologic formation, group of formations, or part of a formation that contains sufficient saturated, permeable material to yield useful quantities of ground water to wells and springs.

Baseflow – Portion of stream discharge derived from ground water; the sustained discharge that does not result from direct runoff or from water diversions, reservoir releases, piped discharges, or other human activities.

Best Management Practice (BMP) – Methods, measures or practices and facilities to prevent or reduce surface runoff and/or water pollution, including but not limited to, structural and non-structural stormwater management practices and facilities and operation and maintenance procedures.

ACCD – Allegheny County Conservation District

ACHD – Allegheny County Health Department

CFS – Cubic Feet per Second.

Channel - A natural or artificial watercourse that conveys, continuously or periodically, flowing water.

Conservation Design - A series of holistic land development design practices that maximize protection of key land and environmental resources, preserve significant concentrations of open space and greenways, evaluate and maintain site hydrology, and ensure flexibility in development design to meet community needs for complementary and aesthetically pleasing development. Conservation Design encompasses the following objectives: conservation/enhancement of natural resources, wildlife habitat, biodiversity corridors and greenways (interconnected open space); minimization of environmental impact resulting from a change in land use (minimum disturbance, minimum maintenance); maintenance of a balanced water budget by making use of site characteristics and infiltration; incorporation of unique natural, scenic and historic site features into the configuration of the development; preservation of the integral characteristics of the site as viewed from adjoining roads; and reduction in maintenance required for stormwater management practices. Such objectives can be met on a site through an integrated development process that respects natural site conditions and attempts, to the maximum extent possible, to replicate or improve the natural hydrology of a site.

Conservation District - A conservation district, as defined in section 3(c) of the Conservation District Law (3 P. S. § 851(c)), which has the authority under a delegation agreement executed with the Department to administer and enforce all or a portion of the erosion and sediment control program in this Commonwealth.

Concentrated Storm Runoff - Surface runoff from rainfall events, which converges and flows primarily through water conveyance features such as swales, gullies, waterways, channels or storm sewers and which exceeds the maximum specified flow rates of filters or perimeter controls intended to control sheet flow.

DEP - The Pennsylvania Department of Environmental Protection.

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

Detention or **To Detain** - The prevention of, or to prevent, the discharge, directly or indirectly, of a given volume of stormwater runoff into surface waters by temporary storage.

Detention Basin - An impoundment designed to collect and retard stormwater runoff by temporarily storing the runoff and releasing it at a predetermined rate. Detention basins are designed to drain completely shortly after any given rainfall event and are dry until the next rainfall event.

Development Site (Site) - See Project Site.

Discharge – To release of water from a project, site, aquifer, drainage basin or other point of interest (verb); The rate and volume of flow of water such as in a stream, generally expressed in cubic feet per second (volume per unit of time) (noun).

Disturbed Area – An un-stabilized land area where an Earth Disturbance is occurring or has occurred.

Ditch - An artificial waterway for irrigation or stormwater conveyance.

Drainage Area - That land area contributing runoff to a single point and that is enclosed by a ridge line.

Drainage System - All facilities and natural features used for the movement of stormwater through and from a drainage area, including, but not limited to, any and all of the following; conduits, pipes and appurtenant features: channels, ditches, flumes, culverts, streets, swales, gutters as well as all watercourses, water bodies and wetlands.

EPA - Environmental Protection Agency.

Earth Disturbance - A construction or other human activity which disturbs the surface of the land, including, but not limited to, clearing and grubbing; grading; excavations; embankments; road maintenance; building construction; the moving, depositing, stockpiling, or storing of soil, rock or earth materials.

Easement – A right of use of a specified portion of land of another for a specified purpose.

Engineer - A professional engineer duly appointed as the engineer for municipality.

Erosion – The wearing away of land surface by water or wind which occurs naturally from weather or runoff, but is often intensified by human activity.

Existing Condition – The dominant land cover during the five (5) year period immediately preceding a proposed Regulated Activity.

FEMA – Federal Emergency Management Agency.

Floodplain - Any land area susceptible to inundation by water from any natural source or delineated by applicable Federal Emergency Management Agency (FEMA) maps and studies as being a special flood hazard area.

Floodway - The channel of the watercourse and those portions of the adjoining floodplains that is reasonably required to carry and discharge the 100-year 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 floodway, it is assumed - absent evidence to the contrary - that the floodway extends from the stream to 50 feet from the top of the bank of the stream.

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

First Order Stream – Upper-most perennial tributary in a watershed that has not yet confluenced with another perennial stream. The confluence of two first order streams forms a "second" order stream.

Freeboard - Freeboard is the difference between the elevation of the design flow in the emergency spillway (usually the 100 year peak elevation) and the top elevation of the settled basin embankment (that is, top of berm). The minimum freeboard shall be one (1) foot.

Ground Water – Water that occurs in the subsurface and fills or saturates the porous openings, fractures and fissures of under-ground soils and rock units.

Hotspots – An area where land use or activities generate highly contaminated runoff, with concentrations of pollutants in excess of those typically found in stormwater.

Hydrologic Soil Group (HSG) - Infiltration rates of soils vary widely and are affected by subsurface permeability as well as surface intake rates. Soils are classified into four HSG's (A, B, C, and D) according to their minimum infiltration rate, which is obtained for bare soil after prolonged wetting. The Natural Resources Conservation Service (NRCS) of the US Department of Agriculture defines the four groups and provides a list of most of the soils in the United States and their group classification. The soils in the area of the development site may be identified from a soil survey report that can be obtained from local NRCS offices or conservation district offices. Soils become less pervious as the HSG varies from A to D.

Hydrology – The study of the properties, distribution, circulation and effects of water on the Earth's surface, soil and atmosphere.

Hydrograph - A graph of discharge versus time for a selected point in the drainage system.

Impervious Cover – See "Impervious Surface".

Impervious Surface - A surface (area), which has been compacted or covered with a layer of material so that it is resistant to infiltration by water. It includes semi-pervious surfaces such as compacted clayey soils, as well as most conventionally surfaced streets, roofs, sidewalks, parking lots, and other similar surfaces. Net Increase of Impervious Surface refers to the difference between the existing impervious coverage and the total impervious surface proposed.

Infiltration – Movement of surface water into the soil, where it is absorbed by plant roots, evaporated into the atmosphere, or percolates downward to recharge ground water.

Intensity - The depth of accumulated rainfall per unit of time.

Intermittent Stream – A defined channel in which surface water is absent during a portion of the year, as ground water levels drop below the channel bottom.

Karst – A type of topography that is formed over limestone or other carbonate rock formations by dissolving or solution of the rock by water, and that is characterized by closed depressions, sinkholes, caves, a subsurface network of solution conduits and fissures through which ground water moves, and no perennial surface drainage features.

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

Level Spreader – A low earthen berm constructed perpendicular to the direction of slope and extending across the width of the slope for the purpose of intercepting surface runoff and spreading it behind the berm to enhance infiltration and reduce erosion and runoff from the slope. The purpose of a level spreader is to prevent concentrated, erosive flows from occurring and to spread out stormwater runoff uniformly over the ground as sheet flow.

Loading – The total amount (generally measured in pounds or kilograms per acre per year) of material (sediment, nutrients, oxygen-demanding material, or other chemicals or compounds) brought into a lake, stream or water body by inflowing streams, runoff, direct discharge through pipes, ground water, the air (aerial or atmospheric deposition) and other sources over a specific period of time (often annually).

Maintenance -The action taken to restore or preserve the as-built functional design of any facility or system.

Meadow Condition - A natural groundcover with less than one viable tree of a DBH of six (6) inches or greater per fifteen-hundred (1,500) square feet within ten (10) years of application; a cover condition for which SCS curve numbers have been assigned or to which equivalent rational method runoff coefficients have been assigned.

MS4 - Municipal Separate Storm Sewer System.

Municipality – the local government that adopted the subject Ordinance.

NOAA - National Oceanic and Atmospheric Administration.

NRCS – Natural Resources Conservation Service.

National Pollution Discharge Elimination System (NPDES) – Created in 1972 under the Clean Water Act to authorize discharges to local receiving waters only pursuant to governmental permits, in an effort to reduce point source and non-point source pollutants.

New Development – Any activity regulated by this Ordinance that is not considered a redevelopment as defined in this Ordinance.

Non-structural Stormwater Management Practices - Passive, site design approaches or regulatory approaches that positively impact water quality and reduce or minimize the generation of stormwater runoff without requiring the construction of specific or discrete stormwater management control structures.

Open Channel – Any natural or man-made watercourse or conduit in which water flows with a free surface.

Open Vegetated Channel – also known as swales, grass channels, and biofilters. These systems are used for the conveyance, retention, infiltration and filtration of stormwater runoff.

PACD - Pennsylvania Association of Conservation Districts.

PADEP – Pennsylvania Department of Environmental Protection.

Pasture Condition – A ground cover of grassland or range with continuous forage for grazing and greater than 75% ground cover and lightly or only occasionally grazed; a cover condition for which the Soil Conservation Service curve numbers have been assigned or to which equivalent rational method runoff coefficients have been assigned.

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

PennDOT – Pennsylvania Department of Transportation.

Percolation Rate – The rate of movement of water under hydrostatic pressure through interstices of rock or soil. For stormwater analysis, it is typically measured as a distance per unit of time (e.g., inches per hour).

Pervious Area – Any area not defined as impervious.

Predevelopment Assumption - The ground cover assumption used when analyzing the stormwater runoff characteristics of a drainage area prior to the proposed development.

Project Site - The specific area of land where any Regulated Activities in the Municipality are planned, conducted or maintained.

Qualified Professional – Any person licensed by the Pennsylvania Department of State or otherwise qualified by law to perform the work required by the Ordinance.

Rainfall Intensity -The depth of accumulated rainfall per unit of time.

Rate - Volume per unit of time.

Receiving Waters – Any water bodies, watercourses or wetlands into which surface waters flow.

Recharge – The replenishment of ground water through the infiltration of rainfall, other surface waters, or land application of water or treated wastewater.

Redevelopment - An existing, developed property and/or a graded, altered and compacted site (as of or after the date of adoption of this Ordinance) that is proposed for reconstruction involving the demolition or partial demolition of the property.

Regulated Activities- Any Earth Disturbances or any activities that involve the alteration or development of land in a manner that may affect post construction stormwater runoff.

Regulated Earth Disturbance Activity – Activity involving Earth Disturbance subject to regulation under 25 Pa. Code Chapters 92, Chapter 102, or the Clean Streams Law.

Release Rate Percentage - The percentage of predevelopment peak rate of runoff from a watershed subarea (as delineated in the Act 167 watershed plan), which defines the allowable post-development peak discharge from any development site in that subarea.

Retention or **To Retain** - The prevention of direct discharge of stormwater runoff into receiving waters or water bodies by temporary or permanent containment in a pond or depression; examples include systems which discharge by percolation to ground water, exfiltration, and/or evaporation processes and which generally have residence times of less than three days.

Retention Basin - An impoundment designed to collect and retard stormwater runoff by temporarily storing the runoff and releasing it at a predetermined rate. Retention basins may also be designed to permanently retain additional stormwater runoff. Retention basins are designed to retain a permanent pool of water during dry weather.

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

Riparian – Pertaining to anything connected with or immediately adjacent to the banks of a stream or other body of water.

Riparian Buffer – An area of land adjacent to a body of water and managed to maintain the integrity of stream channels and shorelines to 1) reduce the impact of upland sources of pollution by trapping, filtering and converting sediments, nutrients and other chemicals, and 2) supply food, cover and thermal protection to fish and other wildlife.

Runoff –see **Stormwater**

SLAMM – Source Loading and Management Model. This model is based on small storm hydrology and pollutant runoff from urban land uses. Pollutant sources are identified and both structural and nonstructural stormwater practices can be accounted for in the model.

SCS – Soil Conservation Service.

SWMM – Stormwater Management Model. EPA developed this model for analyzing stormwater quantity and quality associated with runoff from urban areas. Both single event and continuous simulation can be performed on catchments having storm sewers, or combined sewers and natural drainage, for prediction of flows, stages and pollutant concentrations. Information on SWMM is available at *http://www.epa.gov/ceampubl/swater/swmm/index.htm*.

Sediment – Fragmented material that originated from weathering rocks and decomposing organic material that is transported by, suspended in, and eventually deposited in the streambed.

Sedimentation – Occurs when sediment particles that have been suspended within flowing water are deposited on the stream bottom or floodplain.

Sheet Flow – A flow process associated with broad, shallow water movement on sloping ground surfaces that is not channelized or concentrated.

Special Flood Hazard Area - Those areas identified by the Federal Emergency Management Agency (FEMA), Federal Insurance Administration (FIA) as floodway area (FW), flood fringe area (FF), and general floodplain area (FA); where determined by the Municipality, identified alluvial soils may be included as well.

State Water Quality Requirements - The regulatory requirements to protect, maintain, reclaim, and restore water quality under Pennsylvania Code Title 25 and the Clean Streams Law.

Storm Event - The storm of a specific duration, intensity, and frequency.

Stormwater or **Runoff** - The flow of water overland and/or in water bodies that results from and occurs during and immediately following a rainfall event.

Stormwater Management BMPs- Is abbreviated as **SWM BMPs** or **BMPs** throughout this Ordinance.

Stormwater Management Plan - The approved detailed analysis, design, and drawings of the stormwater management system required for all construction.

Stormwater Management Practices - The designed and/or constructed features which infiltrate, treat, collect, convey, channel, store, inhibit, or divert the movement of stormwater; such practices include structural and non-structural practices.

Structure - Anything constructed or installed with a fixed location on the ground, or attached to something having a fixed location on the ground.

Structural Stormwater Management Practices - Any measures that require the design and construction of a facility to help reduce or eliminate a non-point source of pollution and control stormwater.

Subarea (subbasin) - A portion of the watershed (basin) that has similar hydrological characteristics and drains to a common point.

Subdivision – As defined in The Pennsylvania Municipalities Planning Code, Act of July 31, 1968, P.L. 805, No. 247.

Subgrade -The top elevation of graded and compacted earth underlying roadway pavement.

Swale - An artificial or natural waterway which may contain contiguous areas of standing or flowing water only following a rainfall event, or is planted with or has stabilized vegetation suitable for soil stabilization, stormwater treatment, and nutrient uptake, or is designed to take into account the soil erodibility, soil percolation, slope, slope length, and contributing drainage area so as to prevent erosion and reduce the pollutant concentration of any discharge.

Total Site Area (Site Area) – Total area of the parcel(s) being developed.

USDA – United States Department of Agriculture.

USDOT FHWA – United States Department of Transportation Federal Highway Administration.

Water Body - Any natural or artificial pond, lake, reservoir, or other area which ordinarily or intermittently contains water and which has a discernible shoreline and receives surface water flow.

Watercourse – A permanent or intermittent stream or other body of water, whether natural or man-made, which gathers or carries surface water.

Water Table – The upper most level of saturation of pore space or fractures by subsurface water in an aquifer. Seasonal High Water Table refers to a water table that rises and falls with the seasons due either to natural or man-made causes.

Waters of the Commonwealth - Any and all rivers, streams, creeks, rivulets, impoundments, 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.

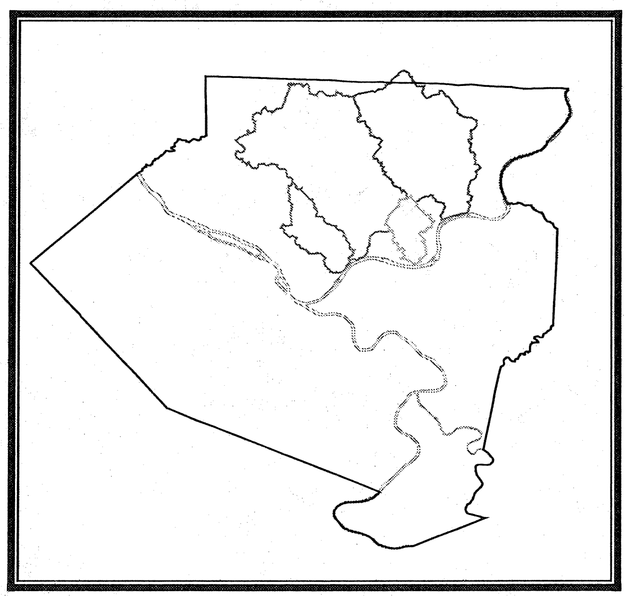
Watershed - Land area that drains to a common water body or downstream point.

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

Wetlands - Land areas that are inundated or saturated by surface or groundwater with 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 (wetlands generally include swamps, marshes, bogs, and similar areas); or areas that are defined and delineated in accordance with the Federal Manual for Identifying and Delineating Jurisdictional Wetlands, dated January 10, 1989, and as may be amended from time to time; or as further defined and delineated by the United States Army Corps of Engineers, the United States Environmental Protection Agency, or the Pennsylvania Department of Environmental Protection.

Woodland Condition - A natural groundcover with more than one viable tree of a DBH (diameter at breast height) of six (6) inches or greater per fifteen-hundred (1,500) square feet which existed within ten (10) years of application; a cover condition for which SCS curve numbers have been assigned or to which equivalent rational method runoff coefficients have been assigned.

Act 167 Stormwater Ordinance
Girtys Runs, Pine Creek, Squaw Run and Deer Creek Watersheds
Allegheny County, Pennsylvania



Ordinance Appendices

Appendices

ORDINANCE APPENDIX A
Release Rate Percentage Tables by Subarea

Note release rate subarea maps and release rate percentage tables may be obtained on the following web site;

http://www.ross.pa.us/engineer/Act%20167/Act%20167%20Update.htm

Original Act 167 Map Plates (tif format)

Plate 2.1 Girtys Run Release Rate Percentage

Plate 2.2 Pine Creek Release Rate Percentage

Plate 2.3 Deer Creek Release Rate Percentage

Plate 2.4 Squaw Run Release Rate Percentage

Original Act 167 Map Plates (pdf format)

Plate 2.1 Girtys Run Release Rate Percentage

Girtys Release Rate Table

Plate 2.2 Pine Creek Release Rate Percentage

Pine Release Rate Table

Plate 2.3 Deer Creek Release Rate Percentage

Deer Release Rate Table

Plate 2.4 Squaw Run Release Rate Percentage

Squaw Release Rate Table

APPENDIX A

RELEASE RATE PERCENTAGES BY SUBAREA
DEER CREEK WATERSHED

Subarea	Municipality	Release Rate Percentage
1	West Deer	100
2	Richland, West Deer	100
3	Richland, West Deer	100
4	Richland, West Deer	100
5	West Deer	100
6	Richland	100
7	Richland, West Deer	100
8	Richland, West Deer	95
9	West Deer	85
10	West Deer	100
11	West Deer	100
12	West Deer	75
13	Hampton, West Deer	75
14	West Deer	80
15	Indiana, West Deer	100
16	Hampton, Indiana, West Deer	100
17	Indiana, West Deer	100
18	West Deer	100
19	West Deer	100
20	West Deer	100
21	Indiana, West Deer	100
22	Indiana	100
23	Indiana	100
24	Indiana	100
25	Harmar, Indiana	100
26	Indiana, West Deer	60
27	Harmar, Indiana	100
28	Harmar, Indiana	100
29	West Deer	100
30	West Deer	100
31	Frazer, West Deer	95
32	West Deer	100
33	Frazer, West Deer	100
34	Frazer, Indiana, West Deer	100
35	Indiana	90
36	Frazer, Indiana, West Deer	80
37	Frazer, Indiana	70
38	Harmar, Indiana	100
39	Harmar	100
40	Harmar	100

APPENDIX A

RELEASE RATE PERCENTAGES BY SUBAREA
GIRTY'S RUN WATERSHED

Subarea	Municipality	Release Rate Percentage
1	Ross, McCandless	100
2	Ross	70
3	Ross	80
4	Ross	65
5	Ross, West View	100
6	West View	100
7	West View, Ross	100
8	West View, Ross	95
9	Ross	75
10	Ross, McCandless	100
11	Ross	100
12	Ross	100
13	Ross	100
14	Ross	65
15	Ross	75
16	Ross, Shaler	85
17	Ross	95
18	Ross, Pittsburgh	95
19	Ross, Pittsburgh	90
20	Ross, Shaler	70
21	Reserve, Ross, Shaler	95
22	Shaler	80
23	Shaler	90
24	Shaler	95
25	Shaler, Millvale, Reserve	100
26	Reserve, Millvale	100

APPENDIX A

RELEASE RATE PERCENTAGES BY SUBAREA
SQUAW RUN WATERSHED

Subarea	Municipality	Release Rate Percentage
1	Fox Chapel, Indiana	100
2	Fox Chapel, Indiana	90
3	Fox Chapel, Indiana	90
4	Fox Chapel	100
5	Fox Chapel, Harmar, O'Hara	85
6	Fox Chapel, Harmar	65
7	Fox Chapel	100
8	Fox Chapel	100
9	Fox Chapel	80
10	Fox Chapel, Indiana, O'Hara	100
11	Fox Chapel	100
12	Fox Chapel	95
13	Fox Chapel	100
14	Fox Chapel, O'Hara	100
15	Fox Chapel, O'Hara	75
16	O'Hara, City of Pittsburgh	100
17	O'Hara	100

APPENDIX A

RELEASE RATE PERCENTAGES BY SUBAREA
PINE CREEK WATERSHED

Subarea	Municipality	Release Rate Percentage
1	Bradford Woods, Marshall, Pine	100
2	Bradford Woods, Franklin Park, Marshall	100
3	Franklin Park, Marshall	100
4	Franklin Park, Marshall	100
5	Franklin Park, McCandless, Marshall	80
6	Franklin Park	100
7	Franklin Park	100
8	Franklin Park	85
9	Franklin Park, McCandless	75
10	Bradford Woods, Marshall, Pine	100
11	Bradford Woods, Pine	100
12	Marshall, Pine	100
13	Franklin Park, Marshall, Pine	95
14	Franklin Park, McCandless, Marshall, Pine	85
15	McCandless, Pine	75
16	Franklin Park, McCandless	60
17	McCandless, Pine	100
18	McCandless	75
19	McCandless	60
20	McCandless	100
21	McCandless	65
22	McCandless	100
23	McCandless	100
24	McCandless	100
25	McCandless, Pine	100
26	McCandless	100
27	McCandless	100
28	McCandless	100
29	McCandless	100
30	McCandless	100
31	Pine	100
32	Pine	90
33	Pine	100
34	Pine	85
35	Pine	80

APPENDIX A

RELEASE RATE PERCENTAGES BY SUBAREA
PINE CREEK WATERSHED
(Continued)

Subarea	Municipality	Release Rate Percentage
36	Pine	70
37	Pine	85
38	Pine	55
39	Pine	100
40	Pine	75
41	Pine	85
42	Pine	85
43	Pine	100
44	McCandless, Pine	80
45	McCandless, Pine	65
46	Pine	100
47	McCandless, Pine	100
48	McCandless, Pine	95
49	McCandless	100
50	Hampton, McCandless	100
51	Hampton, McCandless	100
52	Pine, Richland	100
53	Pine	100
54	Pine, Richland	100
55	Pine, Richland	100
56	Pine, Richland	85
57	Pine, Richland	85
58	Hampton, McCandless, Pine, Richland	90
59	Hampton, McCandless, Richland	100
60	Hampton	100
61	Richland	100
62	Richland	95
63	Richland	100
64	Richland	90
65	Richland	85
66	Richland	80
67	Richland	70
68	Richland	75
69	Richland	65
70	Hampton, Richland	70

APPENDIX A

RELEASE RATE PERCENTAGES BY SUBAREA
PINE CREEK WATERSHED
(Continued)

Subarea	Municipality	Release Rate Percentage
71	Hampton, Richland	85
72	Hampton	85
73	Hampton	65
74	Hampton	100
75	Hampton	100
76	Hampton	100
77	Hampton, McCandless	100
78	Hampton, McCandless	100
79	Richland	100
80	Hampton, Richland	90
81	Hampton, Richland	95
82	Hampton	75
83	Hampton, Richland	100
84	Hampton	85
85	Hampton	100
86	Hampton	85
87	Hampton	95
88	Hampton	80
89	Hampton	75
90	Hampton	75
91	Hampton	80
92	Hampton	60
93	Hampton	85
94	Hampton	100
95	Hampton, McCandless	100
96	Hampton, McCandless	100
97	Hampton, McCandless	100
98	Hampton	100
99	Hampton	85
100	Hampton	75
101	Hampton	75
102	Hampton	100
103	Hampton	100
104	Hampton	65
105	Hampton	95

APPENDIX A

RELEASE RATE PERCENTAGES BY SUBAREA
PINE CREEK WATERSHED
(Continued)

Subarea	Municipality	Release Rate Percentage
106	Hampton	80
107	Hampton	80
108	Hampton	75
109	Hampton	65
110	Hampton	85
111	Hampton	60
112	Hampton, Shaler	100
113	Hampton, Shaler	100
114	Hampton, Shaler	100
115	Hampton, Shaler	100
116	Shaler	100
117	Shaler	100
118	Shaler	100
119	Shaler	100
120	Shaler	100
121	Shaler	100
122	Shaler	100
123	Shaler	100
124	Shaler	100
125	Shaler	100
126	Shaler	100
127	Etna, Shaler	100
128	Hampton, Indiana	100
129	Hampton, Indiana	100
130	Hampton, Indiana	70
131	Indiana	100
132	Hampton, Indiana	80
133	Indiana	70
134	Fox Chapel, Indiana	90
135	Hampton, Indiana	85
136	Fox Chapel, Indiana, O'Hara	95
137	Fox Chapel, Indiana, O'Hara	80
138	Indiana, O'Hara	65
139	Fox Chapel, Indiana, O'Hara, Shaler	100
140	O'Hara, Shaler	70

APPENDIX A

RELEASE RATE PERCENTAGES BY SUBAREA
PINE CREEK WATERSHED
(Continued)

Subarea	Municipality	Release Rate Percentage
141	O'Hara, Shaler	100
142	O'Hara, Shaler	100
143	Etna, Shaler	100
144	Etna	100
145	McCandless	100
146	McCandless, Ross	95
147	Hampton, McCandless	95
148	McCandless, Ross	90
149	McCandless, Ross	85
150	Hampton, McCandless, Ross, Shaler	70
151	Ross, Shaler	70
152	Ross	75
153	Ross, Shaler	60
154	Ross, Shaler	70
155	Shaler	60
156	Shaler	100
157	Shaler	100
158	Etna, Shaler	100
159	Etna, Shaler	100
160	Etna, Shaler	100
161	Etna, Shaler	100
162	Etna, Shaler	100

ORDINANCE APPENDIX B

NON-STRUCTURAL STORMWATER MANAGEMENT PRACTICES ALTERNATIVE APPROACH FOR MANAGING STORMWATER RUNOFF

Natural hydrologic conditions may be altered radically by poorly planned development practices, such as introducing unneeded impervious surfaces, destroying existing drainage swales, constructing unnecessary storm sewers, and changing local topography. A traditional drainage approach of development has been to remove runoff from a site as quickly as possible and capture it in a detention basin. This approach leads ultimately to the degradation of water quality as well as expenditure of additional resources for detaining and managing concentrated runoff at some downstream location.

The recommended alternative approach is to promote practices that will minimize post-development runoff rates and volumes, which will minimize needs for artificial conveyance and storage facilities. To simulate pre-development hydrologic conditions, forced infiltration is often necessary to offset the loss of infiltration by creation of impervious surfaces. The ability of the ground to infiltrate depends upon the soil types and its conditions.

Preserving natural hydrologic conditions requires careful alternative site design considerations. Site design practices include preserving natural drainage features, minimizing impervious surface area, reducing the hydraulic connectivity of impervious surfaces, and protecting natural depression storage. A well-designed site will contain a mix of all those features. The following describes various techniques to achieve the alternative approach:

Preserving Natural Drainage Features. Protecting natural drainage features, particularly vegetated drainage swales and channels, is desirable because of their ability to infiltrate and attenuate flows and to filter pollutants. However, this objective is often not accomplished in land development. In fact, commonly held drainage philosophy encourages just the opposite pattern -- streets and adjacent storm sewers typically are located in the natural headwater valleys and swales, thereby replacing natural drainage functions with a completely impervious system. As a result, runoff and pollutants generated from impervious surfaces flow directly into storm sewers with no opportunity for attenuation, infiltration, or filtration. Developments designed to fit site topography also minimizes the amount of grading on site.

Protecting Natural Depression Storage Areas. Depressional storage areas have no surface outlet, or drain very slowly following a storm event. They can be commonly seen as ponded areas in farm fields during the wet season or after large runoff events. Traditional development practices eliminate these depressions by filling or draining, thereby obliterating their ability to reduce surface runoff volumes and trap pollutants. The volume and release-rate characteristics of depressions should be protected in the design of the development site. The depressions can be protected by simply avoiding the depression or by incorporating its storage as additional capacity in required detention facilities.

Avoiding introduction of impervious areas. Careful site planning should consider reducing impervious coverage to the maximum extent possible. Building footprints, sidewalks, driveways and other features producing impervious surfaces should be evaluated to minimize impacts on runoff.

Reducing the Hydraulic Connectivity of Impervious Surfaces. Impervious surfaces are significantly less of a problem if they are not directly connected to an impervious conveyance system (such as storm sewer). Two basic ways to reduce hydraulic connectivity are routing of roof runoff over lawns and reducing the use of storm sewers. Site grading should promote increasing travel time of stormwater runoff, and should help reduce concentration of runoff to a single point in the development.

Routing Roof Runoff Over Lawns. Roof runoff can be easily routed over lawns in most site designs. The practice discourages direct connections of downspouts to storm sewers or parking lots. The practice also discourages sloping driveways and parking lots to the street. By routing roof drains and crowning the driveway to run off to the lawn, the lawn is essentially used as a filter strip.

Reducing the Use of Storm Sewers. By reducing use of storm sewers for draining streets, parking lots, and back yards, the potential for accelerating runoff from the development can be greatly reduced. The practice requires greater use of swales and may not be practical for some development sites, especially if there are concerns for areas that do not drain in a "reasonable" time. The practice requires educating local citizens and public works officials, who expect runoff to disappear shortly after a rainfall event.

Reducing Street Widths. Street widths can be reduced by either eliminating on-street parking or by reducing roadway widths. Municipal planners and traffic designers should encourage narrower neighborhood streets which ultimately could lower maintenance.

Limiting Sidewalks to One Side of the Street. A sidewalk on one side of the street may suffice in low-traffic neighborhoods. The lost sidewalk could be replaced with bicycle/recreational trails that follow back-of-lot lines. Where appropriate, backyard trails should be constructed using pervious materials.

Using Permeable Paving Materials. These materials include permeable interlocking concrete paving blocks or porous bituminous concrete. Such materials should be considered as alternatives to conventional pavement surfaces, especially for low use surfaces such as driveways, overflow parking lots, and emergency access roads.

Reducing Building Setbacks. Reducing building setbacks reduces driveway and entry walks and is most readily accomplished along low-traffic streets where traffic noise is not a problem.

Constructing Cluster Developments. Cluster developments can also reduce the amount of impervious area for a given number of lots. The biggest savings is in street length, which also will reduce costs of the development. Cluster development clusters the construction activity onto less-sensitive areas without substantially affecting the gross density of development.

In summary, a careful consideration of the existing topography and implementation of a combination of the above mentioned techniques may avoid construction of costly stormwater control measures. Other benefits include reduced potential of downstream flooding, water quality degradation of receiving streams/water bodies and enhancement of aesthetics and reduction of development costs. Beneficial results include more stable baseflows in receiving streams, improved groundwater recharge, reduced flood flows, reduced pollutant loads, and reduced costs for conveyance and storage.

(Source: This appendix is taken from, Guidance on MS4 Ordinance Provisions, Document Number 392-0300-003, by the Pennsylvania Department of Environmental Protection, dated August 2, 2003.)

ORDINANCE APPENDIX C

STORMWATER BEST MANAGEMENT PRACTICES OPERATIONS AND MAINTENANCE AGREEMENT

THIS AGREEMENT, made and entered into this ___________ day of ________, 20____, by and between __________________________________, (hereinafter the "Landowner"), and ______________________________________, Allegheny County, Pennsylvania, (hereinafter "Municipality");

WITNESSETH

WHEREAS, the Landowner is the owner of certain real property as recorded by deed in the land records of Allegheny County, Pennsylvania, Deed Book ___________ at Page ______, Block and Lot No. ______________, (Lot(s) ____ in the _________________Plan of Lots as recorded in Plan Book Volume ___, Page___,) (hereinafter "Property").

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

WHEREAS, the stormwater management BMP Operations and Maintenance Plan approved by the Municipality (hereinafter referred to as the "Plan") for the Property, provides for management of stormwater within the confines of the Property through the use of Best Management Practices (BMPs); and

WHEREAS, the Municipality and the Landowner, his successors and assigns, agree that the health, safety, and welfare of the residents of the Municipality and the protection and maintenance of water quality require that on-site stormwater BMPs be constructed and maintained on the Property; and

WHEREAS, for the purposes of this Agreement, the following definitions shall apply:

- BMP – "Best Management Practice;" activities, facilities, designs, measures or procedures used to manage stormwater impacts from land development, to protect and maintain water quality and groundwater recharge and to otherwise meet the purposes of the Municipal Stormwater Management Ordinance, including, but not limited to, infiltration trenches, seepage pits, filter strips, bioretention, wet (retention) ponds, permeable paving, rain gardens, grassed swales, forested buffers, sand filters and detention basins.

- Infiltration Trench – A BMP surface structure designed, constructed, and maintained for the purpose of providing infiltration or recharge of stormwater into the soil and/or groundwater aquifer,

- Seepage Pit – An underground BMP structure designed, constructed, and maintained for the purpose of providing infiltration or recharge of stormwater into the soil and/or groundwater aquifer,
- Bioretention (Rain Garden) – A BMP overlain with appropriate mulch and suitable vegetation designed, constructed, and maintained for the purpose of providing infiltration or recharge of stormwater into the soil and/or underground aquifer, and

WHEREAS, the Municipality requires, through the implementation of the Plan, that stormwater management BMPs as required by said Plan and the Municipal Stormwater Management Ordinance be constructed and adequately operated and maintained by the Landowner, his successors and assigns.

NOW, THEREFORE, in consideration of the foregoing and intending to be legally bound, the parties hereto agree as follows:

1. The BMPs shall be constructed by the Landowner in accordance with the plans and specifications identified in the SWM Plan.
2. The Landowner shall operate and maintain the BMPs as shown on the Plan in good working order acceptable to the Municipality and in accordance with the specific maintenance requirements noted on the Plan, if any.
3. The Landowner agrees to inspect each BMP annually and after major storm events and correct any deficiencies noted during each inspection. The results of each inspection shall be provided to the Municipality upon request.
4. The Landowner hereby grants permission to the Municipality, its authorized agents and employees, to enter upon the property, at reasonable times and upon presentation of proper identification, to inspect the BMPs whenever it deems necessary. Whenever possible, the Municipality shall notify the Landowner prior to entering the property.
5. In the event that the Landowner fails to operate and maintain the BMPs as shown on the Plan in good working order acceptable to the Municipality, the Municipality or its representatives may enter upon the Property and take whatever action is deemed necessary to maintain said BMPs. This provision shall not be construed to allow the Municipality to erect any permanent structure on the land of the Landowner. It is expressly understood and agreed that the Municipality is under no obligation to maintain or repair said facilities, and in no event shall this Agreement be construed to impose any such obligation on the Municipality.

6. In the event that the Municipality, pursuant to this Agreement, performs work of any nature, or expends any funds in performance of said work for labor, use of equipment, supplies, materials, and the like, the Landowner shall reimburse the Municipality for all expenses incurred plus 10% for administrative overhead within 10 days of receipt of invoice from the Municipality.

7. The intent and purpose of this Agreement is to ensure the proper maintenance of the onsite BMPs by the Landowner; provided, however, that this Agreement shall not be deemed to create or effect any additional liability of any party for damage alleged to result from or be caused by stormwater runoff.

8. The Landowner, its executors, administrators, assigns, and other successors in interests, shall release the Municipality's employees and designated representatives from all damages, accidents, casualties, occurrences or claims which might arise or be asserted against said employees and representatives from the construction, presence, existence, or maintenance of the BMPs by the Landowner or Municipality. In the event that a claim is asserted against the Municipality, its designated representatives or employees, the Municipality shall promptly notify the Landowner and the Landowner shall defend, at his own expense, any suit based on the claim. If any judgment or claims against the Municipality's employees or designated representatives shall be allowed, the Landowner shall pay all costs and expenses regarding said judgment or claim.

9. This Agreement shall be recorded at the Office of the Recorder of Deeds of Allegheny County, Pennsylvania, and shall constitute a covenant running with the Property and/or equitable servitude, and shall be binding on the Landowner, his administrators, executors, assigns, heirs and any other successors in interests, in perpetuity.

ATTEST:

WITNESS the following signatures and seals:

(SEAL) For the Municipality:

____

(SEAL) For the Landowner:

____

ATTEST:

______________________________ (City, Borough, Township)

County of ____________________________, Pensylvania

I, ____, a Notary Public in and for the County and State aforesaid, whose commission expires on the __________ day of __________________, 2___, do hereby certify that ____ whose name(s) is/are signed to the foregoing Agreement bearing date of the ___________ day of ____________________, 2___, has acknowledged the same before me in my said County and State.

GIVEN UNDER MY HAND THIS _____________ day of ___________, 2__.

_________________________________ ______________________________________

NOTARY PUBLIC **(SEAL)**

(Source: This appendix was developed from, Guidance on MS4 Ordinance Provisions, Document Number 392-0300-003, by the Pennsylvania Department of Environmental Protection, dated August 2, 2003.)

ORDINANCE APPENDIX D

List of References Cited and Additional Sources of Information
Prepared: February 2007
Prepared By: NHCOG ACT 167 UPDATE

The following lists of references were used in the preparation of this ordinance and the Act 167 Update Report.

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ORDINANCE APPENDIX E

Credits for Use of Nonstructural BMPs
Example Calculations

The developer may obtain credits for the use of nonstructural BMPs using the procedures outlined below.

Volume Reduction Method #1: Natural Area Conservation

A water quality volume reduction can be taken when undisturbed natural areas are conserved on a site, thereby retaining their pre-development hydrologic and water quality characteristics. Under this method, a designer would be able to subtract the conservation areas from the total site area when computing the water quality protection volume. An added benefit is that the post-development peak discharges will be smaller, and hence, water quantity control volumes will be reduced due to lower post-development curve numbers or rational formula "C" values.

Rule: Subtract conservation areas from total site area when computing water quality protection volume requirements.

Criteria:

- Conservation area cannot be disturbed during project construction and must be protected from sediment deposition.
- Shall be protected by limits of disturbance clearly shown on all construction drawings
- Shall be located within an acceptable conservation easement instrument that ensures perpetual protection of the proposed area. The easement must clearly specify how the natural area vegetation shall be managed and boundaries will be marked [Note: managed turf (e.g., playgrounds, regularly maintained open areas) is not an acceptable form of vegetation management]
- Shall have a minimum contiguous area requirement of 10,000 square feet
- R_v is kept constant when calculating WQ_v
- Must be forested or have a stable, natural ground cover.

Example:

Residential Subdivision
Area = 38 acres
Natural Conservation Area = 7 acres
Impervious Area = 13.8 acres

$R_v = 0.05 + 0.009\ (I) = 0.05 + 0.009\ (36.3\%) = 0.38$

Reduction:

7.0 acres in natural conservation area

New drainage area = 38 – 7 = 31 acres

Before reduction:

$\mathbf{WQ_v = (1.5)(0.38)(38)/12 = 1.81\ ac\text{-}ft}$

With reduction:

$\mathbf{WQ_v = (1.5)(0.38)(31)/12 = 1.47\ ac\text{-}ft}$

(19% reduction in water quality protection volume)

Volume Reduction Method #2: Stream Buffers

This reduction can be taken when a stream buffer effectively treats storm water runoff. Effective treatment constitutes treating runoff through overland flow in a naturally vegetated or forested buffer. Under the proposed method, a designer would be able to subtract areas draining via overland flow to the buffer from total site area when computing water quality protection volume requirements. In addition, the volume of runoff draining to the buffer can be subtracted from the streambank protection volume. The design of the stream buffer treatment system must use appropriate methods for conveying flows above the annual recurrence (1-yr storm) event.

Rule: Subtract areas draining via overland flow to the buffer from total site area when computing water quality protection volume requirements.

Criteria:

- The minimum undisturbed buffer width shall be 50 feet
- The maximum contributing length shall be 150 feet for pervious surfaces and 75 feet for impervious surfaces
- The average contributing slope shall be 3% maximum unless a flow spreader is used
- Runoff shall enter the buffer as overland sheet flow. A flow spreader can be installed to ensure this
- Buffers shall remain as naturally vegetated or forested areas and will require only routine debris removal or erosion repairs
- R_v is kept constant when calculating WQ_v
- Not applicable if overland flow filtration/groundwater recharge reduction is already being taken

Example:

Residential Subdivision
Area = 38 acres
Impervious Area = 13.8 acres
Area Draining to Buffer = 5 acres
$R_v = 0.05 + 0.009\ (I) = 0.05 + 0.009\ (36.3\%) = 0.38$
Reduction:

5.0 acres draining to buffer

New drainage area = 38 – 5 = 33 acres
Before reduction:
$\mathbf{WQ_v = (1.5)(0.38)(38)/12 = 1.81\ ac\text{-}ft}$

With reduction:
$\mathbf{WQ_v = (1.5)(0.38)(33)/12 = 1.57\ ac\text{-}ft}$

(13% reduction in water quality protection volume)

Volume Reduction Method #3: Enhanced Swales

This reduction may be taken when enhanced swales are used for water quality protection. Under the proposed method, a designer would be able to subtract the areas draining to an enhanced swale from total site area when computing water quality protection volume requirements. An enhanced swale can fully meet the water quality protection volume requirements for certain kinds of low-density residential development (see Volume Reduction Method #5). An added benefit is the post-development peak discharges will likely be lower due to a longer time of concentration for the site.

Rule: Subtract the areas draining to an enhanced swale from total site area when computing water quality protection volume requirements.

Criteria:

- This method is typically only applicable to moderate or low density residential land uses (3 dwelling units per acre maximum)
- The maximum flow velocity for water quality design storm shall be less than or equal to 1.0 feet per second
- The minimum residence time for the water quality storm shall be 5 minutes
- The bottom width shall be a maximum of 6 feet. If a larger channel is needed use of a compound cross section is required
- The side slopes shall be 3:1 (horizontal:vertical) or flatter
- The channel slope shall be 3 percent or less
- R_v is kept constant when calculating WQ_v

Example:

Residential Subdivision
Area = 38 acres
Impervious Area = 13.8 acres
$R_v = 0.05 + 0.009\ (I) = 0.05 + 0.009\ (36.3\%) = 0.38$

Reduction:

12.5 acres meet enhanced swale criteria

New drainage area = 38 – 12.5 = 25.5 acres
Before reduction:
$\mathbf{WQ_v = (1.5)(0.38)(38)/12 = 1.81}$ **ac-ft**

With reduction:
$\mathbf{WQ_v = (1.5)(0.38)(25.5)/12 = 1.21}$ **ac-ft**

(33% reduction in water quality protection volume)

Volume Reduction Method #4: Overland Flow Filtration/Groundwater Recharge Zones

This reduction can be taken when “overland flow filtration/infiltration zones” are incorporated into the site design to receive runoff from rooftops or other small impervious areas (e.g., driveways, small parking lots, etc). This can be achieved by grading the site to promote overland vegetative filtering or by providing infiltration or “rain garden” areas. If impervious areas are adequately disconnected, they can be deducted from total site area when computing the water quality protection volume requirements. An added benefit will be that the post-development peak discharges will likely be lower due to a longer time of concentration for the site.

Rule: If impervious areas are adequately disconnected, they can be deducted from total site area when computing the water quality protection volume requirements.

Criteria:

- Relatively permeable soils (hydrologic soil groups A and B) should be present
- Runoff shall not come from a designated hotspot
- The maximum contributing impervious flow path length shall be 75 feet
- Downspouts shall be at least 10 feet away from the nearest impervious surface to discourage "re-connections"
- The disconnection shall drain continuously through a vegetated channel, swale, or filter strip to the property line or structural storm water control
- The length of the "disconnection" shall be equal to or greater than the contributing length
- The entire vegetative "disconnection" shall be on a slope less than or equal to 3 percent
- The surface imperviousness area to any one discharge location shall not exceed 5,000 square feet
- For those areas draining directly to a buffer, reduction can be obtained from either overland flow filtration *-or-* stream buffers (See Method #2)
- R_v is kept constant when calculating WQ_v

Example:

Site Area = 3.0 acres
Impervious Area = 1.9 acres (or 63.3% impervious cover)
"Disconnected" Impervious Area = 0.5 acres

$R_v = 0.05 + 0.009\ (I) = 0.05 + 0.009\ (63.3\%) = 0.62$

Reduction:

0.5 acres of surface imperviousness hydrologically disconnected

New drainage area = 3 – 0.5 = 2.5 acres

Before reduction:

$\mathbf{WQ_v = (1.5)(0.62)(3)/12 = 0.23\ ac\text{-}ft}$

With reduction:

$\mathbf{WQ_v = (1.5)(0.62)(2.5)/12 = 0.19\ ac\text{-}ft}$

(17% reduction in water quality protection volume)

Volume Reduction Method #5: Environmentally Sensitive Large Lot Subdivisions

This reduction can be taken when a group of environmental site design techniques are applied to low and very low density residential development (e.g., 1 dwelling unit per 2 acres [du/ac] or lower). The use of this method can eliminate the need for structural storm water controls to treat water quality protection volume requirements. This method is targeted towards large lot subdivisions and will likely have limited application.

Rule: Targeted towards large lot subdivisions (e.g. 2 acre lots and greater). The requirement for structural practices to treat the water quality protection volume shall be waived.

Criteria:

For Single Lot Development:

- Total site impervious cover is less than 15%
- Lot size shall be at least two acres
- Rooftop runoff is disconnected in accordance with the criteria in Method #4
- Grass channels are used to convey runoff versus curb and gutter

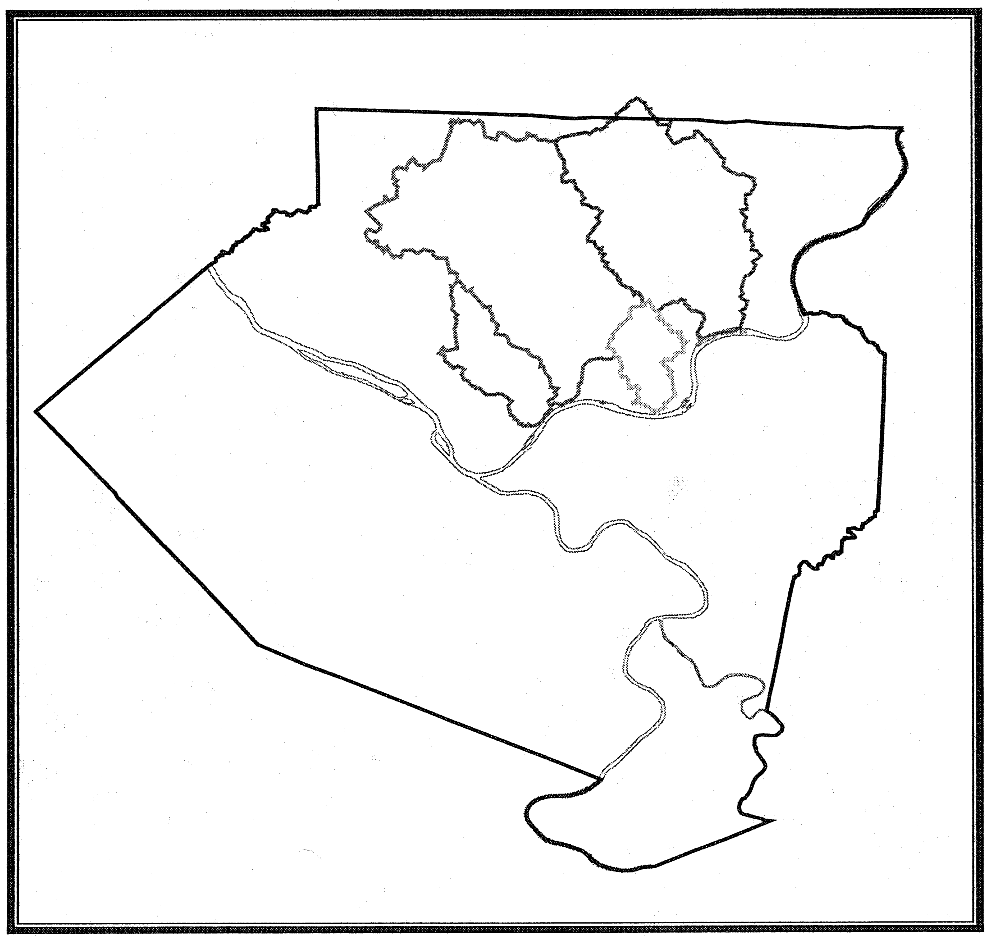
For Multiple Lots:

- Total impervious cover footprint shall be less than 15% of the area
- Lot areas should be at least 2 acres, unless clustering is implemented. Open space developments should have a minimum of 25% of the site protected as natural conservation areas and shall be at least a half-acre average individual lot size
- Grass channels should be used to convey runoff versus curb and gutter (see Method #3)
- Overland flow filtration/infiltration zones should be established (see Method #4)

Ordinance Appendix F

Single Residential Lot Standardized SWM Planning Guidance

Single Residential Lot
Standardized Stormwater Management Planning Guidance



Act 167 Stormwater Management Plan Update
Girtys Runs, Pine Creek, Squaw Run and Deer Creek Watersheds
Allegheny County, Pennsylvania

Prepared By
Art Gazdik, P.E.

Draft
March 27, 2007

Standardized Stormwater Management Planning Guidance
For a Single Residential Lot

Applicability

These criteria may be used to develop a stormwater management (SWM) plan for an individual residential lot in an area where a comprehensive subdivision SWM plan has not been planned or constructed. It is not to be used to plan for multiple lots without the written approval of the Municipal Engineer.

This guidance may not be appropriate for all locations (e.g., in areas on or adjacent to steep slopes, in areas on or adjacent to fill slopes, in areas having unsuitable soil conditions (e.g., clayey soils) or in areas having a high water table). The Municipal Building Inspector or Engineer may require that a more detailed stormwater management plan be prepared by a qualified design professional if, in their opinion, unusual site conditions exist.

These standardized SWM facilities, if properly sized and installed, should provide the water quality volume, infiltration volume and extended detention protections required by the municipality's SWM Ordinance. These standardized facilities are not specifically sized to provide for the peak flow reduction requirement, if any, but will generally provide peak flow control of storm events that do not exceed a 10 year – 24 hour return period.

What are the Standardized SWM facilities?

The Standardized SWM facilities (Standardized BMPs) are a set of three methods, or best management practices (BMPs), that have been selected because of their potential for being sited on individual residential lots. Each of the methods has been sized using a specific set of design assumptions. A list of the Standardized SWM facilities and the basic design assumptions used are outlined below. A more detailed set of the design assumptions used to size the Standardized SWM facilities is provided later in this Guide. It is the Applicant's responsibility to verify that the assumptions are appropriate for the subject property. Construction details and more detailed information about the design installation and maintenance requirements for of each of the facilities are also provided later in this document.

SWM Facility Name	Basic Design Assumptions		
Bioretention	4' Filter Bed Depth	0.5' Ponding Depth	Drain Time = 2 Days
Rock Sump	4' Rock Depth		
Porous Pavement	2' Gravel Depth	0.32 Gravel Porousity	Fill Time = 2 Hours

What is required?

A. Install "Stormwater Management Facilities (BMPs)" to reduce downstream flooding and protect the water quality of our streams.

B. Install erosion and sedimentation control devices during construction to keep silt and sediment from washing into the storm sewers, ditches or streams on or adjacent to the site.

C. Properly record a maintenance agreement to insure the continued maintenance and protection of the SWM facilities.

When is it required?

Applicants will be required to file a SWM plan with their building permit or land disturbance / grading permit application as per the municipality's requirements.

Are professional services required?

Yes, the SWM facilities must be designed by a licensed professional engineer or other Qualified Professional experienced in the design of stormwater management.

Are the Standardized SWM facilities in this Guide required?

No, any SWM facilities meeting the municipality's Stormwater Management Regulations will be acceptable.

How should this Guide be used?

Step 1 – Determine the Impervious Area and the Disturbed Area

Calculate the following:

1. The total area in square feet of roofs, driveways, sidewalks, paved areas and any other impervious surfaces proposed for the lot.
2. The total area in square feet of the lot that is to be disturbed. "Disturbed Area" is all area that is to be stripped of natural vegetation and converted to lawn, roof, pavement, sidewalk or driveway.

Step 2 – Determine the required surface area of the Standardized BMPs

Go to the Determination of SWM Facility Sizing Tables (Disturbed Area Table) and find the table that is titled with a "Disturbed Area = [Value] SF" where [Value] is equal to or greater than the proposed "Disturbed Area" for the lot. For example, if the lot will have a disturbed area of 2200 SF, use the table titled "Disturbed Area = 2500 SF or Less" as shown below.

Using the correct Disturbed Area Table, determine the sizing of the standardized SWM facility or facilities to be used, using the area in square feet of **all** impervious surface tributary to the SWM facility or facilities. This area is referred to as "Area Impervious" on the Table and is found in Column "1".

Go down Column "1" to the "Area Impervious" value that is greater than or equal to the impervious area tributary to the SWM facilities. For example, if it is determined that the total area of all roof and pavements tributary to the SWM facilities will be 1921 square feet (SF), use a value of 2000 square feet to determine the SWM facility sizing for the three standardized best management practices provided in Columns 3, 4 and 5 of the table. NOTE: If runoff from existing impervious areas will also be tributary to the SWM facilities, that area must also be included in the calculations.

For this example where the Disturbed Area is 2200 SF and the Area Impervious is 1921 SF, the surface area (foot print size) of the Standardized BMP Options provided are:

Column 3 - Bioretention Surface Area = 151 SF
Column 4 – Rock Sump Foot Print = 212.5 SF
Column 5 – Porous Pavement Surface Area = 222 SF

Disturbed Area = 2500 SF or Less

Determination of SWM Facility Sizing AG 3/3/7

Note: Disturbed area is all area that is to be stripped of natural vegetation and converted to lawn, roof, pavement, sidewalk or driveway.

Bioretention Assumptions
k = 0.5 ft/day for silt loam
df = filter bed depth = 4'
hf = half of ponding depth = 0.25'
tf = filter drain time = 2 days

Rock Sump Assumptions
Assume 4' Sump Depth

Pourous Pavement Assumptions
n = porosity of gravel = 0.32
d = gravel depth = 2'
k = percolation = 0.5 in/hour
T = fill time = 2 hours

1			2					3	4	5
Area Impervious	Area Impervious	Disturbed Area	**Disturbed Area**	Percent Imperviuos	Volumetric Runoff Coeficient	Water Quality Volume	Water Quality Volume	**Bioretention Surface Area**	**Rock Sump Surface Foot Print**	**Pourous Pavement Surface Area**
(Square Feet)	(acre)	(acre)	**(Square Feet)**	(%)	(Rv)	(acre - feet)	(cubic feet)	**(Square Feet)**	**(Square Feet)**	**(Square Feet)**
250	0.005739	0.0573921	**2500**	10.00%	0.1400	0.0006696	29	**27**	**26.6**	**40**
300	0.006887	0.0573921	**2500**	12.00%	0.1580	0.0007557	33	**31**	**31.9**	**46**
400	0.009183	0.0573921	**2500**	16.00%	0.1940	0.0009278	40	**38**	**42.5**	**56**
500	0.011478	0.0573921	**2500**	20.00%	0.2300	0.0011000	48	**45**	**53.1**	**66**
600	0.013774	0.0573921	**2500**	24.00%	0.2660	0.0012722	55	**52**	**63.8**	**77**
700	0.016070	0.0573921	**2500**	28.00%	0.3020	0.0014444	63	**59**	**74.4**	**87**
800	0.018365	0.0573921	**2500**	32.00%	0.3380	0.0016165	70	**66**	**85.0**	**97**
900	0.020661	0.0573921	**2500**	36.00%	0.3740	0.0017887	78	**73**	**95.6**	**108**
1000	0.022957	0.0573921	**2500**	40.00%	0.4100	0.0019609	85	**80**	**106.3**	**118**
1100	0.025253	0.0573921	**2500**	44.00%	0.4460	0.0021331	93	**87**	**116.9**	**128**
1200	0.027548	0.0573921	**2500**	48.00%	0.4820	0.0023052	100	**95**	**127.5**	**139**
1300	0.029844	0.0573921	**2500**	52.00%	0.5180	0.0024774	108	**102**	**138.1**	**149**
1400	0.032140	0.0573921	**2500**	56.00%	0.5540	0.0026496	115	**109**	**148.8**	**160**
1500	0.034435	0.0573921	**2500**	60.00%	0.5900	0.0028218	123	**116**	**159.4**	**170**
1600	0.036731	0.0573921	**2500**	64.00%	0.6260	0.0029940	130	**123**	**170.0**	**180**
1700	0.039027	0.0573921	**2500**	68.00%	0.6620	0.0031661	138	**130**	**180.6**	**191**
1800	0.041322	0.0573921	**2500**	72.00%	0.6980	0.0033383	145	**137**	**191.3**	**201**
1900	0.043618	0.0573921	**2500**	76.00%	0.7340	0.0035105	153	**144**	**201.9**	**211**
2000	0.045914	0.0573921	**2500**	80.00%	0.7700	0.0036827	160	**151**	**212.5**	**222**
2100	0.048209	0.0573921	**2500**	84.00%	0.8060	0.0038548	168	**158**	**223.1**	**232**
2200	0.050505	0.0573921	**2500**	88.00%	0.8420	0.0040270	175	**165**	**233.8**	**243**
2300	0.052801	0.0573921	**2500**	92.00%	0.8780	0.0041992	183	**172**	**244.4**	**253**
2400	0.055096	0.0573921	**2500**	96.00%	0.9140	0.0043714	190	**179**	**255.0**	**263**
2500	0.057392	0.0573921	**2500**	100.00%	0.9500	0.0045435	198	**186**	**265.6**	**274**

Figure -Example Table “Determination of SWM Facility Sizing (Disturbed Area Table)

Applicants may use a single option to satisfy the SWM requirements or a combination of options.

For example, a single type of facility, say Bioretention, could be installed as set forth below:

SWM Facility Type	Total Required	Actual SF Installed	Percentage of SWM Requirement
	(SF)	(SF)	(%)
Bioretention	151	151	100%
Rock Sump	212.5	0	0%
Porous Pavement	222	0	0%
			100%

or multiple SWM facility types could be proposed:

SWM Facility Type	Total Required	Actual SF Installed	Percentage of SWM Requirement
	(SF)	(SF)	(%)
Bioretention	151	50	33%
Rock Sump	212.5	35	16%
Porous Pavement	222	111	50%
			100%

Step 3 – Preparing the SWM Site Plan

Applicants shall submit [Number] (#) copies of a plot plan survey or site plan drawn on a single sheet no larger that 8 1/2" x 14" (or folded to 8 1/2" x 11") containing all of the following information. (Submission of one plan showing existing conditions and a second plan(s) showing proposed work generally will not be acceptable.)

1) Name and address of owner(s).

2) Lot number, name of subdivision, size of lot, street address, scale, date.

3) North arrow.

4) All existing and proposed structures, including accessory structures, additions, driveways, decks, patios, utilities, storm sewers, sanitary sewers including laterals, fresh-air vents and cleanouts, storm water sumps, swimming pools and sports courts with all dimensions. When the existing sewer lateral is within the limit of disturbance, the site plan must show its exact location based on existing records. When no such records exist, laterals shall be located using underground pipe locator equipment.

5) Setback distances from all property lines. Building lines must be shown.

6) The distance and direction to the nearest intersection.

7) Existing topography by two-foot (2') contours and all proposed grading clearly delineated to distinguish between existing and proposed grades and the datum upon which the grades are based.

8) The limits, type and degree of risk as shown on any Hazard Maps that the municipality has available.

9) Shading, coloring, cross-hatching, etc. between contour lines to clearly distinguish the areas of Steep Slopes (15% - 25%) and Very Steep Slopes (25%+).

10) The PRECISE "Limit of Disturbance" and the area thereof.

11) All right-of-ways, easements, streams or ponds.

12) The location of all proposed utility lines and the associated "Limit of Disturbance".

13) The method of stormwater management in accordance with the requirements set forth in the municipality's Stormwater Management Regulations. The applicant shall include two (2) copies of the design criteria and method of stormwater management with the application. It should be noted that there are many methods of stormwater management, and creative methods of stormwater management will be considered by the Borough.

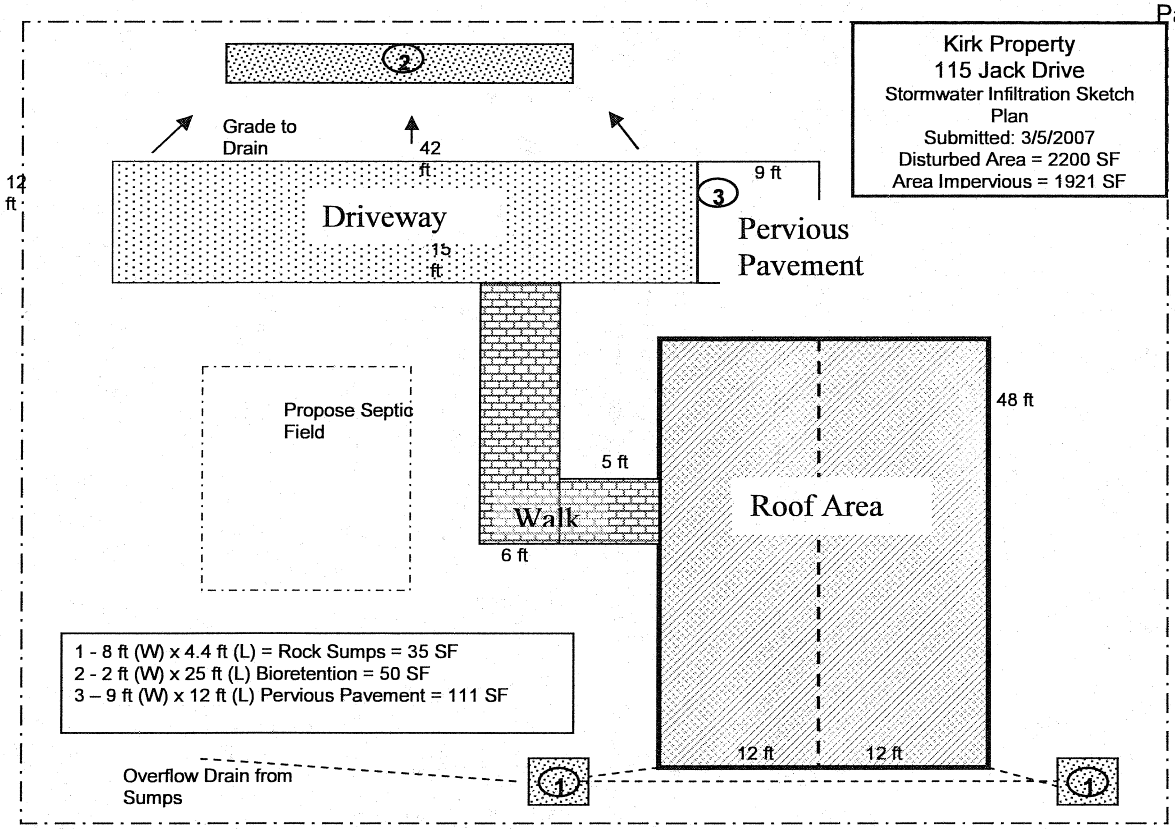
14) Soil erosion and sedimentation control measures.

15) Type of surface on tennis courts and driveways.

17) Show means of disposing of swimming pool water (Must be connected to sanitary sewer, if available).

18) A registered Engineer's or other Qualified Professionals seal.

A simple example site plan is provided on the next below.



Step 4 – Submitting the SWM Plan

The following information shall be submitted with the application for a building permit or, if applicable, the Environmental Disturbance / Grading Permit:

- The Standardized SWM Permit Application
- A fully executed "Stormwater BMPs Operations and Maintenance Agreement"
- The SWM site plan.
- A copy of the "Guidance Sheet" for each type of BMP used.

Step 5 – Installing the Standardized BMPs

Insure that each SWM facility is installed as per the requirements of the "Guidance Sheet" for the type(s) of facilities proposed.

Step 6 – Understanding your maintenance responsibilities

In order to insure that the BMPs will continue to be protected and properly maintained, applicants will be required to enter into a "Stormwater Best Management Practices Operations and Maintenance Agreement". A copy of the agreement is provided in the Appendix C of this document.

Disturbed Area = 1000 SF or Less

Determination of SWM Facility Sizing AG 3/3/7

Note: Disturbed area is all area that is to be stripped of natural vegetation and converted to lawn, roof, pavement, sidewalk or driveway.

Bioretention Assumptions
k = 0.5 ft/day for silt loam
df = filter bed depth = 4'
hf = half of ponding depth = 0.25'
tf = filter drain time = 2 days

Rock Sump Assumptions
Assume 4' Sump Depth

Pourous Pavement Assumptions
n = porosity of gravel = 0.32
d = gravel depth = 2'
k = percolation = 0.5 in/hour
T = fill time = 2 hours

1			2					3	4	5
Area Impervious	Area Impervious	Disturbed Area	**Disturbed Area**	Percent Imperviuos	Volumetric Runoff Coeficient	Water Quality Volume	Water Quality Volume	**Bioretention Surface Area**	**Rock Sump Surface Foot Print**	**Pourous Pavement Surface Area**
(Square Feet)	(acre)	(acre)	**(Square Feet)**	(%)	(Rv)	(acre - feet)	(cubic feet)	**(Square Feet)**	**(Square Feet)**	**(Square Feet)**
250	0.005739	0.02295684	**1000**	25.00%	0.2750	0.0005261	23	**22**	**NA**	**32**
300	0.006887	0.02295684	**1000**	30.00%	0.3200	0.0006122	27	**25**	**NA**	**37**
400	0.009183	0.02295684	**1000**	40.00%	0.4100	0.0007844	34	**32**	**42.5**	**47**
500	0.011478	0.02295684	**1000**	50.00%	0.5000	0.0009565	42	**39**	**53.1**	**58**
600	0.013774	0.02295684	**1000**	60.00%	0.5900	0.0011287	49	**46**	**63.8**	**68**
700	0.016070	0.02295684	**1000**	70.00%	0.6800	0.0013009	57	**53**	**74.4**	**78**
800	0.018365	0.02295684	**1000**	80.00%	0.7700	0.0014731	64	**60**	**85.0**	**89**
900	0.020661	0.02295684	**1000**	90.00%	0.8600	0.0016452	72	**67**	**95.6**	**99**
1000	0.022957	0.02295684	**1000**	100.00%	0.9500	0.0018174	79	**75**	**106.3**	**109**

Disturbed Area = 2500 SF or Less

Determination of SWM Facility Sizing AG 3/3/7

Note: Disturbed area is all area that is to be stripped of natural vegetation and converted to lawn, roof, pavement, sidewalk or driveway.

Bioretention Assumptions
k = 0.5 ft/day for silt loam
df = filter bed depth = 4'
hf = half of ponding depth = 0.25'
tf = filter drain time = 2 days

Rock Sump Assumptions
Assume 4' Sump Depth

Pourous Pavement Assumptions
n = porosity of gravel = 0.32
d = gravel depth = 2'
k = percolation = 0.5 in/hour
T = fill time = 2 hours

1			2					3	4	5
Area Impervious (Square Feet)	Area Impervious (acre)	Disturbed Area (acre)	**Disturbed Area (Square Feet)**	Percent Imperviuos (%)	Volumetric Runoff Coeficient (Rv)	Water Quality Volume (acre - feet)	Water Quality Volume (cubic feet)	**Bioretention Surface Area (Square Feet)**	**Rock Sump Surface Foot Print (Square Feet)**	**Pourous Pavement Surface Area (Square Feet)**
250	0.005739	0.0573921	**2500**	10.00%	0.1400	0.0006696	29	**27**	**NA**	**40**
300	0.006887	0.0573921	**2500**	12.00%	0.1580	0.0007557	33	**31**	**NA**	**46**
400	0.009183	0.0573921	**2500**	16.00%	0.1940	0.0009278	40	**38**	**42.5**	**56**
500	0.011478	0.0573921	**2500**	20.00%	0.2300	0.0011000	48	**45**	**53.1**	**66**
600	0.013774	0.0573921	**2500**	24.00%	0.2660	0.0012722	55	**52**	**63.8**	**77**
700	0.016070	0.0573921	**2500**	28.00%	0.3020	0.0014444	63	**59**	**74.4**	**87**
800	0.018365	0.0573921	**2500**	32.00%	0.3380	0.0016165	70	**66**	**85.0**	**97**
900	0.020661	0.0573921	**2500**	36.00%	0.3740	0.0017887	78	**73**	**95.6**	**108**
1000	0.022957	0.0573921	**2500**	40.00%	0.4100	0.0019609	85	**80**	**106.3**	**118**
1100	0.025253	0.0573921	**2500**	44.00%	0.4460	0.0021331	93	**87**	**116.9**	**128**
1200	0.027548	0.0573921	**2500**	48.00%	0.4820	0.0023052	100	**95**	**127.5**	**139**
1300	0.029844	0.0573921	**2500**	52.00%	0.5180	0.0024774	108	**102**	**138.1**	**149**
1400	0.032140	0.0573921	**2500**	56.00%	0.5540	0.0026496	115	**109**	**148.8**	**160**
1500	0.034435	0.0573921	**2500**	60.00%	0.5900	0.0028218	123	**116**	**159.4**	**170**
1600	0.036731	0.0573921	**2500**	64.00%	0.6260	0.0029940	130	**123**	**170.0**	**180**
1700	0.039027	0.0573921	**2500**	68.00%	0.6620	0.0031661	138	**130**	**180.6**	**191**
1800	0.041322	0.0573921	**2500**	72.00%	0.6980	0.0033383	145	**137**	**191.3**	**201**
1900	0.043618	0.0573921	**2500**	76.00%	0.7340	0.0035105	153	**144**	**201.9**	**211**
2000	0.045914	0.0573921	**2500**	80.00%	0.7700	0.0036827	160	**151**	**212.5**	**222**
2100	0.048209	0.0573921	**2500**	84.00%	0.8060	0.0038548	168	**158**	**223.1**	**232**
2200	0.050505	0.0573921	**2500**	88.00%	0.8420	0.0040270	175	**165**	**233.8**	**243**
2300	0.052801	0.0573921	**2500**	92.00%	0.8780	0.0041992	183	**172**	**244.4**	**253**
2400	0.055096	0.0573921	**2500**	96.00%	0.9140	0.0043714	190	**179**	**255.0**	**263**
2500	0.057392	0.0573921	**2500**	100.00%	0.9500	0.0045435	198	**186**	**265.6**	**274**

Disturbed Area = 5000 SF or Less

Determination of SWM Facility Sizing AG 3/3/7

Note: Disturbed area is all area that is to be stripped of natural vegetation and converted to lawn, roof, pavement, sidewalk or driveway.

Bioretention Assumptions
k = 0.5 ft/day for silt loam
df = filter bed depth = 4'
hf = half of ponding depth = 0.25'
tf = filter drain time = 2 days

Rock Sump Assumptions
Assume 4' Sump Depth

Pourous Pavement Assumptions
n = porosity of gravel = 0.32
d = gravel depth = 2'
k = percolation = 0.5 in/hour
T = fill time = 2 hours

1			2					3	4	5
Area Impervious	Area Impervious	Disturbed Area	**Disturbed Area**	Percent Imperviuos	Volumetric Runoff Coeficient	Water Quality Volume	Water Quality Volume	**Bioretention Surface Area**	**Rock Sump Surface Foot Print**	**Pourous Pavement Surface Area**
(Square Feet)	(acre)	(acre)	**(Square Feet)**	(%)	(Rv)	(acre - feet)	(cubic feet)	**(Square Feet)**	**(Square Feet)**	**(Square Feet)**
250	0.005739	0.11478421	**5000**	5.00%	0.0950	0.0009087	40	**37**	**NA**	**55**
300	0.006887	0.11478421	**5000**	6.00%	0.1040	0.0009948	43	**41**	**NA**	**60**
400	0.009183	0.11478421	**5000**	8.00%	0.1220	0.0011670	51	**48**	**42.5**	**70**
500	0.011478	0.11478421	**5000**	10.00%	0.1400	0.0013391	58	**55**	**53.1**	**81**
600	0.013774	0.11478421	**5000**	12.00%	0.1580	0.0015113	66	**62**	**63.8**	**91**
700	0.016070	0.11478421	**5000**	14.00%	0.1760	0.0016835	73	**69**	**74.4**	**101**
800	0.018365	0.11478421	**5000**	16.00%	0.1940	0.0018557	81	**76**	**85.0**	**112**
900	0.020661	0.11478421	**5000**	18.00%	0.2120	0.0020279	88	**83**	**95.6**	**122**
1000	0.022957	0.11478421	**5000**	20.00%	0.2300	0.0022000	96	**90**	**106.3**	**132**
1100	0.025253	0.11478421	**5000**	22.00%	0.2480	0.0023722	103	**97**	**116.9**	**143**
1200	0.027548	0.11478421	**5000**	24.00%	0.2660	0.0025444	111	**104**	**127.5**	**153**
1300	0.029844	0.11478421	**5000**	26.00%	0.2840	0.0027166	118	**111**	**138.1**	**164**
1400	0.032140	0.11478421	**5000**	28.00%	0.3020	0.0028887	126	**118**	**148.8**	**174**
1500	0.034435	0.11478421	**5000**	30.00%	0.3200	0.0030609	133	**125**	**159.4**	**184**
1600	0.036731	0.11478421	**5000**	32.00%	0.3380	0.0032331	141	**133**	**170.0**	**195**
1700	0.039027	0.11478421	**5000**	34.00%	0.3560	0.0034053	148	**140**	**180.6**	**205**
1800	0.041322	0.11478421	**5000**	36.00%	0.3740	0.0035774	156	**147**	**191.3**	**215**
1900	0.043618	0.11478421	**5000**	38.00%	0.3920	0.0037496	163	**154**	**201.9**	**226**
2000	0.045914	0.11478421	**5000**	40.00%	0.4100	0.0039218	171	**161**	**212.5**	**236**
2100	0.048209	0.11478421	**5000**	42.00%	0.4280	0.0040940	178	**168**	**223.1**	**247**
2200	0.050505	0.11478421	**5000**	44.00%	0.4460	0.0042661	186	**175**	**233.8**	**257**
2300	0.052801	0.11478421	**5000**	46.00%	0.4640	0.0044383	193	**182**	**244.4**	**267**
2400	0.055096	0.11478421	**5000**	48.00%	0.4820	0.0046105	201	**189**	**255.0**	**278**
2500	0.057392	0.11478421	**5000**	50.00%	0.5000	0.0047827	208	**196**	**265.6**	**288**
2600	0.059688	0.11478421	**5000**	52.00%	0.5180	0.0049549	216	**203**	**276.3**	**298**
2800	0.064279	0.11478421	**5000**	56.00%	0.5540	0.0052992	231	**217**	**297.5**	**319**
3000	0.068871	0.11478421	**5000**	60.00%	0.5900	0.0056436	246	**231**	**318.8**	**340**
3250	0.074610	0.11478421	**5000**	65.00%	0.6350	0.0060740	265	**249**	**345.3**	**366**
3500	0.080349	0.11478421	**5000**	70.00%	0.6800	0.0065044	283	**267**	**371.9**	**392**
3750	0.086088	0.11478421	**5000**	75.00%	0.7250	0.0069349	302	**284**	**398.4**	**418**
4000	0.091827	0.11478421	**5000**	80.00%	0.7700	0.0073653	321	**302**	**425.0**	**444**
4250	0.097567	0.11478421	**5000**	85.00%	0.8150	0.0077958	340	**320**	**451.6**	**469**
4500	0.103306	0.11478421	**5000**	90.00%	0.8600	0.0082262	358	**337**	**478.1**	**495**
4750	0.109045	0.11478421	**5000**	95.00%	0.9050	0.0086566	377	**355**	**504.7**	**521**
5000	0.114784	0.11478421	**5000**	100.00%	0.9500	0.0090871	396	**373**	**531.3**	**547**

Disturbed Area = 10,000 SF or Less

Determination of SWM Facility Sizing AG 3/3/7

Note: Disturbed area is all area that is to be stripped of natural vegetation and converted to lawn, roof, pavement, sidewalk or driveway.

Bioretention Assumptions
k = 0.5 ft/day for silt loam
df = filter bed depth = 4'
hf = half of ponding depth = 0.25'
tf = filter drain time = 2 days

Rock Sump Assumptions
Assume 4' Sump Depth

Pourous Pavement Assumptions
n = porosity of gravel = 0.32
d = gravel depth = 2'
k = percolation = 0.5 in/hour
T = fill time = 2 hours

1			2					3	4	5
Area Impervious (Square Feet)	Area Impervious (acre)	Disturbed Area (acre)	**Disturbed Area (Square Feet)**	Percent Imperviuos (%)	Volumetric Runoff Coeficient (Rv)	Water Quality Volume (acre - feet)	Water Quality Volume (cubic feet)	**Bioretention Surface Area (Square Feet)**	**Rock Sump Surface Foot Print (Square Feet)**	**Pourous Pavement Surface Area (Square Feet)**
250	0.005739	0.22956841	**10,000**	2.50%	0.0725	0.0013870	60	**57**	**NA**	**84**
300	0.006887	0.22956841	**10,000**	3.00%	0.0770	0.0014731	64	**60**	**NA**	**89**
400	0.009183	0.22956841	**10,000**	4.00%	0.0860	0.0016452	72	**67**	**42.5**	**99**
500	0.011478	0.22956841	**10,000**	5.00%	0.0950	0.0018174	79	**75**	**53.1**	**109**
600	0.013774	0.22956841	**10,000**	6.00%	0.1040	0.0019896	87	**82**	**63.8**	**120**
700	0.016070	0.22956841	**10,000**	7.00%	0.1130	0.0021618	94	**89**	**74.4**	**130**
800	0.018365	0.22956841	**10,000**	8.00%	0.1220	0.0023339	102	**96**	**85.0**	**141**
900	0.020661	0.22956841	**10,000**	9.00%	0.1310	0.0025061	109	**103**	**95.6**	**151**
1000	0.022957	0.22956841	**10,000**	10.00%	0.1400	0.0026783	117	**110**	**106.3**	**161**
1100	0.025253	0.22956841	**10,000**	11.00%	0.1490	0.0028505	124	**117**	**116.9**	**172**
1200	0.027548	0.22956841	**10,000**	12.00%	0.1580	0.0030227	132	**124**	**127.5**	**182**
1300	0.029844	0.22956841	**10,000**	13.00%	0.1670	0.0031948	139	**131**	**138.1**	**192**
1400	0.032140	0.22956841	**10,000**	14.00%	0.1760	0.0033670	147	**138**	**148.8**	**203**
1500	0.034435	0.22956841	**10,000**	15.00%	0.1850	0.0035392	154	**145**	**159.4**	**213**
1600	0.036731	0.22956841	**10,000**	16.00%	0.1940	0.0037114	162	**152**	**170.0**	**224**
1700	0.039027	0.22956841	**10,000**	17.00%	0.2030	0.0038835	169	**159**	**180.6**	**234**
1800	0.041322	0.22956841	**10,000**	18.00%	0.2120	0.0040557	177	**166**	**191.3**	**244**
1900	0.043618	0.22956841	**10,000**	19.00%	0.2210	0.0042279	184	**173**	**201.9**	**255**
2000	0.045914	0.22956841	**10,000**	20.00%	0.2300	0.0044001	192	**180**	**212.5**	**265**
2100	0.048209	0.22956841	**10,000**	21.00%	0.2390	0.0045722	199	**187**	**223.1**	**275**
2200	0.050505	0.22956841	**10,000**	22.00%	0.2480	0.0047444	207	**195**	**233.8**	**286**
2300	0.052801	0.22956841	**10,000**	23.00%	0.2570	0.0049166	214	**202**	**244.4**	**296**
2400	0.055096	0.22956841	**10,000**	24.00%	0.2660	0.0050888	222	**209**	**255.0**	**306**
2500	0.057392	0.22956841	**10,000**	25.00%	0.2750	0.0052609	229	**216**	**265.6**	**317**
2600	0.059688	0.22956841	**10,000**	26.00%	0.2840	0.0054331	237	**223**	**276.3**	**327**
2800	0.064279	0.22956841	**10,000**	28.00%	0.3020	0.0057775	252	**237**	**297.5**	**348**
3000	0.068871	0.22956841	**10,000**	30.00%	0.3200	0.0061218	267	**251**	**318.8**	**369**
3250	0.074610	0.22956841	**10,000**	32.50%	0.3425	0.0065523	285	**269**	**345.3**	**395**
3500	0.080349	0.22956841	**10,000**	35.00%	0.3650	0.0069827	304	**286**	**371.9**	**421**
3750	0.086088	0.22956841	**10,000**	37.50%	0.3875	0.0074131	323	**304**	**398.4**	**446**
4000	0.091827	0.22956841	**10,000**	40.00%	0.4100	0.0078436	342	**322**	**425.0**	**472**
4250	0.097567	0.22956841	**10,000**	42.50%	0.4325	0.0082740	360	**339**	**451.6**	**498**
4500	0.103306	0.22956841	**10,000**	45.00%	0.4550	0.0087045	379	**357**	**478.1**	**524**
4750	0.109045	0.22956841	**10,000**	47.50%	0.4775	0.0091349	398	**375**	**504.7**	**550**
5000	0.114784	0.22956841	**10,000**	50.00%	0.5000	0.0095654	417	**392**	**531.3**	**576**

Guidance Sheet - Bioretention Areas

Description: Shallow stormwater basin or landscaped area that utilizes engineered soils and vegetation to capture and treat runoff.

KEY CONSIDERATIONS

DESIGN CRITERIA:

- Maximum contributing drainage area of 5 acres
- Often located in "landscaping islands"
- Treatment area consists of grass filter, sand bed, ponding area, organic/mulch layer, planting soil, and vegetation
- Typically requires 5 feet of head

ADVANTAGES / BENEFITS:

- Applicable to small drainage areas
- Good for highly impervious areas, particularly parking lots
- Good retrofit capability
- Relatively low maintenance requirements
- Can be planned as an aesthetic feature

DISADVANTAGES / LIMITATIONS:

- Requires extensive landscaping
- Not recommended for areas with steep slopes

MAINTENANCE REQUIREMENTS:

- Inspect and repair/replace treatment area components

POLLUTANT REMOVAL

80%	**Total Suspended Solids**
60/50%	**Nutrients** - Total Phosphorus / Total Nitrogen removal
M	**Metals** - Cadmium, Copper, Lead, and Zinc removal
No data	**Pathogens** - Coliform, Streptococci, E.Coli removal

STORMWATER MANAGEMENT SUITABILITY

- ✓ **Water Quality**
- 9 **Channel Protection**
- ☐ **Extreme Flood Protection**

Accepts Hotspot Runoff: *Yes (requires impermeable liner)*

9 in certain situations

IMPLEMENTATION CONSIDERATIONS

M	**Land Requirement**
M	**Capital Cost**
L	**Maintenance Burden**

Residential Subdivision Use: *Yes*

High Density/Ultra-Urban: *Yes*

Drainage Area: *5 acres max.*

Soils: *Planting soils must meet specified criteria; No restrictions on surrounding soils*

Other Considerations:

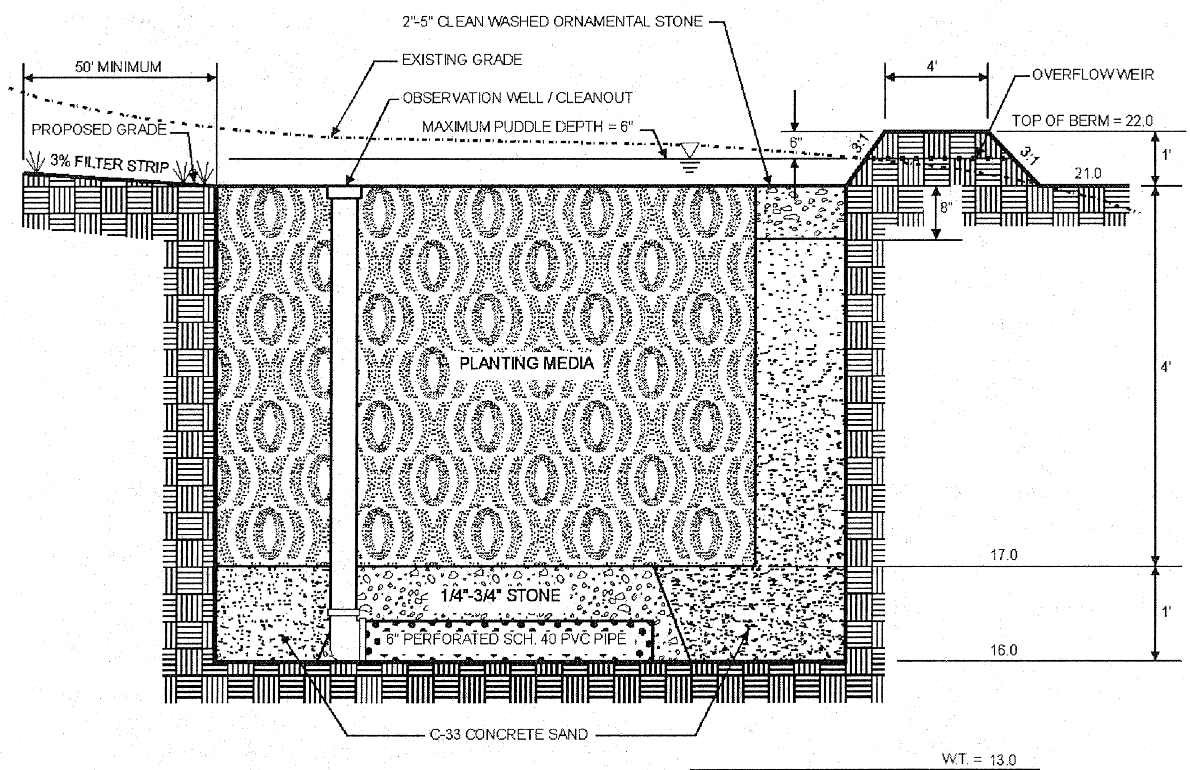
- *Use of native plants is recommended*

L=Low **M**=Moderate **H**=High

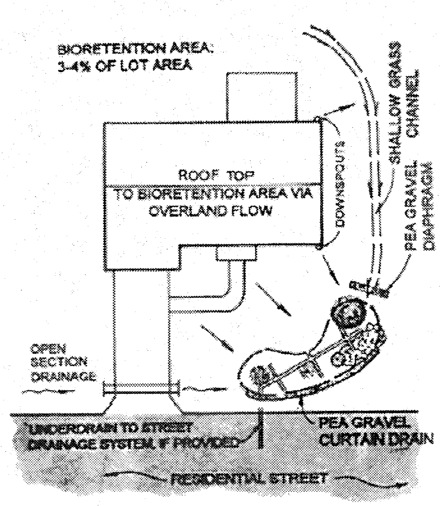
General Description

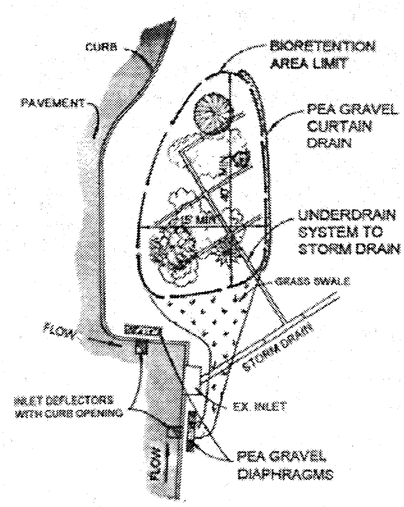
Bioretention areas (also referred to as *bioretention filters* or *rain gardens*) are structural stormwater controls that capture and temporarily store the water quality volume (WQ_v) using soils and vegetation in shallow basins or landscaped areas to remove pollutants from stormwater runoff.

Bioretention areas are engineered facilities in which runoff is conveyed as sheet flow to the "treatment area," which consists of a grass buffer strip, ponding area, organic or mulch layer, planting soil, and vegetation. An optional sand bed can also be included in the design to provide aeration and drainage of the planting soil. The filtered runoff is typically collected and returned to the conveyance system, though it can also be exfiltrated into the surrounding soil in areas where appropriate.



Bioretention Typical Detail (Source: Georgia SWM Manual)





Application and Site Feasibility Criteria

Bioretention areas are suitable for single-family residential lots of 1 acre or less. Because of its ability to be incorporated in landscaped areas, the use of bioretention is extremely flexible.

The following criteria should be evaluated to ensure the suitability of a bioretention area for meeting stormwater management objectives on a site or development.

Physical Feasibility - Physical Constraints at Project Site

- Site Slope – No more than 6% slope
- Minimum Head – Elevation difference needed at a site from the inflow to the outflow: 5 feet
- Minimum Depth to Water Table – A separation distance of 2 feet recommended between the bottom of the bioretention facility and the elevation of the seasonally high water table.
- Soils – No restrictions; engineered media required

Other Constraints / Considerations

- Aquifer Protection – Do not allow exfiltration of filtered hotspot runoff into groundwater

Planning and Design Criteria

*The following criteria are to be considered **minimum** standards for the design of a bioretention facility **for a single family residential lot**. Consult with the local review authority to determine if there are any variations to these criteria or additional standards that must be followed.*

A. LOCATION AND SITING

- Residential Bioretention areas should have a maximum contributing drainage area of 0.25 acres or less; multiple bioretention areas can be used.

- Bioretention systems are designed for intermittent flow and must be allowed to drain and reaerate between rainfall events. They should not be used on sites with a continuous flow from groundwater, sump pumps, or other sources.

- Bioretention area locations should be integrated into the site planning process, and aesthetic considerations should be taken into account in their siting and design. Elevations must be carefully worked out to ensure that the desired runoff flow enters the facility with no more than the maximum design depth.

B. GENERAL DESIGN

- The Standardized bioretention area for a single residential lot consists of:

  (1) Grass filter strip (lawn areas) between the contributing drainage area and the ponding area should where possible be a minimum of 15' in length.
  (2) Ponding area containing vegetation with a planting soil bed,
  (3) Organic/mulch layer must be four (4') in depth.
  (4) Gravel and perforated pipe underdrain system to collect runoff that has filtered through the soil layers (bioretention areas can optionally be designed to infiltrate into the soil).

- A bioretention area design will also include some of the following:

  - Optional **sand filter layer** to spread flow, filter runoff, and aid in aeration and drainage of the planting soil.
  - **Stone diaphragm** at the beginning of the grass filter strip to reduce runoff velocities and spread flow into the grass filter.

C. PHYSICAL SPECIFICATIONS / GEOMETRY

- The planting soil filter bed is sized using a Darcy's Law equation with a filter bed drain time of 48 hours and a coefficient of permeability (k) of 0.5 ft/day.

- The ponding depth of the bioretention areas is 6 inches.

- The planting soil bed must be at least 4 feet in depth. Planting soils should be sandy loam, loamy sand, or loam texture with a clay content ranging from 10 to 25%. The soil must have an infiltration rate of at least 0.5 inches per hour and a pH between 5.5 and 6.5. In addition, the planting soil should have a 1.5 to 3% organic content and a maximum 500 ppm concentration of soluble salts.

- Water should be directed as sheet flow over lawn area to the bioretention area.

- The mulch layer should consist of 2 to 4 inches of commercially available fine shredded hardwood mulch or shredded hardwood chips.

- The sand bed should be 12 to 18 inches thick. Sand should be clean and have less than 15% silt or clay content.

- Pea gravel for the diaphragm and curtain, where used, should be ASTM D 448 size No. 6 ($^1/_8$" to ¼").

- The underdrain collection system is equipped with a 6-inch perforated PVC pipe (AASHTO M 252) in an 8-inch gravel layer. The pipe should have 3/8-inch perforations, spaced at 6-inch centers, with a minimum of 4 holes per row. The pipe is spaced at a maximum of 10 feet on center and a minimum grade of 0.5% must be maintained. A permeable filter fabric is placed between the gravel layer and the planting soil bed.

D. PRETREATMENT

- Adequate pretreatment is provided when all of the following are provided: (a) water flows over grass filter strip (lawn area) prior to entering the bioretention area.

E. OUTLET STRUCTURES

- Outlet pipe is to be provided from the underdrain system to the facility discharge. Due to the slow rate of filtration, outlet protection is generally unnecessary.

F. EMERGENCY SPILLWAY

- An overflow structure and nonerosive overflow channel must be provided to safely pass flows from the bioretention area that exceed the storage capacity to a stabilized downstream area or watercourse. If the system is located off-line, the overflow should be set above the shallow ponding limit.

G. MAINTENANCE ACCESS

- Adequate access must be provided for all bioretention facilities for inspection, maintenance, and landscaping upkeep, including appropriate equipment and vehicles.

H. SAFETY FEATURES

- Bioretention areas generally do not require any special safety features. Fencing of bioretention facilities is not generally desirable.

I. LANDSCAPING

- Landscaping is critical to the performance and function of bioretention areas.

- A dense and vigorous vegetative cover should be established over the contributing pervious drainage areas before runoff can be accepted into the facility.

- The bioretention area should be vegetated to resemble a terrestrial forest ecosystem, with a mature tree canopy, subcanopy of understory trees, scrub layer, and herbaceous ground cover. Three species each of both trees and scrubs are recommended to be planted.

- The tree-to-shrub ratio should be 2:1 to 3:1. On average, the trees should be spaced 8 feet apart. Plants should be placed at regular intervals to replicate a natural forest. Woody vegetation should not be specified at inflow locations.

- After the trees and shrubs are established, the ground cover and mulch should be established.

- Choose plants based on factors such as whether native or not, resistance to drought and inundation, cost aesthetics, maintenance, etc. Planting recommendations for bioretention facilities are as follows:
  - Native plant species should be specified over non-native species.
  - Vegetation should be selected based on a specified zone of hydric tolerance.
  - A selection of trees with an understory of shrubs and herbaceous materials should be provided.

The following are some native plants suitable for rain gardens for the Northeast Region. They are also attractive to butterflies, birds, and other wildlife. Be sure to choose species appropriate for the degree of sun or shade on the site.

Wildflowers, Ferns, Grasses, and Sedges:

- *Asclepias incarnata,* Swamp milkweed
- *Chelone glabra,* White turtlehead
- *Eupatorium maculatum,* Joe-pye weed
- *Lobelia cardinalis,* Cardinal flower
- *Lobelia syphilitica,* Blue lobelia
- *Monarda didyma,* Oswego tea
- *Vernonia noveboracensis,* Common ironweed
- *Athyrium filix-femina,* Lady fern
- *Osmunda regalis,* Royal fern
- *Osmunda cinnamomea,* Cinnamon fern
- *Carex pendula,* Drooping sedge
- *Carex stipata,* Tussock sedge

Trees and Shrubs:

- *Amelanchier laevis,* Shadbush
- *Asimina triloba,* Pawpaw
- *Betula nigra,* River birch
- *Cephalanthus occidentalis,* Buttonbush
- *Clethra alnifolia,* Sweet pepperbush
- *Cornus amomum,* Silky dogwood
- *Fothergilla gardenii,* Dwarf fothergilla
- *Ilex verticillata,* Winterberry holly
- *Lindera benzoin,* Spicebush
- *Liquidambar styraciflua,* Sweet gum
- *Sambucus canadensis,* American elderberry
- *Viburnum dentatum,* Arrowwood

Design Basis

The required planting soil filter bed area is computed using the following equation (based on Darcy's Law):

$$A_f = (WQv)\,(d_f)\,/\,[\,(k)\,(h_f + d_f)\,(t_f)]$$

where:

A_f	=	surface area of ponding area (ft^2)
WQ_v	=	water quality volume (or total volume to be captured in CF)
d_f	=	filter bed depth (4 feet minimum)
k	=	coefficient of permeability of filter media (ft/day) (use 0.5 ft/day for silt-loam)
h_f	=	average height of water above filter bed (ft) (typically 3 inches, which is half of the 6-inch ponding depth)
t_f	=	design filter bed drain time (days) (2.0 days or 48 hours is recommended maximum)

An overflow must be provided to bypass and/or convey larger flows to the downstream drainage system or stabilized watercourse. Nonerosive velocities need to be ensured at the outlet point.

A landscaping plan for the bioretention area should be prepared to indicate how it will be established with vegetation.

Inspection and Maintenance Requirements

Typical Maintenance Activities for Bioretention Areas
(Source: EPA, 1999)

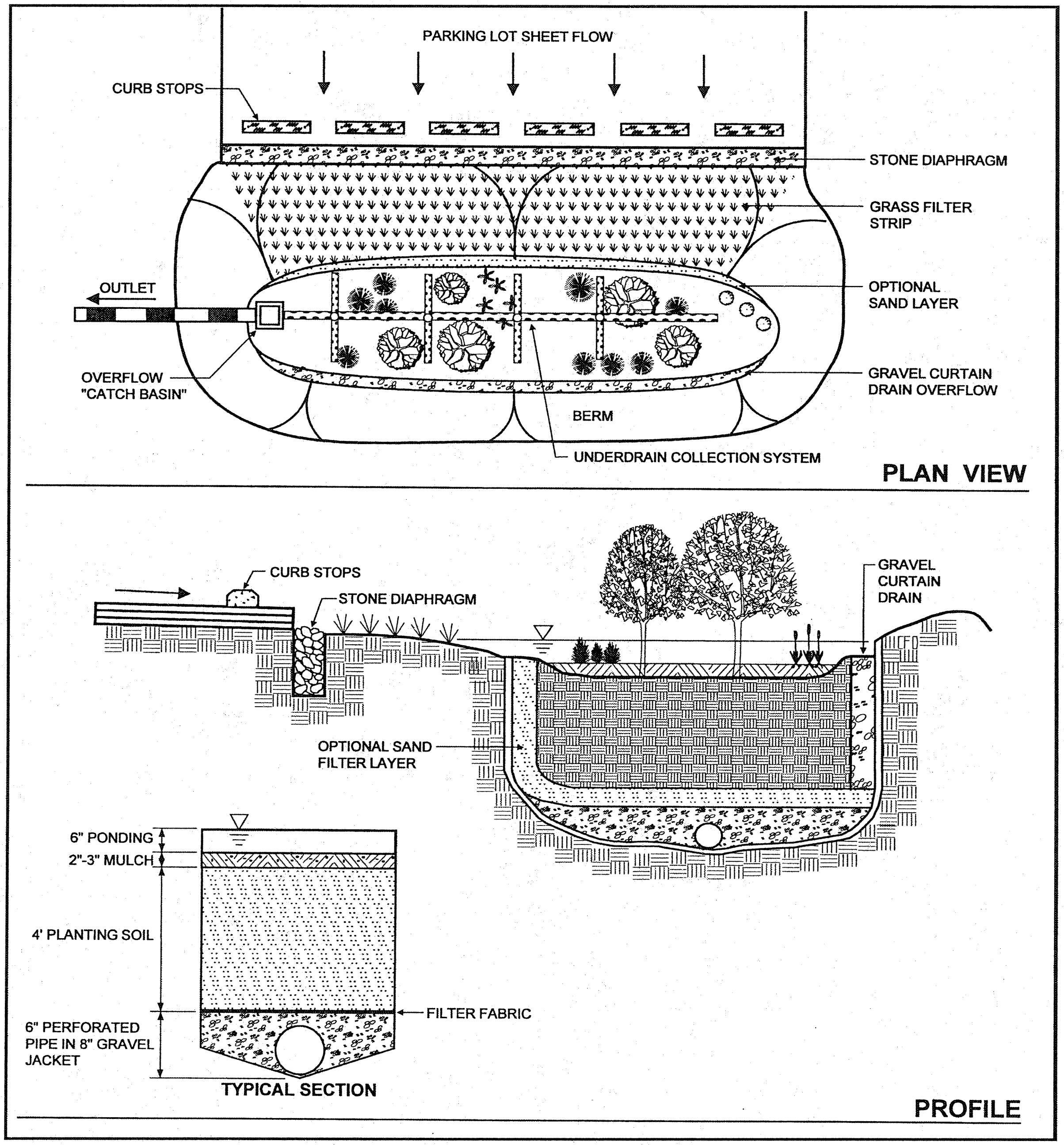
Activity	Schedule
• Pruning and weeding to maintain appearance. • Mulch replacement when erosion is evident. • Remove trash and debris.	As needed
• Inspect inflow points for clogging (off-line systems). Remove any sediment. • Inspect filter strip/grass channel for erosion or gullying. Re-seed or sod as necessary. • Trees and shrubs should be inspected to evaluate their health and remove any dead or severely diseased vegetation.	Semi-annually
• The planting soils should be tested for pH to establish acidic levels. If the pH is below 5.2, limestone should be applied. If the pH is above 7.0 to 8.0, then iron sulfate plus sulfur can be added to reduce the pH.	Annually
• Replace mulch over the entire area. • Replace pea gravel diaphragm if warranted.	2 to 3 years

Additional Maintenance Considerations and Requirements

- The surface of the ponding area may become clogged with fine sediment over time. Core aeration or cultivating of unvegetated areas may be required to ensure adequate filtration.

⚠ Regular inspection and maintenance is critical to the effective operation of bioretention facilities as designed. Maintenance responsibility for a bioretention area should be vested with a responsible authority by means of a legally binding and enforceable maintenance agreement that is executed as a condition of plan approval.

Example Schematic



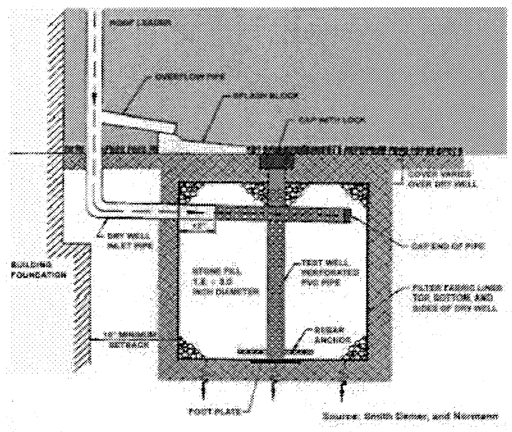
Schematic of a Typical On-line Bioretention Area

(Source: Claytor and Schueler, 1996)

This Guidance document is based upon information adapted from the Georgia Stormwater Manual and the Brooklyn Botanic Garden web site.

Guidance Sheet - Rock Sumps

Standardized Residential SWM Facility
For Single Residential Lots



(Source: PA BMP Manual)

Description: A Dry Well, or Seepage Pit, is a variation on an Infiltration system that is designed to temporarily store and infiltrate rooftop runoff.

KEY CONSIDERATIONS

- Maintain a minimum 2-foot separation to bedrock and seasonally high water table, provide distributed infiltration area (5:1 impervious area to infiltration area - maximum), site on natural, uncompacted soils with acceptable infiltration capacity, and follow other guidelines described in Protocol 2: Infiltration Systems Guidelines
- Maintain minimum distance from building foundation (typically 10 feet)
- Provide adequate overflow outlet for large storms
- Depth of Dry Well aggregate should be between 48 inches
- At least one observation well; clean out is recommended
- Wrap aggregate with nonwoven geotextile
- Maximum drain-down time is 72 hours

STORMWATER MANAGEMENT SUITABILITY

- [x] **Water Quality**
- [9] **Channel/Flood Protection**

SPECIAL APPLICATIONS

- [ ] **Pretreatment**
- [x] **High Density/Ultra-Urban**
- [x] **Other: Overflow Parking, Driveways & related uses**

Residential Subdivision Use: *Yes*
(in common areas that are maintained)

9 in certain situations

General Description

A Dry Well, sometimes called a Seepage Pit, is a subsurface storage facility that temporarily stores and infiltrates stormwater runoff from the roofs of structures. Roof leaders connect directly into the Dry Well, which may be either an excavated pit filled with uniformly graded aggregate wrapped in geotextile or a prefabricated storage chamber or pipe segment. Dry Wells discharge the stored runoff via infiltration into the surrounding soils. In the event that the Dry Well is overwhelmed in an intense storm event, an overflow mechanism (surcharge pipe, connection to larger infiltration area, etc.) will ensure that additional runoff is safely conveyed downstream.

By capturing runoff at the source, Dry Wells can dramatically reduce the increased volume of stormwater generated by the roofs of structures. Though roofs are generally not a significant source of runoff pollution, they are still one of the most important sources of new or increased runoff volume from developed areas. By decreasing the volume of stormwater runoff, Dry Wells can also reduce runoff rate and improve water quality. As with other infiltration practices, Dry Wells may not be appropriate for "hot spots" or other areas where high pollutant or sediment loading is expected without additional design considerations. Dry Wells are not recommended within a specified distance to structures or subsurface sewage disposal systems.

Design Criteria and Specifications

The use of a single stage rock sump is one of several alternatives that may be appropriate for small project area developments. Site parameters which must be considered when determining the suitability of a sump for stormwater control include the following:

- Soil type
- Slope
- Slope Stability
- Discharge location
- Basement elevation
- Offsite stormwater conveyance systems
- Offsite detention systems

Where it is determined that a single stage rock sump is appropriate, the following procedure is designed to provide a fast, simple method to determine the rock volume and orifice size required to provide adequate stormwater control for small projects. In order to develop a practical solution for this type of design problem, several qualifying assumptions are necessary to set the limits for which the procedure is applicable. Those limits were designed to incorporate the type of situation most often encountered. In general, the following conditions must be satisfied in order for the use of single stage rock sumps to be appropriate:

- The project area tributary to the proposed sump is less than 5000 square feet, and consists entirely of impervious (paved or roofed areas) surfaces, i.e., RCN = 98;

- To minimize the sump size, runoff from impervious surfaces may be divided and conveyed to the separate sumps. If runoff from impervious surfaces is not divided, the sump must be designed for the entire area that will be tributary to the facility;

- The pre-development area to be altered must have an existing time of concentration (Tc) of six (6) minutes or less; and

- The single stage rock sump must be designed according to the parameters shown in the attached drawing.

Prior to using the following procedure, the designer must verify that all of the above criteria apply to the subject project. Should any of the conditions not apply, the use of the procedure outlined herein is inappropriate and may result in either the over-design or under-design of the rock sump facility.

DESIGN SIZING

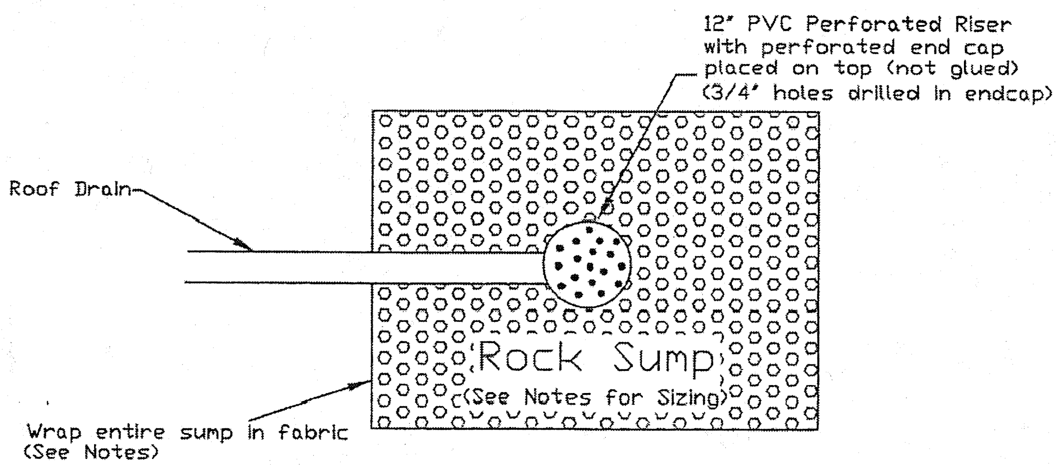
1. Determine the area of the impervious surfaces that will be collected and conveyed to the sump.

2. Enter the sizing table and determine the size of the release orifice and volume of the sump.

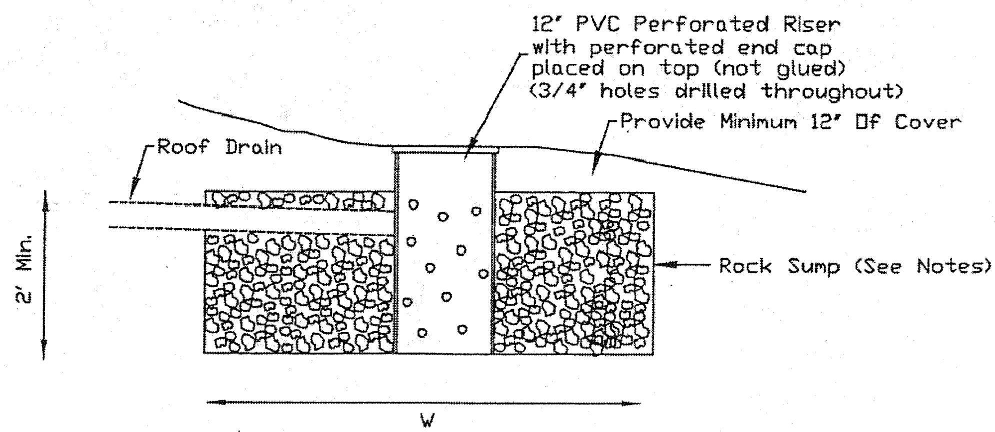
3. Determine the sump dimensions based on the site topography and surface features.

4. Design the sump in accordance with the parameters shown in the attached drawing.

NOTE: If the development will result in an increase in impervious surface of less than 400 square feet, the infiltration sump design (below) should be used. The sump volume should be based on 40 cubic feet of stone for each 100 square feet of impervious surface.



PLAN VIEW



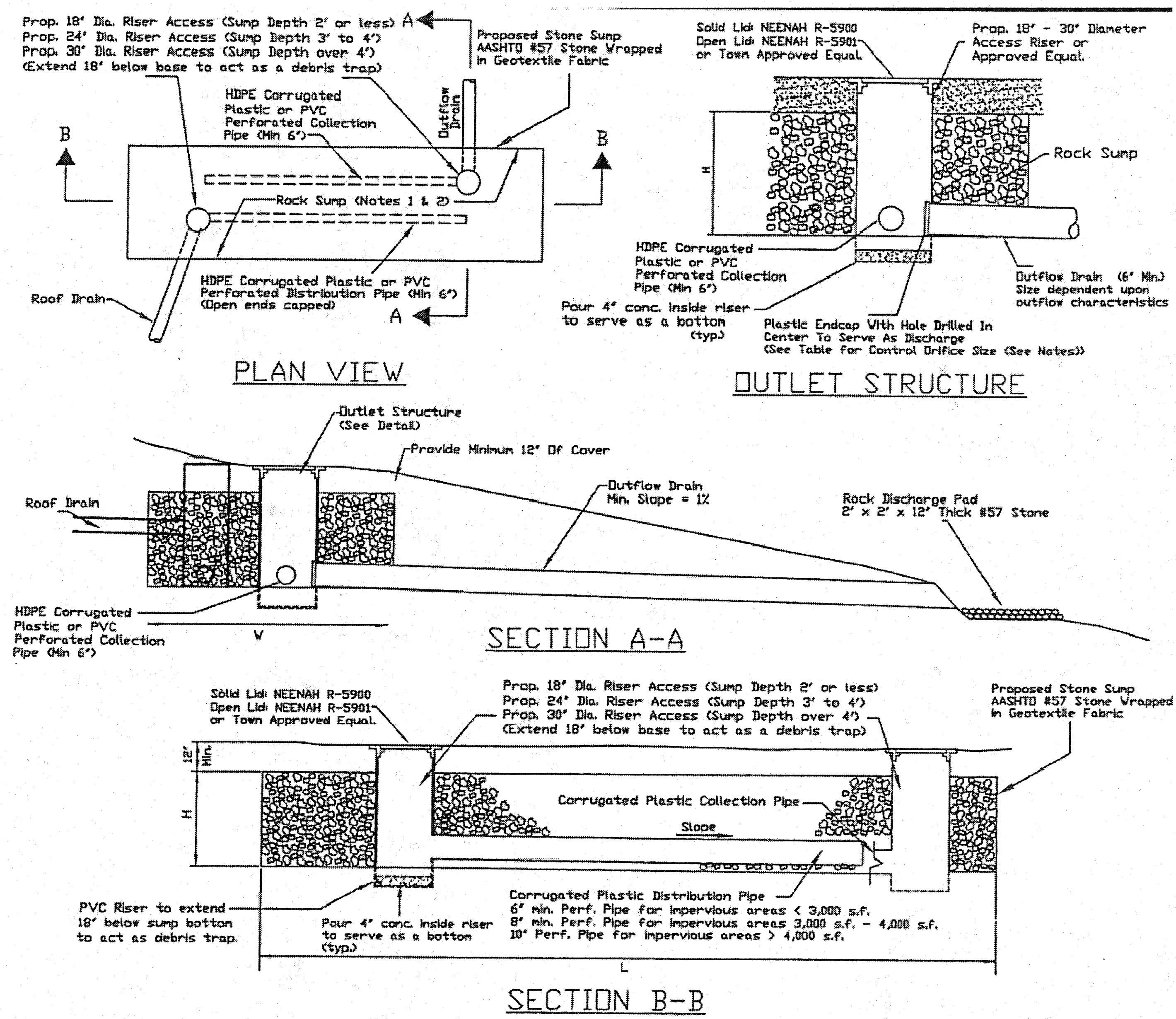
SECTION

Notes:

1. The Rock Sump shall be designed as follows:
   40 c.f. of Rock per 100 s.f. of impervious area
2. Rock Sump shall be constructed of AASHTO #57 Limestone or 2B Gravel.
3. Wrap sump on all sides with PennDOT Class 2, Type B Non-woven Geotextile Material.
4. Dimensions and ratios shall vary as per design volume required.
5. Dry sumps in fill areas not permitted.
6. Cleanouts shall be located just before any horizontal bends.
7. When feasible, the Rock Sump should be located such that the top elevation of the riser pipe is below the basement floor elevation.

THIS DETAIL MAY BE UTILIZED FOR TOTAL IMPERVIOUS AREAS < 400 S.F.

Figure S1 - Rock Sump Detail (< 400 SF of impervious area)
(Detailed from Town of McCandless / Partridge Venture Engineering)



Notes:

1. Design Parameters (volume and outlet control works) shall be based upon the Table of values as shown on Detail SW-5, (400 S.F. < Impervious Area < 5000 s.f.)
2. Rock Sump shall be constructed of AASHTO #57 Limestone or 2B Gravel.
3. Wrap sump on all sides with PennDOT Type B Non-woven Geotextile Material.
4. Dimensions and ratios of L (Length), W (Width) and H (Height) shall vary as per design volume required.
5. Minimum ratio L to W is 3:1; (ie. L = 3W).
6. Dry sumps in fill areas not permitted.
7. Dimensions L (Length) shall be oriented to be parallel to the grade contour alignment.
8. No 90° elbows permitted on cleanout installations.
9. Cleanouts shall be located just before any horizontal bends.
10. All pipe and fittings shall be ASTM D2729.
11. When feasible, the Rock Sump should be located such that the outflow elevation is below the basement floor elevation.

THIS DETAIL MAY BE UTILIZED FOR TOTAL IMPERVIOUS AREAS > 400 S.F. & < 5,000 S.F.

Figure S2 - Rock Sump Detail (> 400 SF & < 5000 SF of impervious area)

(Detailed from Town of McCandless / Partridge Venture Engineering)

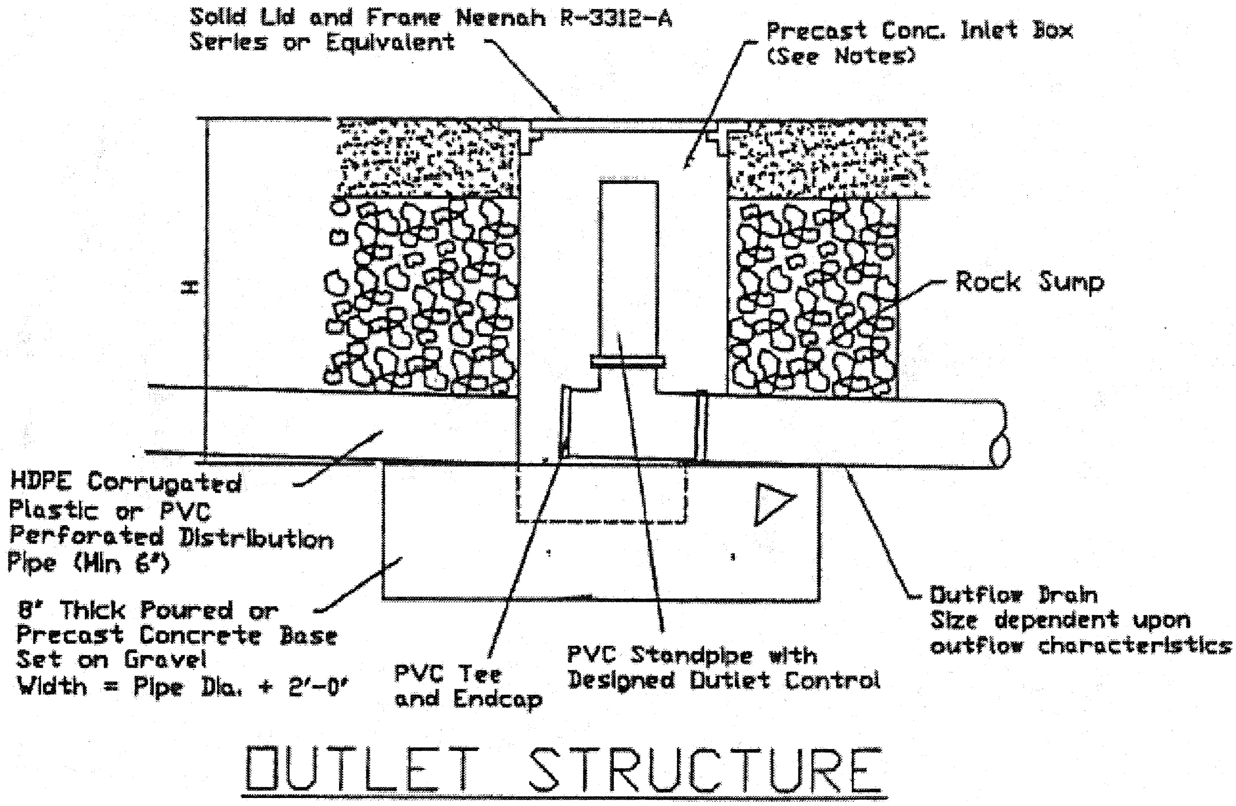


Figure S3 – Sump Outlet Structure
(Information from Town of McCandless / Partridge Venture Engineering)

DESIGN PARAMETERS
RESIDENTIAL ON-LOT SUMP
(TOTAL IMPERVIOUS AREA < 5,000 S.F.)

IMPERVIOUS AREA (SQ. FT.)	DEPTH OF SUMP (FT.)					SUMP VOLUME REQUIRED (CU. FT.)	
	1	2	3	4	5		
	DIAMETER OF OUTLET ORIFICE (IN)					NET	ROCK
400	11/16	9/16	1/2	1/2	1/2	68	170
600	13/16	11/16	5/8	9/16	9/16	102	255
800	15/16	13/16	11/16	5/8	5/8	136	340
1000	1-1/16	7/8	13/16	3/4	11/16	170	425
1200	1-3/16	1-0	7/8	13/16	3/4	204	510
1400	1-1/4	1-1/16	15/16	7/8	13/16	238	595
1600	1-3/8	1-1/8	1-0	15/16	7/8	272	680
1800	1-7/16	1-3/16	1-1/16	1-0	15/16	306	765
2000	1-1/2	1-1/4	1-1/8	1-1/16	1-0	340	850
2200	1-9/16	1-5/16	1-3/16	1-1/8	1-1/16	374	935
2400	1-5/8	1-3/8	1-1/4	1-3/16	1-1/8	408	1020
2600	1-11/16	1-7/16	1-5/16	1-1/4	1-1/8	442	1105
2800	1-3/4	1-1/2	1-3/8	1-1/4	1-3/16	476	1190
3000	1-13/16	1-9/16	1-3/8	1-5/16	1-1/4	510	1275
3200	1-7/8	1-5/8	1-7/16	1-3/8	1-1/4	544	1360
3400	1-15/16	1-5/8	1-1/2	1-3/8	1-5/16	578	1445
3600	2-0	1-11/16	1-9/16	1-7/16	1-3/8	612	1530
3800	2-1/16	1-3/4	1-9/16	1-7/16	1-3/8	646	1615
4000	2-1/8	1-13/16	1-5/8	1-1/2	1-7/16	680	1700
4200	2-3/16	1-13/16	1-11/16	1-9/16	1-7/16	714	1785
4400	2-1/4	1-7/8	1-11/16	1-9/16	1-1/2	748	1870
4600	2-5/16	1-15/16	1-3/4	1-5/8	1-9/16	782	1955
4800	2-5/16	1-15/16	1-3/4	1-5/8	1-9/16	816	2040
5000	2-3/8	2-0	1-13/16	1-11/16	1-5/8	850	2125

Table S1
(Information from Town of McCandless / Partridge Venture Engineering)

Design Basis

The sump designs are based upon documents and detail sheets provided by Partridge Venture Engineering.

Determine the square footage for the Standardized Rock Sump Foot Print from the "Determination of SWM Facility Sizing" table (Disturbed Area Table).

Note that the square footage of the "sump foot print" for the Standardized Design provided in the Disturbed Area Table is based upon an assumed sump rock depth of 4'.

Different sump rock depths may be used. These may be determined by multiplying the "sump foot print" by the assumed rock depth of four (4') feet, to determine the cubic feet of rock required for the sump. Then use Table S1 to select determine the "diameter of the outlet orifice" need for the actual depth proposed.

To determine the sump foot print needed for the actual depth proposed, multiply the cubic feet of rock required by the actual depth of the sump proposed.

Inspection and Maintenance Requirements

As with all infiltration practices, Dry Wells require regular and effective maintenance to ensure prolonged functioning. The following represent minimum maintenance requirements for Dry Wells:

Activity	Schedule
• Initial inspection	By Building Inspector to Insure Proper Sizing
• Ensure that sediment is not directed to the sump	As needed
• Regularly clean out gutters and ensure proper connections to facilitate the effectiveness of the dry well.	As needed, based on inspection
• Evaluate the drain-down time of the Dry Well to ensure the maximum time of 72 hours is not being exceeded. If drain-down times are exceeding the maximum, drain the Dry Well via pumping and clean out perforated piping, if included. If slow drainage persists, the system may need replacing.	As needed, based on inspection
• Reconstruct sump if its no longer functioning as originally designed	As needed, based on inspection
• Replace filter screen that intercepts roof runoff as necessary. If an intermediate sump box exists, clean it out at least once per year.	Annually

This Guidance document is based upon information abstracted from the Georgia Stormwater Manual, the PA SW BMP Manual and the Town of McCandless. .

Guidance Sheet - Porous Pavements

Description: Porous concrete is the term for a mixture of coarse aggregate, Portland cement and water that allow for rapid infiltration of water and overlays a stone aggregate reservoir. This reservoir provides temporary storage as runoff infiltrates into underlying permeable soils and/or out through an underdrain system.

(Photograph Source: Pittsburgh Mobile Concrete)

KEY CONSIDERATIONS

- Soil infiltration rate of 0.5 in/hr or greater required
- Pour the concrete using a volumetric (mobile) mixer
- Excavated area filled with stone media; gravel and sand filter layers with observation well
- Pre-treat runoff if sediment present
- Provides reduction in runoff volume
- Somewhat higher cost when compared to conventional pavements
- Potential for high failure rate if poorly designed, poorly constructed, not adequately maintained or used in unstabilized areas
- Potential for groundwater contamination

STORMWATER MANAGEMENT SUITABILITY

☑ **Water Quality**

9 **Channel/Flood Protection**

SPECIAL APPLICATIONS

☐ **Pretreatment**

☑ **High Density/Ultra-Urban**

☑ **Other: Overflow Parking, Driveways & related uses**

Residential Subdivision Use: *Yes*
(in common areas that are maintained)

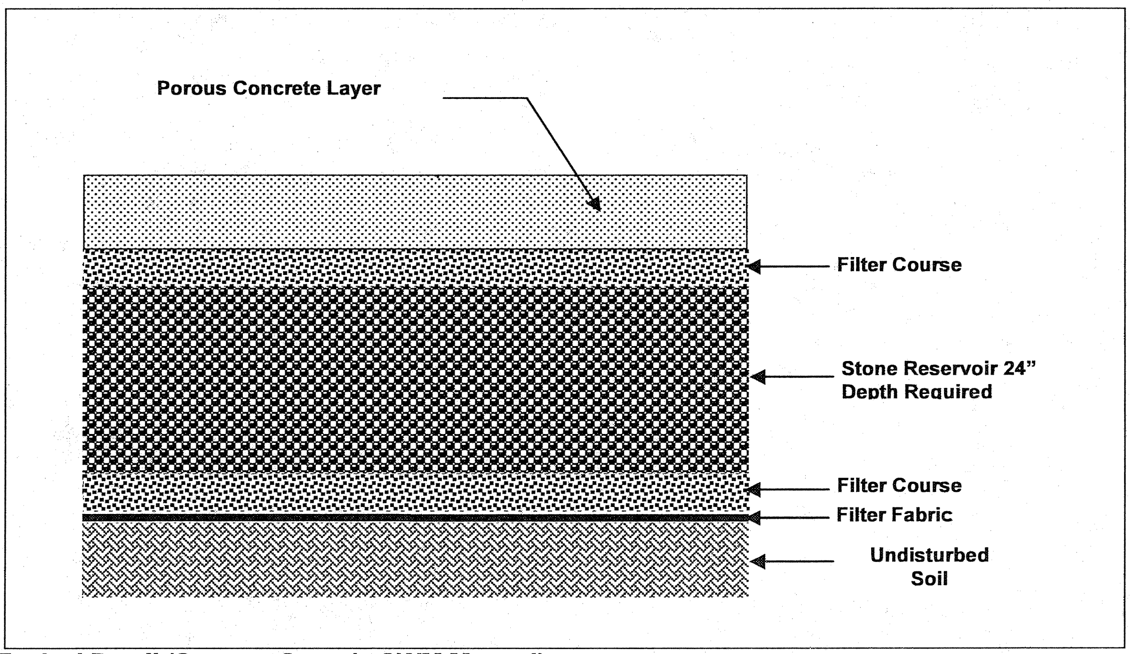
9 in certain situations

General Description – Porous Concrete

Porous concrete (also referred to as *enhanced porosity concrete*, *porous concrete*, *portland cement pervious pavement* and *pervious pavement*) is a subset of a broader family of pervious pavements including porous asphalt, and various kinds of grids and paver systems. Porous concrete is thought to have a greater ability than porous asphalt to maintain its porosity in hot weather and thus is provided as a limited application control. Although, porous concrete has seen growing use, there is still very limited practical experience with this measure.

Porous concrete consists of a specially formulated mixture of Portland cement, uniform, open graded course aggregate, and water. The concrete layer has a high permeability often many times that of the underlying permeable soil layer, and allows rapid percolation of rainwater through the surface and into the layers beneath. The void space in porous concrete is in the 15% to 22% range compared to three to five percent for conventional pavements. The permeable surface is placed over a layer of open-graded gravel and crushed stone. The void spaces in the stone act as a storage reservoir for runoff.

Porous concrete is designed primarily for stormwater quality, i.e. the removal of stormwater pollutants. However, they can provide limited runoff quantity control, particularly for smaller storm events. For some smaller sites, trenches can be designed to capture and infiltrate the channel protection volume (Cp_v) in addition to WQ_v. Porous concrete will need to be used in conjunction with another structural control to provide overbank and extreme flood protection, if required.



Typical Detail (Source: Georgia SWM Manual)

Modifications or additions to the standard design have been used to pass flows and volumes in excess of the water quality volume, or to increase storage capacity or treatment. These include:

- Placing a perforated pipe near the top of the crushed stone reservoir to pass excess flows after the reservoir is filled
- Providing surface detention storage in a parking lot, adjacent swale, or detention pond with suitable overflow conveyance
- Connecting the stone reservoir layer to a stone filled trench
- Adding a sand layer and perforated pipe beneath the stone layer for filtration of the water quality volume
- Placing an underground detention tank or vault system beneath the layers

The infiltration rate of the soils in the subgrade should be adequate to support drawdown of the entire runoff capture volume within 24 to 48 hours. Special care must be taken during construction to avoid undue compaction of the underlying soils which could affect the soils' infiltration capability.

Slopes should be flat or gentle to facilitate infiltration versus runoff and the seasonally high water table or bedrock should be a minimum of two feet below the bottom of the gravel layer if infiltration is to be relied on to remove the stored volume.

Porous concrete has the positive characteristics of volume reduction due to infiltration, groundwater recharge, and an ability to blend into the normal urban landscape relatively unnoticed. It also allows a reduction in the cost of other stormwater infrastructure, a fact that may offset the greater placement cost somewhat.

A drawback is the cost and complexity of porous concrete systems compared to conventional pavements. Porous concrete systems require a very high level of construction workmanship to ensure that they function as designed. They experience a high failure rate if they are not designed, constructed and maintained properly.

Design Criteria and Specifications

- Porous concrete systems can be used where the underlying in-situ subsoils have an infiltration rate greater than 0.5 inches per hour. Therefore, porous concrete systems are not suitable on sites with hydrologic group D and many group C soils, or soils with a high (>30%) clay content. In areas where poor infiltration is expected the gravel bed should be properly graded and an overflow provided to drain the bed so that water will not be trapped in the pervious concrete. During construction and preparation of the subgrade, special care must be taken to avoid compaction of the soils.

- Pour the concrete using volumetric (mobile) mixer.

- Porous concrete systems should typically be used in applications where the pavement receives tributary runoff only from impervious areas. Actual pervious surface area sizing will depend on achieving a 24 hour minimum and 48 hour maximum draw down time for the design storm volume.

- If runoff is coming from adjacent pervious areas, it is important that those areas be fully stabilized to reduce sediment loads and prevent clogging of the porous paver surface. Pretreatment using filter strips or vegetated swales for removal of course sediments is recommended. (see sections 3.3.1 and 3.3.2)

- Porous concrete systems should not be used on slopes greater than 5% with slopes of no greater than 2% recommended. For slopes greater than 1% barriers perpendicular to the direction of drainage should be installed in sub-grade material to keep it from washing away, or filter fabric should be placed at the bottom and sides of the aggregate to keep soil from migrating into the aggregate and reducing porosity.

- A minimum of four feet of clearance is recommended (may be reduced to two feet in coastal areas) between the bottom of the gravel base course and underlying bedrock or the seasonally high groundwater table.

- Porous concrete systems should be sited at least 10 feet down-gradient from buildings and 100 feet away from drinking water wells.

- To protect groundwater from potential contamination, runoff from designated hotspot land uses or activities must not be infiltrated. Porous concrete should not be used for manufacturing and industrial sites, where there is a potential for high concentrations of soluble pollutants and heavy metals. In addition, porous concrete should not be considered for areas with a high pesticide concentration. Porous concrete is also not suitable in areas with karst geology without adequate geotechnical testing by qualified individuals and in accordance with local requirements.
- Porous concrete system designs must use some method to convey larger storm event flows to the conveyance system. One option is to use storm drain inlets set slightly above the elevation of the pavement. This would allow for some ponding above the surface, but would accept bypass flows that are too large to be infiltrated by the porous concrete system, or if the surface clogs.

- For the purpose of sizing downstream conveyance and structural control system, porous concrete surface areas can be assumed to 35% impervious. In addition, credit can be taken for the runoff volume infiltrated from other impervious areas using the methodology in Section 3.1.

- For treatment control, the design volume should be, at a minimum, equal to the water quality volume. The water quality storage volume is contained in the surface layer, the aggregate reservoir, and the sub-grade above the seasonal high water table – if the sub-grade is sandy. The storm duration (fill time) is normally short compared to the infiltration rate of the sub-grade, a duration of two hours can be used for design purposes. The total storage volume in a layer is equal to the percent of voids times the volume of the layer. Alternately storage may be created on the surface through temporary ponding, though this would tend to accelerate clogging if course sediment or mud settles out on the surface.

- The cross-section typically consists of four layers, as shown on the Typical Detail. The aggregate reservoir can sometimes be avoided or minimized if the sub-grade is sandy and there is adequate time to infiltrate the necessary runoff volume into the sandy soil without by-passing the water quality volume. Descriptions of each of the layers is presented below:

  Porous Concrete Layer – The porous concrete layer consists of an open-graded concrete mixture usually ranging from depths of 2 to 4 inches depending on required bearing strength and pavement design requirements. Porous concrete can be assumed to contain 18 percent voids (porosity = 0.18) for design purposes. The omission of the fine aggregate provides the porosity of the porous pavement. To provide a smooth riding surface and to enhance handling and placement a coarse aggregate of 3/8 inch maximum size is normally used. Use No. 89 coarse aggregate (3/8 to No. 50) per ASTM D 448.

  Top Filter Layer – Consists of a 0.5 inch diameter crushed stone to a depth of 1 to 2 inches. This layer serves to stabilize the porous asphalt layer. Can be combined with reservoir layer using suitable stone.

  Reservoir Layer – The reservoir gravel base course consists of washed, bank-run gravel, 1.5 to 2.5 inches in diameter with a void space of about 40% (Clean Washed No. 2B Stone). **The depth of this layer shall be two (2') feet.** A porosity value (void space/total volume) of 0.32 was assumed.

  Bottom Filter Layer – The surface of the subgrade should be an 6 inch layer of sand (ASTM C-33 concrete sand) or a 2 inch thick layer of 0.5 inch crushed stone, and be completely flat to promote infiltration across the entire surface. This layer serves to stabilize the reservoir layer, to protect the underlying soil from compaction, and act as the interface between the reservoir layer and the filter fabric covering the underlying soil.

  Filter Fabric – It is very important to line the entire trench area, including the sides, with filter fabric prior to placement of the aggregate. The filter fabric serves a very important function by inhibiting soil from migrating into the reservoir layer and reducing storage capacity. Fabric should be MIRFI # 14 N or equivalent.

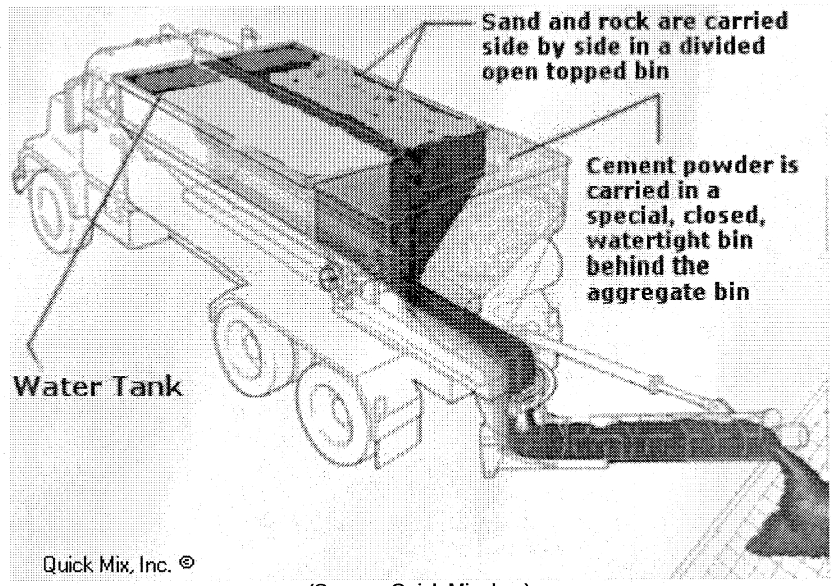
  Underlying Soil – The underlying soil should have an infiltration capacity of at least 0.5 in/hr, but preferably greater than 0.50 in/hr.

- The pit excavation should be limited to the width and depth specified in the design. Excavated material should be placed away from the open trench as not to jeopardize the stability of the trench sidewalls. The bottom of the excavated trench should not be loaded so as to cause compaction, and should be scarified prior to placement of sand. The sides of the trench shall be trimmed of all large roots. The sidewalls shall be uniform with no voids and scarified prior to backfilling. All infiltration trench facilities should be protected during site construction, and should be constructed after upstream areas have been stabilized.

- An observation well consisting of perforated PVC pipe 4 to 6 inches in diameter may be placed at the downstream end of the facility and protected. The well should be used to determine actual infiltration rates.

Volumetric (Mobile) Concrete Mixers

The Mobile Concrete Mixer is a combination materials transporter and mobile concrete mixing plant, mounted on a transport vehicle, usually a truck or trailer, which carries sufficient unmixed material, sand, cement, coarse aggregates, water (and any other chemicals that may be used for special mix designs) to the job to produce fresh concrete, mixed to design specifications.



(Source: Quick Mix, Inc.)

Sand and stone are accurately proportioned by adjusting gates to the correct height. The settings are based on actual calibration of the gate settings done with the specific aggregates being used.

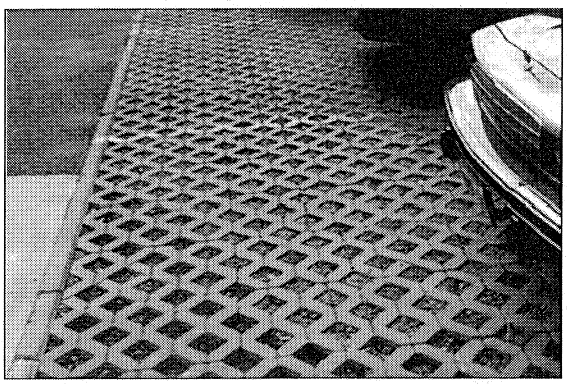

(Source: Pittsburgh Mobile Concrete)

The three basic dry ingredients (sand, stone, and cement powder) simultaneously drop off the main conveyor into the charging end of the mixer at the rear of the unit. At this point, a predetermined metered flow of water also enters the mixer. Action of the combined auger and paddle mixer rapidly, thoroughly, and continuously mixes the ingredients and water to produce a continuous discharge of uniform quality concrete.

The materials blending action is continuous, and may proceed until the ingredient bins are empty. On the other hand, mixing and delivery may be stopped at any time and then started again at the will of the operator. This permits production to be balanced to the demands of the placing and finishing crews and other job requirements

General Description Modular Paver Systems

Modular porous pavers are structural units, such as concrete blocks, bricks, or reinforced plastic mats, with regularly interdispersed void areas used to create a load-bearing pavement surface. The void areas are filled with pervious materials (gravel, sand, or grass turf) to create a system that allows for the infiltration of stormwater runoff. Porous paver systems provide water quality benefits in addition to groundwater recharge and a reduction in stormwater volume. The use of porous paver systems results in a reduction of the effective impervious area on a site.



There are many different types of modular porous pavers available from different manufacturers, including both pre-cast and mold in-place concrete blocks, concrete grids, interlocking bricks, and plastic mats with hollow rings or hexagonal cells

Modular porous pavers are typically placed on a gravel (stone aggregate) base course. Runoff infiltrates through the porous paver surface into the gravel base course, which acts as a storage reservoir as it exfiltrates to the underlying soil. The infiltration rate of the soils in the subgrade must be adequate to support drawdown of the entire runoff capture volume within 24 to 48 hours. Special care must be taken during construction to avoid undue compaction of the underlying soils, which could affect the soils' infiltration capability.

A drawback is the cost and complexity of modular porous paver systems compared to conventional pavements. Porous paver systems require a higher level of construction workmanship to ensure that they function as designed. In addition, there is the difficulty and cost of rehabilitating the surfaces should they become clogged.

The system must be installed based upon the manufactures recommendations. **The gravel layer required for the Standardized Single Lot Residential Facility is a minimum of two (2') feet in depth.**

Design Basis

For the Standardized BMP for a single residential lot, the minimum surface area of the porous pavement was determined from the following equation:

$$A = WQ_v/(n_g d_g + kT/12)$$

Where:

A = Surface Area Porous Pavement (SF)
WQv = Water Quality Volume in CF
n_g = 0.32 = porosity of the gravel
d_g = 2' = depth or gravel layer (feet)
k = percolation = 0.5 inches/hour assumed
T= Fill Time = 2 hours (time for the practice to fill with water), in hours

Inspection and Maintenance Requirements

Typical Maintenance Activities for Porous Concrete Systems

Activity	Schedule
• Initial inspection	Monthly for three months after installation
• Ensure that the porous paver surface is free of sediment	Monthly
• Ensure that the contributing and adjacent area is stabilized and mowed, with clippings removed	As needed, based on inspection
• Vacuum sweep porous concrete surface followed by high pressure hosing to keep pores free of sediment	Four times a year
• Inspect the surface for deterioration or spalling • Check to make sure that the system dewaters between storms	Annually
• Spot clogging can be handled by drilling half-inch holes through the pavement every few feet • Rehabilitation of the porous concrete system, including the top and base course as needed	Upon failure

To ensure proper maintenance of porous pavement, a carefully worded maintenance agreement is essential. It should include specific the specific requirements and establish the responsibilities of the property owner and provide for enforcement.

This Guidance document is based upon information abstracted from the Georgia Stormwater Manual and the Quick Mix, Inc. web site.

STANDARD PROCEDURES
EROSION AND SEDIMENTATION CONTROLS
FOR INDIVIDUAL RESIDENTIAL LOTS

General

Erosion and Sedimentation from individual residential lots can most often be controlled by silt fence along the lower perimeter of all disturbed areas and the installation of a rock construction entrance where construction traffic will enter and exit the site. Standard Construction Detail, Sheet ES-1, shows the typical erosion controls that should be placed on high and low side lots. If the scope of the work requires additional measures on the site, an individual plan must be submitted and approved by the Township of Ross. In all cases, the Contractor is responsible for complying with the provisions of PA DEP Chapter 102.

Temporary Erosion Controls

Silt fence must be installed along the lower perimeter of all disturbed areas and will function as the primary control for the site. A stone construction entrance must be installed at the driveway entrance to the site to help prevent mud from being tracked out onto the roadway. When at all possible, construction vehicles should be restricted to paved surfaces.

All uncompleted disturbed areas on which activity will cease for more than twenty (20) days should be seeded and stabilized. After construction is complete and all areas are stabilized, all temporary control measures may be removed and all monitoring will cease. Stabilization is defined as the establishment of a uniform 70% perennial vegetal cover.

Staging Schedule

In general, the following staging schedule should be followed for small projects"

1. Install the silt fence in accordance with the standard detail shown on Detail Sheet ES-2 along the lower perimeter of all disturbed areas.

2. Install the rock construction entrance in accordance with the standard detail shown on Detail Sheet ES-2 at the entrance to the site. The stone base for the driveway should also be installed as soon as it is graded in order to prevent erosion.

3. Grub the construction area and remove the topsoil, stockpiling it at the area designated on the plans.

4. Construct the site improvements.

5. Seed and mulch all disturbed areas.

6. Remove all E & S Controls once the site is stabilized. An area will not be considered stabilized until a uniform 70% perennial vegetal cover is established over the disturbed area.

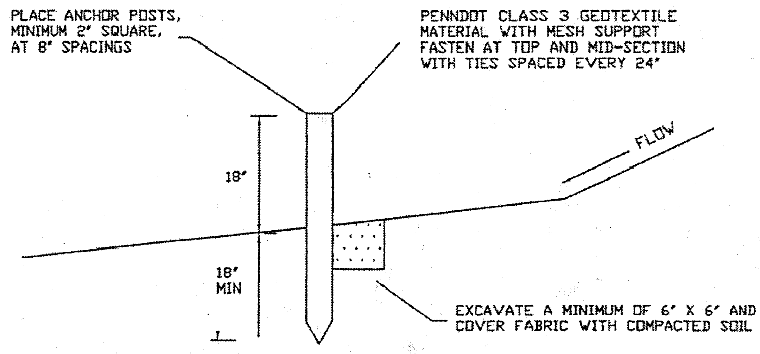
Maintenance Schedule

It shall be the sole responsibility of the contractor to execute the control of inspection, maintenance, and repair of various sediment control facilities according to the guidelines prescribed below.

All control measures must be inspected on a weekly basis, and in all cases immediately following each runoff event. All necessary repairs should be carried out immediately after their identification. Materials cleaned from the BMP's shall be disposed of by spreading them in the topsoil stockpile area.

Silt Fence

Maintenance checks shall include inspecting silt fence for undercutting, tears, collapse offence, and depths of sediment accumulation. All repairs of damaged fence must be performed immediately to ensure that the fence meets design specifications. Sediment should be removed periodically, and in all cases



INSTALLATION:

A TRENCH WILL BE PLOWED OR OTHERWISE EXCAVATED TO THE REQUIRED DEPTH WITH LITTLE, IF ANY, DISTURBANCE TO THE DOWNSLOPE SIDE OF THE TRENCH. THE BOTTOM OF THE TRENCH AND THE FENCE TOP WILL BE PLACED ON A LEVEL GRADE. WHEN IT IS NECESSARY TO CROSS SMALL DEPRESSIONS, THE TRENCH BOTTOM AND FENCE TOP EDGE MAY DEVIATE SLIGHTLY FROM LEVEL GRADE. GRADES IN SUCH SECTIONS WILL NOT EXCEED 1% NOR WILL THE DEVIATION EXTEND FOR MORE THAN 25 FEET.

SUPPORT STAKES WILL BE DRIVEN TO THE REQUIRED DEPTH BELOW THE EXISTING GROUND SURFACE AT SPECIFIED INTERVALS AS ILLUSTRATED.

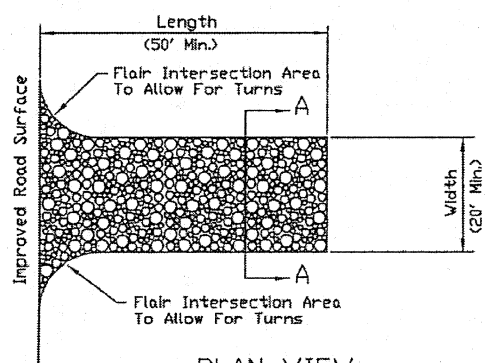
STRETCH AND FASTEN FABRIC TO THE UPSLOPE SIDE OF THE SUPPORT STAKES.

WHERE ENDS OF FABRIC COME TOGETHER, THEY WILL BE OVERLAPPED, FOLDED, AND STAPLED TO PREVENT SEDIMENT BYPASS. AT THE ENDS OF EACH LINE OF SILT FENCE, OR EVERY 100 FEET, WHICHEVER IS S SHORTER, EXTEND THE FENCE UPSLOPE AT A 90 DEGREE ANGLE FOR 4 FEET TO PREVENT ENDFLOW.

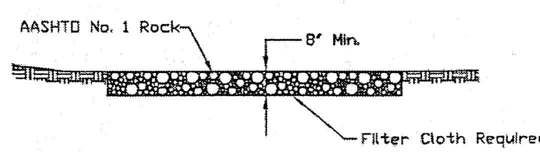
THE TOE ANCHOR WILL BE BACKFILLED AND COMPACTED TO A DENSITY EQUAL TO SURROUNDING SOILS.

SILT FENCE

NO SCALE



PLAN VIEW



SECTION A-A

MAINTENANCE: The structure's thickness will be constantly maintained to the specified dimensions by adding rock. A stockpile of rock material will be maintained on the site for this purpose. At the end of each construction day, all sediment deposited on public roadways will be removed and returned to the

ROCK CONSTRUCTION ENTRANCE DETAIL

NO SCALE

Detail ES-2

(Detail from Town of McCandless / Partridge Venture Engineering)

ORDINANCE APPENDIX C

STORMWATER BEST MANAGEMENT PRACTICES OPERATIONS AND MAINTENANCE AGREEMENT

THIS AGREEMENT, made and entered into this ___________ day of ________, 20____, by and between __________________________________, (hereinafter the "Landowner"), and _____________________________________, Allegheny County, Pennsylvania, (hereinafter "Municipality");

WITNESSETH

WHEREAS, the Landowner is the owner of certain real property as recorded by deed in the land records of Allegheny County, Pennsylvania, Deed Book __________ at Page ______, Block and Lot No. ______________, (Lot(s) ____ in the _________________Plan of Lots as recorded in Plan Book Volume ___, Page___,) (hereinafter "Property").

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

WHEREAS, the stormwater management BMP Operations and Maintenance Plan approved by the Municipality (hereinafter referred to as the "Plan") for the Property, provides for management of stormwater within the confines of the Property through the use of Best Management Practices (BMPs); and

WHEREAS, the Municipality and the Landowner, his successors and assigns, agree that the health, safety, and welfare of the residents of the Municipality and the protection and maintenance of water quality require that on-site stormwater BMPs be constructed and maintained on the Property; and

WHEREAS, for the purposes of this Agreement, the following definitions shall apply:

- BMP – "Best Management Practice;" activities, facilities, designs, measures or procedures used to manage stormwater impacts from land development, to protect and maintain water quality and groundwater recharge and to otherwise meet the purposes of the Municipal Stormwater Management Ordinance, including, but not limited to, infiltration trenches, seepage pits, filter strips, bioretention, wet (retention) ponds, permeable paving, rain gardens, grassed swales, forested buffers, sand filters and detention basins.

- Infiltration Trench – A BMP surface structure designed, constructed, and maintained for the purpose of providing infiltration or recharge of stormwater into the soil and/or groundwater aquifer,

- Seepage Pit – An underground BMP structure designed, constructed, and maintained for the purpose of providing infiltration or recharge of stormwater into the soil and/or groundwater aquifer,

- Bioretention (Rain Garden) – A BMP overlain with appropriate mulch and suitable vegetation designed, constructed, and maintained for the purpose of providing infiltration or recharge of stormwater into the soil and/or underground aquifer, and

WHEREAS, the Municipality requires, through the implementation of the Plan, that stormwater management BMPs as required by said Plan and the Municipal Stormwater Management Ordinance be constructed and adequately operated and maintained by the Landowner, his successors and assigns.

NOW, THEREFORE, in consideration of the foregoing and intending to be legally bound, the parties hereto agree as follows:

1. The BMPs shall be constructed by the Landowner in accordance with the plans and specifications identified in the SWM Plan.

2. The Landowner shall operate and maintain the BMPs as shown on the Plan in good working order acceptable to the Municipality and in accordance with the specific maintenance requirements noted on the Plan, if any.

3. The Landowner agrees to inspect each BMP annually and after major storm events and correct any deficiencies noted during each inspection. The results of each inspection shall be provided to the Municipality upon request.

4. The Landowner hereby grants permission to the Municipality, its authorized agents and employees, to enter upon the property, at reasonable times and upon presentation of proper identification, to inspect the BMPs whenever it deems necessary. Whenever possible, the Municipality shall notify the Landowner prior to entering the property.

5. In the event that the Landowner fails to operate and maintain the BMPs as shown on the Plan in good working order acceptable to the Municipality, the Municipality or its representatives may enter upon the Property and take whatever action is deemed necessary to maintain said BMPs. This provision shall not be construed to allow the Municipality to erect any permanent structure on the land of the Landowner. It is expressly understood and agreed that the Municipality is under no obligation to maintain or repair said facilities, and in no event shall this Agreement be construed to impose any such obligation on the Municipality.

6. In the event that the Municipality, pursuant to this Agreement, performs work of any nature, or expends any funds in performance of said work for labor, use of equipment, supplies, materials, and the like, the Landowner shall reimburse the Municipality for all expenses incurred plus 10% for administrative overhead within 10 days of receipt of invoice from the Municipality.

7. The intent and purpose of this Agreement is to ensure the proper maintenance of the onsite BMPs by the Landowner; provided, however, that this Agreement shall not be deemed to create or effect any additional liability of any party for damage alleged to result from or be caused by stormwater runoff.

8. The Landowner, its executors, administrators, assigns, and other successors in interests, shall release the Municipality's employees and designated representatives from all damages, accidents, casualties, occurrences or claims which might arise or be asserted against said employees and representatives from the construction, presence, existence, or maintenance of the BMPs by the Landowner or Municipality. In the event that a claim is asserted against the Municipality, its designated representatives or employees, the Municipality shall promptly notify the Landowner and the Landowner shall defend, at his own expense, any suit based on the claim. If any judgment or claims against the Municipality's employees or designated representatives shall be allowed, the Landowner shall pay all costs and expenses regarding said judgment or claim.

9. This Agreement shall be recorded at the Office of the Recorder of Deeds of Allegheny County, Pennsylvania, and shall constitute a covenant running with the Property and/or equitable servitude, and shall be binding on the Landowner, his administrators, executors, assigns, heirs and any other successors in interests, in perpetuity.

ATTEST:

WITNESS the following signatures and seals:

(SEAL) For the Municipality:

____

(SEAL) For the Landowner:

____

ATTEST:

______________________________ (City, Borough, Township)

County of ____________________________, Pennsylvania

I, ____, a Notary Public in and for the County and State aforesaid, whose commission expires on the __________ day of __________________, 2___, do hereby certify that ____ whose name(s) is/are signed to the foregoing Agreement bearing date of the ___________ day of ___________________, 2___, has acknowledged the same before me in my said County and State.

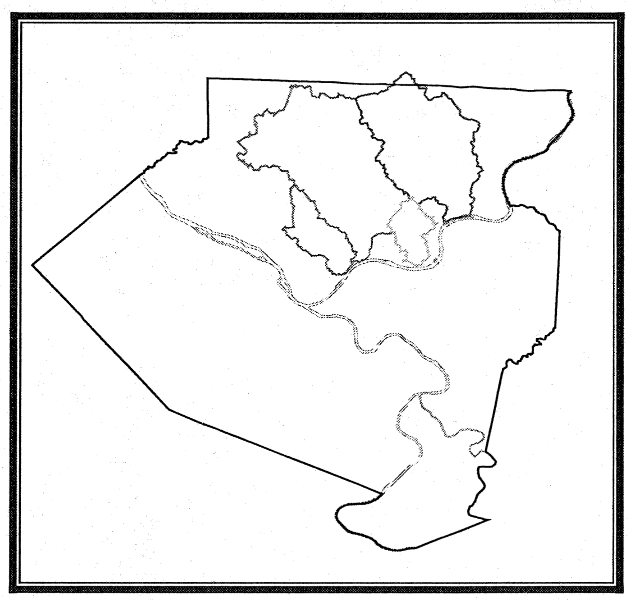
GIVEN UNDER MY HAND THIS _____________ day of ___________, 2__.

_________________________________ _______________________________________

NOTARY PUBLIC **(SEAL)**

(Source: This appendix was developed from, Guidance on MS4 Ordinance Provisions, Document Number 392-0300-003, by the Pennsylvania Department of Environmental Protection, dated August 2, 2003.)

Act 167 Stormwater Management Plan Update
Girtys Runs, Pine Creek, Squaw Run and Deer Creek Watersheds
Allegheny County, Pennsylvania



Report Appendices

Appendix A **Synoptic Precipitation Analysis for the ALCOSAN Service Area (Only Section 3)**

Appendix B **MS4 PAG – 13 Stormwater Management Program Requirements**

Appendix C **MS4 Public Education Advertisements**

Appendix D **Matrices**
- Stormwater Management Ordinance Review Matrix
- Subdivision Ordinance Review Matrix
- Zoning Ordinance Review Matrix
- Grading Ordinance Review Matrix

Appendix E **EPA's Aquatic Buffer Model Ordinance**

Report Appendix A

Synoptic Precipitation Analysis for the ALCOSAN Service Area

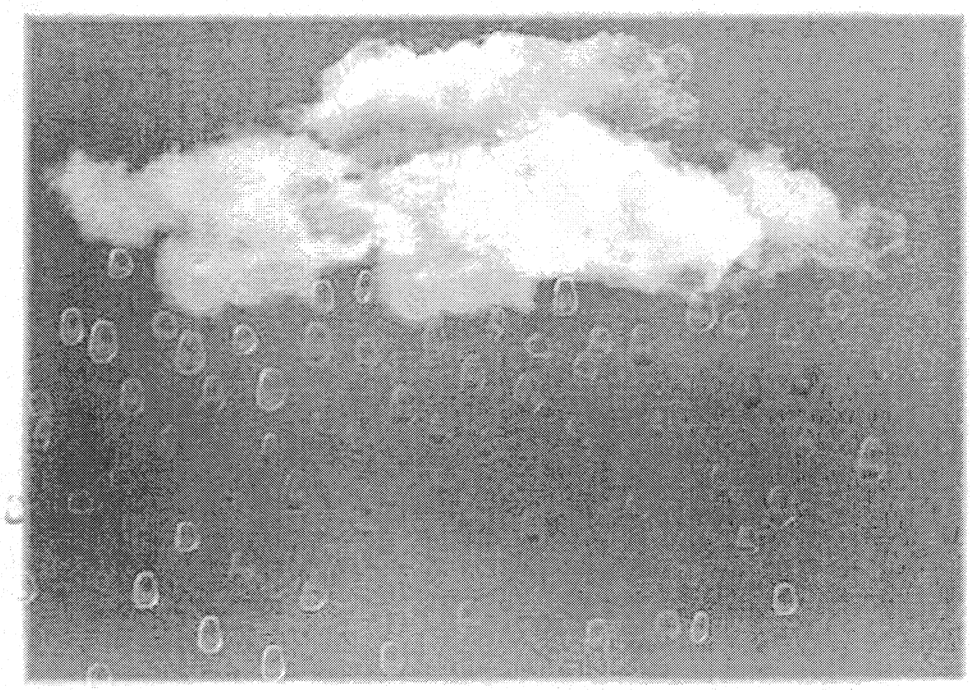
(Note: Includes Only Sections 3 of ALCOSAN Report)

CDM

Allegheny County Sanitary Authority

Synoptic Precipitation Analysis for the ALCOSAN Service Area

February 2003



Final Report

Contents

Section 3 Long-Term Historical Precipitation Analysis

A long-term sequence of precipitation data can be analyzed in a number of different ways to develop relatively concise characterizations, which may then be used to evaluate certain individual time periods. Prior to analyzing the spatially distributed precipitation data collected within the ALCOSAN service area since 1993, a long-term historical precipitation analysis on data collected at the PIA was needed. The data available from the PIA gauge location ranged from 1948 through 2002. The analysis on this historical data set was necessary in order to establish long-term characteristics of precipitation over the ALCOSAN service area.

3.1 Total and Average Precipitation Volumes

The first criterion used for describing historical precipitation was the total volume of precipitation occurring each year. Comparing a particular year's precipitation to the long-term average allowed for determinations of wet- and dry-years. Monthly totals and averages were also computed in the same way to examine seasonal differences. By examining these annual and monthly precipitation totals, the characteristics of precipitation over the ALCOSAN service area for specific time periods could be evaluated.

Figure 3-1 shows the annual precipitation volumes at the PIA from 1948 through 2002. Annual volumes comprised of a complete 12-month record are shown in blue. Annual volumes that are incomplete due to missing and/or insufficient data are shown in red. The average annual precipitation volume of 36.50 inches is shown on the plot by a solid horizontal line and was used as a tool for comparing a particular year's precipitation to the long-term annual average. The average annual precipitation volume plus and minus one standard deviation is shown as well by dashed lines and was used to assess the variability in the annual precipitation volumes.

Figure 3-1 shows that the wettest and driest years on record were 1990 (52.24 in.) and 1963 (25.84 in.), respectively. The nine-year period (1994-2002) evaluated in this report includes years that are among the driest and wettest on record. Examining complete years of the historical record, 1995 is the sixth driest calendar year in terms of total annual precipitation, 1996 is the fourth wettest, and 1994 is the ninth wettest.

Figure 3-2 shows the average monthly precipitation volumes based upon the PIA historical record. Also depicted on the table at the bottom of the figure are the average monthly precipitation volumes plus and minus one standard deviation. These were used to assess the variability in the monthly precipitation volumes. The figure shows that, on average, the summer months of May, June, and July are the wettest months of the year while the months of February and October are the driest.

Figure 3-1: Annual Precipitation Volumes (PIA Historical Record)

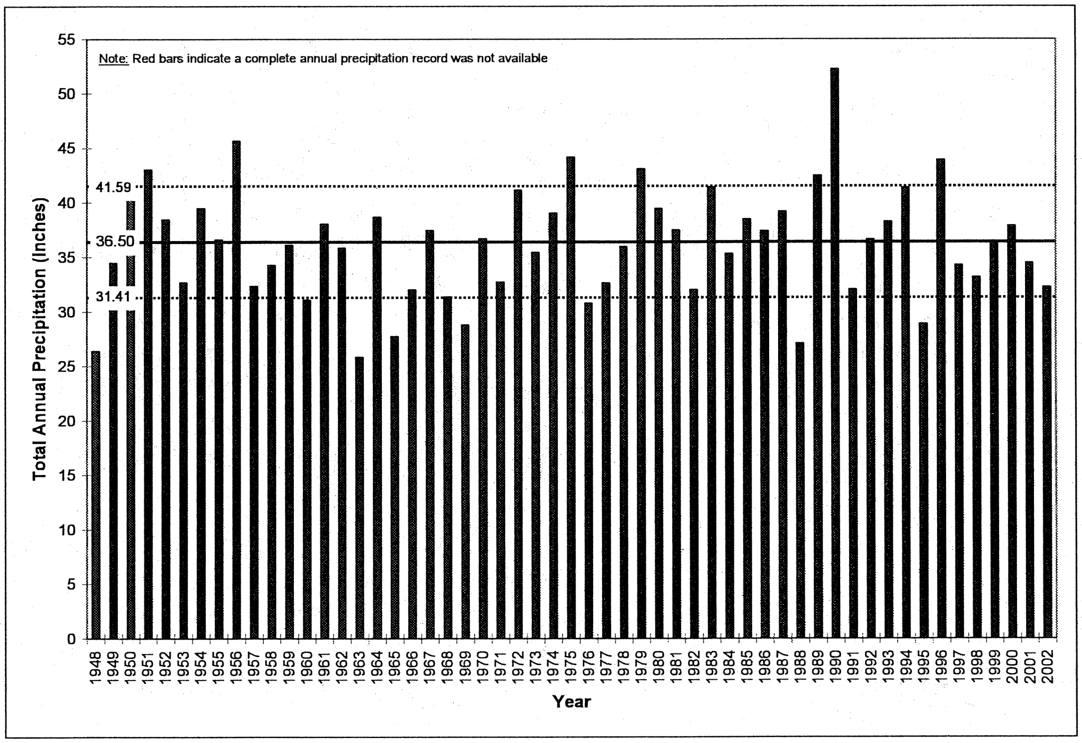
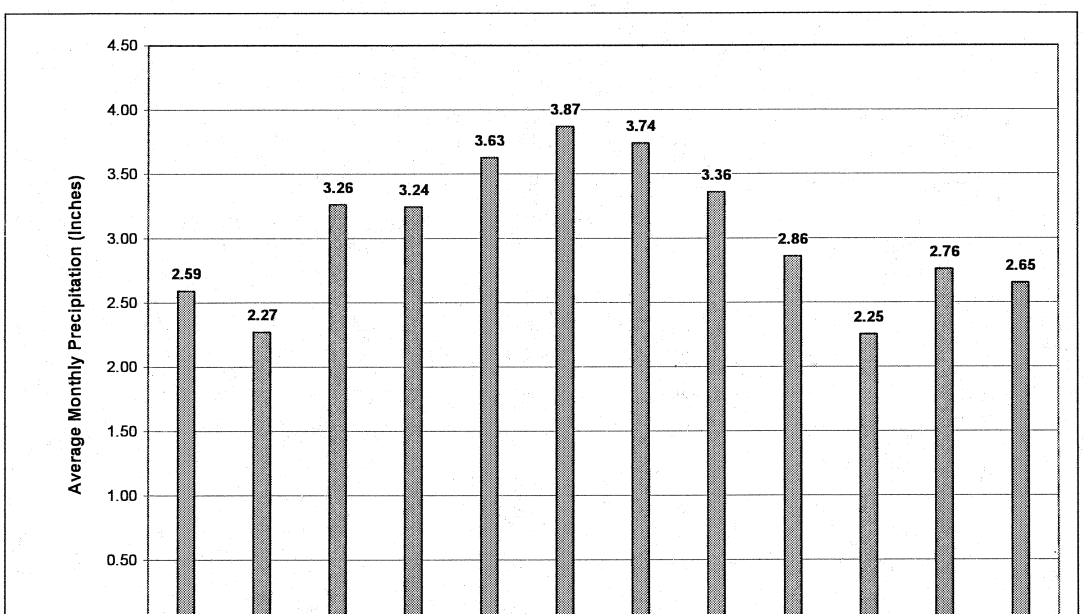


Figure 3-2: Average Monthly Precipitation Volumes (PIA Historical Record)



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Average	2.59	2.27	3.26	3.24	3.63	3.87	3.74	3.36	2.86	2.25	2.76	2.65
Avg+1SD	3.82	3.35	4.58	4.49	5.15	5.78	5.36	5.22	4.27	3.55	4.41	3.92
Avg-1SD	1.37	1.19	1.94	2.00	2.11	1.96	2.12	1.50	1.45	0.96	1.11	1.39

3.2 Historic Event Statistics

In the SWMM package, the Runoff Block is used to read precipitation data and generate overland flows for input into the Transport or Extran Blocks. The purpose of the Rain Block is to read long-term series of precipitation records, perform an optional storm event analysis, and generate a precipitation interface file for input into Runoff. The optional storm event output option was chosen to perform a storm event analysis on the PIA historical precipitation record.

Using this option, information was developed on the characteristics of individual storm events of the PIA historical record. Each storm event in the historical record was characterized by its duration, volume, average intensity, maximum intensity, and the time interval between successive events. The event data was then analyzed using standard statistical procedures to determine the mean and standard deviation, as well as probability distributions and recurrence intervals.

3.2.1 Selection of Minimum Storm Depth & Interevent Time

Prior to performing the storm event analysis, the minimum interevent time (MIT) had to be selected indicating the number of zero-rainfall hours that constitute an interevent period. In other words, the number of consecutive dry hours encountered in the search must be equal to or greater than the MIT in order for the preceding wet period (made up of at least one non-zero precipitation value) to be considered a separate event. Dry periods of duration less than the MIT may exist within an event preceded and followed by wet periods. The number of events for the given period of analysis was directly dependent on the value of MIT. If a value of 1 (the minimum) were chosen for MIT, every contiguous precipitation sequence would be viewed as a separate event. Several urban runoff studies (e.g. EPA, 1983b) have evaluated MITs for precipitation events on the basis of the coefficient of variation (CV) of interevent times, where the CV is the ratio of the standard deviation to the mean. The MIT that gives a CV near 1.0 is usually chosen as the station MIT. This assumes that the interevent times have an exponential distribution for which the mean equals the standard deviation (hence, CV=1.0). Thus, the MIT is chosen to make the empirical data fit the theory.

In addition to selecting a MIT, a minimum precipitation depth was needed to define a storm event as well. For this historical analysis, it was important to differentiate between event precipitation depths that would significantly increase wastewater flows and potentially contribute to CSO discharges, and event precipitation that would be intercepted by vegetation above the ground and depression storage on the ground and not be a potential cause of CSOs. It was important to consider how storm event depths relate to precipitation that is retained on the land surface, infiltrated into the soil, or becomes direct runoff. Precipitation abstraction includes the interception of precipitation on vegetation above the ground, depression storage on the ground surface, and infiltration of water into the soil. Interception and depression storage abstractions are based on the nature of the vegetation and ground surface and would not contribute to CSO discharges.

A sensitivity analysis was performed and a storm event was defined as having greater than 0.10 inches of rainfall with a minimum of 6 dry hours between events. This storm event criteria was selected based upon: 1) the CV for a MIT of 6 hours was very close to 1.0 and 2) small storm event volumes of less than 0.10 inches would result in surface depression and evaporation and have little impact on the volume of runoff and infiltration into sewers. As a result, event volumes less than 0.10 inches were classified as non-contributors to CSOs and 3) rainfall statistics for other U.S. cities, such as those published in the Environmental Protection Agency's *Combined Sewer Overflow Control Manual*, used the same criteria to generate storm event statistics. Based upon the minimum interevent time (6 hours) and minimum event volume (0.10 inches) selected, the average annual number of precipitation events in the ALCOSAN service area, based on the historical record, is 71.35.

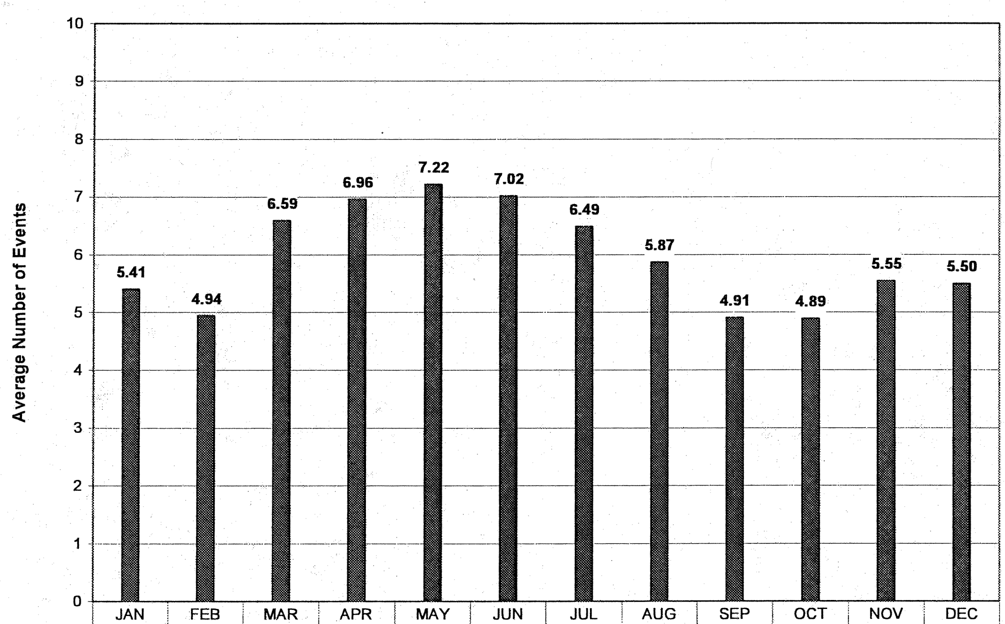
3.2.2 Event Characteristics Summary

Based on the storm event definition discussed in Section 3.2.1, information was developed on the characteristics of individual storm events from the PIA historical record. The sequence of hourly precipitation volumes were grouped into separate events and each storm was then characterized by its duration, volume, average intensity, maximum intensity, and time interval between successive events.

Figure 3-3 shows the average monthly number of events based upon the PIA historical record. Also depicted on the table at the bottom of the figure are the average monthly number of events plus and minus one standard deviation. These were used to assess the variability in the number of events occurring each month of the year. The figure shows that, on average, the most events occur during the summer months of May and June while the fewest occur during the months of February, September, and October.

The event data was further analyzed using standard statistical procedures to determine the mean and standard deviations for the event parameters, as well as their probability distributions. A rainfall characteristics summary table for the PIA historical record is shown on Table 3-1 below. Published mean event precipitation characteristics from other U.S. cities are shown on Table 3-2.

Figure 3-3: Average Monthly Number of Events (PIA Historical Record)



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Average	5.41	4.94	6.59	6.96	7.22	7.02	6.49	5.87	4.91	4.89	5.55	5.50
Avg+1SD	7.47	6.66	8.59	8.91	9.51	9.54	9.07	7.86	6.87	6.82	7.36	7.40
Avg-1SD	3.35	3.22	4.60	5.01	4.93	4.50	3.91	3.88	2.94	2.96	3.73	3.60

Table 3-1: Mean Rainfall Event Characteristics for Pittsburgh, PA [a]

Average Annual Number of Storms [b]	Event Rainfall Statistics Mean Storm Event				
	Volume (in)	Duration (hr)	Average Intensity (in/hr)	Maximum Intensity (in/hr)	Delta [c] (days)
71	0.48	10.5	0.071	0.190	5.16

[a] Based upon 55 years of records at the PIA, from 1948 through 2002

[b] Storm events greater than 0.10 inches with a minimum of 6 dry hours to separate storm events

[c] Delta is the average interval between the midpoint of storm events

Table 3-2: Mean Rainfall Event Characteristics for Six U.S. Locations [a]

City	Average Annual Number of Storms [b]	Event Rainfall Statistics Mean Storm Event			
		Volume (in)	Duration (hr)	Average Intensity (in/hr)	Delta [c] (days)
Atlanta, GA	66	0.71	9.4	0.112	5.55
Louisville, KY	69	0.61	9.5	0.092	5.34
Portland, ME	64	0.66	12.5	0.065	5.79
Newark, NJ	64	0.65	11.1	0.076	5.76
Chicago, IL	58	0.57	9.1	0.095	6.29
Portland, OR	72	0.47	15.7	0.034	5.08

[a] Based upon 42 years of records, from 1949 through 1990

[b] Storm events greater than 0.10 inches with a minimum of 6 dry hours to separate storm events

[c] Delta is the average interval between the midpoint of storm events

3.2.3 Probability Distributions of Precipitation Event Parameters

The frequency of occurrence for a given magnitude of a storm event parameter such as volume may be shown as a plot of its probability distribution, as illustrated in Figure 3-4. Using the selected minimum event volume of 0.10 inches, a total of 3,871 storm events were defined and analyzed in the 55-year historical record. The mean and median storm event volumes were computed to be 0.48 and 0.34 inches, respectively.

Figure 3-4 shows that approximately 10 percent (90th percentile) of the storm events in the 55-year record deposited about 1-inch or more of precipitation. Based upon the average of 71 storm events per year, approximately seven storms per year have a precipitation volume equal to or greater than 1-inch. Furthermore, the plot indicates that approximately 3 percent (97th percentile) of the storm events in the historical record deposited about 1.6-inches or more of precipitation. Based on the average of 71 storm events per year, there are on average two storms per year having a rainfall volume equal to or greater than 1.6-inches. Two events per year averages to one event per six months, so the 1.6-inch storm event could be characterized as the storm event volume with a 6-month return period, or the "6-month storm". A storm event volume recurrence interval summary table for the PIA historical record is shown on Table 3-3 and the volume recurrence intervals for other U.S. cities are shown on Table 3-4.

It is important to note that this 6-month storm definition is not related to duration; the 116 storms equal to or greater than 1.6-inches during the 55-year period have a range of durations. The relationships of storm event durations, intensities, and interevent times are more appropriate for the assessment of storage requirements because events, by definition, provide storm volumes that are typically followed by dry periods that average several days, during which a CSO storage unit is emptied. The probability distributions of storm event duration, average event intensity, maximum event intensity, and interevent times are shown on Figures 3-5 through 3-8, respectively.

Figure 3-4: Probability Distribution of Storm Event Volumes (PIA Historic Record)

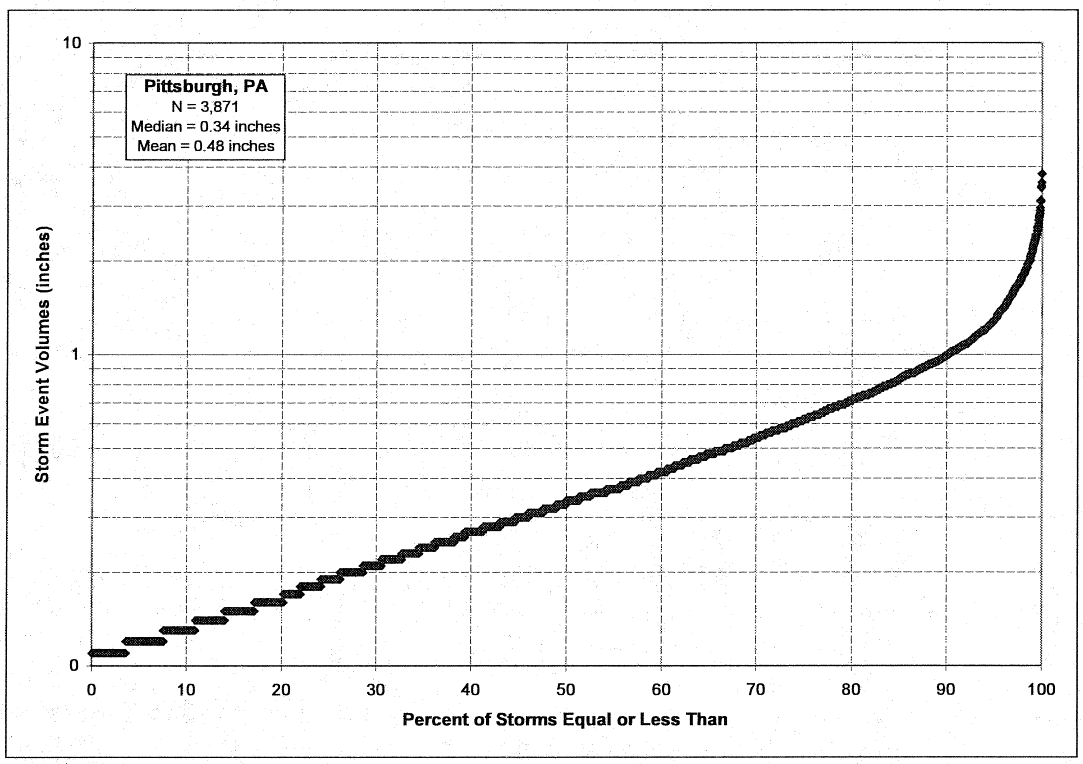


Table 3-3: Storm Event Volumes for Three Recurrence Intervals (Pittsburgh, PA) [a]

Return Period		
3 month	6 month	1 year
1.2 inches	1.6 inches	2.0 inches

[a] The tabulation of recurrence interval volumes indicates rainfall volumes for events that occur on average 3-, 6-, and 12-month intervals

Table 3-4: Storm Event Volumes for Three Recurrence Intervals (Six U.S. Locations) [a]

City	Return Period		
	3 month	6 month	1 year
Atlanta, GA	2.0 inches	2.6 inches	3.2 inches
Louisville, KY	1.6 inches	2.1 inches	2.6 inches
Portland, ME	1.8 inches	2.3 inches	2.8 inches
Newark, NJ	1.7 inches	2.2 inches	2.8 inches
Chicago, IL	1.5 inches	2.1 inches	2.6 inches
Portland, OR	1.4 inches	1.8 inches	2.3 inches

[a] The tabulation of recurrence interval volumes indicates rainfall volumes for events that occur on average 3-, 6-, and 12-month intervals

Figure 3-5 shows that the mean storm event duration over the 55-year period of record was 10.5 hours and the median event duration was 8.0 hours. The figure also shows that approximately 7 percent (93rd percentile) of the storm events in the historical record were 24 hours (1 day) in duration or longer. Based on the average of 71 storm events per year, there are on average 5 storms per year having a storm duration of 24 hours or longer.

Figure 3-5: Probability Distribution of Storm Event Durations (PIA Historic Record)

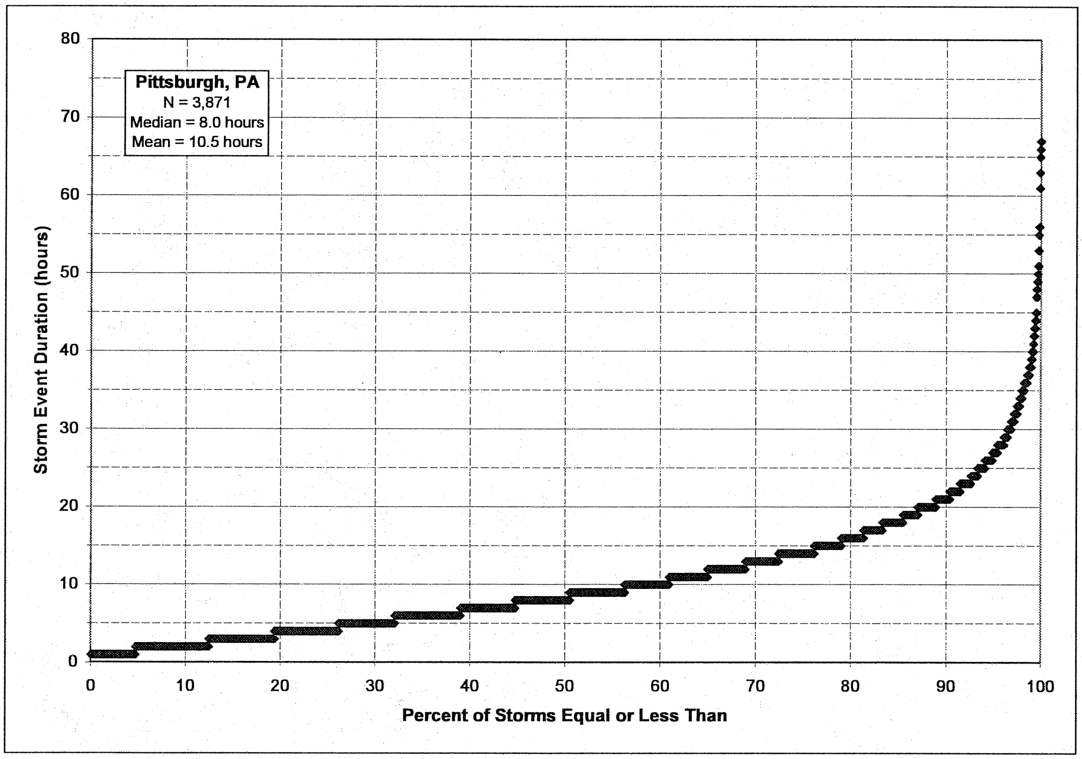


Figure 3-6 shows that the mean storm event intensity over the 55-year period of record was 0.07 inches/hour and the median storm intensity was 0.04 inches/hour. The figure also shows that approximately 20 percent (80th percentile) of the storm events in the historical record had an average event intensity of 0.10 inches/hour or greater. The average event intensity for each storm is defined as the total event volume in inches divided by the total event duration in hours.

Figure 3-7 shows that the mean value for maximum storm event intensity over the 55-year period of record was 0.19 inches/hour and the median value for maximum storm event intensity was 0.13 inches/hour. The figure also shows that approximately 7 percent (93rd percentile) of the storm events in the historical record had a maximum event intensity of 0.50 inches/hour or greater.

The analysis performed for Figure 3-7 differs from that performed for Figure 3-6 in that the maximum storm intensity is the largest hourly precipitation recorded during an event.

Figure 3-6: Probability Distribution of Average Event Intensity (PIA Historic Record)

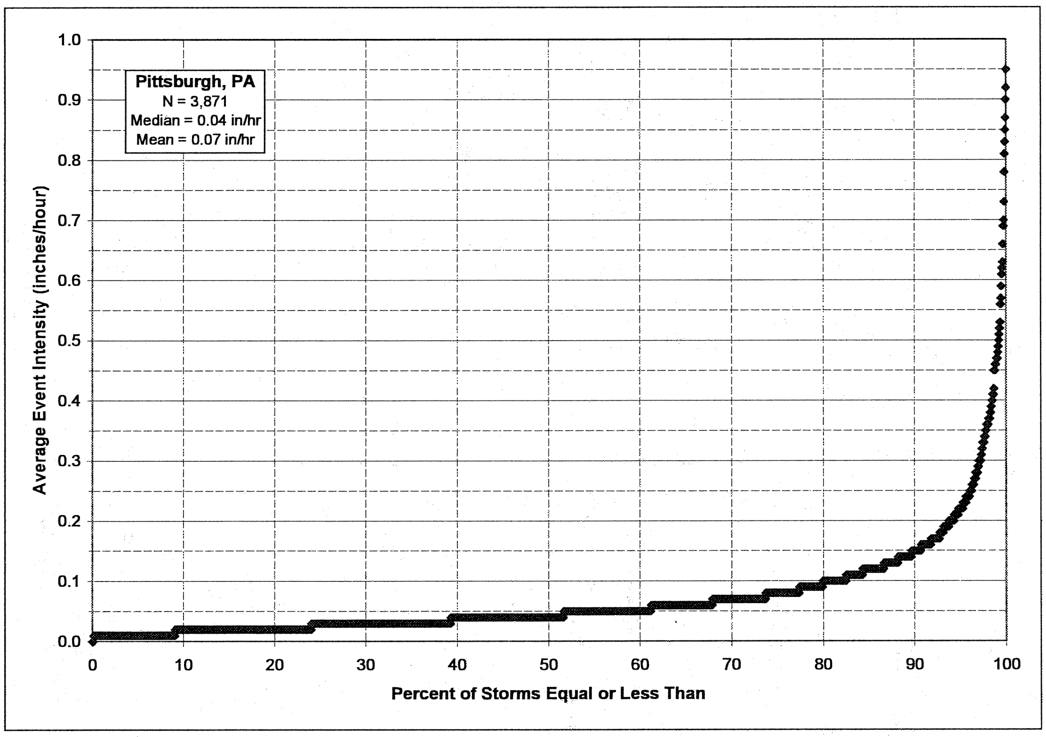


Figure 3-7: Probability Distribution of Maximum Event Intensity (PIA Historic Rec.)

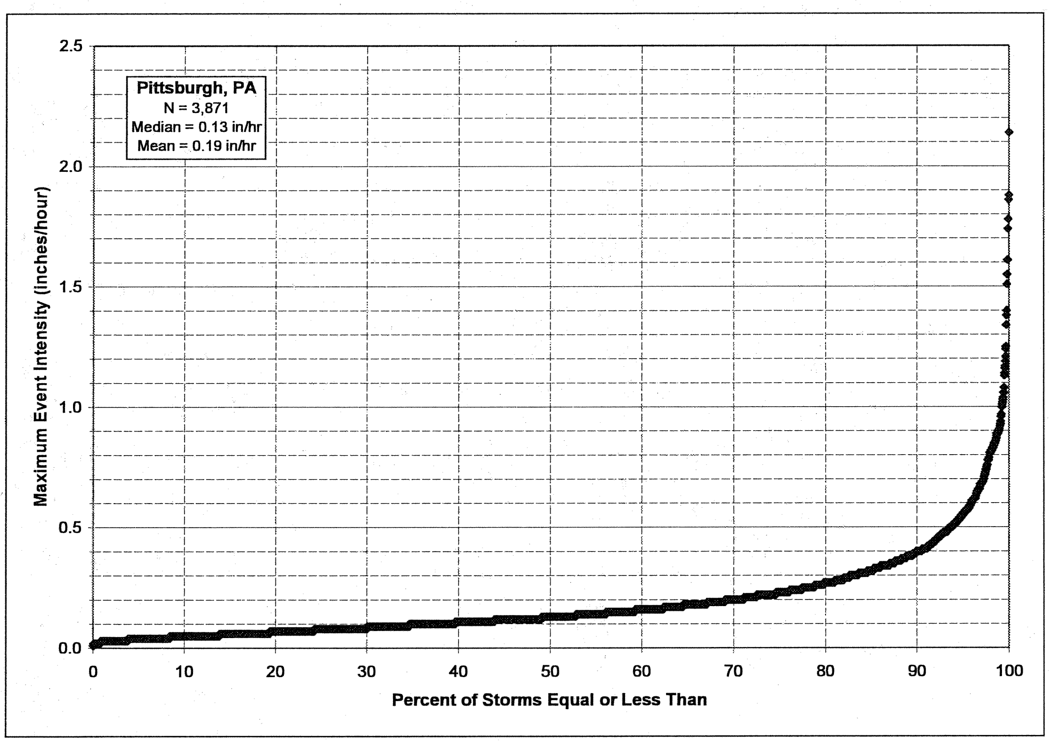
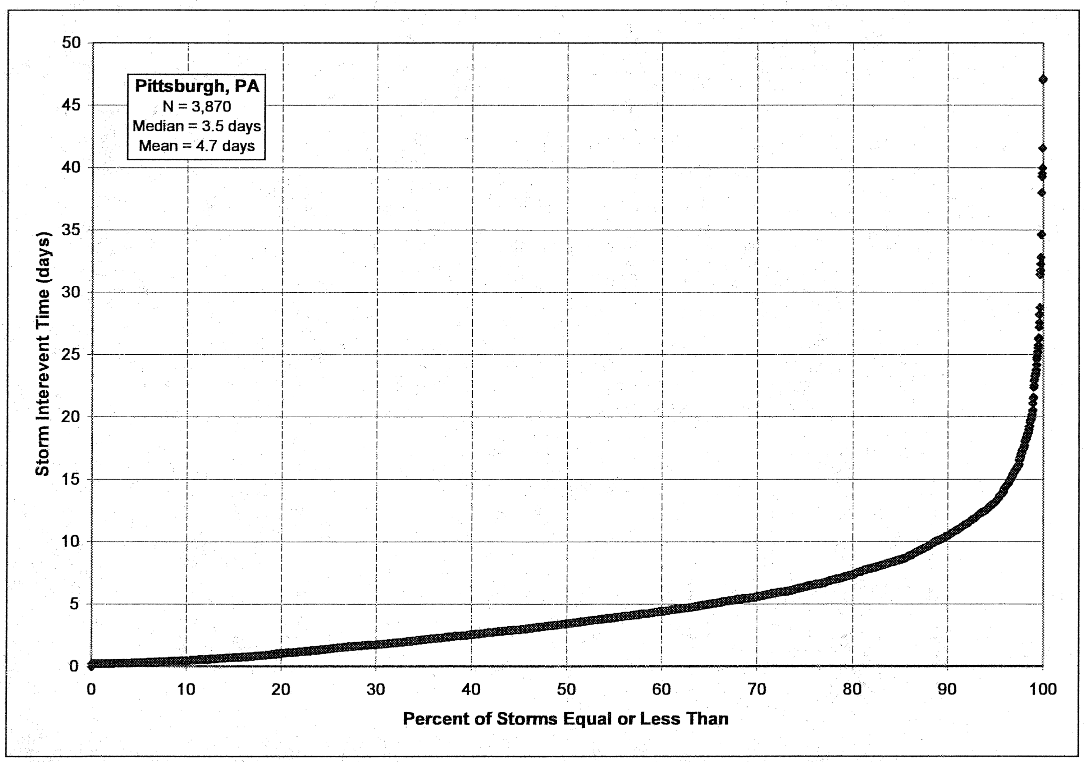


Figure 3-8 below is a plot of the probability distribution of storm interevent time (i.e. the number of dry hours separating storm events) for the PIA historical record. The figure shows that the mean interevent duration over the 55-year period of record was 4.7 days and the median value for interevent duration was 3.5 days. The figure shows that approximately 22 percent (78^{th} percentile) of the storm events in the historical record had approximately 7 dry days (1 week) or longer from the preceding event. The analysis also showed that approximately 4 percent (96^{th} percentile) of the recorded historical storms had approximately 14 dry days (2 weeks) or longer from the preceding storm.

Figure 3-8: Probability Distribution of Storm Interevent Time (PIA Historic Record)



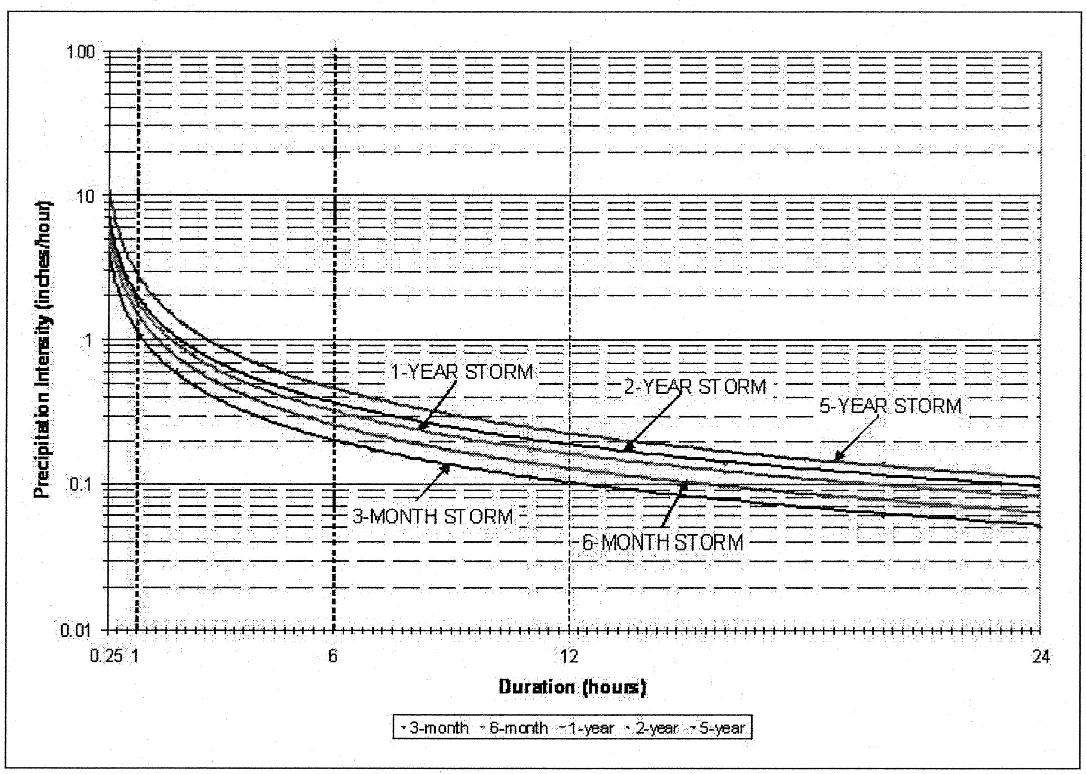
3.2.4 Intensity-Duration-Frequency Analysis

Intensity-Duration-Frequency (IDF) curves were another way of characterizing the variability of rainfall at the long-term PIA rain gauge. These IDF curves were developed by analyzing the hourly rainfall record in such a way as to compute a running sum of volumes for consecutive hours equal to the duration of interest. The set of volumes for that duration were then rank ordered, and based on the length in years of the record, the recurrence interval for any rank/value was determined. Duration was then plotted against average intensity for several constant storm return frequencies. This rainfall analysis procedure can used to calculate the local value for a design storm such as a 1-year, 6-hour design condition.

The results from an IDF analysis form the basis for a single event design storm approach. Using this approach, a single synthetic storm is used for facility design, and the impacts from back-to-back storms are not taken into account. An alternative basis for design is a continuous simulation approach where actual monitored storms are used and the impacts of back-to-back storms are quantified.

Figure 3-9 shows the intensity-duration-frequency curve developed for the long-term rainfall record at the PIA. Five recurrence intervals of 3-months, 6-months, 1-year, 2-years, and 5-years are shown on the plot as the recurrence intervals.

Figure 3-9: Intensity-Duration-Frequency Curve (PIA Historic Record)



Report Appendix B

MS4 PAG – 13
Stormwater Management Program Requirements

3900-PM-WM0100h 12/2002
Protocol

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WATERSHED MANAGEMENT

MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4) STORMWATER MANAGEMENT PROGRAM

PROTOCOL

NOTE:

- **This is a guidance document developed by DEP and approved by EPA Region III, primarily for municipalities to use to comply with their MS4 permit requirements.**
- **This *Protocol* contains detailed plans for developing and implementing a municipal stormwater management program, including schedules and measurable goals, over a five-year period.**
- **MS4s may use all or portions of this *Protocol* to meet their permit requirements; for those requirements where the *Protocol* will not be implemented, the MS4 must develop its own plan which must be approved by DEP.**

MS4 STORMWATER MANAGEMENT PROGRAM

PROTOCOL

INTRODUCTION

GENERAL

This Stormwater Management Program Protocol ("*Protocol*") meets the six Minimum Control Measures required of municipal permittees under the Phase II NPDES Stormwater Regulations (found at 40 CFR §§ 122.26 – 123.35). The implementation of this *Protocol* by municipalities will satisfy the federal NPDES permit requirements for municipal separate storm sewer systems ("MS4s") in those regulations, described in detail at 40 CFR §122.34.

Portions of the federal regulations, which are incorporated into Pennsylvania regulations by reference (at 25 Pa. Code § 92.2), establish six categories of Best Management Practices ("BMPs") that must be met by permittees. These are "narrative" permit effluent limitations. Those BMPs must be designed to reduce the discharge of pollutants from MS4s to the maximum extent practicable, to protect water quality and to satisfy the appropriate requirements of the federal Clean Water Act.

The six BMP categories, also called "minimum control measures" in the federal regulations, are:

1) Public Education and Outreach,
2) Public Participation and Involvement,
3) Illicit Discharge Detection and Elimination,
4) Construction Site Runoff Control,
5) Post-Construction Stormwater Management in New Development and Redevelopment, and
6) Pollution Prevention and Good Housekeeping for Municipal Operations and Maintenance

The federal regulations provide flexibility within those six categories of BMPs. Each municipal stormwater program must be approved by DEP. This *Protocol* contains DEP's recommended and approved approach to each one of the BMPs.

> If a permittee commits to implementing the provisions of this *Protocol* for any Minimum Control Measure (e.g., Construction Site Runoff Control), it does not need an independent review and approval of its stormwater management program by DEP for that Minimum Control Measure.
>
> Where a permittee elects to develop its own program for a Minimum Control Measure, DEP review and approval is required (see the General Permit "Notice of Intent" form and Instructions).

The DEP Protocol contains detailed plans for meeting the permit requirements, with schedules and measurable goals. These schedules will be modified in large part, allowing additional time for compliance, for municipalities who choose to follow a watershed-based approach implementing a DEP-approved Act 167 Plan (or other watershed-based approach approved by DEP).

DEP has developed a General Permit to streamline the permitting process ("PAG-13"). In addition, DEP has several existing programs already in place that municipalities can use to meet some of their permit requirements.

USE OF EQUIVALENT STATE AND LOCAL PROGRAMS TO IMPLEMENT (AND FUND) MS4 MINIMUM CONTROL MEASURES

The federal regulations allow DEP and permittees to use existing qualifying state and local programs to satisfy any of the NPDES General Permit requirements of MS4s (at 40 CFR §122.34(c)). Pennsylvania has several existing programs that can be used by municipalities to meet many of their permit requirements.

First, the Pennsylvania Stormwater Management Act ("Act 167"), 32 P.S. §§ 680.1 *et seq.*, already requires counties and municipalities to develop and implement stormwater management programs, on a watershed-by-watershed basis. The county applies to DEP for project approval, and proceeds in developing the watershed plan with the assistance of the municipalities in the watershed.

> This legal requirement also allows for 75% cost-share funding for both planning and implementation under guidelines established by DEP. The local cost-share can be met, in part, by in-kind service.

Act 167 authorizes *funding* for all of the elements required by the federal regulations. DEP will work with counties and municipalities on appropriate funding parameters to meet the MS4 permit requirements, depending on availability of appropriated funds. This is discussed further in *Appendix 3* to the MS4 permit materials.

Many municipalities are implementing DEP-approved Act 167 plans now, and others are under development. While existing Act 167 plans (and municipal ordinances) will need to be updated to meet the MS4 requirements, these municipalities are in good position to use Act 167 to assist with the MS4 permit requirements.

Second, DEP implements an erosion and sediment pollution control program for any earth disturbance activities statewide. Frequently this is done in concert with the County Conservation Districts (CCDs). Under that statewide regulatory program, persons proposing or conducting earth disturbance activities are required to develop an Erosion and Sediment Control Plan ("E&S Plan") containing BMPs which minimize the potential for accelerated erosion and sedimentation during construction.

These BMPs will satisfy one of the six categories of BMPs required by the federal storm water regulations—*Construction* Site Runoff Control. However, MS4s must have a procedure for site plan review.

For activities involving one acre to less than five acres of earth disturbance with a "point source" discharge (or 5 acres or more regardless of the discharge), an NPDES permit is also required. That permit requires, among other things, the identification of permanent post-construction stormwater management BMPs (see the next section); it also entails DEP or County Conservation District review of E&S Plans.

In addition, a municipality or county may not issue a building or other permit or final approval, to those proposing or conducting earth disturbance activities, until the required NPDES permit (or approved coverage under a General NPDES Permit) has been issued.

Furthermore, under the Conservation District Law, DEP may delegate, by written agreement, the administration and enforcement of the Erosion and Sediment Control Program to a CCD if the CCD has adequate and qualified staff to implement the program. In addition, municipalities can develop working agreements with CCDs to implement municipal responsibilities for erosion and sediment control programs, stormwater management plans or other related activities.

CCDs delegated to implement the NPDES stormwater construction programs receive both permit fees and an annual appropriation to cover the costs of implementation of the program. CCDs can also charge fees for the review of plans for construction and post construction BMPs as well as other stormwater management plans.

Municipalities are not required to utilize the services of the local CCD, and CCDs are not mandated to participate in this process. However, these state and local programs do provide an opportunity for municipalities to utilize existing legal mechanisms to meet these portions of the permit requirements, and for CCDs to maintain their service program in the local community.

Third, DEP implements an NPDES Construction Permit program that addresses post-construction stormwater impacts statewide. Persons proposing or conducting earth disturbance activities are required to develop a Post-Construction Stormwater Management Plan (PCSM Plan) containing BMPs which protect, maintain, reclaim and restore water quality and the existing and designated uses of surface waters of the Commonwealth.

These BMPs will satisfy one of the six categories of BMPs required by the federal storm water regulations—*Post-Construction* Stormwater Management in New Development and Redevelopment.

The PCSM Plan is subject to a detailed review by DEP in "Special Protection" watersheds and in other circumstances where an "Individual Permit" is issued by DEP. When DEP issues approvals under its statewide General Permit for Stormwater Discharges Associated with Construction Activities (PAG-2), a detailed site plan review may not be conducted.

In many watersheds, municipalities can utilize this statewide program by requiring proof of the NPDES permit, with post-construction BMPs, prior to issuing a building or other permit or final approval, to those proposing or conducting earth disturbance activities. However, where the general NPDES permit coverage (PAG-2) is authorized without a site plan review by DEP, the municipality will need to conduct that review to ensure that water quality requirements are met.

To effectively use these existing regulatory programs to meet MS4 requirements, municipalities should have a municipal ordinance and a mechanism that requires review and approval of construction and post construction BMPs for earth disturbance activities equal to or greater than one acre. An agreement with the CCD is one good approach to meeting this requirement for the construction requirements.

OTHER RESOURCES

1. CD-ROM with DEP Supplied Resource Materials for MS4s

   For many of the six minimum control measures, DEP has developed a set of resource materials for municipalities. Educational materials, public participation plan outlines and many other useful materials are available on CD-ROM from your local DEP regional office, as well as on-line on the DEP website (www.dep.state.pa.us, directLINK "stormwater").

2. DEP Pollution Prevention Assistance

   DEP has headquarters and regional office staff available for pollution prevention assistance and guidance. Contact your regional office or visit the DEP website (www.dep.state.pa.us, directLINK "Pollution Prevention").

USING THIS *PROTOCOL* TO MEET PERMIT REQUIREMENTS

Municipal MS4s can commit to implementing all or part of this *Protocol* to meet the permit requirements. To the extent that an applicant adopts all or a portion of the *Protocol*, it becomes a part of the applicant's Authorization to Discharge and permit coverage under the Permit. This includes any commitment to implement a DEP-approved Act 167 plan (or other plan approved by DEP not under Act 167) for the watershed in which the MS4 is located. Lack of Act 167 funding does not diminish the permittee's responsibility to comply with the General Permit.

MS4 STORMWATER MANAGEMENT PROGRAM *PROTOCOL*

PUBLIC EDUCATION AND OUTREACH

MINIMUM CONTROL MEASURE

Summary of Components of This Minimum Control Measure:

- Develop a Public Education Plan
- Implement the Plan, including dissemination of educational materials (including those provided by DEP) to appropriate target audiences

PERMIT YEAR	*SUMMARY OF MINIMUM MEASURE PERMIT REQUIREMENTS*	
	Education Plan	**Educational Program**
Year 1	Determine Target Audience Develop Public Education Plan	• Disseminate materials to all target audiences using appropriate distribution channels • Newspaper advertisement • Other components of Plan
Year 2	Implement the plan Revise Plan as needed	• Disseminate materials to all target audiences using appropriate distribution channels • Newspaper advertisement • Other components of Plan
Year 3	Implement the plan Revise Plan as needed	• Disseminate materials to all target audiences using appropriate distribution channels • Newspaper advertisement • Other components of Plan
Year 4	Implement the plan Revise Plan as needed	• Disseminate materials to all target audiences using appropriate distribution channels • Newspaper advertisement • Other components of Plan
Year 5	Implement the plan Revise Plan as needed	• Disseminate materials to all target audiences using appropriate distribution channels • Newspaper advertisement • Other components of Plan

PUBLIC EDUCATION PLAN

What Does This Section Address?

This section addresses developing a Public Education and Outreach Plan that will assist you in effectively implementing your public education program.

Your public education plan must target the key audiences of 1) homeowners; 2) business owners; and 3) developers. If you effectively educate them on the connection between their actions, stormwater runoff, and water quality, they will most likely have a positive impact on your stormwater management efforts. Your target audiences are also stakeholders since they have the ability to impede or assist you in implementing your stormwater management program.

DEP has developed the educational materials that you will need to implement a public education program; your job is to figure out the best ways to get these materials to your target audiences.

What Do I Need to Do and By When?

Follow the schedule in this Minimum Control Measure, shown above.

Your first goal will be to decide how to reach your target audiences. You have three categories of target audiences that you will need to reach: 1) existing homeowners; 2) existing business owners; and 3) developers. The people that comprise each of these groups have the potential to impact the quality of stormwater in your community.

By the end of Year 1, you should have a comprehensive plan in place that will help you tap into your target audiences' existing communication channels to inform them about improving stormwater quality. During the following permit years, you will update your plan to ensure information about your target audiences is accurate. To accomplish this, complete the following tasks:

Year 1: Develop A Public Education Plan

Complete the public education portion of the plan template.

A template for a plan is included in the References and Resources accompanying this *Protocol* (provided on CD to the municipality, and available on the DEP website, www.dep.state.pa.us, directLINK "stormwater").

Collect information on your three target audience categories. You may use the worksheet provided in the References and Resources. . The questions contained in the template will help you become familiar with the communication channels most used by each target audience. Through this activity, you will create a comprehensive inventory of the newsletters, newspapers, web sites, meetings, magazines, organizations, associations, etc. used by your target audiences.

Years 2, 3, 4 and 5: Update Target Audience Information

Review your plan and provide new information about your target audiences and their communication channels.

During the remaining years of your permit, you are responsible for ensuring that information in your plan is accurate and current. Your target audiences may expand (or condense) in size during the course of a permit year. Ways of communicating may also change from year to year. As you learn of new communication channels (e.g., newsletters, web sites, meetings, etc.), enter this information into your plan and modify your strategies for distributing educational materials. New information will help you to leverage resources for distributing educational materials.

EDUCATIONAL PROGRAM IMPLEMENTATION

What Does This Section Address?

This section provides information on conducting an educational program for the three primary target audience categories in your community. The program focuses on distributing the educational materials provided by DEP that contain messages related to your storm water management program.

Implementing this educational program will also help you to meet your permit requirements for other Minimum Control Measures that also have public education components. These minimum measures include Illicit Discharge Detection and Elimination; Construction Storm Water Runoff Management; and Pollution Prevention and Good Housekeeping for Municipal Operations and Maintenance.

You will find the educational materials needed to implement your educational program under the References and Resources contained in the DEP CD-ROM provided to you, and available on the DEP website, www.dep.state.pa.us, directLINK "stormwater."

What Do I Need to Do and By When?

There are two phases of educational outreach. During the first stage, you focus on raising the awareness of your target audiences. In the second stage, you educate the target audiences about the problems and potential solutions.

These stages of educational outreach will drive the schedule for your educational program, along with the assumption that most people do not know 1) what storm water is and 2) how stormwater affects water quality.

Your permit requirements lay out the "what" and "when" of this minimum measure component; what it does not do is specify the "how." How you will distribute the educational materials to the specified target audiences is up to you. Use your Public Education Plan to determine the most effective means of getting educational materials into the hands of your target audiences.

Any additional educational activities not listed here may be used to show compliance with this Minimum Control Measure. This includes educational activities by watershed groups.

To fulfill the permit requirements associated with this component of the Public Education and Outreach Minimum Control Measure, complete the following tasks during each year of your permit as shown:

Year 1: Raise Target Audiences' Awareness of Your Stormwater Management Program

Distribute the "When It Rains, It Drains" pamphlet to all target audiences.

DEP has made available copies of the pamphlet entitled, "When It Rains, It Drains" In the References and Resources contained in the DEP CD-ROM provided to you, and avialble on the DEP website, www.dep.state.pa.us , directLINK "stormwater." This document addresses the issue of pollution related to stormwater runoff and activities that everyone can use to improve stormwater quality. It also provides an overview of a typical stormwater management program. Using the information on distribution channels in your Public Education Plan, disseminate these pamphlets to all the target audience categories in your community. Select distribution methods in which you have confidence that the target audience will notice and use the information.

Provide a link to DEP's stormwater website www.dep.state.pa.us, directLINK "storm water"). The Internet is a popular way to distribute information that you can use as part of your stormwater educational program. If your local government does not have its own website, look to your Public Involvement and Participation Plan to identify potential partners within the community that maintain their own websites.

Year 2: Continue to Raise Awareness and Begin to Educate All Target Audiences

Distribute Fact Sheets to developers

In all likelihood, your local County Conservation District(s) (CCD) is responsible for implementing and enforcing the Chapter 102 Erosion and Sediment Control program and the NPDES Construction Activity Permit program programs for your municipality. However, you are still responsible for educating developers in your community about their responsibilities under the state and federal stormwater regulations.

To meet this requirement, distribute the Fact Sheets prepared by DEP (see References and Resources CD-ROM) to developers who propose construction activities in your municipality. Through your Public Education Plan, you should have identified distribution opportunities related to the building permit process.

Run a stormwater ad in your local newspaper.

Research shows that most people get their information from local newspapers. Since this is an effective way to reach your target audiences, DEP has provided sample advertisements focused on the issue of stormwater, and practices to reduce the impacts to water quality from storm water runoff. To get the message, people need repeated exposure to it over time. Therefore, it isn't enough to run the ad only once in your local newspaper. Select an ad from the series provided by DEP. Place the ad in your local newspaper so that members of the target audiences have repeated exposure to it.

Distribute posters to schools, community organizations and institutions, and businesses.

Topics such as responsible vehicle maintenance, household hazardous waste disposal, and pet waste management are important to stormwater management. DEP has provided you with a series of posters that convey messages about these topics. Select and distribute the first in the series to schools and businesses.

Storm drain stenciling

While not required by the Protocol, any stenciling done by outside organizations may contribute to meeting your permit requirements for this Minimum Control Measure. DEP has information about stenciling in the References and Resources CD-ROM

Ensure links to DEP stormwater website are maintained.

The link to DEP's website may change from permit year to permit year. To ensure that the target audiences have continued access to this source of information, check any links you may have to DEP's stormwater website and update the links if necessary. If a partner in your stormwater management efforts also has a link to DEP's website, you may want to coordinate with them to ensure their links are also updated.

Years 3-5:Continue Outreach

Continue to distribute Fact Sheets to developers and assess effectiveness.

During Year 2, you began to distribute fact sheets to developers in your community. Continue to distribute these fact sheets through your building permit application process. Identify other ways to get this information to developers using your Public Education Plan.

Run another stormwater ad from the series in your local newspaper.

During Year 2 you selected and ran an ad from the series provided by DEP. You will continue this ad campaign by selecting and running another stormwater ad in your local newspaper at least once per year. As you did during the previous year, place the ad in your local newspaper so that members of the target audiences have repeated exposure to it, each year.

Distribute another poster from the series to schools and businesses.

During Year 2 you selected a poster containing a stormwater management message and distributed it to local schools and businesses. Select a second poster from the series and distribute it to schools and businesses each year.

Do This: Ensure links to DEP stormwater website are maintained.

As you did during Year 2, check any links you may have to DEP's stormwater website and update the links if necessary. If a partner in your stormwater management efforts also has a link to DEP's website, you may want to coordinate with them to ensure their links are also updated.

MS4 STORMWATER MANAGEMENT PROGRAM *PROTOCOL*

PUBLIC INVOLVEMENT AND PARTICIPATION

MINIMUM CONTROL MEASURE

Summary of Components of This Minimum Control Measure:

- Develop a public involvement/participation plan
- Implement the plan

NOTE: *This timeline is extended one year for municipalities implementing a watershed-based approach.*

Permit Year	Public Involvement and Participation Program
Year 1	Develop public involvement/participation program
Year 2	Notify and solicit public input/involvement on SW Plan development and implementation
Year 3	Notify public as needed
Year 4	Notify public as needed
Year 5	Notify public as needed

PUBLIC INVOLVEMENT AND PARTICIPATION PLAN

What Does This Section Address?

This section provides information on what steps are needed to be taken to involve the public with issues related to municipal actions to address stormwater impacts on water quality. This includes new planning initiatives, changes to ordinances and other local regulations.

What Do I Need to Do and By When?

Follow the schedule in this Minimum Control Measure, shown above. If you are following a watershed-based approach under Act 167 (or otherwise as approved by DEP), your schedule of compliance can be delayed one year for each element.

Prior to adoption of any ordinance required under this *Protocol*, provide adequate public notice, opportunities for public review and input, and hold hearings to obtain public feedback as appropriate. This can be done in conjunction with normal public sessions of the municipal governing body. The notice must be published in the local newspaper of general circulation. Ensure broad reach of the public notice, including diverse economic and ethnic backgrounds in the municipality.

When working with your county officials under Act 167, typically the county provides notice and conducts a hearing pursuant to the law. Consider involving citizen groups, watershed organizations and businesses as much as possible, to obtain broad support for your stormwater efforts.

Your permit requirements lay out the "what" and "when" of this minimum measure component; what it does not do is specify the "how." How you will distribute obtain good public participation and involvement is up to you. Use your public involvement/participation program development in Year 1 to determine the most effective means of achieving success in this Minimum Control Measure.

Any additional public participation and involvement activities not listed here may be used to show compliance with this Minimum Control Measure. This includes activities by watershed groups.

OPTIONAL PROGRAMS

DEP has determined that the public participation process under Act 167, when counties and municipalities jointly prepare, adopt and implement a watershed stormwater plan, satisfies the Public Participation Minimum Control Measure. However, some municipalities may wish to do more. This section provides information for supplemental public participation efforts.

Unless you are working under an Act 167 planning effort approved by DEP which specifically includes any of the following elements, Act 167 funding will not be available for these efforts in this permit term.

Public Participation is closely linked to the Public Education and Outreach. Your success in educating the community will have a profound effect on the community's willingness to participate in stormwater related activities. That is why it is important to think about who your target audiences are, how they receive information, and in what type of activities they currently participate. By the end of Year 1, you may want to have a comprehensive plan in place that will guide your efforts to recruit volunteers and obtain participation at public meetings. During the following permit years, you may update your plan to ensure information about your target audiences is accurate. To accomplish this, you may wish to complete any or all of the following tasks:

Develop A Public Involvement and Participation Plan

Complete the public participation portion of the plan checklist

Using information collected, fill in the DEP Public Participation Checklist (References and Resources contained in the DEP CD-ROM provided to you, and available on the DEP website, www.dep.state.pa.us, directLINK "stormwater.") with information about current programs and events within your community. You will have a comprehensive listing of existing volunteer opportunities that you can use to reach volunteer-minded individuals and tap into when planning your own volunteer activities and events.

Using information in the plan, you will produce strategies for recruiting participation from your six categories of stakeholders: municipal employees, homeowners, businesses, schools, watershed associations and other volunteer groups and developers.

Develop a comprehensive stakeholder mailing list.

A complete mailing list of your stakeholders will help you recruit volunteers. You can compile information for your mailing list from a number of different sources, including your planning department, your water department (or other utilities) or the chamber of commerce.

The mailing list should include mailing addresses, at the very minimum. You may also consider including phone number, fax number, and email addresses. In developing your mailing list, be sure to indicate into which of the six stakeholder categories the individual or group falls. This will allow you to conduct targeted mailings, when necessary. If possible, develop and maintain your mailing list in an electronic format, using either a spreadsheet or a database, to allow you easily perform functions such as sorting and creating mailing labels.

- Tap into agencies and organizations that are likely to have mailing information for the six categories of stakeholders.
- Create your mailing list in a way that will allow you to easily sort, update, and generate mailing labels.
- Collect additional information, such as fax numbers and email addresses, if you intend to distribute information using other means besides the mail.

Update Stakeholder and Volunteer Information

Review your plan and provide new information about volunteer opportunities and events.

As you learn of new volunteer organizations, programs and opportunities within your community, enter this information into your plan. New information will help you to establish partnerships and ensure that your volunteer program leverages resources with other programs. At the end of each year, your plan may contain information on new volunteer programs and opportunities. It should also contain updated information about the programs and opportunities that you identified during Year 1. As these programs schedule different events each year, you will want your plan to reflect this information. These are opportunities for you to collaborate, attend and promote your activities. An updated schedule of events in the community will help you plan your activities.

- Continue checking community calendar of events to ensure that the relevant information in your plan is accurate and current.
- Add information about new volunteer organizations and programs that have a similar mission and/or reach similar audiences targeted by your volunteer program.
- Don't just update the plan and let it sit; your plan should serve as a living document that helps you to plan and implement your stormwater volunteer program and other public participation activities.

Update your mailing list.

During the course of permit Year 1, you will obtain information that will impact the accuracy of your mailing list. Most likely you will collect the names of stakeholders who are not already contained in your mailing list through various volunteer events and activities. In addition, you may discover that some of your current addresses for individuals or groups are wrong or have changed. Use information you collect from volunteer sign-up sheets, information requests, and returned mail to update your mailing list.

Conduct Public Meetings

You will find checklists and meeting materials to assist you with these meetings in the References and Resources contained in the DEP CD-ROM provided to you, and available on the DEP website, www.dep.state.pa.us, directLINK "stormwater." The input that you collect during these meetings will help you to strengthen your program and gauge support from meeting attendees.

Use a general stormwater public meeting to kick-off your public education and participation efforts. Through this meeting, you will educate stakeholders about your Stormwater Management Program and solicit their feedback on how the program will work in your community. The goal is to raise their awareness about stormwater issues, what your community will do to better manage stormwater, and opportunities for them to participate.

After the initial public meeting, it is important to maintain a connection with stakeholders to maintain momentum and a sense of purpose/accomplishment. You will provide this connection through your volunteer program, along with another public meeting later in the permit term that updates stakeholders on your progress and successes provide your stakeholders with progress reports and regular updates. Here are useful tasks to conduct:

Your Introductory Public Meeting

Determine appropriate type of public meeting format

Not all public meeting formats are alike, depending on the goal of the meeting and how you would like to structure the agenda. The resource materials provided will help you to determine which type of meeting you would like to plan and conduct. The most appropriate formats for this particular meeting are workshops and open houses.

Initiate meeting preparation activities.

Use the public meeting checklist provided in the References and Resources contained in the DEP CD-ROM provided to you, and avialble on the DEP website, www.dep.state.pa.us , directLINK "stormwater." to begin preparing for your meeting. Preparation activities will include setting a day and time for the meeting, selecting a meeting site, developing the agenda, creating and distributing the meeting announcement, and generating meeting materials. In addition to the meeting checklist, DEP also provided you with a presentation on the Stormwater Management Program in the References and Resources CD. You can modify this presentation for your community and use this during the meeting to provide stakeholders with an introduction to the program. You must ensure that announcements for this meeting reach representatives from all six of your stakeholder categories.

Conduct meeting and solicit stakeholder input.

To begin preparing for your meeting, use the public meeting checklist provided in the References and Resources CD-ROM. Preparation activities will include setting a day and time for the meeting, selecting a meeting site, developing the agenda, creating and distributing the meeting announcement, and generating meeting materials. Be sure that your agenda allots enough time for people to ask questions and provide you with feedback. Someone should have the responsibility for recording comments from the public and the responses that they receive. Keep in mind not all people feel comfortable speaking in public, so you may want to consider having a public comment form available for each participant. You will find an example of this type of form, along with an example evaluation form.

Perform meeting follow-up activities.

The steps that you take after your public meeting are just as important as those you take to plan it. Use the same planning checklist to guide your follow-up activities. Required follow-up activities include preparing a summary of the questions and answers discussed at the meeting, generating a participants' contact list (for inclusion in your mailing list) and compiling public comment forms that you may receive via mail or fax. You may also want to review the information on the meeting evaluation forms for use in planning future public meetings.

The types of information that you collect through your public meeting will help you determine who was/wasn't represented during the meeting, what the perceptions and attitudes are of those who attended and commented and how best to reach your stakeholders in the future. Making this information available to the public, either through newspapers, websites, or a mailing, will also give people a sense that you take their input seriously and that it will influence your efforts.

- Invite representatives from all six of your stakeholder categories. It is important that all stakeholder interests have the opportunity to participate.
- Your agenda should include, but not be limited to, the overview presentation on your stormwater program and time for questions from the audience.
- Have participants sign-in at the door, providing you with their name, mailing address and their stakeholder group affiliation. You might also ask them how they heard about the meeting, to help you advertise in the future. Use this information to update your stakeholder mailing list.
- You should generate a meeting summary that documents all of the questions and answers discussed during the meeting as your meeting record.

Plan and Conduct Public Meeting on Program Progress

<u>Follow the steps from Year 1 to plan, conduct, and follow-up on a public meeting that addresses your efforts related to the Stormwater Management Program.</u>

The process to host another public meeting for your stakeholders is the same that you used during Year 1. You should use the information that you collected from your meeting evaluation forms to aid in planning your second meeting. At this stage in your permit term, you should also have a better understanding of your stakeholders through your volunteer program, as well as your public education efforts. Use this knowledge to decide on the best public meeting format, agenda, presentations, etc. The goal of this meeting is to refresh participants' on the purpose and requirements of your Stormwater Management Program and the progress that you have made to date. Information that you collect from stakeholders during this meeting may benefit you when preparing for your next permit term, which will commence in approximately one year.

- Invite representatives from all six of your stakeholder categories. It is important that all stakeholder interests have the opportunity to participate.
- Your agenda should include, but not be limited to, a review of your stormwater program and time for questions from the audience.
- Have participants sign-in at the door, providing you with their name, mailing address, and their stakeholder group affiliation. You might also ask them how they heard about the meeting, to help you advertise in the future. Use this information to update your stakeholder mailing list.
- You should generate a meeting summary that documents all of the questions and answers discussed during the meeting as your meeting record.

Volunteer Program

By providing stakeholders with an opportunity to get involved in your stormwater management efforts, you will obtain the support that you need to successfully implement all aspects of your Stormwater Management Program. There are many types of volunteer programs that can help manage stormwater and improve your community's water quality.

Choose what types of volunteer program will best suit your community: a volunteer water quality monitoring program; a volunteer storm drain stenciling program; or a volunteer stream clean-up program. All the resource materials you will need to successfully implement any of the three volunteer programs are available to you.

The goal of your volunteer program is to obtain and sustain volunteer support that will aid your stormwater management efforts. To reach this goal, it is important to develop a program that reflects your stakeholders' concerns and interests.

- <u>Will people commit to meeting at a certain time and a certain place on a regular schedule or would people rather have the option of attending a one-time event?</u>

  This could affect whether or not you want to implement a monitoring program that relies upon volunteers' commitment to going out and sampling at certain points on a regular basis. Storm drain stenciling programs and stream clean-ups allow people to commit a larger block of time during a one-day event that may happen seasonally.

- <u>Is it important to your stakeholders to see results immediately, or are they concerned about changes over time?</u>

  Stakeholders that want immediate results for their efforts may be most interested in stream clean-up events that make a short-term impact and has measurable results. Although storm drain stenciling programs result in something that stakeholders can see immediately, they may not feel or see the positive impact of their efforts until the community changes its behavior due to the stencil's message. In monitoring, volunteers will not see any sort of trend in water quality until the program generates a number of samples at various points in the community.

- Are your stakeholders looking for a hands-on experience that is near the water?

A volunteer monitoring program or stream clean-ups may prove more popular among stakeholders looking for an experience that allows them to get up close to local waters. Volunteer safety could be a potential issue for you to consider with programs directly involving water.

- Are there existing programs within your community that already serve a similar purpose?

If stakeholders are involved in water quality monitoring for local watershed groups that encompass your community, it is unlikely that they would sign up for another program that serves the same purpose. It is important to ensure that you don't reinvent the wheel with whatever program you choose. Strive for coordination - avoid duplication.

Once you determine which volunteer program you will implement, get the word out to your stakeholders with an expected timeframe of when you will have the program up and running.

Establish a program schedule, assign roles and responsibilities, recruit volunteers.

Develop a schedule for implementation assign roles and responsibilities for program planning and implementation, and begin to recruit volunteers.

Volunteer Monitoring Program

Determine which type of assessment your program will undertake and develop your study design.

Use the manual entitled *Designing Your Monitoring Program: A Technical Handbook for Community-Based Monitoring in Pennsylvania* as the basis for planning and implementing your monitoring program. This document is a DEP publication and is made available on the CD-ROM. During this permit year, you will focus on designing the program. This involves determining the type of assessment you would like volunteers to conduct and creating the study design. The technical handbook referenced above will walk you through this process. You will want to pay particular attention to Chapters 2 and 5, as well as Appendix 6. These portions of the manual address the study design process and the different types of assessments that you can conduct with your volunteer monitors. Appendix 6 provides worksheets to help you with developing your study design.

Storm Drain Stenciling Program

Do This: Establish procedures for storm drain stenciling.

Read the resource materials in the References and Resources CD-ROM on developing and implementing a storm drain stenciling program.

Advertise volunteer program event/activities to all stakeholders.

The overall goal of your volunteer program is to develop a sustainable volunteer base that expands during each permit year. To reach this goal, you will have to effectively advertise your program and recruit volunteers. This can happen a number of different ways, including newsletter and newspaper articles, websites, mailings, presentations and word-of-mouth. It is important to use communication channels that will reach the various stakeholders within your community. Be sure to make announcements about your volunteer program well in advance of actual events and activities to allow people to plan. You can always send out a "Save the Date" message about an activity and follow-up with more detailed information as the date of the event/activity gets closer.

Volunteer Monitoring Program

Begin monitoring activities according to your program implementation schedule.

Using the program schedule developed during Year 2, kick-off your monitoring program using volunteer support. Ensure that all staff and volunteers follow the study design for the program, and that data are properly recorded and submitted. Be sure to obtain feedback from your volunteers on the monitoring program that you can use to improve the program in following years. Since your goal is to establish a volunteer base that is sustainable, you will need to understand what your volunteers liked and didn't like about their experience.

Storm Drain Stenciling Program

Using procedures established for your program, stencil storm drains in Priority Areas

Recruit more volunteers, and maintain current volunteer base, for your program using information about program implementation during Year 3.

The information you collect from your volunteers during the first year of program implementation can help you sustain and recruit new volunteers. Factors such as time commitment, driving distances, time of day, advertising, availability of children's activities, organization and follow-up could influence your volunteers' decision to continue their participation in your program. Understanding how your volunteers perceived their experience with the program will allow you to make necessary changes and improve program implementation. During this permit year, analyze volunteer feedback from the previous year and adjust your program accordingly. The goal is to maintain the volunteer base that you established during Year 3 and build upon that base with new recruits during Year 4.

Volunteer Monitoring Program

Continue monitoring activities according to your program implementation schedule.

During Year 3, you conducted your initial monitoring activities with volunteers. Review your study design and update it, if necessary, based on your experiences from the first year of program implementation. Following your program schedule that you created in Year 2, continue your monitoring activities. Keep in mind that you may have to allow time for training your new volunteers.

Storm Drain Stenciling Program

Using procedures established for your program, stencil storm drains in additional Priority Areas

MS4 STORMWATER MANAGEMENT PROGRAM *PROTOCOL*

ILLICIT DISCHARGE DETECTION AND ELIMINATION (IDD&E)

MINIMUM CONTROL MEASURE

Summary of Components of This Minimum Measure:

- Develop map of municipal separate storm sewer system outfalls and receiving surface waterbodies
- Prohibit illicit discharges via DEP-approved ordinance
- Implement a IDD&E Program that includes 1) field screening program and procedures and 2) elimination of illicit discharges
- Conduct public awareness and reporting program (see also the Public Education and Outreach portion of this manual)

NOTE: *This timeline is extended one year for municipalities implementing a watershed-based approach.*

PERMIT YEAR	*SUMMARY OF MINIMUM MEASURE* *PERMIT REQUIREMENTS AND MEASURABLE GOALS*			
	Mapping	**Ordinance**	**Program**	**Education**
Year 1	• Complete map of all outfalls	Adopt and enact NOTE: participating in Act 167 planning or implementation may follow a different schedule approved by DEP		• Presentation on IDD&E Program and Ordinance during a public meeting • Distribute educational material (see Public Education and Outreach Minimum Measure)
Year 2	• Establish priority areas for 25% of system	Implement and enforce	• Screen Priority Areas • Take corrective actions to remove illicit discharges (as needed)	• Distribute educational material (see Public Education and Outreach Minimum Measure)
Year 3	• Establish priority areas for 25% of system	Implement and enforce	• Screen Priority Areas • Take corrective actions to remove illicit discharges (as needed)	• Distribute educational material (see Public Education and Outreach Minimum Measure)
Year 4	• Establish priority areas for 25% of system	Implement and enforce	• Screen Priority Areas • Take corrective actions to remove illicit discharges (as needed)	• Distribute educational material (see Public Education and Outreach Minimum Measure)
Year 5	• Establish priority areas for 25% of system	Implement and enforce	• Screen Priority Areas • Take corrective actions to remove illicit discharges (as needed)	• Distribute educational material (see Public Education and Outreach Minimum Measure)

STORM SEWER SYSTEM MAPPING

What Does This Section Address?

This section provides details on the mapping component of the Illicit Discharge Detection and Elimination (IDD&E) Minimum Control Measure.

What is an "outfall?"

The federal regulations define an outfall as "a point source as defined by 40 CFR 122.2 at the point where a municipal separate storm sewer discharges to waters of the United States and does not include open conveyances connecting two municipal separate storm sewers, or pipes, tunnels or other conveyances which connect segments of the same stream or other waters of the United States and are used to convey waters of the United States."

A "point source" is defined as "any discernable, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, vessel, or other floating craft from which pollutants are or may be discharged."

What Should My Map Look Like?

Understanding the location of your separate storm sewer system outfalls is the key to effectively managing stormwater runoff and protecting water quality. Not all system maps will look alike, but they should contain the same basic information and ultimately serve as a tool for your employees responsible for implementing the IDD&E Program, as well as other components of the Stormwater Management Program.

SCALE. The map must be of a scale that shows street-level detail and extends beyond the service boundaries of the municipal storm sewer system. A scale between 1:10,000 and 1:25,000 may be appropriate for many small MS4s that cover a large land area. This scale is acceptable as long as street-level detail can be obtained. Otherwise you should use a map scale that best depicts specific location information for each outfall, as technicians in the field will need street-level detail in order to effectively locate and monitor outfalls.

SYSTEM FEATURES. The goal of the system mapping is to identify all outfalls and the name/location of the receiving water bodies, to support an effort to detect and eliminate illicit discharges.

FORMAT. Only you can determine what format is best for your community. Factors such as staff, money, format of available data and equipment will dictate how you generate your system map. You may wish to use a geographic information system (GIS) to electronically generate your system map. PA DEP recognizes that not all communities have GIS capabilities. For those that do not have GIS capabilities, you can generate your map using other means. The format of your map is not as important as the quality of the information it contains. For help with developing your system map, consult the list of resources provided in Appendix 1.

Where can I get the names of "receiving waters?"

Use the names shown on the relevant USGS Topographical Survey Quadrangle map for your MS4. These can be obtained here:
http://mac.usgs.gov/maplists/mlp001.cgi?initial=1&state=Pennsylvania&listtype=S&scale=1%3A24%2C000%2F1%3A25%2C000+Scale

What is meant by "priority areas?"

This simply means selecting portions of your system by the 1) likelihood of problems and 2) the significance of the problems. For instance, the highest priorities should be the areas within your community that are high-risk for dumping to storm sewer system inlets and illegal connections to the system, such as sections of the system with older sanitary sewer lines or industrial activity and those areas with known incidences of illicit discharges, connections or illegal dumping in the past. The information that you collected when creating the outfall map should prove useful when prioritizing high-risk areas

What Do I Need to Do and By When?

Pursuant to the schedule at the beginning of this section of the *Protocol*, you must have a comprehensive map of your municipal separate storm sewer system (MS4) outfalls and receiving waters that will allow you to effectively implement the illicit discharge detection and elimination program described in the next section of this document. You must also have a list of priority areas in the system for efforts to trace the sources and eliminate illicit and illegal discharges and a procedure for program evaluation and assessment. If you are following a watershed-based approach under Act 167 (or otherwise as approved by DEP), your schedule of compliance can be delayed one year for each element.

<u>Sources of Information</u>

You can accomplish this activity by reviewing city records, drainage maps and existing storm drain maps. You may need to conduct field surveys to verify outfall locations. Field surveys will also give you the opportunity to locate any additional outfalls that were previously unknown.

<u>Developing the Map</u>

Devise an internal coding system for your outfalls that you can use on your system map. This will allow you to reference the location of outfalls easily, rather than using cumbersome and subjective narrative descriptions, when conducting your field screening activities under the IDD&E Program, described later in this section.

Show the location of all outfalls and the names and locations of all surface waters that receive discharges from those outfalls. Include all outfalls that are physically connected to the system, even those that are outside of the Urbanized Area boundary.

High-Risk Problem Areas

Identify areas within your community that are high-risk for dumping to storm sewer system inlets and illegal connections to the system, such as sections of the system with older sanitary sewer lines or industrial activity and those areas with known incidences of illicit discharges, connections or illegal dumping in the past. The information that you collected when creating the outfall map should prove useful when prioritizing high-risk areas.

In addition, you should conduct visual outfall screening during dry weather. Where dry weather flows are observed, conduct field tests of selected pollutants to establish priority areas (this is described later in this *Protocol*). Use the results when evaluating the high-risk areas.

Prioritize these high-risk areas that are likely to have illicit discharges, illegal connections to the system, and illegal dumping. Beginning in Year 2, each year identify the highest priority areas for 25 percent of the system until the entire system is prioritized by the end of the permit term. This list will be the Priority List for Illicit Discharge Elimination described in a following section of this component of the *Protocol*.

IDD&E MINIMUM MEASURE COMPONENT: ILLICIT DISCHARGE ORDINANCE

What Does This Section Address?

This section provides information on the ordinance developed by DEP that will provide the legal authority you need to implement and enforce your Illicit Discharge Detection and Elimination (IDD&E) Program under this Minimum Control Measure. A Model Ordinance is available from DEP.

Can I make changes to the ordinance?

DEP discourages changes to the model ordinance, because it has been prepared to meet the MS4 permit requirements. However, some municipalities already have good stormwater ordinances. Municipalities who do not wish to enact the model ordinance in its entirety must get approval from DEP to ensure that the MS4 permit requirements are met.

DEP sought public comments on the model ordinance and made adjustments in the final version based on the comments.

What Do I Need to Do and By When?

The timing depends on the municipality's involvement in any Act 167 planning and the status of that planning and/or implementation:

The model ordinance must be enacted in the first year of the permit term, except where a municipality commits to a multi-municipal, watershed-based program following this *Protocol*, in which case the schedule is delayed one year. Subsequent to completion of the Act 167 Plan (or Plan Update), the ordinance must be modified to reflect Plan requirements. Regardless of the timing of the Act 167 Plan (or Plan Update) an ordinance must be enacted within the first two years of the permit term, for MS4s participating in the Act 167 process.

ILLICIT DISCHARGE DETECTION AND ELIMINATION

What Does This Section Address?

This section provides information on the IDD&E Program that establishes procedures for identifying and eliminating prohibited discharges of non-stormwater to your storm sewer system.

What Do I Need to Do and By When?

The IDD&E Program consists of the following three elements, which must be implemented according to the schedule (if you are following a watershed-based approach under Act 167 (or otherwise as approved by DEP), your schedule of compliance can be delayed one year for each element):

- Conduct Field Screening
- Identify Source of Illicit Discharges
- Strategy to Remove or Correct Illicit Discharges.

1. FIELD SCREENING

Field screening is necessary to identify the source(s) of the actual illicit discharges. The Priority List that you create each year will serve as the basis for your field screening activities. You must start your annual field screening in Year 2 of your permit. If you are following a watershed-based approach under Act 167 (or otherwise as approved by DEP), your schedule of compliance can be delayed one year.

The Checklist provided in this *Protocol* (see the References and Resources CD-ROM and Appendix 1) must be used when conducting field screening. Every outfall in the Priority Areas must be screened two times a year as each priority area is screened. This activity is something that you can piggy-back onto other existing field activities, such as regularly scheduled fire hydrant inspections, road repairs, landscaping activities, other field work conducted during county preparation of the Act 167 stormwater plan, etc.

Using the Checklist, the staff designated to conduct field screening will go out into the Priority Areas and collect visual data. The screening should be conducted at least 72 hours since the last precipitation event, and that at least 48 hours should pass between the first screening at a particular outfall and the second screening at that outfall. If someone conducting the field screening discovers a dry-weather flow, they (or another designated individual with the proper training) must collect a sample of that flow for analysis. Such a discovery triggers the requirements under the other two program elements:

- Identify Source of Illicit Discharges
- Remove or Correct Illicit Discharges

2. IDENTIFY SOURCE OF THE ILLICIT DISCHARGE

The following IDD&E Program elements only apply if you identify a dry-weather flow during your field screening activities in Years 2, 3, 4, and/or 5. You will need to conduct all the activities described below for each illicit discharge that you identify during field screening.

- **Collect and analyze samples of the dry-weather flow.**

  If you identify a dry-weather flow at an outfall during field screening, take two grab samples of the flow. Analyze the samples for the characteristics and pollutants listed in the Table below.

Dry-Weather Flow Sampling Analysis Requirements

Characteristic/Pollutant	Method
Color	Visual observation
Odor	Visual observation
Turbidity	Visual observation
Sheen/scum	Visual observation
pH	In-field analysis
Total chlorine	In-field analysis
Total copper	In-field analysis
Total phenol	In-field analysis
Detergents/surfactants	In-field analysis
Flow	In-field measurement
Bacteria	Laboratory analysis

As shown in the Table, some parameters only require visual observations while others require more analytical testing. You can use inexpensive colorimetric field test kits to analyze your grab samples for total chlorine, total copper, total phenol, and detergents. You will need this information to effectively determine the type of pollutants and pinpoint the source of the discharge. The field screening checklist, along with the sampling resource materials, referred to in this section will provide you with helpful information on techniques for taking grab samples and the methods to use for analyzing your samples.

- **Identify the source of the discharge.**

The data you obtain from visual, in-field, and laboratory analysis will provide you with the information necessary to determine the source of the dry-weather flow or floatables. Based on the pollutants contained in your grab sample, you should have an idea if the source is from illegal dumping in a storm drain, a cross-connection, or a leak in a pipe. Using this information, you will be able to narrow down the potential sources of the dry-weather flow and begin storm drain investigations by tracing the flow upstream using your storm drain maps and by inspecting upgradient manholes and storm drains. If need be, you can also conduct more focused tests to pinpoint the source.

You may decide to conduct smoke and dye testing; however, these additional costs may not be allowable under the Act 167 reimbursement program.

3. REMOVE OR CORRECT THE ILLICIT DISCHARGE

- **Determine if the flow is from illegal dumping or an improper connection.**

  Once you identify the source, you need to determine if it is a case of improper dumping or if a property owner has an improper physical connection to your storm sewer system. This will help you select the most appropriate method for correcting or removing the discharge. If it is a case of improper dumping, your only recourse may be to conduct intensified education of residents living in and traveling through that area. If it is a case of an improper physical connection, see the next paragraph.

- **Take the appropriate action to correct the discharge.**

  If a violation is found, notify the property owner of the violation. Give the property owner a timeframe for removal of the source. After that time has passed, screen the outfall at which you identified the dry weather discharge. In addition, visit the property again to confirm that the property owner removed or corrected the source. If the property owner has not resolved the problem in the allotted timeframe, you may need to take further action.

- **Document all steps taken**

  The results of all discussions, tests, and screenings, should be documented for follow-up purposes. Progress evaluation of your IDD&E program will depend on the ability to tabulate the number of illicit connections corrected and the status of those in the process of being corrected.

- **List the status of all illicit discharges detected in your Annual Report Form to DEP**

ILLICIT DISCHARGE DETECTION AND ELIMINATION PUBLIC EDUCATION AND OUTREACH

What Does This Section Address?

This section provides a brief overview of the public education and outreach activities linked to the overall IDD&E Minimum Control Measure. Many of these activities link to activities discussed under the Public Education and Outreach Minimum Control Measure and the Public Involvement and Participation Minimum Control Measure, both addressed elsewhere in this Protocol. Completing the activities described under those Minimum Control Measures will help you to meet your public education and outreach requirements under this Minimum Control Measure.

You will need to conduct more public education and outreach activities, however, when you are trying to correct an illicit discharge. This section addresses those additional public education and outreach activities, as well as the schedule for completing public education and outreach activities to meet your permit requirements under this Minimum Control Measure.

What Do I Need to Do and By When?

You can find all the resource materials needed to conduct these public education and outreach activities with the other educational resources (References and Resources CD) . To fulfill the permit requirements associated with this component of the IDD&E Minimum Control Measure, complete the following tasks during each year of your permit (If you are following a watershed-based approach under Act 167 (or otherwise as approved by DEP), your schedule of compliance can be delayed one year for each element):

Year 1: Raise Awareness About Illicit Discharges and the IDD&E Program

- *Present details on the components of the IDD&E Program and Ordinance during a public meeting (see Ordinance requirements in previous section).*

As stated in the previous section, you must share with your community the details of the IDD&E Program and ordinance through a public meeting. This can be a regularly-scheduled public meeting of the municipal officials.

- *Distribute educational materials on the impacts of illicit discharges through the storm sewer system to water quality (see Public Education and Outreach minimum measure requirements).*

Again, there is nothing additional for you to do under this minimum measure, as long as you meet your permit requirements for Public Education and Outreach.

Years 2 - 5: Educate the Public About Illicit Discharges

- *Continue to distribute educational materials on the impacts of illicit discharges through the storm sewer system to water quality.*

Follow your permit requirements for Year 2 of the Public Education and Outreach minimum measure and you will be in compliance with your permit requirements under this minimum measure.

MS4 STORMWATER MANAGEMENT PROGRAM *PROTOCOL*

CONSTRUCTION STORMWATER RUNOFF MANAGEMENT

MINIMUM CONTROL MEASURE

Summary of Components of This Minimum Control Measure:

- Enact, implement and enforce a stormwater control ordinance using DEP model language,
- Require review and approval of Erosion and Sediment Control Plans: (1) for any earth disturbance one acre or more causing runoff to the MS4 (or any earth disturbance five acres or more regardless of the planned runoff), and (2) as a prerequisite for the formal approval of land development and redevelopment plans or the issuance of building permits, and
- Distribute educational materials to land developers with the applications for building permits and other land development/redevelopment permits or approvals (see Public Education and Outreach Minimum Control Measure).

NOTE: *Municipalities that already have similar ordinances only need to amend them to include any of these requirements not already in place (DEP will need to approve alterations from the Model Ordinance)*

NOTE: *This timeline is extended one year for municipalities implementing a watershed-based approach*

PERMIT YEAR	*SUMMARY OF MINIMUM CONTROL MEASURE* *PERMIT REQUIREMENTS AND MEASURABLE GOALS*	
	Construction Site Stormwater Program	**Developer Education**

Year 1	• <u>Ordinance</u>: enact an ordinance requiring:
	  • the review and approval of Erosion and Sediment ("E&S") Control Plans,
	  • for any earth disturbance one acre or more with runoff to the MS4, or five acres or more regardless of the planned runoff, and
	  • as a prerequisite for the formal approval of land development plans or the issuance of building permits
	• <u>Process</u>:
	  • Use municipal resources, a service provider or the local CCD to review E&S Plans,
	  • Using the local CCD, establish an agreement with the local CCD for the review
	• <u>Standard</u>: Require that the Erosion and Sediment Control Plans be developed in accordance with the requirements of Chapters 102 (erosion & sedimentation) of the DEP regulations
		Meet permit requirements and measurable goals for Year 1 under Public Education and Outreach minimum control measure.

Year 2	Implement the ordinance (and any agreement) for review of Erosion and Sediment Control Plans	Meet permit requirements and measurable goals for Year 2 under Public Education and Outreach minimum control measure.

PERMIT YEAR	*SUMMARY OF MINIMUM CONTROL MEASURE PERMIT REQUIREMENTS AND MEASURABLE GOALS*	
	Construction Site Stormwater Program	**Developer Education**
Year 3	Implement the ordinance (and any agreement) for review of Erosion and Sediment Control Plans	Meet permit requirements and measurable goals for Year 3 under Public Education and Outreach minimum control measure.
Year 4	Implement the ordinance (and any agreement) for review of Erosion and Sediment Control Plans	Meet permit requirements and measurable goals for Year 4 under Public Education and Outreach minimum control measure.
Year 5	Implement the ordinance (and any agreement) for review of Erosion and Sediment Control Plans	Meet permit requirements and measurable goals for Year 5 under Public Education and Outreach minimum control measure.

CONSTRUCTION SITE STORMWATER PROGRAM

What Does This Section Address?

This section addresses the requirements for developing and implementing a program to control stormwater runoff from construction sites during earth disturbance activities consisting of one acre or more where there will be runoff to the MS4 (or five acres or more regardless of the planned runoff).

In Pennsylvania, two programs currently exist that address stormwater runoff from construction activities: 1) the Erosion and Sediment Control Program under 25 Pa. Code Chapter 102, and 2) the NPDES Stormwater Construction Permit Program.

The Erosion and Sediment Control Program (also called the "Chapter 102 program"), is described in the regulations at 25 Pa. Code §§102.1 – 102.51. The program requires an Erosion and Sediment Control Plan for any earth disturbance equal to or greater than 5000 square feet. For more information, visit the DEP stormwater website, www.dep.state.pa.us , directLINK "stormwater", or view the regulations here: www.pacode.com/secure/data/025/chapter102/chap102toc.html.

> The Erosion and Sediment Control Plan must contain BMPs appropriate to the site and the surrounding area that might be impacted by the construction activities, as well as for post-construction runoff. The construction activity-related BMPs are available to developers and others through the Erosion and Sediment Pollution Control Program Manual, (DEP ID: 363-2134-008) on DEP's website, www.dep.state.pa.us , directLINK "stormwater," and available at your local CCD.

Generally speaking, an NPDES Stormwater Construction Permit is required for earth disturbance activities (hereinafter referred to as "construction") where (1) the construction disturbs five acres or more, or (2) there is a discharge from a site to the MS4 where earth disturbance is one acre or more.

In most cases, your County Conservation District implements these two programs within your community. DEP is responsible for implementing and enforcing these programs in cases where the County does not have this responsibility.

By requiring review and approval of Erosion and Sediment Control Plans (and proof of NPDES Stormwater Construction Permits where required), and by coordinating your building permit and other land development permits or approvals with the CCD (or DEP in some cases), you will meet your MS4 permit requirements for this component of the Construction Stormwater Runoff Management Minimum Control Measure. Utilizing these existing statewide programs, the municipality avoids the need to do a duplicative, independent review of every Erosion and Sediment Control plan.

What Do I Need to Do and By When?

Pursuant to the schedule at the beginning of this section of the *Protocol*, you must (1) enact an ordinance (or revise your existing one) (2) arrange for review of Erosion and Sediment Control plans, and (3) require proof of issuance of NPDES permits where they are required. After that, you must implement the ordinance and the E&S plan review process. If you are following a watershed-based approach under Act 167 (or otherwise as approved by DEP), your schedule of compliance can be delayed one year for each element.

Ordinance: The ordinance must contain two basic requirements regarding any earth disturbance greater than or equal to one acre that results in runoff to your MS4 (or five acres or more regardless of the planned runoff): (1) review and approval of the Erosion and Sediment Control Plan by the municipality, or the CCD or DEP (e.g., as part of issuance of NPDES Stormwater Construction Permits), and (2) the review and approval (and permit) must also be a prerequisite for any building permits and other land development permits or approvals.

A model ordinance is available from DEP.

Arrangement With County Conservation District: If you use the local CCD for your reviews and approvals, you must have an agreement with your local CCD that addresses these reviews and permitting requirements. This agreement ensures the close coordination between the municipality and the CCD on these important issues affecting water quality.

Satisfaction of these review and approval requirements can be met by a letter from the local CCD (in the county where the project is located) indicating that (1) the CCD has reviewed and approved the applicant's Erosion and Sediment Control Plan developed in accordance with the regulatory requirements and, where required, (2) an NPDES Stormwater Construction Permit has been issued.

In some counties, the CCD may not wish to participate in this approach. In those cases, the municipality will have to make arrangements with DEP. Nothing in PAG-13 or this Protocol changes the requirements in Chapter 102 or the NPDES Stormwater Construction Permit programs.

DEVELOPER EDUCATION

What Does This Section Address?

This section addresses the educational component of the Construction Stormwater Runoff Management Minimum Control Measure. Developers have responsibilities under the existing programs administered by the County Conservation Districts (CCDs) (or DEP). Their projects can be delayed if they are unfamiliar with the Chapter 102 Erosion and Sediment Control Plan requirements, and the interrelationship with municipal building permit and land development approvals.

Therefore, ensuring that developers understand these stormwater management requirements at their sites will ultimately benefit you. Through this Minimum Control Measure component, you will distribute educational materials created by DEP to the developers planning to build in your community. You must perform these activities to be in compliance with your permit requirements.

What Do I Need to Do and By When?

To fulfill the permit requirements associated with this component of the Construction Stormwater Runoff Management Minimum Control Measure, distribute educational materials to developers on the impacts of stormwater runoff and construction site stormwater management requirements (see Public Education and Outreach Minimum Control Measure requirements).

There is nothing additional for you to do under this Minimum Control Measure, as long as you meet your permit requirements for Public Education and Outreach. At this point in your stormwater program, developers working in your community may not be familiar with your stormwater management program under your MS4 permit.

The educational materials introduce the concept of a separate storm sewer system and address the impacts of stormwater runoff from construction sites to the system. By raising developers' awareness about your stormwater program, you are contributing to facilitating the CCD's efforts in securing compliance from developers and are more likely to obtain participation in implementing your program during the remainder of the permit term.

MS4 STORMWATER MANAGEMENT PROGRAM *PROTOCOL*

POST-CONSTRUCTION STORMWATER RUNOFF MANAGEMENT

MINIMUM CONTROL MEASURE

Summary of Components of This Minimum Control Measure:

- Enact, implement and enforce a stormwater control ordinance using DEP model language,
- Coordinate the review and approval of post-construction BMPs simultaneously with the review and approval for construction Erosion and Sediment Control Plans as described in the Construction Minimum Control Measure, and
- Ensure long-term operation and maintenance of the BMPs

NOTE: *This timeline is extended one year for municipalities implementing a watershed-based approach*

PERMIT YEAR	*SUMMARY OF MINIMUM CONTROL MEASURE* *PERMIT REQUIREMENTS AND MEASURABLE GOALS*	
	Stormwater Management Program	**Long Term Operation and Maintenance**
Year 1	• <u>Ordinance</u>: Enact an ordinance requiring: ▪ No formal approval of land development plans or issuance of building permits without municipal approval of post-construction stormwater controls, ▪ For development and redevelopment activities with earth disturbance of one acre or more with runoff to the MS4, or five acres or more regardless of the planned runoff, be conducted in accordance with the ordinance • <u>Process</u>: Rely on DEP review of permits *where applicable (e.g., individual permit issued)*; where no DEP review of post-construction controls is conducted, use municipal resources, or establish an agreement with the local CCD or other service provider (e.g., municipal engineer), for coordination of post-construction BMP approvals • <u>Standard</u>: Require post-construction structural and non-structural BMPs be designed, constructed and maintained to meet (1) the requirements of the approved Act 167 plan and the municipal ordinance, or until such Act 167 Plan is in place, (2) the DEP statewide water quality requirements (e.g., 25 Pa Code Chapter 93).	• Ensure that stormwater BMPs are built, operated and maintained as designed
Year 2	• Implement the ordinance and post-construction BMP approval process	• Ensure that stormwater BMPs are built, operated and maintained as designed
Year 3	• Implement the ordinance and post-construction BMP approval process	• Ensure that stormwater BMPs are built, operated and maintained as designed

PERMIT YEAR	*SUMMARY OF MINIMUM CONTROL MEASURE PERMIT REQUIREMENTS AND MEASURABLE GOALS*	
	Stormwater Management Program	**Long Term Operation and Maintenance**
Year 4	• Implement the ordinance and post-construction BMP approval process	• Ensure that stormwater BMPs are built, operated and maintained as designed
Year 5	• Implement the ordinance and post-construction BMP approval process	• Ensure that stormwater BMPs are built, operated and maintained as designed

POST-CONSTRUCTION STORMWATER RUNOFF MANAGEMENT

What Does This Section Address?

This section applies to management of stormwater runoff after construction is complete. The consideration of the permanent changes to the natural characteristics of a developed area is a key component of addressing the stormwater impacts on water quality. Studies show that as the natural characteristics of a watershed become changed through development and redevelopment, there is an accompanying increase in surface runoff rates and volumes, and a loss of natural infiltration into the groundwater regime. This impacts surface water quality in several ways, including increased loadings of pollutants such as oil and grease, pesticides, sediment and litter, as well as increased temperature of receiving waters. These loadings and impacts can impair existing or designated uses of the water-body, such as aquatic life, water supply and recreation.

Runoff in developed areas also increases stream-bank erosion and habitat destruction. In addition, the loss of infiltration affects the "base flows" of streams which are necessary to support aquatic life and which are particularly vulnerable in times of drought. Finally, excessive stormwater runoff in urbanized areas can create flash flooding problems.

What do I need to do and by when?

First, it is important to remember that management of post-construction run-off goes hand-in-hand with the Construction Minimum Control Measure component. Approvals for construction activities will be dependent on post-construction issues addressed in this section of the *Protocol*. For instance, if an applicant's plan for a land development or redevelopment project adequately addresses stormwater issues *during construction* but does not do so for *post-construction* impacts, then it must not be approved until the post-construction issues are addressed.

You need to implement a post-construction program consisting of (1) an ordinance, (2) a process for review of post-construction plans and (3) use of the correct standard to protect and maintain water quality. This program must be fully implemented within the first permit term, following the schedule at the beginning of this section of the *Protocol*. If you are following a watershed-based approach under Act 167 (or otherwise as approved by DEP), your schedule of compliance can be delayed one year for each element.

1. <u>Enact, implement and enforce a stormwater control ordinance using DEP model language</u>.

   The ordinance will address the other requirements described in this Section of the *Protocol*, such as the proper standard for BMPs and operations and maintenance requirements for the BMPs.

   The ordinance will apply a statewide post-construction requirement until the water quality-based Act 167 Plan is adopted by the County and implemented by the municipality, at which time the municipality will need to amend it to include those requirements. DEP may approve a different schedule as appropriate (e.g., where the plan is or will soon be under development).

   The ordinance will require that all development and redevelopment activities with earth disturbance one acre or more with runoff to the MS4 (or five acres or more regardless of the planned runoff), be conducted in accordance with the ordinance, and in particular that no formal approval of land development plans or issuance of building permits without municipal approval of post-construction stormwater controls.

A Model Ordinance is available from DEP.

2. Commit municipal resources or establish an agreement with the local CCD or other service provider (e.g., municipality's consulting engineer) for coordination of post-construction BMP approvals

   You must have a process to review the post-construction controls in conjunction with the review process for construction approval as described in the Construction Minimum Control Measure. In many cases, you can rely on the DEP permit issued in Special Protection watersheds. Where DEP issues authorizations under its "general permit" (PAG-2), you must conduct the review.

3. Ensure that the post-construction controls will meet state water quality requirements.

   The requirements for post-construction controls depend upon the status of Act 167 Stormwater Management planning in your watershed. Where a water-quality-based Act 167 plan has been completed (or updated), those local watershed requirements apply. Otherwise, statewide requirements must be implemented. Here are more details:

   a. **Watershed-Specific Requirements**

      The Pennsylvania Storm Water Management Act (also known as "Act 167") requires county and multi-municipal planning and implementation of post-construction controls to protect water quality, on a watershed basis. (See the description of this program in the Introduction to this *Protocol*, or visit the DEP stormwater website: www.dep.state.pa.us , directLINK "stormwater". These post-construction control requirements are developed after careful evaluation of the characteristics of the watershed. This *Protocol* uses the Act 167 program as a centerpiece of the MS4 requirements.

      If your county has adopted and DEP has approved an Act 167 Plan, there will be post-construction requirements in that Plan which must be implemented by the municipality. These requirements will set the standard for post-construction BMPs that must be used in your municipality.

      Most *existing* Act 167 Plans will need to be modified to address water quality (and other MS4 permitting issues to meet MS4 requirements such as Illicit Discharge Detection and Elimination). The water quality issues include both pollutant loading and the quantity of water discharged and infiltrated. This *Protocol* requires that municipalities implementing existing Act 167 plans be updated according to the DEP update process, and appropriate changes made to the municipal ordinance.

      Who ensures that the BMP's meet the water quality requirements? It is the municipalities' responsibility. However, DEP will be reviewing post-construction plans for Individual permits, and some County Conservation Districts have the expertise to conduct the reviews under an agreement with the municipality similar to that for the Construction Minimum Control Measure.

   b. **Statewide requirements**

      State regulations require, under 25 Pa. Code Section 93.4, the protection and maintenance of existing uses and the level of water quality necessary to protect those uses in all surface waters, and the protection and maintenance of water quality in "special protection" watersheds. Special protection waters are Pennsylvania's highest quality surface waters and include Exceptional Value (EV) and High Quality (HQ) waters.

      DEP published a Comprehensive Stormwater Policy in September, 2002, which recommended that in order to meet the regulatory requirements of 25 Pa. Code Section 93.4a, persons involved in the development of post construction stormwater management plans should prepare a comparative pre and post construction stormwater management analysis, and

      > In watersheds other than special protection, based upon the comparative stormwater management analysis, planners and applicants should evaluate and utilize infiltration BMPs to manage the net change in stormwater generated or otherwise replicate to the maximum extent possible preconstruction stormwater infiltration and runoff conditions so that post construction stormwater discharges do not degrade the physical, chemical or biological characteristics of the receiving waters. Additionally, water quality treatment BMPs must be employed where necessary to ensure protection of existing uses and the level of water quality necessary to protect those existing uses. Finally, the volume and rate of stormwater discharges must be managed to prevent the physical degradation of receiving waters, such as scour and streambank destabilization;

In special protection watersheds, based upon the comparative stormwater management analysis, planners and applicants can ensure that existing water quality will be protected and maintained by demonstrating that post construction infiltration equals or exceeds preconstruction infiltration and that any post construction discharge will not degrade the physical, chemical or biological characteristics of the special protection surface water. In these special protection watersheds, infiltration BMPs should be used to the maximum extent possible. To the extent that planners and applicants cannot totally infiltrate stormwater to pre construction volumes due to site conditions or limitations, off-site compensation projects in the same watershed and preferably upstream of the project site should be evaluated and employed to protect and maintain water quality. Additionally, water quality treatment BMPs must be employed where necessary to ensure the protection and maintenance of water quality. Finally, the volume and rate of stormwater discharges must be managed to prevent the physical degradation of receiving waters, such as scour and streambank destabilization. [NOTE: PAG-13 is not available for use for MS4s with a discharge to a Special Protection water; see the *Fact Sheet*]

This recommended approach from the DEP policy must be applied by MS4s adopting this *Protocol.*

This aspect of the Post-Construction Minimum Control Measure ensures that building and land development activities in your municipality comply with state law permitting requirements, at the local level.

OPERATION AND MAINTENANCE OF POST-CONSTRUCTION BMPS

What Does This Section Address?

This section addresses your responsibility to ensure that the post-construction BMPs required and approved pursuant to your program, are constructed, operated and maintained.

First, your program must monitor the implementation of the approved BMPs. This can be easily done as part of the regular construction-inspection process.

Many BMPs may be "non-structural"; they will require no operation or maintenance. Examples are: use of open space and vegetated buffers in development design, minimization of soil disturbance and compaction during construction and minimization of directly-connected impervious areas. Other BMPs - "structural BMPs" - will require proper operation and maintenance. For example, wet ponds, grassed swales, infiltration basins and bioretention areas.

What Do I Need to Do and By When?

You need to have a monitoring program that ensures that the post-construction BMPs are constructed, operated and maintained, within the first permit term. If you are following a watershed-based approach under Act 167 (or otherwise as approved by DEP), your schedule of compliance can be delayed one year for each element.

Your program must have two elements:

- Implementation: ensure installation of the BMPs as designed. Coordinate your monitoring with the CCD, especially where a permit has been issued.
- Operation and Maintenance: some of the structural BMPs will require maintenance over time to be effective. You must have a system to monitor these BMPs. If any BMPs are not operated or maintained and are ineffective, develop a plan to address them. The DEP Model Ordinance provide legal tools to accomplish this.

MS4 STORMWATER MANAGEMENT PROGRAM *PROTOCOL*

POLLUTION PREVENTION AND GOOD HOUSEKEEPING FOR MUNICIPAL OPERATIONS AND MAINTENANCE

MINIMUM CONTROL MEASURE

Summary of Components of This Minimum Control Measure:

- Comprehensive Pollution Prevention Program for municipal operations, focusing particularly on vehicle maintenance, fueling and washing, maintenance of stormwater facilities and employee training.
- O&M Program training program for municipal employees.

	SUMMARY OF MINIMUM CONTROL MEASURE PERMIT REQUIREMENTS AND MEASURABLE GOALS		
	O&M Program		
PERMIT YEAR	**Storm Water Facility Operation, Maintenance and Inspection**	**Vehicle Maintenance, Fueling, and Washing**	**Training**
Year 1	Gather information on existing facilities and programs	Gather information on existing operations and programs	No requirement
Year 2	Develop an operation, maintenance and inspection program for stormwater facilities	Develop pollution prevention-based O&M Program for vehicle maintenance, fueling and washing	Conduct basic awareness training for municipal employees
Year 3	Implement O&M Program for stormwater facilities	Implement O&M program for vehicle maintenance, fueling and washing	Train Municipal employees on new procedures developed for stormwater facility operation, maintenance and inspection and vehicle maintenance, fueling and washing
Year 4	Implement O&M Program for stormwater facilities	Implement O&M program for vehicle maintenance, fueling and washing	Train new employees
Year 5	Implement O&M Program for stormwater facilities	Implement O&M program for vehicle maintenance, fueling and washing	Update training on procedures Continue training

POLLUTION PREVENTION PROGRAM FOR MUNICIPAL OPERATIONS

What Does This Section Address?

This section will help you make sure that you have a pollution prevention/good housekeeping program ("P2 Program") for municipal operations to minimize stormwater impacts from your MS4. The focus will be on (1) inspection, operation, maintenance and repair of municipally-owned stormwater facilities in the municipality such as detention and retention basins and other Best Management Practices, and (2) pollution prevention related to municipal vehicle operations. You will also need to do some training of municipal employees for these new procedures, addressed in the next section.

Do I need to address *ALL* municipal operations in my P2 Program?

No. During this permit term the scope of the P2 Program should primarily focus on maintenance of the storm sewer system and other stormwater management facilities, vehicle operations and employee training.

There are several best management practices to address stormwater impacts from your MS4, and you may want to address these as well. However, they are not required under this *Protocol*. These include: landscaping (including pesticide, herbicide, and fertilizer use), deicing, oil recycling, tire collection, and household hazardous waste collection. If you have these types of programs in place, they will strengthen the O&M program that your stormwater permit requires you to develop. If you do not participate in these types of activities, you may want to consider them. During this permit term, however, your permit requires you only to address the three areas of your municipal operations listed above and described in more detail in the next section.

What Do I Need to Do and By When?

Your municipality may already have some of these procedures in place, so first it will be necessary to evaluate current programs. Following the schedule above, you will spend the first year of the permit term getting familiar with the existing stormwater sewer system and programs that exist within your municipality. In the remainder of the permit term, you will develop and implement the O&M Program that focuses on Pollution Prevention ("P2") and implement training for municipal employees.

Your permit requires you to bring existing pollution prevention programs up to a certain minimum level, so it is important to see what you already have in place. In many cases, an existing program may meet the minimum requirements and, therefore, not need any improvement.

Year 1: Compile information on existing facilities, operations/maintenance, inspection and pollution prevention programs

To gain an understanding of existing municipal aspects in the three focus areas, determine from various municipal departments all available information on existing:

- MS4 stormwater system features, such as catchment and detention basins *(NOTE: this may also be determined in the Illicit Discharge Detection and Elimination Minimum Control Measure implementation),*
- Municipal programs to ensure proper operations and maintenance of the MS4 stormwater system features,
- Municipal vehicle operations, in particular vehicle maintenance, fueling, and washing; pay specific attention to the following: (1) frequency of activities, (2) types of substances used, (3) materials storage , handling, and disposal practices, and (4) employee training.

Year 2: Develop O&M Program

Stormwater Facilities

Inspect all municipally-owned stormwater facilities

Stormwater control facilities (and other BMPs) are important components of the MS4 and its ability to prevent stormwater impacts downstream. You must establish "baseline" information on these facilities in your MS4, if you haven't done so already. Your inspections should document current conditions and identify any needed maintenance or repair. If any system features are not functioning properly, a plan to address the deficiencies must be developed.

Develop a Stormwater Facility Operations and Maintenance Program

Using the criteria and requirements described below for Year 3, establish an operations and maintenance program for all municipally-owned storm system facilities and other BMPs. All municipally-owned facilities will be inspected at least annually during the remainder of the permit term (years 3, 4, and 5) to ensure they are meeting design criteria and are properly maintained and functional. By the end of year 2, you must have a detailed schedule for inspecting all stormwater facilities, and for their operation and maintenance.

Municipal Vehicles

Develop a Vehicle Operations and Maintenance Program

Using the criteria and requirements described below, establish an operations and maintenance program for all municipal vehicle operations.

Obtain materials needed for implementing the O&M Program during Year 3.

The program that you will implement during Year 3 and beyond require some up-front planning and a few materials that you may or may not currently use at your facilities. During this permit year, prepare for implementing P2 practices related to vehicle maintenance, fueling, and washing by obtaining and/or creating the following (if you don't already have them)(*these costs are typically NOT reimbursable under Act 167)*:

- Dry absorbent material (e.g., kitty litter, straw, or sawdust) for cleaning up spills;
- Receptacles for disposal of oily rags, used filters, batteries, spent coolants, degreasers, etc.;
- Drip pans for fluid collection and recycling;
- Covered or pervious (e.g., gravel or grass) washing areas;
- Signs that remind employees of P2 practices.

Year 3: Implement O&M Program

By the end of year three, you must put the following policies and practices into place. You will use the training program described in the next section of this Minimum Control Measure as the primary method of educating employees about these procedures.

Since many of these activities are easy-to-implement procedures, any additional costs to the municipality are not reimbursable under Act 167.

Vehicle Maintenance, Fueling, and Washing

Fueling:

- Place overfill prevention equipment on Underground Storage Tanks (USTs). Watch the transfer constantly to prevent overfilling and spilling (*NOTE: this is not Act 167 reimbursable*)
- Discourage "topping off" of fuel tanks through training and posting signs
- Avoid cleaning fueling areas with running water. Consider using a damp cloth on the pumps and a damp mop on the pavement rather than a hose
- Control spills immediately. Small spills can be cleaned up with rags and larger spills can be cleaned with dry absorbent material such as kitty litter, straw or sawdust. **Do not wash petroleum spills into the storm drain**

Maintenance:

- Make proper disposal of greasy rags, oil filters, air filters, batteries, spent coolant, degreasers, etc. easy by providing appropriate receptacles. Locate waste and recycling drums in properly controlled areas off the yard, preferably areas with a concrete slab and secondary containment
- Avoid hosing down work areas
- Put leaking vehicles coming in for service under cover or immediately place drip pans under them
- Collect leaking or dripping fluids in drip pans or containers
- Keep a drip pan under the vehicle while you unclip hoses, unscrew filters, or remove other parts
- Do not pour liquid waste into floor drains, sinks, outdoor storm drain inlets, or other storm drains or sewer connections
- Place oil filters in a funnel over the waste oil recycling or disposal collection tank to drain excess oil before disposal, then crush and recycle oil filters; ask your oil supplier or recycler about recycling oil filters.

Washing:

- If possible, utilize commercial car washes. They typically recycle washwater or direct it to a wastewater treatment plant.
- Create and use designated cleaning areas, preferably indoors where wash wastewater can be recycled or directed to treatment. If indoor washing is not possible, create specific areas to wash cars on gravel, grass, or other permeable surfaces.
- Block off storm drains while washing or use an insert to catch wash water. Make inserts and dams available
- Convert to use of phosphate-free biodegradable detergents

- Pump soapy water from car washes into a sanitary sewer drain. If pumping into a drain is not feasible, pump car wash water onto grass or landscaping to provide filtration
- Be sure to check state and federal requirements regarding use of the sanitary sewer system.

Stormwater Facility Maintenance

<u>Inspect stormwater detention/retention facilities and other BMPs:</u>

- Follow the inspection schedule developed during Year 2. Conduct planned maintenance activities.

<u>Inspect and clean catch basins:</u>

- Inspect each catch basin at least once annually to determine if it needs cleaning and note any repair needs. If the depth of deposits is greater than or equal to one-third the depth from the basin bottom to the invert of the lowest pipe or opening into or out of the basin (EPA, 1999), have the catch basin cleaned as soon as possible. Inspect catch basins in which debris significantly exceeds the one-third depth standard twice annually.
- Dispose of sediment and debris removed from catch basins in a proper manner, as this may be classified as hazardous waste. It will require chemical analysis to determine appropriate disposal techniques.

Years 4 - 5: Continue Implementation of P2 Policies and Practices for the O&M Program

<u>Implement O&M Program initiated during Year 3:</u>

You should continue to implement the O&M Program throughout Years 4 and 5.

POLLUTION PREVENTION & GOOD HOUSEKEEPING TRAINING

What Does This Section Address?

This section provides more detail on how to train municipal employees in pollution prevention and good housekeeping. Getting employees involved in pollution prevention is the key to a successful program.

What Do I Need to Do and By When?

To meet this requirement, you must (1) conduct basic awareness training of your municipal employees regarding stormwater management and (2) ensure that your employees understand the new procedures developed in the O&M Program described in the previous section.

You must also establish a basic level of awareness of stormwater issues among municipal employees, especially those in management and those responsible for implementing the O&M Program. The educational materials provided to you under the Public Education and Outreach Minimum Control Measure will be used for that awareness training

Training employees on proper procedures is a routine function in most municipalities. The permit requirement under this Minimum Control Measure simply involves incorporating the new procedures developed for the two target areas of the O&M Program - inspection, maintenance and repair of stormwater facilities. The relevant employees need to know what is expected of them, based on the permit requirements and commitment of the municipality in this Protocol.

Employee training is a routine function in municipalities and therefore the costs for incorporating stormwater issues is not reimbursable under Act 167.

OTHER OPTIONAL OPERATIONS, MAINTENANCE AND GOOD HOUSEKEEPING BMPS

Other BMPs

The BMPs described above are the minimum measures required for the DEP-approved program under this *Protocol*.

Some municipalities may wish to implement additional BMPs, and several which are particularly useful are described below.

Deicing Operations

Find an alternative to road salt.

Use of deicing materials other than salt in areas that drain to environmentally sensitive areas (e.g., Special Protection Waters). It is up to you to determine what you consider to be an environmentally sensitive area. Research alternative deicing materials. A list of references to help start your research is below.

- Technical Release: HITEC Releases ICE BAN® Evaluation Report
  http://www.dep.state.pa.us/dep/deputate/pollprev/technology/techalpha/articles/hitec.html

Establish "Snow storage areas."

Designate "Snow storage areas" around the municipality for temporary storage of snow that has been removed from the roadways. All Snow storage areas should be at least 100 feet from surface waters or groundwater drinking water sources.

- Locate all new salt/deicing material storage piles outside the 100-year floodplain.
- Continue operations of any existing storage piles within the 100-year floodplain until you use all materials.After you use materials at these locations, close and relocate the storage area outside the 100-year floodplain.
- Cover all new salt/deicing material storage piles with tarps, hard shelters or contain them with dikes or berms.

Establish Proper Application Techniques

- Apply deicing materials according to manufacturer's recommendations for the given circumstance. When determining the amount to apply, consider road width, traffic concentration, proximity to surface waters, and road temperature to prevent overapplication.
- Use trucks with calibration devices on their spreaders exclusively.
- Avoid applying deicing materials near surface waters, groundwater drinking water sources or other environmentally sensitive areas. In areas which drain to HQ/EV waters, apply alternative deicing materials such as sand or salt substitutes.

Cleaning Snow Storage Areas

- Clean each snow storage area after snow has melted by collecting debris and trash picked up in the snow removal process. This will aid in preventing floatables from entering surface waters.

Landscaping

Ensure applicators have state license.

Application:

- Pretest soils to determine proper application rates.
- Apply fertilizer, herbicides, and pesticides exactly according to manufacturer guidelines, as more is not always better in the case of chemical application.
- Ensure all applicators are licensed by the state. Require applicators to attend training to keep abreast of proper application techniques as detailed in the Pollution Prevention Training section.

APPENDIX 1

REFERENCES AND RESOURCES

GENERAL: CD with Reference and Resource materials—DEP has prepared a compendium of materials to help municipalities and other MS4s implement the Minimum Control Measures. The CD contains all DEP provided material in electronic format for printing, distributing or web posting by MS4s. It is also available from the DEP stormwater website, **www.dep.state.pa.us**, directLINK "stormwater."

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BMP References:

Pennsylvania Handbook of Best Management Practices for Developing Areas (1997)
Address: PACD
225 Pine St.
Harrisburg, PA 17101
(717) 236-1006 - telephone
(717) 236-6410 - fax
Website: http://www.pacd.org/products/bmp/bmp_handbook.htm
http://www.pacd.org/products/bmp/bmp_orderform.htm
Cost: web download – free (limited browser version)
printed version - $20-30

2000 Maryland Stormwater Design Manual (10/2000)
Address: Maryland Department of the Environment
Water Management Administration
Nonpoint Source Program
2500 Broening Highway
Baltimore, MD 21224
(410) 631-3543 or 1-800-633-6101
Website: http://www.mde.state.md.us/environment/wma/stormwatermanual/Manual_CD/Introduction.pdf
http://www.mde.state.md.us/environment/wma/stormwatermanual/publist2.htm
Cost: October 2000 edition, web download – free
April 2000 edition, printed version - $25

Center for Watershed Protection

http://www.cwp.org

Delaware Conservation Design For Stormwater Management Guidance Manual (1997)
Address: DNREC
Division of Soil and Water Conservation
Sediment and Stormwater Program
89 Kings Highway
Dover, DE 19901
Website: http://www.dnrec.state.de.us/dnrec2000/Divisions/Soil/Stormwater/Apps/DesignManualRequest.htm
Cost: $25

Revised Manual for New Jersey: Best Management Practices for Control of Nonpoint Source Pollution from Stormwater (5/2000, 5th draft)

Address: NJDEP
Division of Watershed Management
Sandra A. Blick
PO Box 418
Trenton, NJ 08625-0418
H2Oshed@dep.state.nj.us

Website: http://www.state.nj.us/dep/watershedmgt/bmpmanual.htm

Cost: web download - free

New York State Stormwater Management Design Manual (10/2001)

Address: New York State
Department of Environmental Conservation
625 Broadway
Albany, NY 12233

Website: http://www.dec.state.ny.us/website/dow/swmanual/swmanual.html

Cost: web download - free

OTHER

Bertram, Bruce, and Wolf, Jim, P.E. "Ground Water & Source Water Protection: Structural and Non-structural controls for Effective Management of Salt Storage Piles." Presented to the Ground Water Protection Council Award Forum, September 25, 2001, Reno, NV. http://www.saltinstitute.org/pubstat/wolf-betram.html

City of Allentown, PA, "City of Allentown Stormwater Best Management Practices." City of Allentown, Revised December, 2001.

EPA:

United States Environmental Protection Agency, Office of Water, Washington, D.C. EPA 832-F-99-011 September 1999.

United States Environmental Protection Agency, Office of Water (4503F), Washington, D.C., EPA-841-F-95-008b October 1995.

http://www.epa.gov/npdes/menuofbmps/poll_16.htm

http://www.epa.gov/npdes/menuofbmps/poll_12.htm

http://www.epa.gov/npdes/menuofbmps/poll_8.htm

http://www.epa.gov/npdes/menuofbmps/poll_11.htm

Common Sources of Groundwater Contamination, http://www.dep.state.pa.us/dep/deputate/watermgt/wc/subjects/srceprot/whpovr_tbl1.htm.

Salt Institute, “Proper Salt Storage.” http://www.saltinstitute.org/39.html

Salt Institute, “Salt Institute Voluntary Salt Storage Guidelines for Distribution Stockpiles.” http://www.saltinstitute.org/51.html.

http://www.dep.state.pa.us/dep/deputate/airwaste/wm/recycle/document/letitlay.htm (mowing).

http://www.epa.gov/npdes/pubs/spillprv.pdf.

http://www.epa.gov/npdes/pubs/swcontam.pdf.

http://www.epa.gov/npdes/pubs/empltrng.pdf.

http://www.epa.gov/npdes/pubs/catchbas.pdf.

http://es.epa.gov/oeca/fedfac/cfa/vmf/area6.html.

http://www.epa.gov/npdes/pubs/visnspct.pdf.

http://www.dnrec.state.de.us/del-auto.htm.

http://www.dnrec.state.de.us/delfltmg.htm.

http://es.epa.gov/oeca/ofa/pollprev/vehicle.html.

http://www.ccar-greenlink.org/documents/cat1100/doc1104.html.

http://www.pca.state.mn.us/water/pubs/8-04.pdf (vehicle washing).

http://es.epa.gov/oeca/fedfac/cfa/vmf/p2vehwash.html (P2 @ vehicle washing).

APPENDIX 2

STORMWATER MANAGEMENT ACT (ACT 167) PLANNING FUNDING AVAILABILITY TO MUNICIPALITIES

Background on Act 167

In Pennsylvania, Act 167 (32 P.S. §§ 680.1 *et seq.*) provides for the preparation of watershed-based stormwater management plans by counties with the assistance of municipalities, and the implementation of such plans by municipalities. These stormwater management plans must be designed to preserve and restore the flood carrying capacity of Commonwealth streams, to preserve, to the maximum extent practicable, natural stormwater runoff regimes and natural course, current and cross section of waters of the Commonwealth, and to protect and conserve groundwater and groundwater recharge areas.

Act 167 establishes the minimum requirements for stormwater plans. Counties can also add additional elements with the approval of DEP. Many of the required elements of the county plan to be implemented by the municipalities are consistent with the MS4 minimum measures, and additional elements required by the federal MS4 requirements can be added.

For instance, the Act 167 plans are developed with input from a broad based local advisory committee and are subject to public comment. The plans are implemented at the municipal level and any alteration or development (or redevelopment) of land which may affect stormwater runoff characteristics must be done in a manner consistent with the plan (e.g., construction and post-construction controls that are required as appropriate to the watershed). In addition, the plan must be reviewed and, if necessary, revised every five years (which correlates with the five year NPDES General Permit term).

Under EPA's regulations, all municipalities within a watershed may jointly apply for a permit (or coverage under a General permit). Therefore, the Pennsylvania Act 167 program is well-suited for use in meeting the municipal permit requirements.

Funding Opportunities for MS4s

Act 167 provides for reimbursement of planning and implementation of stormwater management plans under a 75/25 cost-share arrangement. Therefore, Act 167 can be used to provide up to 75% funding for the allowable costs of development and implementation of many of the required MS4 Minimum Control Measures. This approach provides the opportunity for significant cost savings for small MS4s and provides enhanced protection of the environment through the watershed-based approach.

This Protocol is DEP's pre-approved program for meeting all MS4 permit requirements. The Act 167 program now has an "MS4 module" containing stormwater management activities which are consistent with this Protocol. For example, the MS4 requirement to develop a map of the storm sewer system outfalls is part of that MS4 module in the Act 167 program, and MS4s may get reimbursement for those activities as described in the module. Contact the Stormwater Management program for details.

For funding/reimbursement purposes, here is a summary of the relationship between Act 167 and MS4 elements:

MS4 BMP Category	Act 167
Public Education and Outreach	Limited funding because DEP will provide materials for municipalities to use
Public Participation/Involvement	Some funding for public notices, hearings and involvement/outreach during development of the watershed plan. DEP resource materials will be available for optional elements
Illicit Discharge Detection and Elimination	Reimbursement will be allowed for reasonable costs of system mapping of outfalls, as well as reasonable costs for enacting the ordinance and field screening, per DEP guidance in the Stormwater Management Program

Construction Site Runoff Control	Only very limited funding (e.g., enactment of the ordinance) because this can be funded through a fee-based approach by the municipality, and educational materials are available from DEP
Post-Construction Runoff Control	In accordance with 25 Pa. Code Chapter 111
Pollution Prevention/Good Housekeeping for Municipal Operations	Some funding available, per DEP guidance

Act 167 funding is only available for municipalities participating in a multi-municipal watershed-based plan under Act 167, approved by DEP.

Existing Act 167 plans and implementing municipal ordinances will need to be revised to include and to reference MS4 Minimum Control Measures. MS4s in these watersheds will need to arrange for a plan update on the same time schedule as other MS4s not already involved in the Act 167 program.

DEP has developed a Model Stormwater Management Ordinance for municipalities that can be used to meet the Act 167 and MS4 requirements. This model ordinance will address the several elements of MS4 requirements requiring a local ordinance—illicit discharges, construction and post-construction. This model ordinance will be available for use by municipalities, including those that do not choose to use the Act 167 funding mechanism. DEP will also be streamlining the existing Act 167 plan development process to facilitate the transition to a coordinated Act 167/MS4 program.

While the Act 167 funding described here is authorized, if the appropriations are not sufficient to fund every MS4's stormwater program, the MS4 must still meet the permit requirements.

MS4s and counties interested in participating in the Act 167 process should contact the Division of Water Use Planning, 717-783-7420.

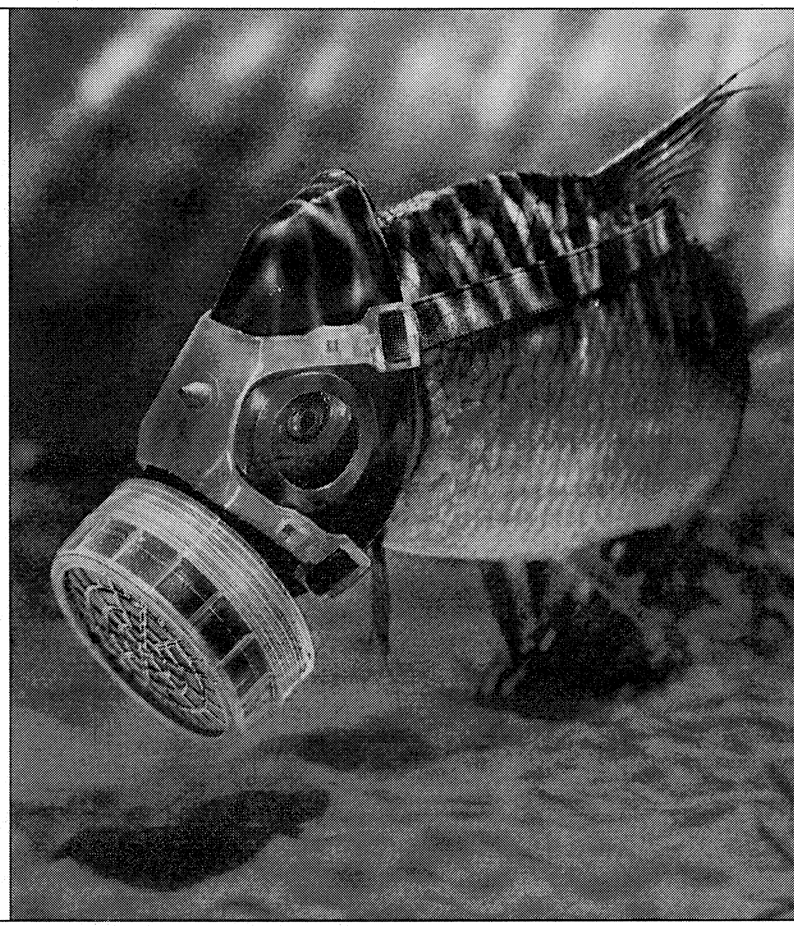
Report Appendix C

MS4 Public Education Advertisements

Guess where you're really putting your lawn fertilizer.

Every year the snow melts, the rain falls, and the water that runs off your yard carries fertilizers, herbicides and pesticides into our creeks and streams. And finally into our rivers. Depositing pollutants that can harm fish, wildlife, and vegetation. Even compromise our major source of drinking water. Our rivers.

But we can all do something about it and still keep our yards looking beautiful. In fact, a lot of dedicated people and municipalities are already working on it. And you can help too.



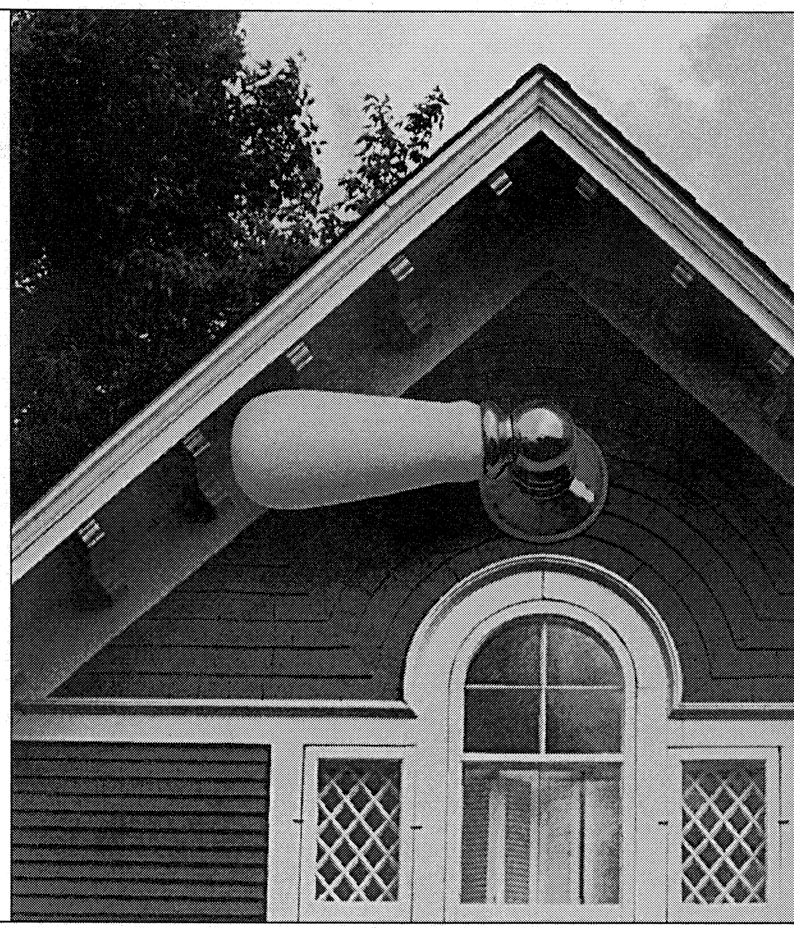
Plant more trees and shrubs so you'll have less bare lawn surface that allows storm water runoff. Use eco-friendly lawn fertilizers. If you need pesticides and herbicides, limit their use.

To find out more, visit our website. You'll be helping to protect our most valuable liquid asset. Our water.

3 Rivers
Wet Weather
Demonstration Program

Clean water starts in our own backyard. Go to 3riverswetweather.org for a free guide on how you can help.

Is your roof flushing raw sewage into our rivers?



Whenever it rains, water flows off hundreds of thousands of roofs, into downspouts and down our storm drains. If our downspouts are connected to the underground sewer lines, storm water can overload the lines. Causing sewage to overflow into our rivers —the source of the water we use everyday.

Fortunately, there's a solution. Many dedicated people and municipalities are working on it.

You can help too. Check with your local community about whether you need to disconnect your downspouts from the sewer system.

Connect a rain barrel to your home's downspout so the water can be captured, conserved and used later on your yard or garden. Plant trees and other vegetation to reduce storm water runoff from your yard.

To find out more, visit our website. Because the only thing that should flow into our rivers is clean water.

3 Rivers Wet Weather
Demonstration Program

Clean water starts in our own backyard. Go to 3riverswetweather.org for a free guide on how you can help.

What goes into our rivers impacts what goes into your glass.

Ever wonder where the water in your glass comes from? For most of us, it comes from our rivers. But when rain falls and snow melts, the resulting storm water can run down hills, flow through creeks and streets, and overwhelm our aging sewer systems.

Everything this water touches—from the chemicals in our yards, to the motor oils in our streets, and even raw sewage—is washed into our major source of drinking water. Our rivers.

But there is a solution. A lot of dedicated people and municipalities are working on it. And you can help too.

Use environmentally friendly lawn and garden products. Never pour oil or paint in a storm drain.

Check with your local community about disposing of or recycling paint, oil and other chemicals. Because when it comes to clean water, we all drink from the same faucet.

3 Rivers Wet Weather *Demonstration Program*

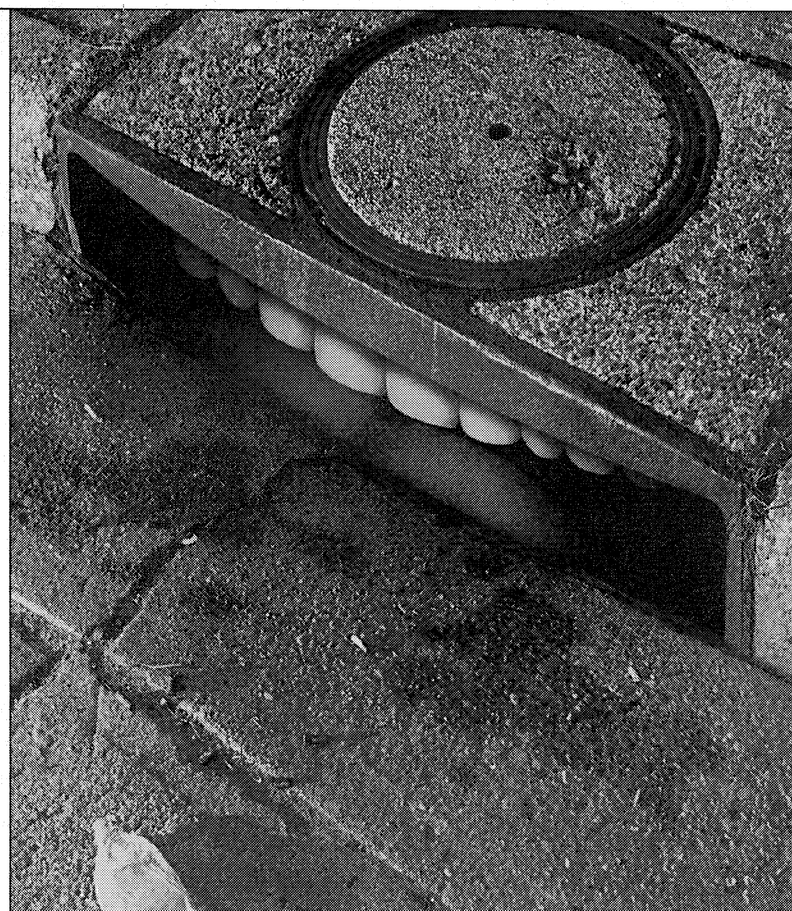
Clean water starts in our own backyard. Go to 3riverswetweather.org for a free guide on how you can help.

What we feed into our storm drains can poison our rivers.

When the rain falls and the snow melts, a flood of water runs off our roofs, roads and yards and down into our streets. Everything the water touches is swept down those streets and fed directly into our storm drains. And then flows out into our rivers—the major source of our drinking water.

Trash. Paint. Oil. Fertilizers. Animal waste. Anything in the path of the storm water can find its way to our rivers through our storm drains.

But there is something we can do about it. In fact,



a lot of dedicated people and municipalities are working on it right now. You can help too.

Use environmentally friendly lawn and garden products. Properly dispose of oil, paints and other household chemicals. And please, don't litter the street or the landscape.

To find out more, visit our website. And discover how to keep our rivers from going down the drain.

3 Rivers
Wet Weather
Demonstration Program

Clean water starts in our own backyard. Go to 3riverswetweather.org for a free guide on how you can help.

Report Appendix D

Matrices

- Stormwater Management Ordinance Review Matrix
- Subdivision Ordinance Review Matrix
- Zoning Ordinance Review Matrix
- Grading Ordinance Review Matrix

[illegible] Act 167 Update Number	Municipality	Watershed(s) within Municipal Limits	Separate SWM Ordinance (Number & Date)	Other Location of SWM Regulations (Ord. Name & Date)	Does SWM Reference Flood Plain Management Ordinance?	Does SWM Reference State Water Quality (Chapter 93)?	SWM Design Storms (2-, 10-yr, etc.)	Release Rates	Act 167 Release Rates Referenced?	Identified Municipal Precipitation (Rainfall/Storm Event)	TR-55 Acceptable Methodology	Rational Method Acceptable Methodology	Use of Infiltration Allowed	SWM BMP Maintenance Requirements	Wetland Delineation Required?	Drainage Easement Required? (Min. Width)	Acreage Requiring SWM
1	Aspinwall Boro.	—	—	Grading and Excavating Ord. 895-118 (12/10/03) Subdivision Chapter 22-592, 858 & 859	22-853.5; and Floodplain Ord. - Chapter 8	—	2, 10, 100-yr for SWM 22-858 25-yr storm sewers, 50-yr culverts, and 100-yr open watercourses Grading 8-118.8.1	—	—	—	22-858.A(1) and (2)	—	—	Maintenance Security grading structural integrity, proper functioning, and maintenance of improvements; Security paid for 18 months; 15% of public improvements 22-408	—	20 ft min 22-858	> 1 acre
2	Bradford Woods Boro.	Pine Creek 392-190-14(8)	392 (01/05)		392-190-13(C)(1)(b)	392-190-3(B), 190-6	2,10,100-yr storms 392-190-14(8)(1)	100% Pre 392-190-14(8)(2) and Appendix C	392-190-14(8)(2) and Appendix C	2 yr -2.13 in 10 yr - 3.23 in 100 yr - 4.58 in 392-190-14(8)(1)	392-190-14(8)(2)	—	Focus of municipal sw ordinance is on stormwater infiltration 392-190-3(E) Multiple use BMPs such as ball fields are encouraged 392-190-13(B)(4)	See ordinance. Req. include- -Identify proposed ownership entity -Include maintenance program for all BMPs, outlining type of maintenance activities, probable frequencies, personnel and equipment requirements, and estimated annual maintenance costs -Identify method of financing continuing operation and maintenance if BMP is to be owned by other than Borough or other governmental agency 392-190-13(C)(7) and Maintenance for privately-owned sw BMPs 392-190-13	392-190-13(C)(1)(c)	150 392-190-13(E)(1)(1)	All 392-190-13(A)
3	Etna Boro.	Pine Creek	1191 (07/21/87)	—	1191-202.1.2.b; Flood Plain Management Ordinances 1111 (9/15/78), 1143 (5/24/83), 1222 (4/18/92), and 1237 (9/18/95)	—	2, 10, 100-yr storms 1191.301, 2, 25-yr stormdrains	100% Pre 1191-301.2.1.a	—	2 yr - 2.14 in 10 yr - 3.22 in 100 yr - 5.72 in 1191-301.3.1	1191-301.3.2.c.(2)	—	Yes, Vague Language	1191-202.1.8 and 1191-401	—	—	< 3,000 sq ft imp surface
4	Fox Chapel Boro.	Squaw Run Pine Creek Guyasuta Run Glade Run 437-404(8)(A)(1)		See Subdivision 437-404 (01/83)	437-404(5)(D)(1)(b)	437-404(2)(A)	2,10,100-yr storms 437-404(8)(C)(1)	"Release rate percentage for each subarea is shown on the Borough's Watershed Map" 437-404(8)(C)(1), 100% or Act 167 rates		2 yr -2.13 in 10 yr - 3.23 in (3.25 in for Glade Run) 100 yr - 4.58 in 437-404(8)(C)(1)	437-404(8)(C)(2)(c)(2)		Focus of municipal sw ordinance is to encourage stormwater infiltration 437-404(2)(C) and Multiple use BMPs such as ball fields are encouraged 437-404(10)(B)(4) and BMPs to meet State WQ req. may include replication of preconstruction stormwater infiltration cond. 437-404(15)(C)(1)	See ordinance. Req. include- -Identify proposed ownership entity -Include maintenance program for all BMPs, outlining type of maintenance activities, probable frequencies, personnel and equipment requirements, and estimated annual maintenance costs -Identify method of financing continuing operation and maintenance if BMP is to be owned by other than Borough or other governmental agency 437-404(5)(D)(7) and Maintenance for privately-owned sw BMPs 437-404(18)	437-404(5)(D)(1)(c)	Easement width not specified 437-404(5)(D)(5)	≥ 3,000 sq ft imp surface 437-404(8)(C)(1) and definition in 427-404(4) for "small development"
5	Franklin Park Boro.	Big Sewickley Creek Pine Creek Little Sewickley Creek Lowries Run Kilbuck Creek 435-184-28(G)(1)(a)		435-184-28 and Appendix E (11/88)		—	2,10,100-yr storms 435-184-28 Appendix E (A)(1)	Per 435-184-28(G)(1)(b), Appendix E (Table E-1) with release rates is on file in borough offices		2 yr -2.14 in 10 yr - 3.24 in 100 yr - 4.58 in 435-184-28 Appendix E (A)(1)	435-184-28 Appendix E (A)(2)(c)(2)		Purpose of municipal ordinances on erosion control and stormwater management is to encourage natural infiltration of rainfall 435-184-28(A)(3) and Routed flow over grass is a method of stormwater runoff detention and control that municipal ordinance suggests may be utilized in sw mgmt syst. 435-184-28 Appendix E (B)(1)(c)(7)	See ordinance. Req. include- -Identify proposed ownership entity -Include maintenance program for all BMPs, outlining type of maintenance activities, probable frequencies, personnel and equipment requirements, and estimated annual maintenance costs -Identify method of financing continuing operation and maintenance if BMP is to be owned by other than Borough or other governmental agency 435-184-28(C)(2)(e)(7) and Maintenance for privately-owned sw facilities 435-184-28(J)	435-184-28(C)(2)(e)(3)(c)	Easement width not specified 435-184-28(C)(2)(e)(8)	≥3,000 ft² impervious surf area 435-184-28(C)(2)(e)
6	Frazer Twp.	Deer Creek	70 (05/04/88)	Ord 51 Ord 87-802-A, 803-A, 807-A (04/18/89) Ord 113 (09/23/92) Zoning 87-1303.B.(c).(1) Discussion of Ord #63 within Ord 87-808-a) for storm drainage systems (not provided)	No, but Zoning Ord Sect 1621.A states requirements	—	2, 10, 100-yr storms 70-5.D "drainage facilities designed largest storm every 5 years" 69-15	100% or County provides rates 70-5.E	Reference to "County" 167 of 1978	2 yr - 2.14 in 10 yr - 3.23 in 100 yr - 5.72 in	70-5.3	—	stone filled dry wells 87-808-A.2	SWM Agreement Maintenance Schedule Twp Access (Sect 5.G) If incomplete work, Twp completes and bills owner/dev Fee for 10-years Twp inspection costs 88-18 (General Info), and 51-1984	—	—	<3,000 sq ft or < 7,500 sq ft new imp areas Plus exemptions
7	Hampton Twp.	Pine Creek Deer Creek SWO 401(A)	Stormwater Management Ordinance (SWO) - No Ordinance # (03/05 Draft)	Subdivision and Land Development Ordinance Article 7	No, but they have one (475)	Yes - watershed and waterway classification is required in SW Plan SWO 203(B)(1)	2,10,100-yr storms SWO 403(8)	Listing of Release Rate percentages is on Watershed Subarea Map, located in TWP office SWO 403(G)(1). This map is also part of Hampton's Zoning Ordinance.	SWO 403(B)(3)	2 yr -2.14 in 10 yr - 3.23 in 100 yr - 4.59 in (see SWO 403(C)) SWO 403(8)(2)	SWO 403(C)(1)		BMPs to meet State WQ req. may include replication of preconstruction stormwater infiltration cond. SWO 404(C)(1) and Routed flow over grass, as well as seepage pits, seepage trenches, level spreaders, or other infiltration structures are methods of stormwater runoff detention and control that municipal ordinance suggests may be utilized in sw mgmt syst. SWO 406(A)(3)	See ordinance. Req. include- -Identify proposed ownership entity -Include maintenance program for all BMPs, outlining type of maintenance activities, probable frequencies, personnel and equipment requirements, and estimated annual maintenance costs -Identify method of financing continuing operation and maintenance if BMP is to be owned by other than Borough or other governmental agency SWO 203(G) and Maintenance for privately-owned sw facilities BMPs SWO 408	SWO 203(A)(4)	35ft for detention/retention facilities SWO 406(B)(17); 20ft for storm drainage SWO 406 (C)(18)	>3,000 sq ft SWO 203(A)
8	Harmar Twp.		281 (11/88)		—	—	2,10,100-yr storms 281-514(8)	100% 281-514(7)	—	2 yr -2.14 in 10 yr - 3.23 in 100 yr - 5.72 281-514(8)	281-514(7)	—	—	See ordinance. Req. include- -party responsible for maintenance; -continuing schedule of maintenance; -TWP access to sw control facilities for inspec. and maint. -insp and maint. req. 281-514(9)	—		>3,000 sq ft imp surf 281-514(2)
9	Indiana Twp.	Deer Creek Pine Creek Squaw Run 230(3)(8)	230 (01/88)		230 Appendix B (4)	—	2,10,100-yr storms 230(3)(8)(1)	85-100% 230 Appendix A	230 Appendix A	2 yr -2.14 in 10 yr - 3.23 in (WA to Squaw Run Wtrshd) 100 yr - 4.55 in 230(5)(8)(1)	230(3)(8)(2)	—	Focus of municipal sw ordinance is on stormwater infiltration 230-1(3) Multiple use BMPs such as ball fields are encouraged 230 (p.21)	See ordinance. Req. include- -Identify proposed ownership entity -Include maintenance program for all BMPs, outlining type of maintenance activities, probable frequencies, personnel and equipment requirements, and estimated annual maintenance costs -Identify method of financing continuing operation and maintenance if BMP is to be owned by other than Borough or other governmental agency 230(3)(8) and Maintenance for privately-owned sw facilities 230(3)(8) (p.23)	230(3)(8)(3)	Easement width not specified 230(3)(8)	>3,000 sq ft 230(3)(c)(1)
10	Marshall Twp.	Big Sewickley Creek Pine Creek Brush Creek 354-174-21(G)(1)	—	354-174-21 and Appendix A to 354 (12/98)	No, but they have one (174-27)	—	2,10,100-yr storms 354 Appendix A (A)(1)	80% 354 Appendix A (A)(2)(a)	354 Appendix A (A)(2)(a)	2 yr -2.14 in 10 yr - 3.24 in 100 yr - 4.58 in 354 Appendix A (B)(1)	354 Appendix A (A)(2)(c)(1)	—	Focus of municipal sw ordinance is on stormwater infiltration 354-174-21(A)(3) Routed flow over grass, as well as seepage pits, seepage trenches, level spreaders, or other infiltration structures are methods of stormwater runoff detention and control that municipal ordinance suggests may be utilized in sw mgmt syst. 354 Appendix A(B)(1)(c)(8)	See ordinance. Req. include- -Identify proposed ownership entity -Include maintenance program for all BMPs, outlining type of maintenance activities, probable frequencies, personnel and equipment requirements, and estimated annual maintenance costs -Identify method of financing continuing operation and maintenance if BMP is to be owned by other than Borough or other governmental agency 354-174-21(C)(7)(g) and Maintenance for privately-owned sw BMPs 354-174-21(J)	354-174-21(C)(2)(e)(3)	Easement width not specified 354-174-21(C)(2)(e)	≥3,000 ft² 354-174-21(C)(2)(e)(2)
11	McCandless Twp.	Pine Creek Girty's Run Lowries Run 913.08(a)	1318 (07/18/05)	—	913.04D.1(8)	Yes	2,10,100-yr storms 913.09C.2	Pine Creek & Girty's Run - see Appendix A, Lowries Run - 100% 913.09E	913.09C.3	2 yr -2.14 in 10 yr - 3.24 in 100 yr - 4.58 in 913.09C.2	913.09D.1	Upon approval	Yes 913.13.F	See ordinance. Req. include- -Identify proposed ownership entity -Include maintenance program for all BMPs, outlining type of maintenance activities, probable frequencies, personnel and equipment requirements, and estimated annual maintenance costs -Identify method of financing continuing operation and maintenance if BMP is to be owned by other than Borough or other governmental agency 913.14 and 913.06D	913.04D.1	15 ft min	All impervious
12	Middlesex Twp. (Butler County)	—	80 (04/83)	21-1213.2 (10/92)	80-404 and 80-803.3	80-387	2,10,25,100-yr storms 80-303(A)(2)	—	—	1 yr - 2.2 in 2 yr - 2.6 in 10 yr - 3.8 in 25 yr - 4.3 in 100 yr - 5.0 in 80-304	80-304	80-304(1)	Ordinance requires minimization of impervious surfaces and infiltration runoff through seepage beds and infiltration trenches where soil cond. permit 80-301(d) and 80-322(A) E & S design and construction req. to maintain infiltration capacity 80-305 Roof drains should not be connected to streets, sanitary, or storm sewers or roadside ditches to promote infiltration of stormwater where advantageous 80-351(d)	Drainage Plan for site shall contain an operation and maintenance plan, establish responsibilities for continuing operating and maintenance. Maintenance agreement for privately owned stormwater facilities. See ordinance for additional req. 80 Art VIII	80-403(A.4)	15ft 80-403(A.29)	≥5,000 ft2 80-302(8.1)
13	Millvale Boro.	Girty's Run 1731-106.1	1731 (04/11/07)		1731-104.3(1)(9)		2,10,100-yr storms 1731-109.3(1)	Appendix not included with SWM Ord 1731-108.3(2)(a) Appendix A	1731-108.3(2)(a)	2 yr -2.14 in 10 yr - 3.23 in 100 yr - 4.59 in 1731-109.3(1)	1731-109.3(2)(d)(2)		Encourage natural infiltration of rainfall to preserve groundwater supplies and stream flows. 1731-101(3)	See ordinance. Req. include- -Identify proposed ownership entity -Include maintenance program for all BMPs, outlining type of maintenance activities, probable frequencies, personnel and equipment requirements, and estimated annual maintenance costs -Identify method of financing continuing operation and maintenance if BMP is to be owned by other than Borough or other governmental agency 1731-104.3(f) and 1731-111.2	1731-104.3(1)(e)	Widths not specified. 1731-104.3(6)	Creation of >3,000 ft² impervious surface area 1731-104.2(1)

MICOG Act 167 Update
SWM Matrix
[illegible]

Number	Municipality	Watershed(s) within Municipal Limits	Separate SWM Ordinance (Number & Date)	Other Location of SWM Regulations (Ord. Name & Date)	Does SWM Reference Flood Plain Management Ordinance?	Does SWM Reference State Water Quality (Chapter 93)?	SWM Design Storm (2-yr, 10-yr, etc.)	Release Rates	Act 167 Release Rates Referenced?	Identified Municipal Precipitation (Rainfall/Storm Event)	TR-55 Acceptable Methodology	Rational Method Acceptable Methodology	Use of Infiltration Allowed	Stormwater Maintenance Requirements	Wetland Delineation Required?	Drainage Easement Required? (Y/N) Width	Acreage Requiring SWM
14	O'Hara Twp.	Squaw Run Pine Creek 72-10.85E	1133 (03/05)	1119-8.4.3 and 72-10.85(E)	72-11.728(3)(b)	1133-301 and 305	2, 10, 100-yr storms 72-10.85E(3) 2, 10, 25, 100-yr storms 1133-308.A.3 100-yr storm sewer systems 1119-8.4.3(8)(1)(I)	—	No rates specified, just referenced in Act 167 Watershed Stormwater Management Plans 1133-308.A.3	1 yr - 2.3 in 2 yr - 2.8 in 10 yr - 3.8 in 25 yr - 4.4 in 100 yr - 5.2 in 1133-309.B	1133-309	1133-309	Infiltration BMP's used to maximum extent. Post-construction infiltration shall replicate pre-construction infiltration. 1133-308 Infiltration calculation and methodology requirements stated. Multiple infiltration guidelines stated. 1133-307 Above ground detention detain the 1-yr storm and allow to naturally infiltrate and recharge groundwater table. 1133-308.N	Provide financial security. Operations and maintenance plan with routine maintenance actions and schedules. Responsibilities to improvements dedicated to municipality. Maintenance Agreement required for privately owned SW facilities, including rights-of-way for access/inspection by municipality. Twp may provide maintenance upon failure of owner to maintain facilities following notice and at developers cost. Payment into Municipal Stormwater Maintenance Fund. 1133 Art.8	1133-302C and 72-10.85B(4)	15 ft access around SWM facility 1133-403(B)(20)	≥5,000 ft2 1133-303(A)
15	Pine Twp.	Pine Creek North Fork Brush Creek Montour Creek Breakneck Creek 84-22	84-22,23,25,26 from Ch. 84 (08/93)	78-31(J and X) (12/95)	—	—	2,10,100-yr storms 84-22 (C)(1)	84-22(C)(2) Appendix A to Ch 84 - not provided for review.	84-22 (C) (2)	2 yr - 2.14 in 10 yr - 3.23 in 100 yr - 5.72 in 84-22 (C)(1)	84-22 (C)	—	Multiple use BMPs such as ball fields are encouraged 84-23(3)(4)	Stormwater Mgmt Plan for site shall establish responsibilities for continuing operating and maintenance of all proposed stormwater control facilities. Maintenance agreement for privately owned stormwater facilities. See ordinance for additional req. 84-25	78-31U and V and 78-140(2)(a)	Width not specified. 78-23	≥3,000 ft² 78-17D
16	Pittsburgh	Girty's Run Monongahela River Title 9-806.07E and F	—	Title 9 (08/98) Subdivisions-4,5 (02/98)	No, but they have one (Title 9-906.02)	—	2, 5, 10, 50, 100-yr storms (Girty's Run) Title 9-806.07.E.1(c) 2, 10, 25, 100-yr storms (Monongahela River) Title 9-806.07.F.2	Range from 50-100% See Title 9-806.07	Title 9-806.07	2 yr - 2.50 in 5 yr - 3.61 in 10 yr - 4.31 100 yr - 5.71 in Title 9-806.07.F.2 (Monongahela River)	Title 9-806.07.E and F	See ordinance for special req. Title 9-806.07.E and F	Focus of SW-O, Stormwater Management Overlay District is on stormwater infiltration Title 9-806.07(A) SW Ordinance recommends minimizing impervious surface to maximize infiltration and reduce runoff Title 9-806.07.E.1(a)	See ordinance. Req. include- -identify proposed ownership entity -include maintenance program for all facilities, outlining type of maintenance activities, probable frequencies, personnel and equipment requirements, and estimated annual maintenance costs -identify method of financing continuing operation and maintenance if BMP is to be owned by other than the municipality or other governmental agency Title 9-806.07.D(11)	Title 9-806.07.D(3)(9)	Easement width not specified Subdivision-6.0 and Title 9-806.07D(9)	≥5,000 ft² Title 9-806.07.E & F
17	Reserve Twp.	—	618 (08/04)	—	—	619-305	2,10,25,100-yr storms 619-308	—	—	1 yr - 2.3 in 2 yr - 2.8 in 10 yr - 3.8 in 25 yr - 4.4 in 100 yr - 5.2 in 619-309	619-309	619-309	Infiltration BMPs shall be evaluated and utilized to the maximum extent possible to manage the net change in stormwater runoff generated so that post-construction discharges do not degrade the physical, chemical or biological characteristics of the receiving waters. 619-306	Project Plan for the development site shall contain and operations and maint. Plan shall outline routine maint of facility. Plan will also establish resp for continuing O & M of all sw control facilities 619-702 Maintenance Agreement for Privately Owned SW Facilities 619-703	619-403(B)(4)	15 ft 619-403(B)(20)	≥5,000 ft² 619-303
18	Richland Twp.	Pine Creek Deer Creek Glade Run Breakneck Creek 278-514(8) and 117-831(L)	404 (03/05)	278-514 (09/81)	278-513 and 117-1021(8)	404-301	2,10,100-yr storms 278-514(8)(E)	Range from 85-100% See 278-514(8)	278-514(6)	2 yr - 2.14 in 10 yr - 3.23 in 100 yr - 4.58 in 278-514(8)(E)	278-514(8)	—	Infiltration may be used as a BMP through replication of pre-construction stormwater infiltration conditions 404-304	Stormwater Mgmt Plan for site shall establish responsibilities for continuing operating and maintenance of all proposed stormwater control facilities. Maintenance agreement for privately owned stormwater facilities. See ordinance for additional req. 278-514(9)	278-514(2)(B)(1)(d)	15ft 404-401(B)(d) 404-405	≥3,000 ft² 278-514(2)(A)
19	Ross Twp.	Pine Creek Girty's Run 2147-305(4)	2147 (03/2005)	Zoning 2025 Chap 14 (12/92)	2025-1401(1)	2147-305	2,10,25,100-yr storms 2147-308(A)(3)	—	2147-308	1 yr - 2.3 in 2 yr - 2.8 in 10 yr - 3.8 in 25 yr - 4.4 in 100 yr - 5.2 in 2147-310	2147-307(4)	2147-309	Focus of municipal sw ordinance is on stormwater infiltration 2147-102(F) Infiltration BMPs shall be evaluated and utilized to the maximum extent possible to manage the net change in stormwater runoff generated so that post-construction discharges do not degrade the physical, chemical or biological characteristics of the receiving waters. 2147-308 Order of pref for stormwater BMPs (infiltration is 4th of 8) 2147-309(G)	Project Plan for site shall establish responsibilities for continuing operating and maintenance of all proposed stormwater control facilities. Maintenance agreement for privately owned stormwater facilities. See ordinance for additional req. 2147-702	2147-302(C) and 403(3)(4)	15ft 2147-403(B)(20)	≥5,000 ft² 2147-303
20	Shaler Twp.	—	1813-190 (04/2002)	—	1813-190-20	1813-190-12	1,2,10,25,100-yr storms 1813-190-18(B)	—	—	1 yr - 2.3 in 2 yr - 2.8 in 10 yr - 3.8 in 25 yr - 4.4 in 100 yr - 5.2 in 1813-190-18 (B)	1813-190-16	1813-190-16	Municipal stormwater ordinance has provisions that encourage stormwater infiltration to prevent degradation of surface and ground water quality and to protect other water resources 1813-190-2(F) Infiltration BMPs shall be evaluated and utilized to the maximum extent possible to manage the net change in stormwater runoff generated so that post-construction discharges do not degrade the physical, chemical or biological characteristics of the receiving waters. 1813-190-13 Order of pref for stormwater BMPs (infiltration is 4th of 8) 1813-190-15(D)(4)	The project plan for the site shall contain an operation and maintenance plan that outlines the required routine maintenance to ensure proper operation of the facility(ies). See ordinance for additional responsibilities 1813-190-30 Maintenance agreement for privately owned stormwater facilities 1813-190-31	1813-190-9(C)	15ft 1813-190-19(B)(2)(c)	≥5,000 ft² 1813-190-10(A)
21	Sharpsburg Boro.	—	—	508 (01/54)	—	—	Min criteria = 100 yr. Higher freq. used in sensitive areas and where overflow would endanger public health 22-508(17)	—	—	—	22-508(14)	22-508(15)	SW mgmt controls including groundwater recharge methods such as seepage pits, beds or trenches must be shown on a map. When these structures are used, the location of septic tank infiltration areas and wells must be shown. 22-508(2)(1)(a)	Maintenance program for sw mgmt control facilities must be included in sw mgmt plan. Program must include the proposed ownership of the control facilities and financial resp. of any req. maint. 22-508(2)(E) and A maint prog for control facilities must be included as part of the grading and drainage plan. Maint during development activities is resp of contractor, developer, and owner. Ordinance provides guidelines on maint. of permanent control facilities. See ordinance for details. 22-508(18)(C)	—	—	≥3,000 ft² 22-508(1)(A)
22	West Deer Twp.	Bull Creek Deer Creek 258-8.7.1	187, 188, 189, 190 (07/88)	258-8.4.3: 8.1 (04/86)	258-8.3.3(2) and Floodplain Ord in 196 and 268 Art XVI	—	2,10,100-yr storms 258-8.8.1	Release rate % for subbasins in Deer Creek Watershed are in Appendix # 3 (not provided for review). All areas of Bull Creek assumed to be 100% 258-8.8.3	—	2 yr - 2.14 in 10 yr - 3.24 in 100 yr - 4.58 in 258-8.8.1	258-8.8.2	258-8.8.2	Purpose of the sw ordinance is to encourage natural infiltration of rainfall to preserve groundwater supplies and streamflows 258-8.1.3 Ordinance provides list of detention and control methods which may be used in sw mgmt. Methods involving infiltration include seepage pits, seepage trenches, level spreaders, or other infiltration structures; rooted flow over grass. 258-8.12.2(A)(3)	See ordinance. Prelim SW Plan shall include- -identify proposed ownership entity - maintenance program for all BMPs, outlining type of maintenance activities, probable frequencies, personnel and equipment requirements, and estimated annual maintenance costs -identify method of financing continuing operation and maintenance if BMP is to be owned by other than Twp or other governmental agency 258-8.3.3(G) SW Mgmt Plan for site shall establish responsibilities for continuing operating and maintenance of all proposed stormwater control facilities. Maintenance agreement for privately owned stormwater facilities. See ordinance for additional req. 258-8.9	Yes, if a permit is required from Allegheny County Soil Conservation 258-4.4.2(C)(6) and 258-8.3.2(A)(3)	10ft 258-8.4.3(E) 258-8.3.3(E) Stormwater Ordinance #187	≥3,000 ft² 258-8.3.2
23	West View Boro.	—	1415 (02/11/04) May be superseded by "Stormwater Management Ch 115"	—	—	1415-103 and 304	—	—	—	—	—	—	Municipality finds that stormwater can be an important water resource by providing groundwater recharge for water supplies and base flow of streams, which also protects and maintains surface water quality. 1415-102(D) To control post-construction sw impacts from earth disturbance activities, State Water Quality Req. can be met by BMPs incl. site design, which provide for replication of pre-construction infiltration conditions 1415-304(C)(1) SW Ordinance has Appendix with Low Impact Development Practices - Includes infiltration 1415-Appendix A	BMP Operations and Maint Plan for project site shall establish resp for continuing op and maint of all permanent sw BMPs. See ordinance for details. 1415-402 Operations and Maintenance for Privately owned Stormwater BMPs 1415-405	—	15ft 1415-401 (B) (1) (I) and 1415-408	No regulated Earth Dist activities in Municip shall commence until approval by the municip of BMP Operations and Maint Plan which describes how the permanent sw BMPs will be properly operated and maintained. 1415-401

Footnotes
— = Item not addressed in ordinances
Highlighted cells = Information not found in stormwater and grading ordinances. This information may be found in other ordinances for this municipality, such as zoning and subdivisions.

Legend
1 of 2
2 of 2

NHCOG Act 167 Update
Subdivision Matrix
6/29/2005

Number	Municipality	Ordinance # and Date	Reference SWM	Buffer Zone	Residential Row & Roadway Widths	Maximum Road Slope Residential	Maximum Vertical Curve Residential	Are Curbs Required? (Y/N)	Sidewalks Required? (No/One Side/ Both)	Sidewalk Width	References E&S 25 PA Code 102	Drainage Easement Required (Y/N,Width)	Drainage Standards (Pipe, Inlets, Etc.)	Storm Sewer Design (Storm Year)	Wetland Delineation Required (Y/N)	Swales Allowed?	Reference Method of Stormwater Control	Landscape Requirements	Tree Conservation Requirements?	Are Private Roads Allowed? (Y/N)	If yes how many lots may a Private Road serve?	Alternative Paving Methods Allowed?	Is Parking Lot Landscaping Required?	Are Soil Maps Required? (soil types/slide-prone soils)	Are Parking Lot BMPs Required?
1 ①	Aspinwall Boro.	#871 05/22/91	Noted	-	noted	noted	noted	yes	yes- 1 side	4' min	noted	Yes/20'	-	2-10-100	-	-	TR55	noted	-	-	-	-	-	-	-
2	Bradford Woods Boro.	#3531 11/11/96	Noted	Noted	noted	noted	noted	yes	noted	noted	noted	Yes/20'	noted	-	-	-	-	noted	noted	yes	four (4) to six (6)	yes	-	-	-
3 ②	Etna Boro.	Allegheny County	Noted	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	Fox Chapel Boro.	#437 01/17/83	Noted	-	noted	noted	noted	yes	no	N/A	noted	Yes/-	noted	2-10-100	③	yes	TR55	noted	-	yes	no limit	no	PRD's & some I/O	yes	④
5	Franklin Park Boro.	#435-96 11/20/96	Noted	Noted	50/26	12%	5%	yes	yes undefined	4' min	noted	Yes/-	noted	-	-	-	-	noted	-	yes	-	-	yes	-	-
6	Frazer Twp.	A. #67 04/06/89	-	Noted	50/24	⑤	1%	as deemed necessary	as deemed necessary	4' min	noted	Yes/15' Min	-	-	-	-	-	-	noted	-	-	-	-	-	-
7	Hampton Twp.	#583 2/26/00	Noted	noted in zoning	50/21	12%	3%	yes	as deemed necessary	4' min	noted	Yes/20'	noted	2-10-100	-	yes	TR55	limted to trees in subdivision	limited	no	-	-	noted in zoning	yes	-
8	Harmar Twp.	#215 03/08/76	Noted	-	50/20-36'	7-12%	1%	yes	yes/either/ or	3' min	-	Yes/20'	-	2-10-100	-	-	-	-	-	yes	one (1)	-	-	-	-
9	Indiana Twp.	A. #215 07/85	-	noted in zoning	50/24	12%	noted	yes	as deemed necessary	4' min	-	Yes/20' Min	noted	2-10-100	-	-	-	noted	noted	-	-	-	yes	-	-
10	Marshall Twp.	#2771 12/06/95	Noted	noted in zoning	50/22	12%	noted	-	yes	-	noted	-	noted	2-10-100	yes	-	TR55	noted	noted	yes	-	-	-	-	⑥
11 ⑨	McCandless Twp.	1318 07/18/05	Noted	Noted	50/24	12%	-	-	yes	4'	yes	Yes/20' Min	noted	2-10-100	-	yes	TR55	noted	limited	limited	-	no	limited	yes	yes
12	Middlesex Twp. (Butler County)	#96 10/15/03	Noted	Noted	42-56/22-32	12%	-	-	yes- not defined	4' min	noted	Yes/20'	-	-	-	-	-	noted	-	-	-	-	-	-	-
13	Millvale Boro.	Follows Guide Lines of Allegheny County																							
14	O'Hara Twp.	#119 04/13/04	Noted	Noted	50'/25	12%	-	yes	as deemed necessary	4' min	noted	Yes/25'	noted	100 yr	-	-	PA DOT	noted	noted	no	-	-	-	-	-
15	Pine Twp.	#122-78 05/17/82	Noted	Noted	-	-	formula provided	yes	-	-	noted	-	-	-	yes	yes	⑦	noted	noted	yes	one (1)	-	yes	-	-
16	Pittsburgh	-	Noted	limited	-	12%	-	as deemed necessary	as deemed necessary	-	-	-	-	-	-	-	-	limited	-	yes	-	-	-	-	-
17	Reserve Twp.	#549	-	noted in zoning	50/22	12%	3%	as deemed necessary	-	4'	-	-	noted	-	-	-	-	-	-	-	-	-	-	-	-
18	Richland Twp.	#278 09/18/91	Noted	Noted	50/22	12%	1%	yes	yes	4'	noted	Yes/20'	noted	25 yr	-	-	TR55	noted	limited	discouraged	-	-	-	-	-
19	Ross Twp.	#1536 03/31/86	Noted	noted in zoning	50/31.5	12%	-	-	as deemed necessary	-	noted	Yes/15' Min	-	-	-	-	-	-	-	-	-	-	-	-	-
20	Shaler Twp.	#608 01/28/54	Noted in Zoning	-	-	-	-	-	where required	4'	noted in zoning	-	-	-	-	-	-	-	noted in zoning	-	-	-	-	-	-
21	Sharpsburg Boro.	#488 07/08/91	Noted	noted in zoning	50-120/30-46	7-10%	1%	yes	yes- not defined	4'	noted	-	-	-	-	-	rational	noted	limited	discouraged	two (2)	-	-	-	-
22	West Deer Twp.	#258 04/17/96	Noted	for mobile homes	50/25	12%	⑧	yes	as deemed necessary	4'	noted	noted in SWM	noted	25 yr	yes	-	TR55	noted in zoning	no	yes	four (4)	permitted	yes	permitted	yes ⑨
23	West View Boro.	#1160 03/06/74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

- Item not addressed in ordinance.

① References slope of land, stripping of top soil, major excavation/grading/filling.
② Etna has no subdivision ordinance. All information found in zoning ord. # 1248.
③ Reference "Natural Resources Ordinance".
④ BMPs referenced, but no specifics addressing parking lots.
⑤ Arterial- 6%, Collection- 10%, Local- 12%.
⑥ Referenced but is not required.
⑦ Pine Twp. references six (6) methods.
⑧ Algebraic difference.
⑨ Combined Planning and Zoning Ordinance.

NHCOG Act 167 Update
Zoning Matrix
6/29/2005

Number	Municipality	Ordinance Number and Date	General Lot Sizes (sq. ft. or Ac)	Range of Minimum Lot Sizes (width)	Range of Minimum Front Yard Set Back	Range of Minimum Side Yard Set Back	Range of Minimum Rear Yard Set Back	PRDs Allowed (Y/N)	Planned Residential Requirement	Accommodate Reasonable Community Growth (Y/N)	Maintain Stability of Residential, Commercial, & Industrial Areas (Y/N)	Slopes- Average/Steep/ Very Steep	Establishment of Zoning Districts	Natural Features Analysis	Preserve Natural Resources & Environmentally Critical Lands (Y/N)	Density/Area	⑲ Is % Cover Restricted?	Standards for Open Space & Common Ground	Protection of Watercourses and Wetlands	Protection of Significant Natural Areas	Avoidance of Hazardous Development	Parking Ratio (Office Building Per 1000 SF)	Parking Ratio (Retail Per 1000 SF)
1	Aspinwall Boro. ⑭	775 06/15/83	2k to 4k	-	10 to 25	2.5 to 10	≤ 25	-	-	-	-	-	yes 9	-	-	-	-	noted	-		-	3	5
2	Bradford Woods Boro.	375 04/08/02	1 Ac	-	75	75	75	yes	noted	-	-	-	yes 3	-	-	-	10%	-	-	-	-	5	5
3	Etna Boro.	1248 11/18/97	1.5k to 20k	25 to 100	5 to 15	5 to 10	15 to 25	-	-	-	-	-	yes 6	-	-	-	-	-	-	-	-	-	-
4	Fox Chapel Boro.	319 11/15/73	1Ac to 3Ac	150 to 250	50 to 75	20 to 40	30 to 40	yes	noted	-	-	-	yes 5	-	yes	noted	30%	-	-	noted	-	-	-
5	Franklin Park Boro.	434-96 11/21/96	2k to 40k	20 to 150	25 to 50	7.5 to 20	20 to 30	yes	noted	-	-	-	yes 7	-	yes	noted	-	-	noted	noted	-	3	5
6	Frazer Twp.	-	⑥ 21.7k	100	35	24	40	yes	noted	yes	yes	-	yes 7	-	-	-	40%	-	-	-	-	2.8	5
7	Hampton Twp.	627 10/22/03	0.25Ac to 5Ac	60 to 200	30 to 60	25 to 40	10 to 40	yes	noted	yes	yes	noted	yes 11	noted	yes	1 - 8 units/Ac	10 to 90%	noted	noted	noted	noted	⑤	5
8	Harmar Twp.	331 11/17/99	6000 to 40k	40 to 125	20 to 65	10 to 40	10 to 40	yes	noted	yes	yes	-	yes 7	-	-	-	-	noted	-	-	①	②	③
9	Indiana Twp.	328 02/04/05	5k to 10Ac	30 to 500	5 to 50	10 to 50	10 to 50	yes	noted	-	-	noted	yes 10	-	-	1 - 20 units/Ac	25 to 50%	-	-	-	-	5	-
10	Marshall Twp. ⑦	357 02/28/05	20 to 40k	100 to 150	40	15	35 to 50	yes	noted	yes	yes	noted	yes 4	noted	yes	noted	18 to 30%	noted	noted	noted	noted	⑧	7
11	McCandless Twp.	1318 07/18/05	12.5 to 20k	-	35	10 to 20	40	yes	noted	yes	yes	noted	yes 17	limited	limited	1.2 - 17.5 units/Ac	25%	noted	yes	noted	yes	3.3	5 to 5.5
12	Middlesex Twp. ⑫ (Butler County)	21 10/07/92	22k to 43k	100 to 150	50	10 to 25	10 to 50	yes	noted	-	-	-	yes 6	-	-	2 - 4 units/Ac	35%	noted	-	-	-	4	10
13	Millvale Boro.	1567 10/04/83	2k to 10k	20 to 40	5 to 15	10% of width	5 to 15	-	-	-	-	-	yes 5	-	-	-	30 to 50%	-	-	-	-	.5/ empl	2
14	O'Hara Twp. ⑪	1091 12/17/02	20k	90	40	15	40	yes	noted	-	-	-	yes 7	-	yes	-	-	noted	-	-	-	3	5
15	Pine Twp.	213 06/07/93	0.5 to 2Ac	70 to 200	25 to 60	10 to 40	40 to 50	yes	noted	-	-	-	yes 8	-	-	-	50%	-	-	-	-	3	5
16	Pittsburgh	Title Nine 02/26/99	⑮	⑮	5 to 30	5 to 30	15 to 30	-	-	⑯	-	noted	yes	noted	-	-	90%	⑰	noted	-	⑱	2	2 to 5.7
17	Reserve Twp.	610	10k to 40k	75 to 200	30 to 50	15 to 30	25 to 50	yes	noted	-	-	-	yes 7	-	-	-	-	-	-	-	-	5	5
18	Richland Twp.	101 04/18/01	④	60 to 200	25 to 50	10 to 40	25 to 60	yes	noted	yes	yes	-	yes 11	-	yes	-	10% to 30%	-	noted	noted	noted	-	-
19	Ross Twp.	2035 12/09/02	1k to 10k	20 to 100	25 to 30	7.5 to 20	25 to 30	yes	noted	yes	yes	⑩	yes 11	-	-	6/Ac to 40/Ac	-	-	-	-	-	3	5 + 1 per emp
20	Shaler Twp. ⑨	1650 04/24/90	5k	50	20	5	10	yes	noted	yes	yes	-	yes 10	-	yes	-	-	noted	noted	noted	-	5	-
21	Sharpsburg Boro.	305 11/25/68	-	-	-	-	-	-	-	-	-	-	yes 7	-	-	-	-	-	-	-	-	-	-
22	West Deer Twp. ⑬	269 04/05/97	15k to 43.5k	75 to 100	35	15 to 35	10 to 40	yes	noted	yes	yes	noted ⑩	yes 11	-	-	noted	yes	noted	noted	-	①	2.8	3
23	West View Boro.	1141 02/16/72	2.5k to 5k	22 to 125	25	5 to 30	25	-	-	-	-	-	yes 5	-	-	-	-	-	-	-	-	2	2.5

- Item not addressed in ordinance.

① Flood plain districts/ Land subject to flooding
② Range 1:200 to 1:600
③ Range 1:200 to 1:2000
④ Lot Area: 7500 to 80,000
⑤ 1 space per 200 ft^2 to 1 space per 300 ft^2
⑥ Based on Res. Moderate Density District
⑦ Based upon Suburban Residential District (SR)
⑧ Min- 1sp per 200 ft^2; Max- 1sp per 300 ft^2
⑨ Based upon R-2
⑩ Discussed steep slopes
⑪ Based upon R-2
⑫ Based upon R-1
⑬ Based upon R-3 SRD
⑭ Based upon AR-2
⑮ Min lot size noted 8000 ft^2 (3200 ft^2 for parks)
⑯ Noted- appears to be directed to the universities
⑰ Noted in "Riverfront Overlay District"
⑱ Flood Plain
⑲ Bradford Hills, Indiana, and Pine Twp. referenced this item in subdivision ord. as well.

NHCOG Act 167 Update
Grading and Erosion Sediment Control Matrix
2/7/2006

Number	Municipality	Separate Grading Ordinance (Number and Date)	Other Location of Grading Regulations (Ord. Name & Date)	Separate E&SC Ordinance (Number & Date)	Other Location of E&SC Regulations (Ord. Name & Date)	Maximum Allowable Cut Slope	Maximum Allowable Fill Slope	Are There Steep Slope Restrictions?	Description of Steep Slope Restrictions	Limiting Slope Where Development is not Permitted?	Are Soil Type Maps Required?	Slide-Prone Soils Delineated?	Stream Buffers Required?	Stream Buffer Widths	Development Buffers Required?	Development Buffer Width	Drainage Easement Required?	Drainage Easement Width
1	Aspinwall Boro.	995-9.Part 1 Grading (12/10/03)	--	--	995-Chapters 8, 27 & 22 (12/10/03)			Chapter 9-110.C.1 and 9-110.C.2	Fill slopes toeing into natural slopes greater than 4H:1V not made without report. Benching required on existing slopes of 5H:1V prior to fill placement	--	9-109.C 9-110.C 22-608.A.(1)						22-606	15 ft min sewers and other utilities 20 ft min stormwater
2	Bradford Woods Boro.	249 (08/74)	--	--	249 (09/74) 392-190-15(D) and 392-190-8	2H:1V 249-129-6(A)	2H:1V 249-129-6(A)				392-190-10 (C)(1)(d)	Geological hazards should be considered in stormwater design 392-190-15(A)(3) Borough may require special precautions when stormwater BMPs are installed in landslide-prone soils 392-190-16(B)(5)					392-190-10(E)(1)(i)	15ft
3	Etna Boro.	--	--	--	1191-202.1.5, 1191-303, 1143.2.13.C.5.g	--	--	1111-4.02.A.(4)	3H:1V pond side slopes, 2H:1V flood prone areas Ord. 1111-4.02.A.(4)	--	1191-202.1.2.d	"Special Precautions" 1191-402.4	1143-2.13.F	50 ft from top of bank within floodplain areas	--	--	1191-202.1.6, and 1191-401.2.1.b	Width not specified
4	Fox Chapel Boro.	--	455-123 (08/85)	--	437-404(14) (01/83) 443 (12/83)						437-404(5)(D) (1)(d)	Borough may require special precautions when sw BMPs installed in landslide-prone soils 404(17)(D)					437-404(5) (D)(5)	
5	Franklin Park Boro.	--	435-96-184-31 (11/96)	--	435-96-184-28(I) (11/96)	3H:1V 435-184-31(B)(1)					435-184-28(C) (3)(a)[1][d]	Ordinance lists specific cut slope req. for landslide-prone soils 435-184-31(B)(1)(a)&(b) Borough may require special precautions when sw BMPs installed in landslide-prone soils 435--28(K)(4)					435-184-28 (C)(3)(a)[5]	Easement width not specified
6	Frazer Twp.	68 (4/6/89)	Subdivision Ord 51 (07-27-78) 113 (09-23-2002)	--	Ord 70-4.B (05-04-89) Ord 68-6.B and 68-13 Subdivision Ord 51-816	2H:1V 3H:1V 67-807.A.4 and 68-11.A	Exceptions for fill slope % throughtout. General fill placement criteria (compaction, no fill over trees or other materials, etc.) noted in 68-12	Zoning Ord Section 121-A.3 114-26 70-5.F.4 68-11	16% to 25% slopes allow for <60% of such areas to be developed > 26% slope only as authorized by Township engineer. Allows for development of steep slopes for property greater than 25 acres. Ponds 3H:1V Landslide prone soils >25% slopes - 3H:1V Landslide prone soils <25% slopes - 2H:1V Other soils - 1.5H:1V	--	68-6.B	Recognized in Permit Exceptions 68-4 and 68-10.C	--	--	Ord 68-14.D Ord 51-814.B Ord 67-807.A.5, 67-807.A.8, and 67-809.A	3 ft from property lines for retaining walls 10 ft min planting screen No grading within 5 ft of property line 20 ft from commercial or industrial use next to residential or open land - must be planted	51-706.D 51-706.E 51-810	15 ft min For natural water courses, conform to line of stream and adequate width to preserve and manitain natural drainage
7	Hampton Twp.	584 (02/00)	--	--	584-43 (02/00) SWO 408 583-710 (02/00)	2H:1V 584-41.1	2H:1V 584-42.1	584-32.5 and 584-11	Slopes > 25% shall not be graded		203(A)(5) 584-21.2.8	The Administrator may require special precautions when grading occurs in landslide-prone soils 584-21.2.12					406(B)(17) 406 (C)(10)	25ft for detention/retention facilities 20ft for storm drainage
8	Harmar Twp.	--	215-504	--	215	3H:1V Many exceptions. See Ordinance 302-111(1)					215-514 (xiii) Addendum to Sect. 3	Ordinance lists specific cut slope requirements for landslide-prone soils 302--111(A) & (B)						
9	Indiana Twp.	229 (07/87)	--	--	230(3)(d)(2) (07/87) 229(14) (07/87)	2H:1V 229(12)(1)	2H:1V 229(13)(1)				230(3)(d)(4)	Plan for grading permit must indicate any landslide prone areas 229(6)(2)(a)(11) Landslide-prone soils shall not be graded until reviewed and approved by soils engineer. 229(12)(1)(a) Township may require special precautions when sw BMPs installed in landslide-prone soils 230(d)(p.25)					230(3)(d)	Easement width not specified
10	Marshall Twp.	101 Ch 88 (10/74)	--	--	354-174-21(I) and 174-23 (12/95) 277 (12/95)	3H:1V Exceptions. See Ordinance 101-88-13(A)	3H:1V Exceptions. See Ordinance 101-88-14(A)				354-174-21 (C)(3)(a)(4)	Township may require special precautions when stormwater BMPs are installed in landslide-prone soils 174-21(K)(4)	101-88-19(A)	The top or bottom edge of excavation and fills shall be at least 25 ft from the nearest bank of any stream or body of water.			354-174-21(C)(3)(e)	Easement width not specified

NHCOG Act 167 Update
Grading and Erosion Sediment Control Matrix
2/7/2006

Number	Municipality	Separate Grading Ordinance (Number and Date)	Other Location of Grading Regulations (Ord. Name & Date)	Separate E&SC Ordinance (Number & Date)	Other Location of E&SC Regulations (Ord. Name & Date)	Maximum Allowable Cut Slope	Maximum Allowable Fill Slope	Are There Steep Slope Restrictions?	Description of Steep Slope Restrictions	Limiting Slope Where Development is not Permitted?	Are Soil Type Maps Required?	Slide-Prone Soils Delineated?	Stream Buffers Required?	Stream Buffer Widths	Development Buffers Required?	Development Buffer Width	Drainage Easement Required?	Drainage Easement Width
11	McCandless Twp.	625 (04/73) 519-1705 (03/69)	–	–	519-1367.02(g) (03/69) 519-1375.10 (03/69) SWM Ord 979 (02/88)	2H:1V 519-1705.05(a)	3H:1V 519-1705.05 (a)				519-1375.04 (c)(1)(D)	Slide prone soils require special precautions and soil testing required. 519-1705.11(c)					519-1371.04(g)	15ft min
12	Middlesex Twp. (Butler County)	91 (05/03)	21-1213 (10/92)	–	90-305 (04/03) 91-103.17 (05/03)	2H:1V 91-103.13	2H:1V 91-103.14	21-1203	Natural or finished slope >25% is considered a steep slope >40% = grading or construction not permitted >25% but < 40% = may be altered under guidance of Twp Grading Ord and other req.	>40% 21-1203	96-403.5.6 90-403(A.7)	Must show location of landslide-prone areas on pre-application for development 96-403.4.17 Geologic report required in land development plan for development in landslide-prone soils 21-1203.3	90-Art III(E) and	–	21-1202	5 to 20ft	90-403(A.20)	15ft
17	Reserve Twp.	402 (05/81)	–	–	–	1H:1V 2H:1V 402 Sect 4	2H:1V 402 Sect 10	–	–	–	619-403(B)(7)	Landslide-prone conditions must be included in preliminary development plans 610-Art IV-A(4)(b)	–	–	610 Art VI	10ft minimum	619-403(B)(20)	15ft
18	Richland Twp.	76 (11/72)	–	–	278 (09/91)	3H:1V Exceptions. See Ordinance 76-111	–	–	–	–	278-514(2) (B)(1)(e)	Prelim Plan requires identification of any potentially unstable areas. 278-402(2)(l)	278-510(9)	–	278-510(6)	–	404-401(B)(l) 404-406	15ft
19	Ross Twp.	Ch. 22-Grading and Ch. 9 - Excav (10/98)	–	–	Ch. 22-Grading and Ch. 9 - Excav (10/98)	11/2H:1V Exceptions. See Ch. 9-110 and Ch. 22	2H:1V Exceptions. See Ch. 9-111 and Ch. 22	2035-1401(6) and Ch 22-602(5) and Ch 22-Grading and Excav (Ch 9-110(6))	12-14.9% - 40% area may be disturbed (30% in landslide prone area) 15-25% - 30% area may be disturbed (20% in landslide prone area) 25% & Above - 15% area may be disturbed (4% in landslide prone area)	–	2147-403(B)(7)	Applicant for grading permit must demonstrate that proposed development is not within a landslide-prone area Ch 9-110(6)(C) and Ch. 22	2147-401	–	2035-1402, 1803(1)(E)	Ranges from 15 to 50 ft	2147-403(B)(20)	15ft
20	Shaler Twp.	1813 (04/03)	–	–	1353 (03/75)	1.5H:1V 1353-140-6(A)	2H:1V 1353-140-6(A)	1650-225-132(D)(1)(C)	Slope of 25% or more - no units permitted Slope of 15% to 25% - Max total disturbance shall not exceed 5% of the total area	25%	1813-190-19(B)(2)(g)	Development plan must include delineation of areas in which rock formations are unstable 1650-225-132(A)(1)(c)	1813-190-15(F)	–	1650-225-132(D)(9)	–	1813-190-19(B)(2)(t)	15ft
21	Sharpsburg Boro.	–	488 (07/91)	–	488 (07/91) see Subdivision 22-506(c)	2H:1V Exceptions. See 22-507(4)	–	–	–	–	22-506(B)(6)	–	–	–	–	–	–	–
22	West Deer Twp.	101 (11/74)	258-7.3	–	258-7.1.4 187, Section 910	3H:1V 101 Sect 11	3H:1V 101 Sect 4(6)	–	–	–	101Sect 6 258-4.3.3(J) and 8.3.3(A)(4)	Preliminary plan requires delineation of all slide-prone areas 258-4.3.3(J)	–	–	269 Art XXI	–	258-6.4.3(B) 258-8.3.3(E)	10ft
23	West View Boro.	1109 (10/67)	–	–	1415 (12/87)	1H:1V 1109-77-10(A)	1.5H:1V 1109-77-11	–	–	–	1109-77-5(A)(2)(a)(3)	–	–	–	–	–	1415-401 (B) (1) (i) 1415-406	15ft

Footnotes
– = Item not addressed in ordinances
Highlighted cells = information not found in stormwater and grading ordinances. This information may be found in other ordinances for this municipality, such as zoning and subdivision

NHCOG Act 167 Update
Grading and Erosion Sediment Control Matrix
2/7/2006

Number	Municipality	Deforestation Regulations	Vegetative Mitigation Requirements	When is ACCD Review Required? (Acres)	Wetland Delineation Required?	Use of Infiltration Allowed	Post-Construction BMPs Required?	Acreage Requiring E&SCP
1	Aspinwall Boro.	Protect all trees in areas of extreme grade change. Prevent unnecessary removal of trees. 9-112.7 Major shade trees adequately protected and preserved to extent possible. 22-603.4	All graded surfaces planted or otherwise protected w/in 30 days and maintained until growth well extablished. Minimize distrubed area exposure with temporary E&SC measures immediately. 9-112.6 Design, installation and maintenance of E&SC measures by County Conservation District standards. 9-112.9	>5,000 sq. ft.	--	--	Vague language throughout Chapters 9 and 22	Exemptions to required Grading Permit include farming, driveway paving, retaining walls, minor activities that do not adversely affect natural flow of stormwater, draiange or landscape in a gross are of up to 25 acres on one property. 9-107
2	Bradford Woods Boro.		Immediately upon completion of grading, all areas not designated for building or paving shall be mulched and planted. See 249-129-6(F)	>5,000 ft2 392-190-8(B)	392-190-10(C)(1)(c)	Focus of municipal sw ordinance is on stormwater infiltration 392-190-3(E) Multiple use BMPs such as ball fields are encouraged 392-190-15(B)(4)	The owner of any property on which an excavation or fill has been made shall maintain it in good condition and repair and also all retaining walls, cribbing, drainage structures, fences, ground cover, and other protective devices as req. by permit. Borough may req. prop owner to make restoration of a safe grading condition if there is evidence of deterioration or erosion any time after grading work is completed. 249-129-13	
3	Etna Boro.	--	Permanent vegetation installed as soon as practicable, and regain natural vegetation wherever feasible 1191-303.5 (e&f)	1191-202.2 1191-303.3	--	Yes, Vague Language	--	--
4	Fox Chapel Boro.		Permanent vegetation and erosion control structures should be installed as soon as practical during construction activities 437-404(14)(E)(5)		437-404(5)(D)(1)(c)	Focus of municipal sw ordinance is to encourage stormwater infiltration 437-404(2)(C) and Multiple use BMPs such as ball fields are encouraged 437-404(10)(B)(4) and BMPs to meet State WQ req. may include replication of preconstruction stormwater infiltration cond. 437-404(15)(C)(1)	Ordinance references PADEP requirements to implement and maintain postconstuction stormwater BMPs after earth disturbance activities are complete. These may include infiltration, treatment, and stream bank and stream bed protection. 437-404(15)	
5	Franklin Park Boro.		Permanent vegetation and erosion control structures should be installed as soon as practical during construction activities 435-184-28 Appendix E (B)(5)(e)		435-184-28(C)(3)(a)[1][c]	Purpose of municipal ordinances on erosion control and stormwater management is to encourage natural infiltration of rainfall 435-184-28(A)(3) and Routed flow over grass is a method of stormwater runoff detention and control that municipal ordinance suggests may be utilized in sw mgmt syst. 435-184-28 Appendix E (B)(1)(c)(7)		
6	Frazer Twp.	Preservation of existing trees 51-815 No more than 50% of any forest may be cleared or developed. Zoning Ord Section 1621-A.4	Follow E&SC Handbook fo Allegheny County 68-15 Grass after each "phase" of grading 67-807.A.8	No acreage stated. Ord 51-501.G.6	--	stone filled dry wells 67-808-A.2	--	>5 acres Ord 51-816.A.1 Grading permit required for each site, many exceptions. 68-3 and 68-4
7	Hampton Twp.	Large-scale cutting of trees for sole purpose of clearing land unless incidental to imminent development is prohibited. 584-32	Permanent vegetation and erosion control structures should be installed as soon as practical during construction activities 409(F)(5) and 584-44		SWO 203(A)(4)	BMPs to meet State WQ req. may include replication of preconstruction stormwater infiltration cond. SWO 404(C) (1) and Routed flow over grass, as well as seepage pits, seepage trenches, level spreaders, or other infiltration structures are methods of stormwater runoff detention and control that municipal ordinance suggests may be utilized in sw mgmt syst. SWO 406(A)(3)	Ordinance references PADEP requirements to implement and maintain postconstuction stormwater BMPs after earth disturbance activities are complete SWO 404(D) The owner of any property on which an excavation or fill has been made shall maintain it in good condition and repair and also all retaining walls, cribbing, drainage structures, fences, ground cover, and other protective devices as req. by permit. 584-29.1	
8	Harmar Twp.	Wherever practical, large trees shall be preserved. 302-117(3)	Slope areas shall be planted with fast-catching erosion-resisting materials immediately upon completion of grading work. Hardy perennial grasses shall be sown after initial planting. 302-115(3)		--	--	The owner of any property on which an excavation or fill has been made shall maintain it in good condition and repair and also all retaining walls, cribbing, drainage structures, fences, ground cover, and other protective devices as req. by permit. 302-116	
9	Indiana Twp.		Permanent vegetation and erosion control structures should be installed as soon as practical during construction activities 230(3)(d)(2)		230(3)(d)(3)	Focus of municipal sw ordinance is on stormwater infiltration 230-1(3) Multiple use BMPs such as ball fields are encouraged 230 (p.21)	The owner of any property on which an excavation or fill has been made shall maintain it in good condition and repair and also all retaining walls, cribbing, drainage structures, fences, ground cover, and other protective devices as req. by permit. Borough may req. prop owner to make restoration of a safe grading condition if there is evidence of deterioration or erosion any time after grading work is completed. 229(17)	
10	Marshall Twp.	Stripping of vegetation shall be kept to a feasible minimum: wherever practical, natural vegetation shall be retained, protected, and supplemented. 174-23(B)(1) Wherever practical, large trees shall be preserved 101-88-19(C)	In order to prevent erosion, grading permitee shall be required to provide adequate surface treatment by installing ground cover. 101-88-15 Disturbed soils shall be stabilized by permanent vegetation and/or mechanical erosion control and drainage measures as soon as practical during in the development process. Temporary vegetation and/or mulching shall be used to protect exposed critical areas during developement. 174-23(B)(3)	354-174-23(A)(1)	354-174-21(C)(3)(a)(3)	Focus of municipal sw ordinance is on stormwater infiltration 354-174-21(A)(3) Routed flow over grass, as well as seepage pits, seepage trenches, level spreaders, or other infiltration structures are methods of stormwater runoff detention and control that municipal ordinance suggests may be utilized in sw mgmt syst. 354 Appendix A(B)(1)(c)[6]	Permanent vegetation and erosion control structures should be installed as soon as practical during construction activities 354 Appendix A (B)(5)(e) The owner of any property on which an excavation or fill has been made shall maintain it in good condition and repair and also all retaining walls, cribbing, drainage structures, fences, ground cover, and other protective devices as required by permit. 101-88-18	

NHCOG Act 167 Update
Grading and Erosion Sediment Control Matrix
2/7/2006

Number	Municipality	Deforestation Regulations	Vegetative Mitigation Requirements	When is ACCD Review Required? (Acres)	Wetland Delineation Required?	Use of Infiltration Allowed	Post-Construction BMPs Required?	Acreage Requiring E&SCP
11	McCandless Twp.		Immediately upon completion of grading, all areas not designated for building or paving shall be mulched and planted. See ref. for other requirements. 519-1705.05(f)		519-1375.04(c)(1)(C)		Perm controls and facilities for long term protection 519-1367.02.g.2.G	
12	Middlesex Twp. (Butler County)	Wherever practical, large trees shall be preserved. 91-103.19.8	All disturbed soil surface shall be stabilized by effective seeding prior to Nov 1st. 91-103.19.9	All (Butler County) 91-103.17.1	90-403(A.4)	Ordinance requires minimization of imperv surfaces and infiltration runoff through seepage beds and infiltration trenches where soil cond. permit 90-301(I) and 90-302(A) E & S design and construction req. to maintain infiltration capacity 90-305 Roof drains should not be connected to streets, sanitary, or storm sewers or roadside ditches to promote infiltration of stormwarrer where advantageous 90-301(J)	The owner of any property on which an excavation or fill has been made shall maintain it in good condition and repair and also all retaining walls, cribbing, drainage structures, fences, ground cover, and other protective devices as req. by permit. Twp may req. prop owner to make restoration of a safe grading condition if there is evidence of deterioration or erosion any time after grading work is completed. 91-103.18	All? Text refers reader Ch 102, Title 25, Part I DEP Erosion Control req. 103.17.1
17	Reserve Twp.	Wherever practical, large trees shall be preserved. 402 Sect 13(4)	402 Sect 11	> 1 acre 619-304	619-403(B)(4)	Infiltration BMPs shall be evaluated and utilized to the maximum extent possible to manage the net change in stormwater runoff generated so that post-construction discharges do not degrade the physical, chemical or biological characteristics of the receiving waters. 619-306	The owner of any property on which a land operation project has been conducted shall maintain it in good condition and repair and also all retaining walls, cribbing, drainage structures, fences, ground cover, and other protective devices as req. by permit. Twp may req. prop owner to make restoration of a safe grading condition if there is evidence of deterioration or erosion any time after grading work is completed. 402 Sect 12	≥5,000 ft² 619-304
18	Richland Twp.	Whenever possible, trees shall not be removed. 278-510(3) Whenever feasible, natural vwegetation shall be retained, protected, and supplemented 512(2)(C)	Temp veg and mulching shall be used to protect exposed critical areas during dev. Permanent final vegetation and structural erosion control and drainage measures shall be installed as soon as practical in the development 278-512(2)(F & G)	–	278-402(2)(I)	Infiltration may be used as a BMP through replication of pre-construction stormwater infiltration conditions 404-304	Post construction BMPs include infiltration, treatment, and streambank and streambed protection. 404-304 The owner of any property on which an excavation or fill has been conducted shall maintain it in good condition and repair and also all retaining walls, cribbing, drainage structures, fences, ground cover, and other protective devices as req. by permit. Twp may req. prop owner to make restoration of a safe grading condition if there is evidence of deterioration or erosion any time after grading work is completed. 76 Ch 9-116	≥5,000 ft² 404-303(B)
19	Ross Twp.	No significant environmentally sensitive areas shall be physically disturbed 2035-1803((1)(Q)	Planting of sod, shrubs, or other vegetation of slopes to prevent localized erosion shall be required 22 Ch 9-112	>0.5 acre 2147-304	2147-403(B)(4)	Focus of municipal sw ordinance is on stormwater infiltration 2147-102(F) Infiltration BMPs shall be evaluated and utilized to the maximum extent possible to manage the net change in stormwater runoff generated so that post-construction discharges do not degrade the physical, chemical or biological characteristics of the receiving waters. 2147-306 Order of pref for stormwater BMPs (infiltration is 4th of 6) 2147-308(D)	The owner of any property on which an excavation or fill has been conducted shall maintain it in good condition and repair and also all retaining walls, cribbing, drainage structures, fences, ground cover, and other protective devices as req. by permit. Twp may req. prop owner to make restoration of a safe grading condition if there is evidence of deterioration or erosion any time after grading work is completed. Ch 9-113 and Ch. 22	≥5,000 ft² 2147-304(A)
20	Shaler Twp.	Development should minimize tree clearance and no portions of trees 8 inches or greater shall be removed unless necessary for development. Ordinance provides extensive guidelines on protecting trees from damage during construction. 1650-225-132(D)(2)	Immediately upon completion of grading, all areas not designated for building or paving shall be mulched and planted. Planting shall be appropriate to maintain slopes from erosion. 1353-140-6(F)	≥1 acre 1813-190-11(A)	1813-190-19(B)(2)(d)	Municipal stormwater ordinance has provisions that encourage stormwater infiltration to prevent degradation of surface and ground water quality and to protect other water resources 1813-190-2(F) Infiltration BMPs shall be evaluated and utilized to the maximum extent possible to manage the net change in stormwater runoff generated so that post-construction discharges do not degrade the physical, chemical or biological characteristics of the receiving waters. 1813-190-13 Order of pref for stormwater BMPs (infiltration is 4th of 6) 1813-190-15(D)(4)	The owner of any property on which an excavation or fill has been conducted shall maintain it in good condition and repair and also all retaining walls, cribbing, drainage structures, fences, ground cover, and other protective devices as req. by permit. Twp may req. prop owner to make restoration of a safe grading condition if there is evidence of deterioration or erosion any time after grading work is completed. 1353-140-13	≥5,000 ft² 1813-190-11(A)
21	Sharpsburg Boro.	–	–	–	–	SW mgmt controls including groundwater recharge methods such as seepage pits, beds or trenches must be shown on a map. When these structures are used, the location of septic tank infiltration areas and wells must be shown. 22-506(D)(1)(a)	Vague language throughout 22-506 which mainly addresses stormwater management controls, drainage, and erosion and sediment controls.	Any 22-507(1)
22	West Deer Twp.	Tree guards during constr and limitations to cuts and fills near trees to assure their healthy growth 258-7.3.8 Wherever feasible, natural vegetation shall be retained, protected, and supplemented. 258-7.2 and 258-7.1.4(E)(8)	Permanent (final) vegetation and structural erosion control and drainage measures shall be installed as soon as practical in the development. 258-7.2.6	All 258-7.1.1(A)	258-4.4.2(C)(6) and 258-8.3.3(A)(3)	Purpose of the sw ordinance is to encourage natural infiltration of rainfall to preserve groundwater supplies and streamflows 258-8.1.3 Ordinance provides list of detention and control methods which may be used in sw mgmt. Methods involving infiltration include seepage pits, seepage trenches, level spreaders, or other infiltration structures; routed flow over grass. 258-8.12.2(A)(3)	Provisions shall be made to effectively accommodate the increased runoff caused by changed soil and surface conditions during and after development. 258-7.2.7	Any 258-7.1.1
23	West View Boro.	Wherever practical large trees shall be preserved. 1109-77-15(C)	–	–	–	Municipality finds that stormwater can be an important water resource by providing groundwater recharge for water supplies and base flow of streams, which also protects and maintains surface water quality. 1415-102(D) To control post-construction sw impacts from earth disturbance activities, State Water Quality Req. can be met by BMPs incl. site design, which provide for replication of pre-construction infiltration conditions 1415-304(C)(1) SW Ordiance has Appendix with Low Impact Development Practices - Includes infiltration 1415-Appendix A	Section discusses BMP requirements to control runoff from development after earth disturbance activities are complete. Req. include need to implement post-construction sw BMPs with assurance of long-term operations and maintenance of those BMPs. 1415-304 and 1109-77-14 The owner of any property on which an excavation or fill has been conducted shall maintain it in good condition and repair and also all retaining walls, cribbing, drainage structures, fences, ground cover, and other protective devices. 1109-77-14	≥5,000 ft² 1415-303

Legend	
1 of 4	3 of 4
2 of 4	4 of 4

Report Appendix E

EPA's Aquatic Buffer Model Ordinance

Aquatic Buffer Model Ordinance

L *This ordinance focuses primarily on stream buffers. Communities creating coastal buffers may wish to incorporate additional features. For an example of a coastal buffer ordinance, see the Rhode Island ordinance.*

Section I. Background

Buffers adjacent to stream systems and coastal areas provide numerous environmental protection and resource management benefits that can include the following:

1) Restoring and maintaining the chemical, physical, and biological integrity of the water resources
2) Removing pollutants delivered from urban stormwater
3) Reducing erosion and sediment entering the stream
4) Stabilizing stream banks
5) Providing infiltration of stormwater runoff
6) Maintaining base flow of streams
7) Contributing the organic matter that is a source of food and energy for the aquatic ecosystem
8) Providing tree canopy to shade streams and promote desirable aquatic organisms

L *This benefit applies primarily to forested buffer systems. In some communities, such as prairie settings, the native vegetation may not be forest. See the example ordinance from Omaha, Nebraska, for an example.*

9) Providing riparian wildlife habitat
10) Furnishing scenic value and recreational opportunity

It is the desire of the _______________(*Natural Resources or Planning Agency*) to protect and maintain the native vegetation in riparian and wetland areas by implementing specifications for the establishment, protection, and maintenance of vegetation along all stream systems and/or coastal zones within our jurisdictional authority.

Section II. Intent

The purpose of this ordinance is to establish minimal acceptable requirements for the design of buffers to protect the streams, wetlands, and floodplains of _ (*jurisdiction*); to protect the water quality of watercourses, reservoirs, lakes, and other significant water resources within ________________(*jurisdiction*); to protect ________=s (Jurisdiction=s) riparian and aquatic ecosystems; and to provide for the environmentally sound use of _______________=s (*jurisdiction*=s) land resources.

Section III. Definitions

Active Channel — The area of the stream channel that is subject to frequent flows (approximately once per one and a half years) and that includes the portion of the channel below the floodplain.

Best Management Practices (BMPs) — Conservation practices or management measures that control soil loss and reduce water quality degradation caused by nutrients, animal wastes, toxics, sediment, and runoff.

Buffer — A vegetated area, including trees, shrubs, and herbaceous vegetation, that exists or is established to protect a stream system, lake, reservoir, or coastal estuarine area. Alteration of this natural area is strictly limited.

Development
1) The improvement of property for any purpose involving building
2) Subdivision or the division of a tract or parcel of land into two or more parcels
3) The combination of any two or more lots, tracts, or parcels of property for any purpose
4) The preparation of land for any of the above purposes

Nontidal Wetlands — Those areas not influenced by tidal fluctuations that are inundated or saturated by surface water or groundwater 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.

L *The definition of Anontidal wetland≅ here is adapted from the definition of Awetland≅ used by the USEPA and the US Army Corps of Engineers.*

Nonpoint Source Pollution — Pollution that is generated by various land use activities rather than from an identifiable or discrete source and is conveyed to waterways through natural processes, such as rainfall, stormwater runoff, or groundwater seepage rather than direct discharges.

One Hundred-Year Floodplain — The area of land adjacent to a stream that is subject to inundation during a storm event that has a recurrence interval of 100 years.

Pollution — Any contamination or alteration of the physical, chemical, or biological properties of any waters that will render the waters harmful or detrimental to
1) Public health, safety, or welfare
2) Domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses
3) Livestock, wild animals, or birds
4) Fish or other aquatic life

Stream Channel — Part of a watercourse either naturally or artificially created that contains an intermittent or perennial base flow of groundwater origin. Base flows of groundwater origin can be distinguished by any of the following physical indicators:
1) Hydrophytic vegetation, hydric soil, or other hydrologic indicators in the area(s) where groundwater enters the stream channel in the vicinity of the stream headwaters, channel bed, or channel banks
2) Flowing water not directly related to a storm event
3) Historical records of a local high groundwater table, such as well and stream gauge records.

Stream Order — A classification system for streams based on stream hierarchy. The smaller the stream, the lower its numerical classification. For example, a first-order stream does not have tributaries and normally originates from springs and/or seeps. (See Figure 1.)

Stream System — A stream channel together with one or both of the following:

1) 100-year floodplain
2) Hydrologically related nontidal wetland

Streams — Perennial and intermittent watercourses identified through site inspection and US Geological Survey (USGS) maps. Perennial streams are those which are depicted on a USGS map with a solid blue line. Intermittent streams are those which are depicted on a USGS map with a dotted blue line.

L *Defining the term Astream≅ is perhaps the most contentious issue in the definition of stream buffers. This term determines the origin and the length of the stream buffer. Although some jurisdictions restrict the buffer to perennial or Ablue line≅ streams, others include both perennial and intermittent streams in the stream buffer program. Some communities do not rely on USGS maps and instead prepare local maps of all stream systems that require a buffer.*

Water Pollution Hazard — A land use or activity that causes a relatively high risk of potential water pollution.

Section IV. <u>Applications</u>

A) This ordinance shall apply to all proposed development except for that development which meets waiver or variance criteria as outlined in Section IX of this regulation.
B) This ordinance shall apply to all timber harvesting activities, except those timber harvesting operations which are implementing a forest management plan that has been deemed to be in compliance with the regulations of the buffer ordinance and has received approval from ___________(*state forestry agency*).
C) This ordinance shall apply to surface mining operations except that the design standards shall not apply to active surface mining operations that are operating in compliance with an approved _____________(*state or federal agency*) surface mining permit.
D) The ordinance shall not apply to agricultural operations that are covered by an approved Natural Resources Conservation Service (NRCS) conservation plan that includes the application of BMPs.

L *Communities should carefully consider whether exempt agricultural operations from the buffer ordinance because buffer regulations may take land out of production and impose a financial burden on family farms. Many communities exempt agricultural operations if they have an approved NRCS conservation plan. In some regions, agricultural buffers may be funded through the Conservation Reserve Program (CRP). For further information, consult the Conservation Technology Information Center (CTIC) at <u>www.ctic.perdue.edu</u>.*

L *Livestock operations near and around streams may be regulated by communities. Livestock can significantly degrade the stream system and accelerate streambank erosion. The King County Livestock Management Ordinance is one example of a local livestock ordinance. For more information, contact the King County Department of Development and Environmental Services at*

(206) 296-6602.

E) Except as provided in Section IX, this ordinance shall apply to all parcels of land, structures, and activities that are causing or contributing to
   1) Pollution, including nonpoint source pollution, of the waters of the jurisdiction adopting this ordinance
   2) Erosion or sedimentation of stream channels
   1) Degradation of aquatic or riparian habitat

Section V. <u>Plan Requirements</u>

A) In accordance with Section IV of this ordinance, a plan approved by the appropriate agency is required for all development, forest harvesting operations, surface mining operations, and agricultural operations.
B) The plan shall set forth an informative, conceptual, and schematic representation of the proposed activity by means of maps, graphs, charts, or other written or drawn documents so as to enable the agency an opportunity to make a reasonably informed decision regarding the proposed activity.
C) The plan shall contain the following information:

L *The ordinance can identify the scale of maps to be included with the analyses in items 2) through 7). A 1"=50' to 1"=100' scale will generally provide sufficient detail.*

   1) A location or vicinity map
   2) Field-delineated and surveyed streams, springs, seeps, bodies of water, and wetlands (include a minimum of 200 feet into adjacent properties)
   3) Field delineated and surveyed forest buffers
   4) Limits of the ultimate 100-year floodplain

L *The limits of the ultimate floodplain (i.e., the floodplain under Abuilt-out≅ conditions) might not be available in all locations.*

   5) Hydric soils mapped in accordance with the NRCS soil survey of the site area
   6) Steep slopes greater than 15 percent for areas adjacent to and within 200 feet of streams, wetlands, or other water bodies

L *The ordinance may also explicitly define how slopes are measured. For example, the buffer may be divided into sections of a specific width (e.g., 25 feet) and the slope for each segment reported. Alternatively, slopes can be reported in segments divided by breaks in slope.*

   7) A narrative of the species and distribution of existing vegetation within the buffer

D) The buffer plan shall be submitted in conjunction with the required grading plan for any development,and the forest buffer should be clearly delineated on the final grading plan.
E) Permanent boundary markers, in the form of signage approved by (*natural resources or planning agency*), shall be installed prior to final approval of the required clearing and grading plan. Signs shall be placed at the edge of the middle zone (See Section VI.I).

Section VI. **Design Standards for Forest Buffers**

A) A forest buffer for a stream system shall consist of a forested strip of land extending along both sides of a stream and its adjacent wetlands, floodplains, or slopes. The forest buffer width shall be adjusted to include contiguous sensitive areas, such as steep slopes or erodible soils, where development or disturbance may adversely affect water quality, streams, wetlands, or other water bodies.

B) The forest buffer shall begin at the edge of the stream bank of the active channel.

C) The required width for all forest buffers (i.e., the base width) shall be a minimum of 100 feet, with the requirement to expand the buffer depending on
   1) Stream order
   2) Percent slope
   3) 100-year floodplain
   4) Wetlands or critical areas

The width of the stream buffer varies from 20 feet to 200 feet in ordinances throughout the United States (Heraty, 1993). The width chosen by a jurisdiction will depend on the sensitivity and characteristics of the resource being protected and the political realities in the community.

A) In third-order and higher streams, 25 feet shall be added to the base width of the forest buffer.

B) The forest buffer width shall be modified if steep slopes are within close proximity to the stream and drain into the stream system. In those cases, the forest buffer width may be adjusted.

Several methods may be used to adjust buffer width for steep slopes. Two examples follow:

Method A

Percent Slope	Width of Buffer
15%-17%	add 10 feet
18%-20%	add 30 feet
21%-23%	add 50 feet
24%-25%	add 60 feet

Method B

Percent Slope	Type of Stream Use	
	Water Contact Recreational Use	Sensitive Stream Habitat
0% to 14%	no change	add 50 feet
15% to 25%	add 25 feet	add 75 feet
Greater than 25%	add 50 feet	add 100 feet

C) Forest buffers shall be extended to encompass the entire 100-year floodplain and a zone with a minimum width of 25 feet beyond the edge of the floodplain.

D) When wetland or critical areas extend beyond the edge of the required buffer width, the buffer shall be adjusted so that the buffer consists of the extent of the wetland plus a 25-foot zone extending beyond the wetland edge.

H) Water Pollution Hazards
The following land uses and/or activities are designated as potential water pollution hazards and must be set back from any stream or water body by the distance indicated below:
1) Storage of hazardous substancesX(150 feet)
2) Aboveground or underground petroleum storage facilitiesX(150 feet)
3) Drain fields from onsite sewage disposal and treatment systems (i.e., septic systems)X(100 feet)
4) Raised septic systemsX(250 feet)
5) Solid waste landfills or junkyardsX(300 feet)
6) Confined animal feedlot operationsX(250 feet)
7) Subsurface discharges from a wastewater treatment plantX(100 feet)
8) Land application of bio-solidsX(100 feet)

For surface water supplies, the setbacks should be doubled.

A community should carefully consider which activities or land uses should be designated as potential water pollution hazards. The list of potential hazards shown above is not exhaustive, and others may need to be added depending on the major pollutants of concern and the uses of water.

I) The forest buffer shall be composed of three distinct zones, with each zone having its own set of allowable uses and vegetative targets as specified in this ordinance. (See Figure 2.)

Although a three-zone buffer system is highly recommended, the widths and specific uses allowed in each zone may vary between jurisdictions.

I) Zone 1, Streamside Zone
   a) Protects the physical and ecological integrity of the stream ecosystem.
   b) Begins at the edge of the stream bank of the active channel and extends a minimum of 25 feet from the top of the bank.
   c) Allowable uses within this zone are highly restricted to
      i) Flood control structures
      ii) Utility right of ways
      iii) Footpaths
      iv) Road crossings, where permitted
   d) Target for the streamside zone is undisturbed native vegetation.

This ordinance assumes that the native vegetation in the stream corridor is forest. In some regions of the United States, other vegetation such as prairie may be native. See the Omaha, Nebraska, buffer ordinance for an example of a stream buffer ordinance that protects nonforested systems.

2) Zone 2, Middle Zone
   a) Protects key components of the stream and provides distance between upland development and the streamside zone.
   b) Begins at the outer edge of the streamside zone and extends a minimum of 50 feet plus any additional buffer width as specified in this section.
   c) Allowable uses within the middle zone are restricted to
      i) Biking or hiking paths
      ii) Stormwater management facilities, with the approval of *(local agency responsible for stormwater)*.
      iii) Recreational uses as approved by _________________ *(planning agency)*.
      iv) Limited tree clearing with approval from _______________ *(forestry agency or planning agency)*.
   d) Targets mature native vegetation adapted to the region.

3) Zone 3, Outer Zone
   a) Prevents encroachment into the forest buffer and filters runoff from residential and commercial development.
   b) Begins at the outward edge of the middle zone and provide a minimum width of 25 feet between Zone 2 and the nearest permanent structure.
   c) Restricts septic systems, permanent structures, or impervious cover, with the exception of paths.
   d) Encourages the planting of native vegetation to increase the total width of the buffer.

Section VII. <u>Buffer Management and Maintenance</u>

A) The forest buffer, including wetlands and floodplains, shall be managed to enhance and maximize the unique value of these resources. Management includes specific limitations on alteration of the natural conditions of these resources. The following practices and activities are restricted within Zones 1 and 2 of the forest buffer, except with approval by ________________ *(forestry, planning or natural resources agency)*
   1) Clearing of existing vegetation
   2) Soil disturbance by grading, stripping, or other practices
   3) Filling or dumping
   4) Drainage by ditching, under-drains, or other systems
   5) Use, storage, or application of pesticides, except for spot spraying of noxious weeds or non-native species consistent with recommendations of ___*(forestry agency)*
   6) Housing, grazing, or other maintenance of livestock
   7) Storage or operation of motorized vehicles, except for maintenance and emergency use approved by ____________*(forestry, planning, or natural resources agency)*

B) The following structures, practices, and activities are permitted in the forest buffer, with specific design or maintenance features, subject to the review of _*(forestry, planning, or natural resources agency)*:
   1) Roads, bridges, paths, and utilities:
      a) An analysis needs to be conducted to ensure that no economically feasible

alternative is available.

b) The right-of-way should be the minimum width needed to allow for maintenance access and installation.

c) The angle of the crossing shall be perpendicular to the stream or buffer to minimize clearing requirements

d) The minimum number of road crossings should be used within each subdivision, and no more than one fairway crossing is allowed for every 1,000 feet of buffer.

2) Stormwater management:

e) An analysis needs to be conducted to ensure that no economically feasible alternative is available and that the project either is necessary for flood control or significantly improves the water quality or habitat in the stream.

f) In new developments, onsite and nonstructural alternatives will be preferred over larger facilities within the stream buffer.

g) When constructing stormwater management facilities (i.e., BMPs), the area cleared will be limited to the area required for construction and adequate maintenance access as outlined in the most recent edition of _ (*refer to stormwater manual*).

L *Rather than placing specific stormwater BMP design criteria in an ordinance, it is often preferable to reference a manual. With this approach, specific design information can be changed over time without going through the formal process needed to change ordinance language.*

L *The* Maryland Stormwater Design Manual *is one example of an up-to-date stormwater design manual. For more information, go to* www.mde.state.md.us. *Under topics, choose "Stormwater Design Manual."*

h) Material dredged or otherwise removed from a BMP shall be stored outside the buffer.

3) Stream restoration projects, facilities, and activities approved by ______ (*forestry, planning, or natural resources agency*) are permitted within the forest buffer.

4) Water quality monitoring and stream gauging are permitted within the forest buffer, as approved by ______________(*forestry, planning or natural resources agency)*:.

5) Individual trees within the forest buffer that are in danger of falling, causing damage to dwellings or other structures, or causing blockage of the stream may be removed.

6) Other timber cutting techniques approved by the agency may be undertaken within the forest buffer under the advice and guidance of (*state or federal forestry agency*) if necessary to preserve the forest from extensive pest infestation, disease infestation, or threat from fire.

C) All plans prepared for recording and all right-of-way plans shall clearly

1) Show the extent of any forest buffer on the subject property

2) Label the forest buffer

3) Provide a note to reference any forest buffer stating: AThere shall be no clearing, grading, construction or disturbance of vegetation except as permitted by the agency.≅

4) Provide a note to reference any protective covenants governing all forest buffer areas stating: AAny forest buffer shown hereon is subject to protective covenants that may be found in the land records and that restrict disturbance and use of these areas.≅

D) All forest buffer areas shall be maintained through a declaration of protective covenant, which is required to be submitted for approval by (*planning board or agency*). The covenant shall be recorded in the land records and shall run with the land and continue in perpetuity.

L *This protective covenant can be kept either by the local government agency responsible for management of environmental resources or by an approved nonprofit organization. An example conservation easement is included later in this section.*

E) All lease agreements must contain a notation regarding the presence and location of protective covenants for forest buffer areas and shall contain information on the management and maintenance requirements for the new property owner.

F) An offer of dedication of a forest buffer area to the agency shall not be interpreted to mean that this automatically conveys to the general public the right of access to this area.

G) ____________________ (*responsible individual or group*) shall inspect the buffer annually and immediately following severe storms for evidence of sediment deposition, erosion, or concentrated flow channels and corrective actions taken to ensure the integrity and functions of the forest buffer.

L *A local ordinance will need to designate the individual or group responsible for buffer maintenance. Often, the responsible party will be identified in protective covenants associated with the property.*

H) Forest buffer areas may be allowed to grow into their vegetative target state naturally, but methods to enhance the successional process such as active reforestation may be used when deemed necessary by _______________ (*natural resources or forestry agency*) to ensure the preservation and propagation of the buffer area. Forest buffer areas may also be enhanced through reforestation or other growth techniques as a form of mitigation for achieving buffer preservation requirements.

L *Explicit forestry management criteria are often included in a forestry or natural resources conservation ordinance. An example forest conservation ordinance from Frederick County, Maryland is included in the miscellaneous ordinances section of this site.*

Section VIII. Enforcement Procedures

A) _______________ (*director of responsible agency)* or his/her designee is authorized and empowered to enforce the requirements of this ordinance in accordance with the procedures of this section.

B) If, upon inspection or investigation, the director or his/her designee is of the opinion that any person has violated any provision of this ordinance, he/she shall with reasonable promptness issue a correction notice to the person. Each such notice shall be in writing and shall describe the nature of the violation, including a reference to the provision within this ordinance that has been violated. In addition, the notice shall set a reasonable time for the abatement and correction of the violation.

C) If it is determined that the violation or violations continue after the time fixed for abatement and correction has expired, the director shall issue a citation by certified mail to the person who is in violation. Each such notice shall be in writing and shall describe the nature of the violation, including a reference to the provision within this ordinance that has been violated and what penalty, if any, is proposed to be assessed. The person charged has 30 days within which to contest the citation or proposed assessment of penalty and to file a request for a hearing with the director or his/her designee. At the conclusion of this hearing, the director or his/her designee will issue a final order, subject to appeal to the appropriate authority. If, within 30 days from the receipt of the citation issued by the director, the person fails to contest the citation or proposed assessment of penalty, the citation or proposed assessment of penalty shall be deemed the final order of the director.

A) Any person who violates any provision of this ordinance may be liable for any cost or expenses incurred as a result thereof by the agency.
B) Penalties that may be assessed for those deemed to be in violation may include the following:
   1) A civil penalty not to exceed $1,000.00 for each violation. Every day that such violation(s) continue will be considered a separate offense.
   2) A criminal penalty in the form of a fine of not more than $1,000.00 for each violation, imprisonment for not more than 90 days, or both. Every day that such violation(s) continue will be considered a separate offense.
   3) Anyone who knowingly makes any false statements in any application, record, or plan required by this ordinance shall upon conviction be punished by a fine of not more than $1,000.00 for each violation, imprisonment for not more than 30 days, or both.

Specific penalties will vary between communities, and should reflect realistically enforceable penalties given the political realities of a jurisdiction.

F) In addition to any other sanctions listed in this ordinance, a person who fails to comply with the provisions of this buffer ordinance shall be liable to the agency in a civil action for damages in an amount equal to twice the cost of restoring the buffer. Damages that are recovered in accordance with this action shall be used for the restoration of buffer systems or for the administration of programs for the protection and restoration of water quality, streams, wetlands, and floodplains.

Section IX. **Waivers/Variances**

A) This ordinance shall apply to all proposed development except for activities that were completed prior to the effective date of this ordinance and had received the following:
   1) A valid, unexpired permit in accordance with development regulations
   2) A current, executed public works agreement
   3) A valid, unexpired building permit
   4) A waiver in accordance with current development regulations.
B) The director of the agency may grant a variance for the following:
   1) Those projects or activities for which it can be demonstrated that strict compliance with the ordinance would result in a practical difficulty or financial hardship
   2) Those projects or activities serving a public need where no feasible alternative is available
   3) The repair and maintenance of public improvements where avoidance and

minimization of adverse impacts to nontidal wetlands and associated aquatic ecosystems have been addressed

4) Those developments which have had buffers applied in conformance with previously issued requirements

C) Waivers for development may also be granted in two additional forms, if deemed appropriate by the director:

1) The buffer width made be reduced at some points as long as the average width of the buffer meets the minimum requirement. This averaging of the buffer may be used to allow for the presence of an existing structure or to recover a lost lot, as long as the streamside zone (Zone I) is not disturbed by the reduction and no new structures are built within the 100-year floodplain.

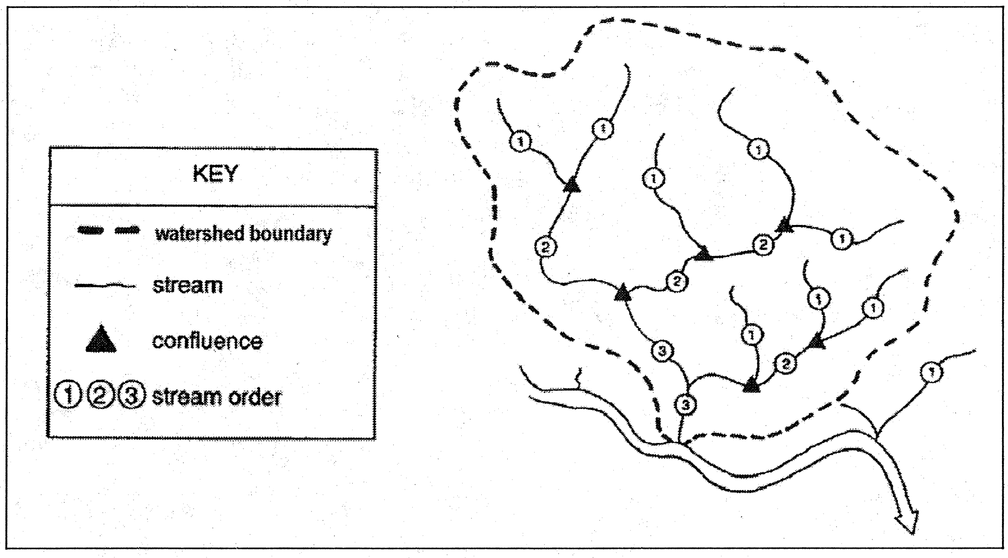
2) ____________________ (*planning agency*) may offer credit for additional density elsewhere on the site in compensation for the loss of developable land due to the requirements of this ordinance. This compensation may increase the total number of dwelling units on the site up to the amount permitted under the base zoning.

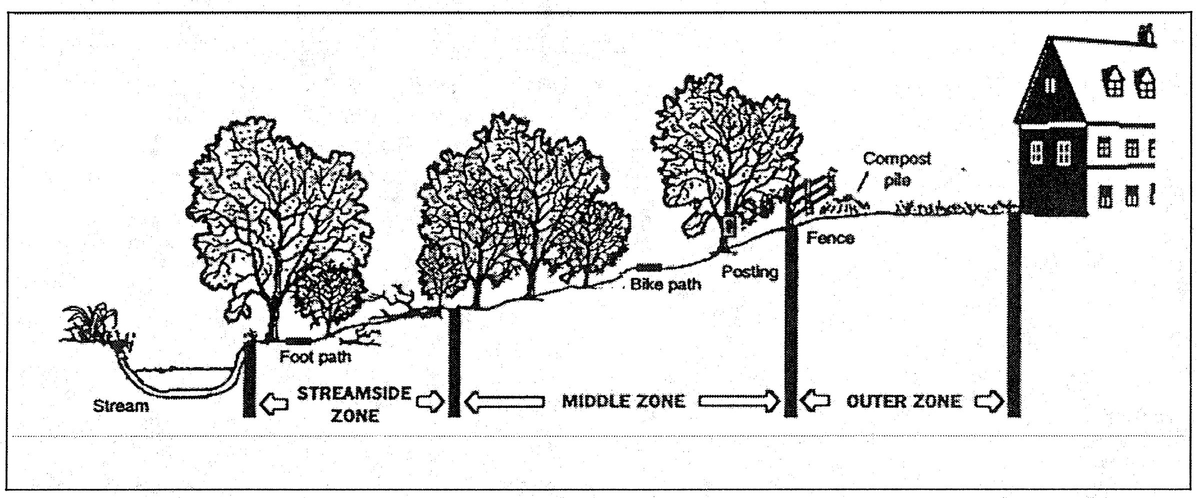
D) The applicant shall submit a written request for a variance to the director of the agency. The application shall include specific reasons justifying the variance and any other information necessary to evaluate the proposed variance request. The agency may require an alternative analysis that clearly demonstrates that no other feasible alternatives exist and that minimal impact will occur as a result of the project or development.

E) In granting a request for a variance, the director of the agency may require site design, landscape planting, fencing, signs, and water quality best management practices to reduce adverse impacts on water quality, streams, wetlands, and floodplains.

Section X. <u>Conflict With Other Regulations</u>

Where the standards and management requirements of this buffer ordinance are in conflict with other laws, regulations, and policies regarding streams, steep slopes, erodible soils, wetlands, floodplains, timber harvesting, land disturbance activities, or other environmental protective measures, the more restrictive shall apply.


KEY
watershed boundary
stream
confluence
①②③ stream order


Compost pile
Fence
Posting
Bike path
Foot path
Stream
STREAMSIDE ZONE
MIDDLE ZONE
OUTER ZONE

References

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