

Bushkill Creek Watershed Protection Plan



MARCH 2005

Presented to:
Pennsylvania Department of Environmental Protection
Growing Greener Grants Center

Prepared for:
Bushkill Stream Conservancy
Easton, Pennsylvania

Prepared by:
F. X. Browne, Inc.
Marshalls Creek, Pennsylvania

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Executive Summary

The Bushkill Creek watershed encompasses 80 square miles of Northampton County, PA, stretching from Blue Mountain to the Delaware River in Easton, PA. The existing land-uses and insufficient implementation of best management practices throughout the watershed are the primary contributors of nonpoint source pollution and nutrient loads to Bushkill Creek. The Bushkill Creek Watershed Protection Plan encompasses information gathered during two separate Growing Greener grant projects: the Bushkill Creek Watershed Protection Project – Phase I, and the Bushkill Creek Watershed Protection Project – Phase II.

The primary goals of the project were to document the environmental threats to the Bushkill Creek Watershed, to educate the watershed residents about ways to protect the watershed, and to outline actions that could be taken by the Bushkill Stream Conservancy, municipalities, and citizens within the watershed to protect the quality of Bushkill Creek, the quality of life in the watershed, and the wildlife habitats that exist.

The overall goal of this project was to complement the earlier Bushkill Creek Watershed Protection Growing Greener grant by performing a municipal ordinance audit of the six additional townships in the Bushkill Creek watershed, other than Bushkill Township, which was audited during the second round of Growing Greener funding. In addition, this project was intended to provide public education and outreach to residents of the watershed in the form of environmental education seminars and public meetings where the local citizens can contribute to the development of the watershed protection plan. The end result of this and the former Bushkill Creek Watershed Project was to develop a detailed watershed protection plan for the entire Bushkill Creek watershed.

The project accomplished every one of the goals outlined in the original work plan. One deviation from the original work plan was that the initial round of public meetings was not conducted in the various watershed townships. It was decided that it would be more productive to spend time on the ordinance reviews and meetings with Lehigh Valley Planning Commission (LVPC). This ended up being a wise decision, since the recommendations formed during this project were used by LVPC in the development of their “Ten Municipalities Comprehensive Plan.” Additionally, recommendations from the LVPC were incorporated into the Bushkill Creek Watershed Protection Plan, making for a much more complementary set of regional planning documents.

1.0 Introduction

1.1 Goals and Objectives

The Bushkill Stream Conservancy received Growing Greener Grants from the Pennsylvania Department of Environmental Protection in 2001 and 2002 to conduct investigations, implement watershed protection measures, and provide watershed education to citizens throughout the Bushkill Creek watershed. The end result of the project is the Bushkill Creek Watershed Protection Plan, which incorporates the findings of both Growing Greener projects. The Plan outlines the overall watershed management and protection goals for the Bushkill Creek watershed, and includes ordinance reviews, BMP recommendations, and an overall strategy for implementing watershed protection measures throughout the entire watershed. By educating watershed citizens and visitors, and identifying opportunities to improve the quality of the Bushkill Creek Watershed, the Bushkill Creek Watershed Protection Project has gone a long way toward improving the water quality of the Bushkill Creek, and thus the quality of life for watershed residents.



1.2 Bushkill Stream Conservancy

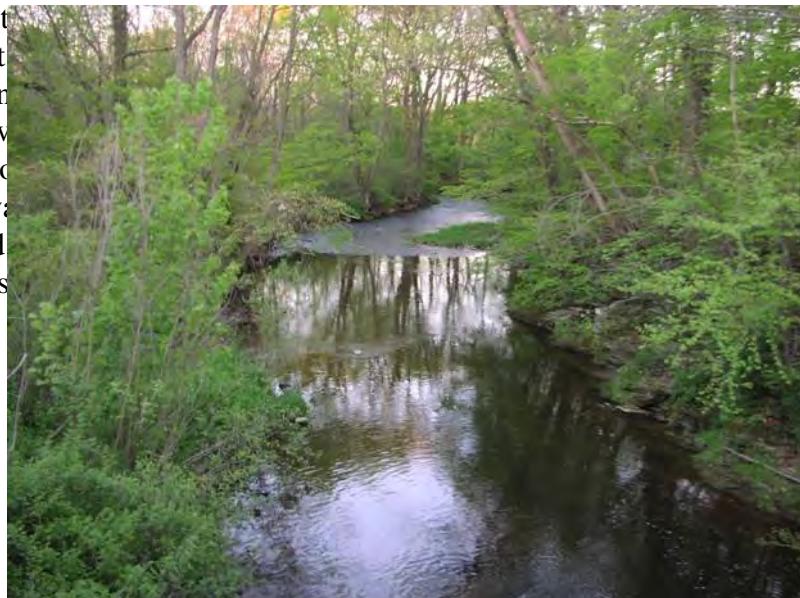
The Bushkill Stream Conservancy is a nonprofit partnership dedicated to the conservation and enhancement of the Bushkill and its environs. The Conservancy initiated the Bushkill Creek Watershed Protection Project as part of their ongoing support of education, recreation, environmental research, and conservation programs to benefit Bushkill Creek.

In the past five years the Bushkill Stream Conservancy has secured funding totaling approximately \$250,000 to carry out a wide variety of programs and projects directly related to the health of the Bushkill creek watershed and the educational goals of the Conservancy. Activities have included:

- Serving as the steering committee for the Two Rivers Area Greenway Plan commissioned by the Two Rivers Council of Governments. The plan serves as a blueprint for future projects in the watershed.
- Installation of automated real-time monitors recording stream flow, conductivity, and other data at six locations on the stream and its tributaries.

- Purchase of advanced analytical equipment for use in a water quality monitoring program carried out by Easton Area High School students.
- Creation and publication of a guide to notable historical sites in the watershed.
- Creation of a geographical information system (GIS) database installed on the Conservancy's computer located at the Jacobsburg Environmental Education Center
- Assistance in the establishment of an Environmental Advisory Committee in Bushkill Township.
- Communications with local, county, state and federal agencies on a wide variety of issues, including stormwater management, sinkhole problems, development, open space, and other matters relating to watershed quality
- Funding of stream improvement projects, including erosion control and safety measures at the Bushkill Park duck-feeding area in Palmer Township, in cooperation with Forks of the Delaware Chapter of Trout Unlimited

Additional projects on the agenda of the streambank erosion control project at a property known as Henry's Woods; installation of a nature trail; and a Coldwater Fish Passage Project with the goal of securing its designation as a "Coldwater Fish Passage Landscape Initiative" to identify and protect coldwater space, natural areas, and historic sites.



1.3 Other Project Partners and Stakeholders

The success of the Bushkill Creek Watershed Protection Project would not have been possible without the cooperation of several important stakeholders and project partners.

Each partner and their role in this project are listed in Table 1.1.

Table 1.1
Important Project Partners in the Bushkill Creek Watershed Protection Project

Partner	Project Role
Bushkill Stream Conservancy	Project administrator - Administered grant, provided

	volunteers for data collection, and contributed to educational program
PA Department of Environmental Protection (PA DEP)	Funding and technical support, assistance with education program
Watershed municipalities	Assisted with ordinance audits and public education program
F. X. Browne, Inc.	Project consultant - technical support, design of educational materials, design of monitoring program, and development of management plan.
Lafayette College	Assisted with the development of the water quality monitoring program.
Retired Senior Volunteer Program (RSVP)	Assisted with the development of the water quality monitoring program.
Lehigh Valley Planning Commission, Pennsylvania Spatial Data Access, Pennsylvania Environmental Council	Assisted with the development of the GIS database for the watershed
Northampton County Conservation District	Assisted with nonpoint source problem area identification
Northeast Institute of Aquatic Plant Management, US Fish & Wildlife Service, Pennsylvania Lake Management Society, and the Nature Conservancy	Assisted with development of education program

Other watershed stakeholders working with the Bushkill Stream Conservancy include:

- Pennsylvania Department of Conservation and Natural Resources,
- Pennsylvania Department of Transportation,
- Pennsylvania Environmental Council,
- Pennsylvania Resource Conservation and Development Council,
- Jacobsburg Environmental Education Center,
- Forks of the Delaware Chapter of Trout Unlimited,
- Save Brookwood Group,
- Easton Area High School,
- Jacobsburg Historical Society,
- Heritage Conservancy,
- Wildlands Conservancy,
- Lafayette College,
- Muhlenberg College,
- Delaware and Lehigh National Heritage Corridor, and
- Delaware River Basin Commission.

1.4 Bushkill Creek Watershed Protection Project Accomplishments

The Bushkill Creek Watershed Protection Project has been completed over a period of several years using multiple partners and sources of funding. Environmental threats to the Bushkill Creek watershed were documented, watershed residents were educated about ways to protect the watershed, and the Bushkill Stream Conservancy, municipalities, and citizens within the watershed are now armed with a comprehensive action plan to protect the quality of Bushkill Creek. Specific details about each project task are outlined below.

1.4.1 Audit of Township Ordinances and Regulations

An audit was conducted of the municipal ordinances and regulations from all the Bushkill watershed townships (Bushkill, Forks, Palmer, Lower Nazareth, and Moore Townships) to determine their effectiveness in protecting the quality of the Bushkill Creek watershed. During this process, a comprehensive list of ordinance and regulation deficiencies was compiled, and recommendations for watershed protection measures were made. Recommendations included but were not limited to: changing setbacks and minimum lot sizes in certain areas, protecting riparian buffers, adding language that encouraged attention to stormwater management and watershed protection techniques, and requiring attention to the locations of wastewater treatment facilities and water supplies on all maps and permits. The list of deficiencies and recommended ordinance changes is provided in Appendix B.

A framework for the adoption of watershed protection ordinances for each of the watershed townships including all recommended ordinances and applicable (section specific where possible) instructions for their presentation and adoption is included in Appendix B. Developing protective ordinances is one of the most effective ways a Township can protect water quality by ensuring that the adverse effects of development are kept to a minimum.

The ordinance recommendations for Bushkill Township are currently being used by the Bushkill Township Environmental Advisory Council in an effort to upgrade the Township's ordinances before the high rate of new development occurring throughout the Lehigh Valley results in permanent, adverse impacts to the local environment and water quality.

1.4.2 Inventories of Watershed Problem Areas

Watershed investigations were performed to identify existing nonpoint source pollution problem areas throughout the upper portion of the Bushkill Creek Watershed. Investigated watershed areas included streambanks, culverts, roadways, roadway stream crossings, storm drainage outfalls, and parking lots. Areas of excessive stormwater runoff and soil erosion were documented for all existing land uses including commercial, residential, institutional, public, industrial, and agricultural. The

watershed investigations were coordinated by F. X. Browne, Inc. and conducted by volunteer members of the Bushkill Stream Conservancy. The Northampton County Conservation District assisted with this task by identifying known agricultural nonpoint source problem areas throughout the watershed. Sixty problem areas were identified throughout the watershed. Nonpoint source problem areas are discussed in Section 3.2. A map of watershed problem area locations, including a table with restoration costs and priority rankings, is provided in Appendix C.

1.4.3 Watershed Protection Education Brochures

A series of five four-color educational brochures were developed for distribution to Townships within the Bushkill Creek Watershed. Copies of each brochure are provided in Appendix D. Brochures included:

- Water Quality and Watershed Management in the Bushkill Creek Watershed
- Surface Water and Groundwater Resources in the Bushkill Creek Watershed
- Stormwater Management in Bushkill Creek Watershed
- Watershed Protection at the Municipal Level - Benefits for the Bushkill Creek Watershed
- Riparian Corridors and Riparian Corridor Restoration in the Bushkill Creek Watershed

The brochures were designed, printed, and distributed to Jacobsburg State Park, Bushkill Township, and the Bushkill Stream Conservancy in the summer of 2003. Digital files of each brochure were also provided to the Bushkill Stream Conservancy for reprinting or updating for future educational activities. To date, the majority of the brochures have been used for educational purposes.

The series of brochures was designed to emphasize the presence, activity, and goals of the Bushkill Stream Conservancy in protecting the health of the Bushkill Creek watershed. They were also intended to encourage watershed municipalities and citizens to take an active role in the protection of the Bushkill Creek watershed. People have a tendency to avoid what they don't understand; by providing knowledge, these watershed education efforts will help watershed residents feel more invested in the protection of Bushkill Creek, and more powerful to create positive change.

1.4.4 Educational Seminars and Workshops

Several watershed management seminars and workshops were designed for use by the Bushkill Stream Conservancy to provide environmental education to technical and professional audiences, as well as to laypeople. Presentation materials for the seminars are provided in Appendix E. Power Point presentations of each of the seminars, including embedded narrative notes, have been provided to the Bushkill Stream Conservancy for future use. The following seminars and workshops were designed as part of this project:

- Stormwater Management
- Roadway Maintenance

- Controlling Invasive Plant Species
- Wetlands and Water Resources

1.4.5 Stream and Watershed Identification Signs

A complete list and detailed GIS based map of all roadway stream crossings within the Bushkill Creek Watershed was developed, including all crossings of named and unnamed streams and tributaries. The list and map were then included as part of a grant application to the Southeast Pennsylvania Resource Conservation & Development Council, who has a statewide program for producing and installing stream crossing identification signs. The grant was approved for installation of 67 signs at all significant stream crossings throughout the entire Bushkill Creek Watershed, from the City of Easton to the headwaters along the Blue Mountain Ridge. The signs were installed at roadway crossings for each stream and tributary with coordination from the Pennsylvania Department of Transportation (PADOT). Bushkill Stream Conservancy worked closely with other watershed groups, municipalities, and local politicians for the support and approval for installation of the stream crossing signs along state, public, and private roadways and bridges. In addition, a standard watershed boundary identification sign was developed and reproduced for installation at all major points of crossing by state and township roads into the Bushkill Creek Watershed. These signs are larger than the stream crossing signs so that they are more visible and contain additional information, including a map of the watershed, appropriate logos, and the Internet address for the Bushkill Stream Conservancy, www.bushkill.org.

Printed versions of the watershed boundary and sample stream crossing signs are provided in Appendix F. A GIS-based map that marks the locations of each of the signs within the watershed area and a list of stream crossing and watershed boundary sign locations is also provided in Appendix F. The signs will serve as a reminder to watershed residents that their actions within the watershed have a direct impact on the quality of their local water resources. They will also announce to watershed visitors that the citizens of the Bushkill Creek Watershed care about the health and protection of the area.

1.4.6 Development of Water Quality Monitoring Program

The Bushkill Stream Conservancy and Lafayette College have been performing water quality monitoring in the Bushkill Creek Watershed over the past several years. However, no formal water quality monitoring program has existed and the efforts of the various monitoring groups were not widely documented or coordinated. Therefore, as part of this project, a formal program was developed to be implemented by Lafayette College and the Bushkill Stream Conservancy in order to consolidate water quality data and formally outline and implement a watershed monitoring plan. Automated stream water quality monitoring stations were established for the collection of valid data on a long-term basis. The Bushkill Stream Conservancy worked together with Lafayette College, RSVP, and other groups to establish a coordinated monitoring program. This included the development of a spreadsheet database for management and archiving of the collected data, for use by all the monitoring participants. A volunteer water quality monitoring program guidance manual was produced as part of this task. This manual is provided in Appendix G. The Bushkill Stream

Conservancy also purchased a dissolved oxygen/temperature/conductivity meter to collect higher-quality data from Bushkill Creek and its tributaries.

1.4.7 Bushkill Creek Watershed Protection Plan

The development and implementation of a formal watershed protection plan is critical to the successful preservation and protection of the high quality water resources within the Bushkill Creek Watershed. Information about nonpoint source problem areas, the watershed monitoring plan, and ordinance reviews performed during this project were used to complete this Bushkill Creek Watershed Protection Plan. A GIS database has been created with raw layers provided by the Lehigh Valley Planning Commission, Pennsylvania Spatial Data Access (PASDA), and the Pennsylvania Environmental Council. This GIS database includes a nonpoint source problem area layer, an invasive plant layer, a watershed sign location layer, and a hydric soils layer. These maps are included in the Watershed Protection Plan, and were used to determine trends and document management needs within the watershed. Several of the maps were provided to the Bushkill Stream Conservancy for educational displays and presentations, and for use on their website.

2.0 Watershed Characteristics

The Bushkill Creek watershed encompasses 80 square miles of Northampton County, PA, stretching from Blue Mountain to the Delaware River in Easton, PA. The watershed begins near the mouth of the Lehigh River in Easton, Pennsylvania and extends north to the Appalachian Trail along the Kittatinny Ridge; and west from the Delaware River to Moore Township, Northampton County, Pennsylvania, as shown in Figure 2.1.

Bushkill Township is the largest municipality within the watershed, comprising approximately 50 percent of the total watershed area and nearly the entire watershed area of the main stem of Bushkill Creek. Other municipalities within the watershed include the townships of Plainfield, Forks, Palmer, Lower Nazareth, and Moore, along with the boroughs of Easton, Nazareth, Wind Gap, Tatamy, and several other smaller boroughs.



Bushkill Creek Watershed Northampton County, Pennsylvania

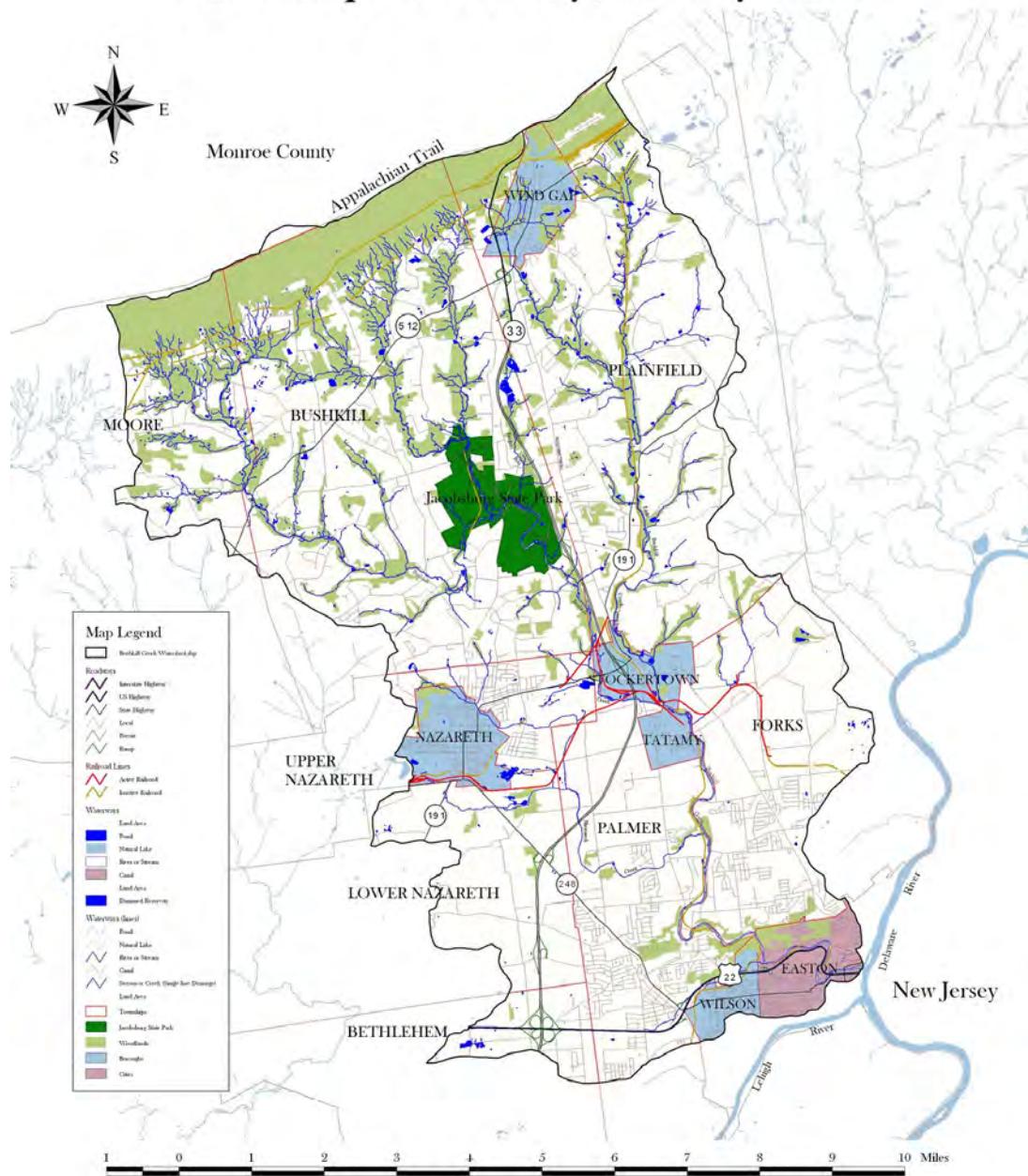


Figure 2.1

**Bushkill Creek Watershed Showing Political Boundaries
Northampton County, Pennsylvania
Northampton County GIS Mapping (L VPC, 2000)**

2.1 Water Resources

The water resources in the Bushkill Creek watershed are extremely important to the economy and well-being of the watershed residents. The many small and large streams are the central components of the Lehigh Valley ecology. The Bushkill Creek and its tributaries drain from the Kittatinny Mountains to the Delaware River, creating an interconnected web of greenways and unique natural areas. The various water features in the watershed are described in the following sections. A Glossary of Watershed Terms is provided in Appendix A.

2.1.1 Streams

The many small streams that form the beginning of Bushkill Creek originate at the base of Blue Mountain in northern Moore and Bushkill Townships. The mainstem of the Bushkill flows in a southeasterly direction through rolling farmland in Bushkill Township, passing through Jacobsburg State Park before entering the farmlands of Palmer and Forks Townships. The Bushkill eventually empties into the Delaware River just north of the Route 22 Bridge in Easton, a much more urbanized area than the upper watershed.

Four major tributaries join Bushkill Creek: Sober's Run in Bushkill Township, that drains the north-central part of the watershed; Little Bushkill Creek in Plainfield Township, that drains the northeastern section of the watershed; Schoeneck Creek in Nazareth and Palmer Townships, that drains the western portion of the watershed; and Spring Brook that drains a very small portion of the lower watershed in the City of Easton.

Bushkill Creek is classified as a High Quality Cold Water Fishery (HQ-CWF) stream. Groundwater recharge along the wooded slopes of Blue Mountain provides a critical source of high quality baseflow to the headwaters of the Creek in Bushkill, Plainfield, and Moore townships. The southern end of Bushkill Creek is stocked with brown and rainbow trout, while the northern end has a thriving population of native brook trout. The Little Bushkill, Spring Brook, and several other unnamed tributaries are also classified as HQ-CWF streams. The Little Bushkill is also stocked with brown and rainbow trout.



Sobers Run is currently classified as a HQ-CWF but investigations are underway to determine whether the classification may be upgraded to an Exceptional Value (EV) stream. In the lower basin,

Schoeneck Creek, a Warm Water Fishery (WWF) stream, is considered impaired due to impacts from a nearby quarry.

Areas that would most likely become flooded in a storm event of such magnitude that would only occur once in a hundred years are classified by the Federal Emergency Management Agency (FEMA) as 100-year floodplains. These riparian areas are especially sensitive to erosion when development and vegetation loss occurs. In the Bushkill Creek watershed, 100-year floodplains occur along the majority of Bushkill, Little Bushkill, and Schoeneck Creeks. An additional floodplain occurs in Forks Township that is not directly adjacent to a stream drainage.

2.1.2 Wetlands

Wetlands are most common in the Bushkill Creek watershed along the foot of the Kittatinny Mountains, although several other wetland complexes and vernal pools exist in the watershed. Many of these wetland areas are considered “Outstanding Natural Areas” based on a 1999 Natural Areas Inventory of Northampton and Lehigh Counties by the Pennsylvania Science Office of the Nature Conservancy. Knechts Ponds and Moorestown Wetlands, both in Bushkill Township, fall into that category. The Bushkill Creek watershed wetlands help to buffer the headwater streams from stormwater runoff while providing important wildlife habitat.

A variety of wetlands are found in the project area. Forested swamp communities include red maple, black ash, yellow birch, Eastern hemlock, black gum, winterberry, highbush blueberry, sphagnum mosses, sedges, skunk cabbage, cinnamon fern, and sensitive fern. Floodplain forests include silver maple sycamore, river birch, black willow, green ash, American ash, American elm, box elder, Northern spicebush, ninebark, silky dogwood, Virginia creeper, and poison ivy. Floodplains on smaller waterways include pin oak, swamp white oak, silver maple, red maple, ash sycamore, black walnut, spicebush, nettles, cut-leaved coneflower, wing-stem, jewelweed, and wildflowers. Vernal pools are topographic depressions with shallow standing water during the springtime that later dry-up during the dryer summer months, making them very critical breeding areas for many amphibian species. Such vernal pools are common along the foot of the Blue Mountain Ridge in the headwaters of Bushkill Creek. Graminoid marshes which are present but less common in the Bushkill Creek Watershed include cattails, sedges, rushes, and grasses.

2.1.3 Ponds and Impoundments

Unlike many larger watersheds in Eastern Pennsylvania, the Bushkill Creek Watershed does not include any lakes. Ponds are common, however, as would be expected in an agricultural landscape. There are also several run-or-the-river dams along Bushkill Creek which were historically used for milling and industrial operations. Many of these old run-or-the-river impoundments are now the focal point of public parks and recreational areas along Bushkill Creek. Most of the dams for these impoundments are in great disrepair and should be removed to restore the natural flow of Bushkill Creek and re-open the stream channel to migratory fishes which are believed to have once spawned in rocky substrate and cool, clean water.

2.1.4 Public Access

Interstate 78 is a major route providing access to the Bushkill Creek watershed from New Jersey and New York City to the east and Bethlehem, Harrisburg, and Allentown to the west. Other major roads in the watershed include State Routes 191, 512, 33, and 611. The Bushkill Creek watershed is easily accessible from urban areas such as Harrisburg (90 miles), Allentown (15 miles), Philadelphia (60 miles), and New York City (70 miles).

There are several areas of public access to the Bushkill Creek from the surrounding watershed:

- Jacobsburg State Park and Environmental Education Center: near Belfast, the park has an extensive network of streamside and upland trails open to hiking, biking, and horseback riding.
- Plainfield Township Bike Path: former rail line that follows the Little Bushkill Creek from Stockertown to Pen Argyl, with entry points off the Sullivan Trail in Stockertown, Gall Road in Belfast, and Route 191 at Edelman, among others.
- Palmer Rails-to-Trails: a former Conrail line along the mainstem, Edgewood Avenue to the Borough of Tatamy, with a side trail along the lower portion of Schoeneck Creek.
- Catch-and-Release Fishing Area: off Bushkill Drive, from Edgewood Avenue to the 13th Street bridge in Easton, accessible from the Palmer Trail.
- Bushkill Drive opposite Easton Cemetery: a future public access is planned for this site, given to the Bushkill Stream Conservancy by Lafayette College
- The Appalachian Trail: along the crest of Blue Mountain in State Game Lands 168, the trail marks the northern boundary of the Bushkill Watershed. Access from Smith Gap Road, about a mile northwest of the stream's headwaters near Bender's Junction, and off Rt 33 at Wind Gap
- Road rights-of-way: access to the Bushkill at a number of locations, including Bushkill Drive in Forks Township, Tatamy Road near Bushkill Park in Palmer Township, and an abandoned section of Filetown Road near Belfast, among others.
- Penn Pump Park: the site of an unsupervised "swimming hole" in Forks and Palmer; the area of Penn Pump downstream from the dam is popular with anglers.
- Metz Park: in Tatamy Borough, the park is located on the Bushkill.

- Newhart Park: the Little Bushkill Creek flows through the park in the Borough of Stockertown.

2.2 Land Resources

The Bushkill Creek watershed is located in Northampton County, Pennsylvania, in an area known as the Lehigh Valley, or “Two Rivers” area. The Bushkill Creek and Lehigh River both empty into the Delaware River on the eastern end of the Allentown-Bethlehem-Easton metropolitan area, which is the third largest metropolitan area in the Commonwealth of Pennsylvania. The land area of the Bushkill Creek watershed is varied, exhibiting different physiographic characteristics in the northern and southern portions of the watershed, as discussed below.

2.2.1 Topography

Two major sections of the Ridge and Valley physiographic province occur in the Bushkill Creek watershed: the Blue Mountain section and the Great Valley section. The Blue Mountain section occupies the northern edge of the watershed. The highest point in the watershed is Blue Mountain in northwestern Bushkill Township, rising 1,576 feet above sea level. The rest of the watershed lies within the Great Valley section of the Ridge and Valley Province, consisting of rolling terrain to the south of the mountains. The lower portion of the watershed is fairly flat, which historically has lent itself to agricultural land use. A very narrow band of land running in a northeast-southwest direction within Forks and Palmer townships is considered part of the Reading Prong Section of the New England Province. This strip is part of the very southern extent of the multi-state region known as “The Highlands.”

Steep slopes occur in a number of areas within the Bushkill Creek watershed. The most prevalent areas of steep slopes occur on the south slopes of the Kittatinny Mountains along the northern edge of the watershed, and in several areas along the Bushkill Creek. Human-made steep slopes along highway embankments and in quarries are common in the more developed areas in the southern end of the watershed.

2.2.2 Geology

Most of the upper half of the Bushkill Creek watershed is located in shale and slate geology. Blue Mountain is a generally flat-topped ridge of erosion-resistant sandstone and quartzite conglomerate. The lower half of the watershed is characterized by gently undulating hills underlain by carbonate geology (limestone and dolomite). The many carbonate springs help maintain cool water temperatures in the watershed streams throughout the summer, providing an excellent brown trout fishery.

Historically, the geology of the Great Valley physiographical region is suitable for raw materials. The shales of the Martinsburg geologic formation in the northern part of the watershed were used in slate manufacturing. The Jacksonburg formation, located in Nazareth Borough, is used for the

manufacturing of cement. The dolomites and limestones that underlie the southern portion of the Great Valley are of the Allentown formation, and are extracted as crushed stone.

2.2.3 Soils

Three main soil types occur in the Bushkill Creek watershed. Along the northern mountain ridge, soils are very stony and gravelly. South of the mountains, a band of shaly soil extends southward to Nazareth/Stockerton area. South of this area, bedrock is composed of various carbonate compositions and the overlying soils are deep, well drained, and of a moderately fine or medium texture. Sinkholes are common throughout, especially in the Stockertown/Tatamy area where the natural hydrology is believed to be greatly altered. Soils in this southern section are highly suitable for agricultural use and are more productive than the shaly soils that lie to the north.

A large concentration of hydric soils with broad areas containing both major and minor hydric components occurs along the entire base of Blue Mountain. Hydric soils are soils that are likely to be associated with wetland areas as their saturated and seasonally saturated conditions provide prime growing conditions for wetlands plant species and prevent the growth of many uplands species. These hydric soils areas are generally not well suited for on-lot septic systems or in-ground foundations, but there are many areas of upland inclusions where soils are suitable for building and development.

2.3 Land Use

The land use in the Bushkill Creek watershed varies greatly by region. Much of the upper half of the Bushkill Creek watershed is dominated by woodlands, agriculture, and low-density residential development. The wooded areas generally follow the streams (mainstem, Sober's Run, Engler Run, and Little Bushkill Creek), forming "greenways" from Blue Mountain to Jacobsburg State Park. These riparian corridors absorb rainfall and runoff, keep the streams shaded and cool, and provide important habitat for flora and fauna.

The lower half of the watershed has a decidedly different character. Former agricultural areas in the lower watershed are experiencing rapid commercial and residential development, while the southernmost area of the watershed in and around Easton has been suburban/urban/industrial for over a century. Several large cement quarries are located near the center of the watershed in the Nazareth/Stockertown area, and numerous abandoned dams from former water-powered mills are present along the lowest three miles of the stream.

2.4 Population and Growth Potential

Historically, the majority of the Bushkill Creek watershed consisted of large and small privately owned farms with very little forested land. What forested land that existed was primarily confined to wetlands, floodplains, and the steep slopes of the Kittatinny Ridge. However in recent years the mass conversion of these farmlands for residential, commercial, industrial, and institutional development has become a serious threat to the wetlands, ponds, and streams within this watershed. Within the

next few years the rate of development is expected to increase further following the connection of State Highway 33 to Interstate Route 78, a main artery to the New York City metropolitan area. Therefore, the Bushkill Stream Conservancy and other municipalities and groups are racing to implement watershed protection measures in the watershed.

Between the 1990 Census and the 2000 Census, the Bushkill Creek Watershed and the surrounding areas have experienced an extremely high rate of growth. The population of Upper Nazareth Township increased 29.7%, and increase of 1,013 people. Bushkill Township has increased 26.7%, and increase of 1,470 people. The other townships and boroughs in the watershed have experienced less dramatic increases in population, ranging from 2.6% to 7.2%, or 46 to 310 people. The following table summarizes growth rates in terms of population and housing units by municipality.

Table 2.1
Bushkill Creek Watershed
Growth Rates & Housing Increases

Municipality	2000 Population	1990 Population	Population Change	Percent Change	No. of Housing Units
Bushkill Township	6,982	5,512	1,470	26.7	2,406
Moore Township	8,673	8,470	255	3.0	3,464
Nazareth Borough	6,023	5,713	310	5.4	2,658
Pen Argyl Borough	3,615	3,492	123	3.5	1,506
Plainfield Township	5,668	5,444	224	4.1	2,191
Stockertown Borough	687	641	46	7.2	293
Tatamy Borough	930	873	57	6.5	356
Upper Nazareth Township	4,426	3,413	1,013	29.7	1,364
Wind Gap Borough	2,812	2,741	71	2.6	1,294

Data from the United States Census Bureau via the Pennsylvania State Data Center

The number of housing units has increased by over 10% in Northampton County. A significant portion of this increase has occurred in the Bushkill Creek Watershed.

2.5 Cultural and Historical Resources

The Bushkill Creek watershed has a rich cultural history, and every effort should be made to preserve existing cultural and historical resources within the watershed. The area was originally settled by the Lenape, who were part of the larger Algonquin Nation that once inhabited the Eastern US and Canada. The Lenape cleared large tracts of land for farming. The tribe was eventually forced from their ancestral lands after William Penn and his sons took ownership of the lands to the west of the Delaware. Although no Lenape archaeological sites have been formally identified in the Bushkill Creek watershed, artifacts such as arrowheads are often found, especially near waterways. Any sites that may be discovered in the future should be protected and preserved.



The Bushkill Creek watershed was traditionally made up of farming communities, many of which persist today

resources. None of the mills are currently in operation, but several of the old buildings still exist. Although the seven small dams along the Bushkill are no longer necessary and may be negatively impacting water quality, every effort should be made to preserve the buildings and cultural resources associated with the former mills.

As the industrial era began, the City of Easton grew at the confluence of the Delaware and Lehigh Rivers. Canals were established from Easton to Jim Thorpe and from Easton to Bristol to provide access to river corridors linking the timber and coal-producing regions to the north with the busy New York City and Philadelphia markets. The canals received less use and eventually ceased operation once the railroads were established along the river corridors, but the Lehigh Navigation Canal is now restored and operates as the Hugh Moore Canal Museum in Easton. During the late 19th and early 20th Centuries, the Lehigh Valley became a hub of industrial activity. Many mineral extraction operations, especially slate production, came into being, several of which are still in operation today. Although agriculture is still strong in the lower Bushkill watershed, many farms

Permanent European settlement began in the 1730s in the Bushkill Creek/Lehigh Valley area. German immigrants became the most prominent group. Many of the new settlers had been farmers in their home countries, and were therefore attracted to the fertile soils of the lower Bushkill valley. In colonial times, the Bushkill Creek and its tributaries were recognized for their power-generating abilities and many small dams and mills were built along the rivers. Iron forges, particularly the famous Henry iron furnaces used to make guns, were also built in the valley in order to take advantage of the water

ceased operation were sold when their workers moved to Easton and Bethlehem.

The population of the area declined during the 1950s as many of the old mills closed down. However, there are now large amounts of suburban growth in the region. While the population of Northampton County has increased by 50 percent since 1950, to accommodate this growth, every effort should be made to improve the quality of the natural resources, and revitalization of the historic buildings.

One important cultural site, the Jacobsburg Homestead, lies almost entirely within Jacobsburg State Park. Although the park was established in 1926, the district is now on the National Register of Historic Places. The park is a living history museum that depicts the life and times for all of our nation's major conflicts from the American Revolution to the Civil War.

The Henry Homestead, a stone house built in 1750, became the most prominent weapon of the western frontier due to its durability, accuracy, and relatively low cost. Only the foundations remain from the colonial village of Jacobsburg. The Jacobsburg Historical Society administers and operates the Henry Homestead within the park.



Historical and cultural resources such as this stone house at the Henry Homestead, should be preserved within the Bushkill Creek Watershed

A number of other cultural and historical structures, including homesteads, mills, bridges, and industrial sites, exist in the Bushkill Creek watershed, primarily in Easton and Nazareth. Many of these sites are either listed or eligible for National Register of Historic Places (NRHP) status. Four National Register listed Historic Districts fall within the Bushkill Creek watershed, including the College Hill Neighborhood in Easton, the Easton District, the Jacobsburg District, and the Nazareth District. Every effort should be made to preserve these sites, and to identify additional historic sites that may be eligible for NRHP status.

2.6 Management History and Prior Studies

A number of recent management initiatives have been implemented in the Lehigh Valley region that include or affect the Bushkill Creek watershed. Any future watershed planning should be consistent with existing plans and management initiatives. Although not a large volume of data or prior studies exist for the Bushkill Creek watershed, current projects should yield beneficial data in the future. Current initiatives and prior studies are discussed below.

2.6.1 Current Management Initiatives

Two Rivers Area Greenways Plan

The Two Rivers Area Council of Governments has produced the Two Rivers Area Greenway Plan (URDC, 2004) for consideration and implementation throughout the Bushkill Creek Watershed. This Plan outlines a mechanism for establishing conservation and recreation greenways throughout the Bushkill Creek and lower Lehigh River watersheds. These greenways will link recreational trails, protect headwater streams and other sensitive ecological areas, and provide for an increase in open space within the watershed. Each of the municipalities in the watershed is encouraged to adopt the

Greenways Plan through a formal resolution that is provided as an appendix to the plan. The Greenways Plan is discussed further in Section 5.1.2.

Official Maps

In 2004, Bushkill Township adopted a resolution to place riparian woodland greenways on their Official Map, which is an ordinance under Pennsylvania's Municipal Planning Code. This action provides the municipality with an effective and powerful planning tool to protect remaining riparian woodlands from new development. All development and other activities requiring municipal approval must include provisions that will preserve and protect the mapped riparian woodlands within the township. Protection may be afforded through a number of alternatives including, land purchase, conservation easements, dedicated open space as part of new development, deed restrictions on wooded areas of new lots, etc.

Other municipalities within the Bushkill Creek Watershed are encouraged to create or revise Official Maps to provide for similar environmental protection initiatives. Environmental protection is allowed as part of the Official Map, and this widely underutilized planning tool should be implemented wherever practicable. Specifically, the townships of Moore and Plainfield should consider adding riparian woodlands to their Official Maps, in similar fashion to Bushkill Township, as both townships contain appreciable tracts of riparian woodlands and similar development pressures.

Act 167 Stormwater Management Plans

The Pennsylvania Stormwater Act of 1978 (Act 167) created a stormwater management planning program is mandated, administered, and mostly funded by the state (75 percent share). Act 167 planning must be performed by the respective counties in a given watershed, and then adopted and implemented by the municipalities, a rather uniquely structured "sharing" of government authority and powers. The overriding goal of the Act 167 program is to maintain the watershed's "natural" or pre-development water balance to the extent possible and to prevent degradation of water quality through addition of nonpoint source pollution resulting from stormwater runoff (Cahill Associates, Inc. 2005).

The Lehigh-Northampton Counties Joint Planning Commission (JPC) completed the first Bushkill Creek Watershed Act 167 Storm Water Management Plan in 1992. The Plan is currently being updated. In addition, the Lehigh Valley Planning Commission recently updated the Act 167 Plan for the Little Lehigh Creek watershed. The Plan was adopted by Lehigh County in 2004. Each of the municipalities in the watershed is encouraged to adopt a similar Act 167 Plan. Stormwater planning is discussed in further detail in Section 5.3.1 of this Plan.

Bushkill Creek Corridor Redevelopment Plan

The Easton City Council is in the process of approving the Bushkill Creek Corridor Redevelopment Plan. The Redevelopment Plan identifies the Bushkill Creek Corridor's boundaries and establishes

allowed uses based on the city's zoning laws. The Plan also highlights seven properties that the Redevelopment Authority may purchase. The redevelopment Authority will eventually implement the Redevelopment Plan along 13th and North Third Streets. The Plan aims to spur economic development and improve access to natural resources such as the Bushkill Creek.

State Game Land 168

State Game Land 168 encompasses 5,644 acres in Plainfield, Bushkill, and Moore Townships at the northern edge of the watershed. The land is steep, forested open space terrain that is managed by the Pennsylvania Game Commission as whitetailed deer habitat for hunting. The gamelands abut the National Appalachian Trail. The area provides beneficial open space lands that protect the watershed's headwater streams.

Jacobsburg Environmental Education Center

Jacobsburg State Park is managed as a wildlife preserve and center for heritage and environmental education. The park occupies 1,168 acres in the center portion of the Bushkill Creek watershed. The park offers 18.5 miles of multi-use trails for hiking, mountain biking, cross-country skiing, and horseback riding. It is also used for picnicking, fishing, hunting, and wildlife watching. The Jacobsburg Environmental Education Center at the park offers environmental education programs from the preschool environmental awareness programs to high school level environmental problem solving programs, historical programs, teacher workshops and public interpretive programs.

The cultural, historical, and natural resources offered by this area are extremely important to the residents of Northampton County and surrounding areas. The park serves as a "hub" of recreational land in the Two Rivers Area Greenways Plan, and provides beneficial open space land.

2.6.2 Water Quality Studies

Within the Bushkill Creek Watershed, macroinvertebrate studies by Muhlenberg College and Lafayette College show that the tributary steams in the upper watershed are of much higher quality than those in the lower watershed. This is reflective of the differences in land uses, soil types, and topography in the upper and lower watershed areas.

Historical water quality data are presented and summarized within the new Access database developed as part of this project (see Appendix H).

2.6.3 Other Initiatives

Open Space Funds

Northampton County has also passed a \$37 million open space referendum, and several of the municipalities within the watershed are working on passing their own local open space referenda to use as leverage for matching funds against the county moneys.

PADCNR Pilot Project

The Bushkill Creek Watershed, as part of the Two Rivers Area for which a comprehensive Greenways Plan was recently completed, has become the focus for a new pilot project aimed at fully implementing the Greenways Plan. PADCNR has committed substantial financial and staffing resources toward this effort.

2.7 Challenges and Issues

The Bushkill Creek watershed is very diverse and presents a unique set of challenges to efforts to protect watershed resources. Probably the most serious challenge is the rapid pace of development within the watershed. The recent connection of Rt-33 and I-78 will further increase development pressure in the upper watershed. Development increases the amount of impervious surfaces in a watershed, which not only increases the amount and velocity of stormwater runoff, but also reduces groundwater recharge. Stormwater runoff carries nutrients and sediments to surface waters, which can negatively affect water quality. Site development can lead to siltation problems if proper erosion control methods are not followed, and development along streams can damage stream buffers. In addition, increased development can also lead to an increase in nonpoint source pollution via fertilizer use, wastewater discharges, and household and commercial chemical contamination.

Although the water quality in the upper Bushkill Creek watershed is generally quite good, the same cannot be said for the lower watershed downstream of Stockertown. Two tributaries are formally listed as Clean Water Act Impaired Streams (303d list) due to wastewater and quarry discharges, and monitoring efforts have periodically documented high nitrates, sediments, and conductivity, and poor macroinvertebrate diversity near Easton. Bushkill Creek has the dubious distinction of having the worst water quality at its mouth of all lower Delaware tributaries surveyed by Delaware River Basin Commission in its recent report “Lower Delaware Monitoring Program: 2000-2003 Results and Water Quality Management Recommendations.”

Quarry discharges containing fine sediment and sinkhole activity between Stockertown and Tatamy are major problems in the watershed. Invasive plant species invading riparian and other natural areas and displacing native species also present an imminent concern.



Streams in the Bushkill Creek watershed should be protected from the negative effects of increasing development

3.0 Watershed Pollutant Sources

3.1 Point Sources

Due to relatively good, suitable soils for on-lot septic systems throughout much of the Bushkill Creek Watershed, centralized wastewater treatment facilities have been confined largely to the more densely populated urban areas. Fifteen housing units in Bushkill Township are hooked into the Nazareth Sewer and approximately ten businesses are hooked into the Wind Gap Sewer (Secretary, Bushkill Township).

Nazareth Sewage Treatment Plant is a sequencing batch reactor plant that provides treatment for Nazareth Borough and Upper Nazareth Township, as well as a few other areas in neighboring municipalities. Pen Argyl Sewage Treatment Plan provides service for Pen Argyl Borough. Wind Gap Sewage Treatment Plant is a sequencing batch reactor secondary sewage treatment plant what serves Wind Gap and Plainfield. The Easton Sewage Treatment Plant provides service for Palmer Township; however, most of the population lives outside of the project area. The following table summarizes the point source burden and population served within the Bushkill Creek Watershed.

Table 3.1 Point Sources in the Bushkill Creek Watershed			
Sewage Treatment Plant (STP)	Municipality	Sewage Treatment Flows (MGD)	Population Served
Nazareth STP	Nazareth Borough	0.64	5,713
	Upper Nazareth Township	0.07	1,420
Pen Argyl STP	Pen Argyl Borough	0.62	3,492
Wind Gap STP	Wind Gap Borough	0.49	2,741
	Plainfield Township	0.12	167
Easton STP	Palmer Township	1.01	14,018

Data for the Joint Planning Commission of Lehigh and Northampton Counties (1995)

Bushkill Township was identified by the Joint Planning Commission of Lehigh and Northampton Counties in a 1995 document as having potential on-lot sewage disposal problem areas. These areas include: scattered sites along Moorestown Road (Rt. 512) from Plainfield Township west to Keller Road; Bushkill Acres along Cherry Hill Road from Clearfield Road west to Hahn Road; and Cherry Hill around Bushkill Center Road at the intersection of Henry and Cherry Hill Roads.

Plainfield Township was identified for potential on-lot sewage disposal problems at Belfast along Sullivan Trail (Rt. 115) from Bangor Road (Rt. 191) north to Fulmar Road; Rasleytown surrounding intersections of Rasleytown, Benders Church, and Bookshelf Roads; Edelman along Bangor Road (Rt. 191) between School Road and Bookshelf Road; and West Pen Argyl southside of Pennsylvania Avenue (Rt. 512) from Wind Gap to Pen Argyl.

Upper Nazareth Township was identified as having potential sewage treatment problems in Christian Springs at the southeast corner of the intersection Daniels Road (Rt. 946) and Bath Pike (Rt. 248).

Point source discharge impacts from unknown sources and treatment processes have also been discovered through water quality monitoring efforts by local universities within the stretch of Bushkill Creek that flows through the City of Easton prior to emptying into the Delaware River. There are continuing efforts to identify the source and nature of these discharges.

3.2 Nonpoint Sources

Sixty problem areas were identified throughout the watershed. In general, the majority of the identified problem areas involved erosion, stormwater runoff, and inadequate stormwater erosion and sedimentation pollution controls. A surprising number of the problem areas were located within Jacobsburg State Park, including several areas where fishing access stabilization sites and streambank stabilization measures should be installed. All identified nonpoint source pollution problem areas were compiled in tabular and map format. A GIS data layer was created which included the location of each problem area, photographs of each site, a recommended BMP or retrofit to address the problem, and a cost estimate for each BMP. The table and a copy of the GIS map are provided in Appendix C. The information provided as a result of these investigations can be used to seek funding to construct and implement specific BMPs to address the problems noted. A discussion of funding sources is provided in Section 6 of this report.

The severe sinkhole problem that has developed in the middle portion of the watershed represents a serious impact on the water quality and quantity in Bushkill Creek. Sinkholes are not considered to be a nonpoint source pollution problem and the location of the sinkholes is just south of Bushkill Township. Therefore, this issue is not included in the watershed problem area assessment, but it is addressed as part of the watershed protection regulation audit. To date, a model Sinkhole Ordinance has been developed and presented to Palmer Township as necessary to address stormwater management issues for newly proposed development of large tracts that are within karst areas. The Sinkhole Ordinance has been provided to the Lehigh Valley Planning Commission, and will also be provided to the other watershed municipalities which contain karst areas.

A severe streambank erosion problem area was identified in Henry's Woods at Jacobsburg State Park prior to the initiation of this project. The problem area is currently being corrected through design, permitting, and construction funds provided through Pennsylvania's Growing Greener Program. The construction will be completed during late spring of 2005. A prior Growing Greener Grant awarded to the Bushkill Stream Conservancy (sponsored by the Northampton County Conservation District) was recently completed which upgraded NPS controls at four large farms with the upper portion of the Bushkill Creek Watershed.

4.0 Management Recommendations and Strategies

The protection and management of the Bushkill Creek watershed can be outlined in four general management goals:

1. Control and manage development,
2. Control and manage invasive species,
3. Control and reduce nonpoint source pollution, and,
4. Restore natural stream flows.

Specific strategies for accomplishing these management goals are outlined in the following sections. An Action Plan for implementing the Bushkill Creek Watershed Protection Plan is provided in Section 6.2.

4.1 Control and Manage Development

The protection of the Bushkill Creek watershed is a priority for the Bushkill Creek Stream Conservancy and its various partners. The conservancy must work to control and manage new growth in the watershed. This task is critical to protect the water quality of the creek. The demand for new development and housing is high, but there are many areas of publicly-protected lands exist within the watershed that are not suitable for development. Growth management includes the use of a variety of strategies including ordinance development, zoning, and comprehensive planning.

4.1.1 Ordinance and Comprehensive Plan Development

The zoning ordinance, subdivision and land development ordinance, and comprehensive plan are the three major documents that define and implement municipal land planning under the Pennsylvania Municipal Planning Code.

Code. The Bushkill Stream Conservancy should work with the watershed municipalities to update and improve their ordinances and comprehensive plans to regulate development in a manner that protects and conserves water resources.

A list of ordinance recommendations and deficiencies for each watershed Township, as well as a framework for adoption, is provided in Appendix B.

A major recommendation that arose from the ordinance audits was the recommendation that Bushkill Township replace its current Weed Ordinance with a Natural Landscape Ordinance and a Noxious



Smart growth principles should be used to control and manage development in the Bushkill Creek watershed

Weed Ordinance (also provided in Appendix B). The current weed control ordinance inhibits the natural management of stormwater and has negative implications in terms of protecting natural communities and natural hydrology. The ordinance currently requires that lots be free of weeds or plant growth in excess of 10 inches, except trees and shrubs, unless the land is used for gardens or agriculture. Natural vegetation, such as tall grasses, forests, and scrub/shrub communities, provides habitat for wildlife, reduces stormwater runoff, buffers noise, and provides scenic views. The combination of the proposed Natural Landscape and Noxious Weed Ordinances promotes the use and un-manicured growth of native plants, while requiring that noxious weeds be removed or controlled to prevent their spread and damage to adjacent properties. These ordinances allow for mowing and landscaping, but encourage growth of native plants in back and side yards, particularly on sites near natural areas (i.e. near Jacobsburg Environmental Education Center).

The Bushkill Stream Conservancy should work with the various watershed municipalities to ensure that their existing and future ordinances and plans are being implemented properly. Developing progressive and well-designed planning documents is futile if they are not well implemented. Ordinance definitions must be clear, concise, and accurate for ordinances to be effective. All environmental regulation definitions should be checked and revised as necessary. Particular attention should be given to the definition of “wetlands” and “waters” as well as methodology for their delineation.

4.1.2 Greenways Planning

In September 2004, the Two Rivers Area Council of Governments released a draft version of the “Two Rivers Area Greenway Plan.” The Two Rivers Area includes the entire Bushkill Creek watershed, as well as the lower portion of the Lehigh River watershed. The document is intended to serve as comprehensive plan for preserving the connectivity of the open spaces around the natural features in the Two Rivers area. The goal of the Plan is to concentrate new development in existing developed areas, and to restore and protect open space areas around the rivers, lakes, and ridges as interconnected, undeveloped “greenways.” The Plan employs a “hub and spoke” concept, wherein Jacobsburg Environmental Education Center serves as a hub, or concentrated recreation area, with multiple spokes (river corridors and mountain ridges) connecting other recreational areas. Using this concept, headwater areas and riparian buffers will be preserved, recreational opportunities will be enhanced within the watershed, sustainable growth patterns will be established, and watershed protection education opportunities among watershed residents will be increased.

Each of the municipalities in the Bushkill Creek watershed should pass a resolution to adopt the Two Rivers Area Greenway Plan. The Plan will only be effective with widespread participation, since the connectivity of greenway areas in neighboring municipalities is critical for the success of the program. The Greenways Plan includes an action plan and information on potential funding sources for the implementation of the plan.

In 2004, Bushkill Township adopted a resolution to place riparian woodland greenways on their Official Map. This action provides the municipality with the first option to purchase greenways lands or to direct development should the lands become available for development or subdivision. Each of

the municipalities within the Bushkill Creek watershed should include similar greenways planning on their Official Maps.

4.1.3 Targeted Land Acquisition and Preservation

Targeted land acquisition and protection involves working with private landowners to acquire or protect land through deed restrictions and conservation easements. Targeted land acquisition is a powerful companion to protecting lands through municipal land planning. The Heritage Land Conservancy and Wildlands Conservancy have land holdings in the watershed, and several of the municipalities (Forks, Moore, Palmer) have designated open space conservation lands. Despite active land conservation efforts by many groups, additional land acquisition is needed in several key areas, such as along the Sobers Run riparian corridors, Moorestown Wetlands, Rissmillers Woods, and Knects Ponds.

The Bushkill Stream Conservancy should continue working with land trusts and conservation organizations, municipalities, and county planners to establish and refine land acquisition and protection targets, develop relationships with key landowners and acquire addition lands in critical areas. To protect water resource quality, the Two Rivers Area Greenways Plan should be used by the Bushkill Stream Conservancy and land trust partners to identify critical land protection targets.

With regard to the selection of specific parcels, the following targets should be considered:

- Acquire lands that are particularly susceptible to development because of market pressures, existing zoning, and land characteristics.
- Focus on acquisition of large land parcels rather than many small parcels.
- Acquire land in headwater and riparian areas.
- Specific efforts should be directed to engaging the major landowners in the watershed in permanently protecting the land that falls within the greenways areas outlined in the Two Rivers Area Greenways Plan.

4.1.4 Outreach to Developers

An important and often overlooked tool for managing development is to form collaborative relationships with developers that encourage the use of new technologies to improve stormwater management, reduce ecological disturbance, and protect natural landscape features. This collaborative approach invites developers to become active partners in the conservation of the essential features of the watershed.

To facilitate this process, the Bushkill Stream Conservancy should periodically sponsor a developer's roundtable. The roundtable would be professionally facilitated and would allow a dialogue between area developers, planners, natural resource professionals, and other stakeholders concerning ways that these groups can work collaboratively to achieve common and individual goals.

The Conservancy should also create a developers certification program that would require developers to undergo a training program in low-impact development techniques and a commitment to protect and respect critical natural resources. The certification program could provide marketing and branding appeal to developers looking to distinguish themselves among consumers and municipalities.

4.1.5 Land Protection Public Education and Outreach

Public education and outreach is a key aspect of building broad support for land protection. The Bushkill Stream Conservancy should continue to work to build public awareness and support for growth management programs. The Conservancy should undertake the following actions to advance this goal:

- Coordinate with local realtors to distribute educational "Welcome to the Watershed" materials to new home buyers and renters,
- Update additional education materials to the Conservancy web site to explain specific growth management and land conservation efforts,
- Produce and distribute a "Landowner's Guide to Conservation in the Bushkill Creek Watershed" brochure to major landowners within the watershed,
- Write articles for local and regional newspapers, newsletters, township bulletins, web sites and other mass media about the Conservancy's sustainable growth efforts,
- Maximize media coverage for land acquisition and conservation activities through the use of press releases and ground-breaking ceremonies, and
- Conduct surveys and key person interviews to determine the public's perceptions about threats to the natural and scenic character of the watershed, as well as the loss of open space. The findings should be publicized in order to encourage public

education and outreach efforts that advance open space, growth management, and conservation efforts.

4.2 Control and Manage Invasive Species

Controlling and managing invasive species is a significant management goal in the Bushkill Creek Watershed. Invasive plants are usually non-native plants that have no natural enemies. These invasive species overrun the communities into which they are introduced. Only about 10 percent of introduced plants become invasive, but once these plants become established, they are difficult to eliminate. Invasive species alter the natural ecology of an area by outcompeting and eliminating native species. In the Bushkill Creek watershed, the management of populations of purple loosestrife, Japanese knotweed, multiflora rose, tree-of-heaven, garlic-mustard, bush honeysuckle, Japanese barberry, and common reed have been identified. If left unchecked, these populations could dramatically and irreversibly impact thousands of acres of upland, wetland, and riparian habitats.

4.2.1 Invasive Species Educational Programs

Educational programs are offered through Jacobsburg Environmental Education Center and the Bushkill Stream Conservancy, with additional training available locally through The Nature Conservancy office in Long Pond. Bushkill Stream Conservancy has developed a powerpoint presentation and has held public seminars to educated the general public about invasive plant species, their respective impacts, and their management.

4.2.2 Removal and Management

Currently, there is no active management program within the Bushkill Creek Watershed. This is a major recommendation of this plan. Management efforts have been undertaken at Jacobsburg State Park and the Graver Arboretum where there is a special focus on maintaining native plant assemblages. Additionally, some citizens have implemented management and control practices on their own private property to eradicate unwanted invasive, exotic species.



Japanese knotweed along a Bushkill Creek watershed stream

The Bushkill Stream Conservancy and The Nature Conservancy are both in the process of developing invasive plant management programs. These programs should focus on the most highly environmentally sensitive areas such as Moorestown Wetlands, Rissmiller Woods, and Knechts Ponds, but should also include all other watershed areas as part of a comprehensive management strategy to control the introduction and spread of invasive and exotic plant species.

4.2.3 Monitoring Program

The Bushkill Stream Conservancy has developed an invasive and exotic species monitoring program that integrates Global Positioning Systems (GPS) locating of sites with their new Geographic Information Systems (GIS) database. This program is still new, but has proven to be highly effective as a tool for mapping and monitoring invasive species. The GIS allows excellent mapping that is tied to data regarding species, aerial coverage, suggested control methods, and photographs of the sites.

Monitoring is also recommended to gain long-term control, as most of the species that are treated will require several growing seasons worth of treatment efforts to gain full eradication. Monitoring results should be included in the GIS database to allow for more efficient and effective cataloguing of efforts and successes.

4.3 Control and Reduce Nonpoint Source Pollution

Nonpoint source pollution (e.g. sediment and nutrient loading) from existing agricultural, residential, commercial, and industrial development within the watershed is negatively impacting some of the waterbodies within the Bushkill Creek watershed. Nonpoint source Best Management Practices (BMPs) should be implemented to reduce existing sources of nonpoint source pollution in the watershed. These BMPs include:

- Stormwater management at residential, commercial, and industrial sites
- Management of agricultural runoff from farm fields and barnyards
- Road and trail maintenance to reduce erosion
- Site development erosion and sedimentation control
- Streambank and shoreline stabilization
- Riparian buffer restoration and protection
- Wastewater management
- Watershed education

These measures should be implemented only at sites where significant, low-cost pollution reduction can be reliably achieved. The most effective BMPs are those that offer public participation and education opportunities. The specific nonpoint source problem areas discussed in Section 3.2 of this Plan should be targeted first. A prioritized Action Plan for BMP implementation is provided in Section 5.2.

4.3.1 Stormwater Management

Stormwater runoff from forested, agricultural, and developed areas contains high concentrations of sediments, nutrients, and other pollutants. Development activities result in increased impervious surfaces. This leads to an increase in both the amount and velocity of stormwater, and causes higher rates of erosion. Historically, stormwater management has focused on reducing the frequency and severity of downstream flooding by reducing the peak discharge from post-developed sites. This was typically achieved by storing water in large detention basins that offered little treatment. More recently, stormwater management has been redefined to include the removal of pollutants, thereby improving and protecting the quality of downstream waters. Increasing groundwater recharge by increasing stormwater infiltration is another important stormwater management goal. Innovative stormwater BMPs focus on stormwater infiltration to achieve flood control while removing pollutants and recharging groundwater.

Urban Stormwater

A significant amount of developed land exists in the Bushkill Creek watershed, especially in the southern part of the watershed. Beginning in March 2003, as part of Phase II of the National Pollutant Discharge Elimination System (NPDES) storm water program the US EPA required both large and small municipal separate storm sewer systems (MS4s) to implement a storm water management program as a means to control polluted discharges from these MS4s. The NPDES Phase II regulation requires that each affected MS4 incorporate the following stormwater Minimum Control Measures (MCMs) into their normal operations to reduce nonpoint source pollutants from stormwater runoff:

1. Public education and outreach
2. Public participation and involvement
3. Illicit discharge detection and elimination
4. Construction site runoff control
5. Post-construction runoff control
6. Pollution prevention and good housekeeping

The installation of stormwater BMPs will help the MS4 municipalities within the Bushkill Creek watershed to comply with the new EPA Stormwater Phase II regulations. Recommendations for addressing minimum control measures can include such activities as public education programs, storm sewer stenciling, identification of potential BMP retrofit areas to improve stormwater quality, or an effective street sweeping program. During the watershed investigations, several commercial establishments were identified that had large parking lots. Such large impervious surfaces should be retrofitted with stormwater BMPs to reduce runoff and filter pollutants. The approximate cost to retrofit the existing identified urban stormwater problem areas in the Bushkill Creek watershed is \$103,000, as shown in Appendix C.



Buffer strips, bioretention areas, or other stormwater controls should be used to break up large impervious surfaces such as parking lots

Structural and non-structural stormwater management controls should be encouraged for new development in the Bushkill Creek watershed. The following structural and non-structural management controls are designed to decrease runoff, erosion, and subsequent water quality problems: stormwater ordinances, retention basins, detention basins, bioretention systems, sand filters, infiltration trenches, constructed wetlands, grassed waterways, vegetated swales, and filter strips. In developed areas, stormwater management should primarily focus on urban stormwater controls such as sand filters, water quality inlets, bioretention systems, and infiltration

structures. These stormwater controls do not require vast areas of land, and therefore can be integrated into existing urban settings. In areas of future development or redevelopment, stormwater management controls such as infiltration basins, extended detention basins, constructed wetlands, and buffer strips should be constructed or implemented. These stormwater control measures typically require larger tracts of land and therefore should be incorporated or designed as part of the land development planning process.

If an existing commercial establishment changes ownership and the new owner needs approvals from the local municipality, local ordinances should be in place to require improving stormwater runoff quality from the site before approvals are granted. Possible stormwater quality treatment systems that could be installed on a developed property include sand filters, peat filters, or bioretention systems. The purpose of these systems is to treat stormwater runoff from parking lots and roads. These systems are installed to treat the first 0.5 inches of stormwater runoff, which is commonly called the “first flush.” One inexpensive way commercial establishments can reduce runoff and improve stormwater quality is to cut breaks into their curbs, or remove the curbs altogether, allowing stormwater to run off the parking lot and into adjacent vegetated areas or grassed swales.

In addition to urban stormwater BMPs, opportunities to reduce stormwater in suburban and rural areas should be pursued. Watershed homeowners should be encouraged to direct roof runoff to dry pits or rain barrels to reduce the amount of stormwater that enters the lake. Using a rain barrel or cistern gives the homeowner the advantage of water use reduction by storing rain water for watering gardens or lawns during dry periods. Homeowners should be educated about the benefits of planting attractive rain gardens on their properties to increase infiltration and groundwater recharge.

Stormwater Ordinances and 167 Plans

The Pennsylvania Department of Environmental Protection has mandated that all municipalities within the Bushkill Creek Watershed have adopted updated Act 167 Stormwater Management Plans by the summer of 2005. These plans will help to control flooding caused by increased development and will also help to improve water quality by requiring water quality Best Management Practices as part of stormwater management plans. The Lehigh Valley Planning Commission (LVPC) has developed a model Act 167 plan that meets the regulatory requirements of the federal National Pollution Discharge Elimination Systems (NPDES) regulations and has passed this new plan along for use by all municipalities within the Lehigh Valley, as well as other municipalities across the Commonwealth. LVPC is also working on a revised Act 167 plan specifically for the Bushkill Creek Watershed. This new plan will represent the most effective, watershed-wide stormwater management planning for the Bushkill Creek Watershed and should be adopted immediately upon release by all municipalities within the watershed.

Agricultural Management

Nonpoint source pollution from agricultural runoff is a source of nutrient (phosphorus and nitrogen) and sediment loadings to Bushkill Creek and its tributaries. Pollutant loadings from agricultural land uses can be reduced by the implementation of both traditional and innovative agricultural best management practices.

According to the watershed investigations performed during this study, an estimated \$68,000 would be required to install agricultural BMPs at two different problem area sites in the Bushkill Creek watershed. Limited access to private lands and farms during the field investigations in this study made it difficult to identify specific agricultural problem areas and BMP needs on private land. The Bushkill Stream Conservancy should work together with the Northampton County Conservation District, Natural Resources Conservation Service (NRCS), Delaware Riverkeeper, and other conservation organizations to educate and encourage more farmers to adopt nutrient management plans and install BMPs on their land.



Bushkill Creek watershed farm in need of erosion control measures and riparian buffer to protect tributary stream (bottom right)

Nutrient management and conservation management plans are a high priority and should be developed for all farms within the watershed. Nutrient Management Plans and Conservation Management Plans are especially important on farms that produce or receive manure, particularly concentrated animal feeding operations (CAFOs). Spreading, injecting, or incorporating manure on cropland is a significant source of nutrients to lakes and streams, especially immediately prior to or during the growing season when algae growth potential is the highest. Proper manure management, through the implementation of a nutrient management plan, is essential for improving water quality.

Agricultural BMPs should be implemented throughout the Bushkill Creek watershed. Each agricultural BMP targets a particular problem. A number of BMPs are designed to prevent erosion occurring on cultivated land. These BMPs include: contour stripcropping, cover cropping, and pasture and hayland management. Contour stripcropping combines farming with field stripcropping. Contour farming involves plowing, planting, and cultivating along topographic contours; whereas, field stripcropping involves farming alternating strips of cultivated crops and grasses or legumes. Cover cropping is the planting of grasses or legumes for seasonal protection against erosion. Pasture and hayland management refers to the establishment or re-establishment of perennial native forage plants. Pasture and hayland management can include reseeding areas that are 30 to 40 percent bare.

Integrated pest management is a BMP designed to reduce pesticide use. With integrated pest management, a variety of pesticide alternatives are used including biological controls such as the introduction of natural enemies, habitat diversification, and the use of disease- and pest-resistant plants. Pesticide and fertilizer application, when necessary, is timed to coincide with specific weather patterns and conditions for optimum efficacy. Soil testing and plant analysis help prevent crop over-fertilization by allowing farmers to determine how much fertilizer is needed for successful crop production. Local Cooperative Extensions, such as the Penn State Cooperative Extension Service, can test soil and plant material for nitrogen and phosphorus to determine appropriate fertilizer application rates. Farmers within the watershed should be made aware of this service and encouraged to contact the Cooperative Extension Service.

Manure management is another important agricultural BMP for protecting water quality. Manure management can include manure sampling, calibrating manure spreaders, and manure storage facilities. Manure sampling involves testing manure to determine nitrogen and phosphorus content. This information is important for developing nutrient management plans. Calibrating manure spreaders involves applying a measured amount of manure by determining the specific application rate of the manure spreader. Manure storage facilities are structures used to store manure to protect waterways from nutrient contamination. During the watershed investigations, several opportunities for manure storage facilities were found.

Livestock Management can prevent erosion and water quality degradation by maintaining adequate land-to-livestock ratios, maintaining productive forage, rotating grazing, locating feeders away from streams and lakes, limiting livestock access to streams using fencing, and planting riparian buffer strips. One of the watershed problem areas identified during the watershed investigations involved streambank erosion where cows and horses were not fenced out of the stream.

Planting riparian buffers around streams is probably the most important BMP for protecting water quality in watershed streams. Riparian buffers filter contaminated runoff and prevent nutrients and sediments from entering the water. However, in many cases, landowners may be unwilling or unable to create large riparian buffers or dedicate viable farmland for best management practices. One other option is critical area planting, which involves planting native vegetation in areas prone to erosion. With this BMP, efforts are focused on smaller but more critical areas.

The Conservation Reserve Enhancement Program (CREP) is a voluntary program that pays participants to plant hardwood trees or establish grass filter strips, riparian forest buffers, vegetation, and other conservation practices on environmentally sensitive land. Currently, the local NRCS office assists property owners in the Bushkill Creek watershed to gain enrollment in the CREP program. The Northampton County Conservation District should encourage more property owners to enroll in the CREP program and to install additional BMPs on their properties.

4.3.3 Road and Trail Maintenance

Roads can have a negative impact on the natural community in watersheds. Roads change the hydrology of the watershed by redirecting water from its otherwise natural flow patterns. Roads increase nonpoint source pollution by increasing the amount of impervious surfaces, thereby preventing infiltration of stormwater into the ground. Roads also create an unnatural disturbance that promotes the growth of invasive plant species. Sediment washing from dirt and gravel roads is a significant source of nonpoint source pollution in rural areas such as the northern part of the Bushkill Creek watershed.

Traditional thinking in road maintenance has been to get water off of the roads and into low-lying areas such as streams by the quickest means possible. However, this results in excess nutrients and sediment entering streams. Inadequate drainage structures such as culverts can cause downstream erosion. Several instances of roadside erosion and sediments entering streams via damaged or inadequate drainage structures were evident in the Bushkill Creek watershed during watershed investigations. All watershed roads should be graded and the road edges well vegetated.

Pennsylvania's Dirt and Gravel Road Pollution Prevention Program is a water pollution abatement program that offers local municipalities special funding and technical support to repair, manage and maintain their dirt and gravel roads in environmentally safe ways. The program is administered through County Conservation Districts and local Quality Assurance Boards. The relatively few dirt and gravel roads in the watershed should be properly maintained so that sediment does not enter the waterways. The Northampton County Conservation District has already begun improving dirt and gravel roads within the watershed through this program, and that work should be continued and expanded. The PA State Conservation Commission and Center for Dirt and Gravel Road Studies periodically hold Environmentally Sensitive Maintenance training courses, which include modules on drainage, road maintenance techniques, erosion prevention and sediment controls, bank stabilization, roadside vegetation management, and grant procedures. Municipal highway crew

members that are responsible for maintenance of dirt and gravel roads in the Bushkill Creek watershed should be encouraged to attend the training courses.

Road and highway maintenance is important in this watershed since many roads, including State Routes 22 and 33, run adjacent to Bushkill Creek and its tributaries. Many smaller roads are within the direct drainage areas of these water bodies. A number of roadside erosion sites were documented during the watershed investigation studies for this project. These sites are listed in Appendix C, and should be repaired using methods such as grassed swales, riprap swales, bank stabilization, bioengineering techniques, level spreaders, and other methods. Roadside swales should be properly maintained and should always be immediately stabilized if they are disturbed. Properly sized culverts at stream crossings and under driveways and cross streets are imperative, as well as adequate roadside drainage structures. Emergency procedures should be established to handle accidental spills such as cargo fuel or other materials. The use of ice melting materials, such as calcium chloride and magnesium chloride, is necessary on occasion to ensure safe driving conditions. These chemicals should be used only when necessary and only in amounts required to provide effective results.

The total estimated cost to repair all the roadside erosion sites listed in Appendix C is approximately \$15,500. This could be accomplished by applying for funding to repair whole stretches of road, or sections of the watershed through the Dirt and Gravel Road Pollution Prevention Program or the Growing Greener Grant Program.

Many of the same principles that apply to dirt and gravel road maintenance also apply to trail maintenance. Eroded soils and pet waste on riverside trails can contribute significant amounts of nutrients and sediments to surface waters. The trails within the Bushkill Creek watershed, especially in Jacobsburg State Park, should be maintained and inspected annually for erosion problems. Many trail erosion and streambank stabilization problems along trails in Jacobsburg State Park were identified during the watershed investigations for this project, as listed in Appendix C. General trail repair costs total \$9,000, with additional streambank stabilization costs totaling \$105,100. This includes several stabilized fishing access sites that would reduce foot traffic along the streambanks in popular areas.

Jacobsburg State Park staff, along with groups of local trail users, should maintain and improve the trails in the park in order to improve access to the area. Greater accessibility will likely breed



Eroded trail in need of stabilization in the Bushkill Creek watershed

increased interest in preserving and protecting Bushkill Creek and its tributaries. Trail users should be educated via signage or information on trail maps about ways to protect trails from erosion. Trail improvement options include installing water bars or check dams, providing better trailside drainage structures, including boardwalks or bridges over wet areas or ephemeral streams, limiting trail access during certain times of the year, re-routing damaged trails, and covering trails with natural materials such as wood chips. American Trails, a nonprofit organization working on behalf of all trail interests, has some excellent trail maintenance information on their website at <http://www.americantrails.org/resources/ManageMaintain/>.

4.3.4 Site Development Erosion and Sedimentation Control

Nonpoint source pollution from site development may be very significant during earthmoving and construction activities. The potential for soil erosion is very high until the site is stabilized with permanent vegetative cover, and is further heightened when soils are “highly erodible” or steeply sloped. Typically, large-scale development projects receive greater attention with respect to the installation and maintenance of proper erosion and sedimentation pollution controls. However, smaller construction projects such as single family residential sites in many cases lack proper erosion and sedimentation pollution controls.

Erosion and sedimentation pollution control plans are required for all earthmoving activities, large and small. Federal Phase II Stormwater regulations require any project disturbing more than one acre of land to obtain an NPDES Permit. The County Conservation District reviews the erosion and sedimentation control plans for any construction projects that propose the disturbance of one or more acres of land to ensure their adequacy and subsequently enforce their proper execution. Smaller projects, although they do not require a federal permit, do require an adequate erosion and sedimentation control plan. However these plans are generally not reviewed. Enforcement of the activities at these smaller sites is more difficult due to the unsure timing of the actual earthmoving and the general lack of project information.

The Northampton County Conservation District currently regulates and enforces erosion and sedimentation control within the Bushkill Creek watershed. It is likely that the Conservation District will effectively enforce proper erosion and sedimentation pollution control for all large projects that require formal project review. The Conservation District should strive to inspect smaller projects to ensure



Sediment-laden stormwater runoff through an improperly installed silt fence

proper installation and maintenance of erosion and sedimentation controls. Local citizens and developers should be made aware of the erosion and sedimentation control regulations. Watershed residents should be made aware that site development or any earthmoving activities that lack or have inadequate erosion and sedimentation controls should be immediately reported to the Conservation District. Additionally, all municipalities should help with enforcement of implementation of erosion control plans by using building permits and certificates of occupancy as leverage to require proper plan implementation.

4.3.5 Streambank and Shoreline Stabilization

Streambank erosion is one of the major sources of nonpoint source pollution in watersheds. Certain nutrients as well as many other “pollutants” adhere to eroded soil particles and are transported to the streams and downstream surface waters. During the watershed investigations, eroded streambanks were observed along the Bushkill Creek, Schoeneck Creek, Sobers Run, Little Bushkill Creek, and several smaller tributaries, as shown in Appendix C. It is likely that other areas of streambank erosion exist along the tributaries on private land that could not be inspected as part of this project. A more thorough evaluation of all streambanks in the watershed should be performed to locate and determine the magnitude of all streambank erosion problem areas within the watershed.



Severe streambank erosion such as this site at the Nazareth High School contributes significant amounts of sediments and nutrients to Schoeneck and Bushkill Creeks

Restoration of eroded streambanks is a cost-effective way to significantly reduce sediment and nutrient loadings to Bushkill Creek and its tributaries. By using bioengineering (vegetative) or a combination of bioengineering and structural engineering streambank stabilization techniques, the erosion problem can be corrected while the stabilized streambank can serve as a vegetative buffer and, in many cases, a restored riparian corridor. Riparian buffers along the streams will reduce the quantities of sediments and nutrients that enter the streams via stormwater runoff.

A variety of methods are designed to stabilize eroded streambanks and reduce continued erosion and sedimentation. Some methods reduce the amount and velocity of water in the stream, others involve relatively high cost structural controls such as rip-rap and gabions, and still others involve relatively low-cost controls such as willow twigs, grasses, shrubs, or wetland vegetation. Lower cost, bioengineering approaches should be used wherever practical to stabilize the severely eroded streambank areas noted on the nonpoint source problem area map. Where warranted, a structural stabilization element should be included in the

overall project design to ensure long term stabilization and to provide adequate protection against high streamflows and high flow velocities.

In addition to streambank stabilization projects, the Bushkill Stream Conservancy should work together with the Forks of the Delaware Trout Unlimited Chapter to install fish habitat structures in strategic areas of the watershed. Fish habitat structures can include boulders, logs, cribs, j-hook rock vanes, LUNKER structures, and others. Care must be taken when installing fish habitat structures, however, since when constructed improperly they can actually cause damage to streambanks. Fish habitat structures should always be designed and sited by a professional.

Streambank stabilization problems should receive a high priority for the implementation of watershed best management practices since sediment and nutrients are carried directly from the eroded site to downstream surface waters. Costs to install streambank stabilization measures at various problem areas are presented in Appendix C. The total estimated cost to install all streambank stabilization measures listed in Appendix C is \$308,100. This includes \$105,100 to restore streambank problem areas within Jacobsburg State Park. Streambank stabilization costs could be reduced by using volunteer labor for planting and construction. It may be easiest to address streambank stabilization one stream reach at a time in order to spread out costs over time.

4.3.6 Riparian Buffer Restoration and Protection

Adequately vegetated or buffered streams remove pollutants from stormwater runoff. In addition to pollutant removal, stream buffers reduce water temperature, maintain stream flow during dry seasons, stabilize streambanks, decrease erosion potential, provide valuable wildlife habitat, provide improved in-stream aquatic habitat, provide flood control, and enhance the natural landscape by providing visually appealing “green belts.” During the watershed investigations, several streams were identified



Bushkill Creek watershed stream in need of stabilization and riparian buffer restoration

were identified that had inadequate riparian buffers, as shown in Appendix C. Riparian buffers should be enhanced wherever necessary in the Bushkill Creek watershed. The total cost to restore riparian buffers at the two problem area sites is \$1,500. In addition, several of the streambank stabilization sites also need riparian buffers.

A permanent wooded buffer along all streambanks is the most desirable buffer to provide stable ground cover and shading of the stream channel. Warm season grasses should be planted to establish an effective temporary buffer until the more

permanent shrubby and woody buffer can become established. A narrow strip of warm season grasses should be maintained between the wooded buffer and any tilled fields to provide maximum filtration for agricultural runoff.

In addition, for both existing and new development, the protection, development, and enhancement of stream buffers should be encouraged. A riparian stream conservation ordinance should be adopted by all the municipalities in the Bushkill Creek watershed for this purpose. It is recommended that the Riparian Corridor Conservation District Model Ordinance developed by Montgomery County, Pennsylvania be modified and adopted for use in the Bushkill Creek Watershed. A summary of the model ordinance is provided in Appendix I.

4.3.7 Wastewater Management

Due to its rural nature, the Bushkill Creek watershed contains many on-lot septic systems. On-lot problems exist primarily where conventional septic leach fields were installed in areas of seasonal high and normal high water tables, shallow bedrock, and low permeability soils. In the Bushkill Creek watershed, watershed citizens should be educated about protecting their drinking water supplies from contamination. Decentralized wastewater systems should be considered whenever multiple on-lot systems are failing, or when wastewater infrastructure is being upgraded or replaced. Decentralized wastewater recommendations should be included in municipal ordinances, comprehensive plans, and Act 537 Plan revisions.

On-Lot Wastewater Systems

On-lot, or septic systems become a nonpoint source pollution problem when improper installation, siting, or maintenance leads to system failure and leakage of sewage into surface or groundwater. The Bushkill Creek watershed townships and boroughs should each develop and implement on-lot disposal system management programs. The programs should include pre-construction and construction guidelines to ensure properly designed and constructed on-site wastewater disposal systems. The program should also require standard pumping schedules and routine maintenance guidelines based on household size and septic tank size. The Township Sewage Enforcement Officer (SEO) would be in charge of implementing the program. A critical facet of the program should be public education campaign in the form of seminars and brochures to educate watershed residents and municipal officials about proper installation and maintenance of on-lot septic systems.

The identification of malfunctioning septic systems is a priority and should be implemented by property owners and SEOs with the assistance and encouragement of the Bushkill Stream Conservancy. Pinpointing exactly which systems are actually causing significant impairment is a challenge that continues to baffle many watershed managers and SEOs. Some common options for identifying septic system problems include:

- Using mailed surveys to ask residents about the age, condition, and maintenance of their septic systems,

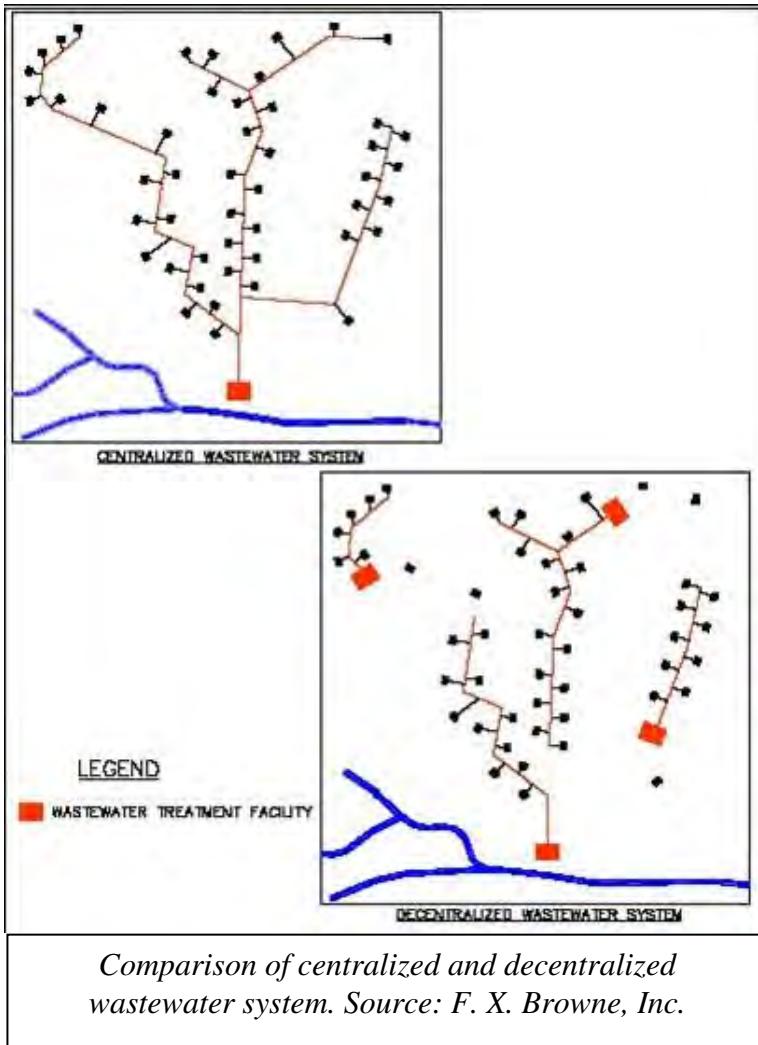
- Using dye tests and direct visual inspection to determine if specific septic systems are functioning properly,
- Using GIS analysis of soil type, building age, slope, and other “predictor variables” to predict likely areas that have septic malfunctions, and
- Reviewing permits for on-site treatment systems to identify potentially malfunctioning systems.

Using only one of these methods is usually insufficient to produce meaningful results. The Conservancy may want to conduct a preliminary GIS analysis to jump start this effort. The Conservancy should develop a generic guidebook or brochure that explains the various assessment options and provides suggestions for how to conduct a multi-phased septic system assessment program. The brochure should identify methods for financing on-lot system repairs and replacements. The brochure should also include the SEO’s contact information in case a malfunctioning septic system is suspected and needs to be reported.

Decentralized Wastewater Systems

A decentralized wastewater system is defined by the US EPA as “An onsite or cluster wastewater system that is used to treat and dispose of relatively small volumes of wastewater, generally from individual or groups of dwellings and businesses.” A centralized wastewater system uses gravity or pressure sewers to transport all of the wastewater in the area to one location for treatment and disposal, usually to a stream discharge.

As the need for upgrading larger wastewater treatment facilities is increasing and costs are rising, decentralized treatment options are becoming more and more attractive, especially in waterfront communities. In their report entitled “Response to Congress on Use of Decentralized Wastewater Treatment Systems”, the US EPA indicated concern about the gap between



wastewater needs and available federal-state funding. The report indicated the need to identify and implement alternatives to costly centralized treatment and collection systems. The conclusion of the EPA report states that “adequately managed decentralized wastewater systems are a cost-effective and long-term option for meeting public health and water quality goals.”

Decentralized wastewater disposal consists of a system of clusters. Wastewater from each cluster is transported to a smaller wastewater system for treatment and disposal. A decentralized wastewater system breaks up the service area into smaller clusters. Instead of one centralized treatment facility, there are two or more smaller, decentralized wastewater treatment facilities. The cluster treatment systems, being smaller due to the reduced cluster wastewater flow, may be on-site systems such as a mound, drip system, or spray irrigation system. It could also be a small package treatment plant that discharges to a stream.

There are several advantages to decentralized wastewater systems:

1. Decentralized systems usually do not promote uncontrolled growth like centralized systems often do.
2. Decentralized systems often are less expensive to construct and operate. They reduce the length of sewers needed and do not sewer unpopulated areas.
3. Decentralized systems, consisting of a series of smaller wastewater flows, have a greater potential for on-site disposal. Most centralized wastewater systems require a wastewater treatment plant with stream discharge because of the larger wastewater flows being treated.
4. If on-site treatment and disposal is feasible, decentralized systems, by using on-site soil disposal, provide better treatment, better meet EPA and DEP water quality antidegradation requirements, and recharge groundwater.

In existing communities located near sensitive environmental areas such as rivers, lakes, and wetlands, decentralized systems can offer distinct benefits. Waterfront communities often run into water quality problems when seasonal residences that were originally built on soils unsuitable for on-lot wastewater treatment begin to age and have septic system failures. In addition, waterfront homes are increasingly being converted to year-round residences whose wastewater systems are insufficient to treat the increased usage. Since waterfront real estate is usually at a premium, very little land and money may exist for the construction of a centralized treatment facility, so a series of smaller, decentralized systems may be the best option. Decentralized systems can be targeted toward clusters of homes with the most serious problems, leaving newer, well-functioning septic systems out of the loop.

There are, however, several disadvantages to decentralized wastewater systems. They usually require more up-front soils testing to locate suitable sites. They may also require slightly higher engineering

design fees. Although system maintenance is typically lower than a centralized system, it could be more complicated for multiple cluster systems.

Act 537 Plans

The municipalities in the Bushkill Creek watershed should develop or update the Act 537 Sewage Facilities Plans for their townships to ensure adequate wastewater planning for potential residential, commercial, and industrial development. All Act 537 Plans should contain an evaluation of wastewater needs. The Act 537 Plans should include a physical description of the municipal planning area, a description of current wastewater systems, an evaluation of wastewater treatment needs, an evaluation of alternatives, and recommended plans to address problem areas. The Pennsylvania DEP's Bureau of Water Quality administers the Act 537 program. The Act 537 program will provide fifty percent of the funding in order to complete a DEP approved wastewater facilities plan.

4.3.8 Watershed Education

Watershed education and public participation are important aspects of any watershed management or NPDES Phase II stormwater program. The development of environmental education programs designed for school-aged children and adults is an effective watershed management approach. Citizen involvement and practices benefiting the watershed should be publicized and encouraged. Positive practices include periodic septic system maintenance, stormwater management, recycling of yard wastes, safe storage and disposal of toxic materials, farm conservation management planning, timber management planning, environmentally sound recreation behavior, and proper lawn and yard maintenance. Citizens should also be discouraged from using invasive plant species in their yard or garden landscaping. Training citizens to recognize and remove non-native invasive species in the watershed can have a positive impact on the spread of noxious weeds.



Watershed residents should be educated about ways they can help reduce stormwater runoff and implement watershed protection measures on their own properties

An environmental education program was developed and implemented as part of the Bushkill Creek Watershed Protection Project. The program includes environmental education brochures, watershed protection workshops, and stream and watershed boundary signs, as described in Section 1.4. The educational materials developed as part of this program should continue to be used at Jacobsburg

Environmental Education Center and other watershed events to increase awareness about watershed protection efforts.

In addition, the public education program should be expanded to include the development of programs for the public and local school districts, the installation of educational kiosks at parks, fishing accesses, or other highly visible areas, and the distribution of additional fact sheets on a variety of topics to homeowners, township officials, township staff, municipal engineers, area-wide consulting firms, planners, surveyors, developers, and realtors. Important topics to be targeted for public education initiatives include septic system maintenance, lawn and yard care, watershed protection ordinances and planning, and information about the Bushkill Stream Conservancy.

4.4 Restore Natural Stream Flows

To the greatest extent possible, the streams in the Bushkill Creek watershed should be restored to their original flow patterns via removal of all or some of the obsolete small dams, and by repairing sinkhole damage in the watershed. Both of these types of activities will entail extensive permitting and involvement of the PA DEP and other agencies.

4.4.1 Dam Removal

Although dams have many societal benefits, they can also cause considerable harm to rivers. Dams can block fish migrations, flood spawning and riverside habitat, increase stream temperatures, and change the natural flows of a river. Dams can inhibit the ability of fish to move in response to thermal stress, address feeding needs, escape other environmental stressors, or access upstream spawning habitat. According to American Rivers, at least 465 dams have been removed from our nation's waterways - and at least 100 more are either committed for removal or under active consideration for removal.

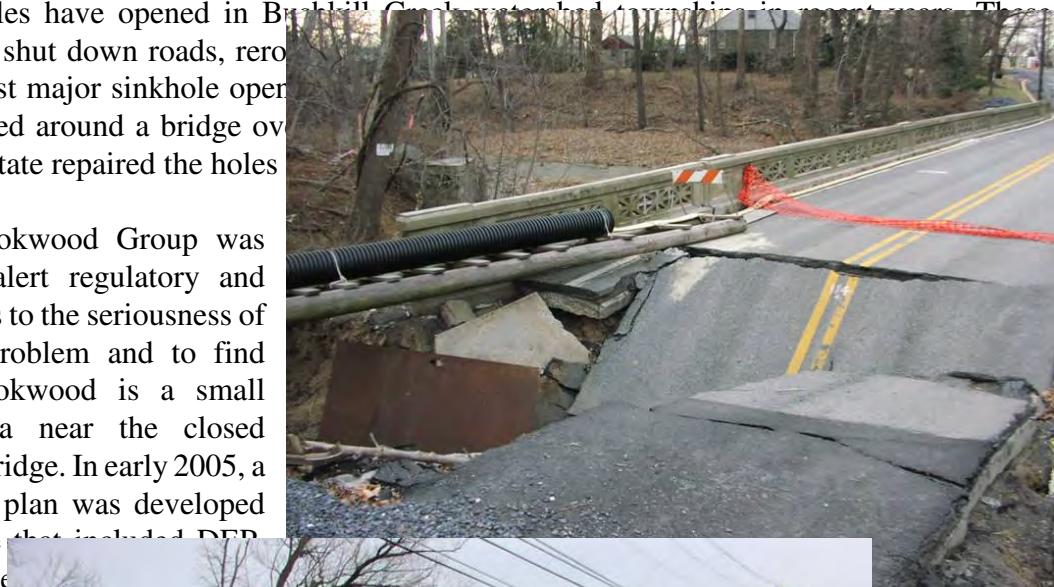
The two main justifications for dam removal are safety and ecological impacts. The average life expectancy of a dam is 50 years, and a full one-quarter of all US dams are now more than 50 years old. Dam breaches due to structural flaws or large storms can cause serious property damage and loss of life. Ultimately, decisions to remove dams must reflect an understanding of the ecological, economic, and cultural costs and benefits associated with maintenance or removal of the structure. Design options that allow for the partial removal of the structure or the reduction of ecological impacts through means other than removal (e.g., modifications to the dam structure, installation of fish passage, etc.) must also be considered in terms of their costs and benefits.

Seven run-of-the-river dams exist on Bushkill Creek. These dams were once associated with old mills, but none of the mills are still in use and most have been torn down or destroyed. A comprehensive feasibility study is recommended to determine if, when, and how each of the dams on the Bushkill should be removed. A well-designed feasibility study will foster a collaborative design process in which the full range of costs and benefits associated with various stakeholder groups (e.g. landowners, conservation groups, fishing clubs, etc.) are considered.

4.4.2 Sinkholes

Several sinkholes have opened in Bushkill Creek watershed, causing significant damage. These sinkholes have shut down roads, rerouted streams, and caused significant property damage. The first major sinkhole opened in 2004, and many more have opened since then. These sinkholes opened around a bridge over a stream, and have caused significant damage to the bridge and the stream bed. The state has been repairing these sinkholes for several months as the state repaired the holes.

The Save Brookwood Group was organized to alert regulatory and elected officials to the seriousness of the sinkhole problem and to find solutions. Brookwood is a small residential area near the closed Tatamy Road bridge. In early 2005, a rapid response plan was developed by a task force that included DEP, PennDOT, the U.S. Fish and Wildlife Service, the U.S. Forest Service, the U.S. Army Corps of Engineers, and the U.S. Geological Survey. The plan requires the state to fix a sinkhole "if it endangers private or public health or a transportation infrastructure, stream quality or habitat."



*Sinkholes near Route 33 bridge
Red lines depict direction of groundwater flow*

The plan requires the state to fix a sinkhole "if it endangers private or public health or a transportation infrastructure, stream quality or habitat."

or degrades stream quality or aquatic habitat.

Bushkill Stream Conservancy officially opposes any sinkhole repairs until such time as a comprehensive hydrogeological study of the entire sinkhole area has been completed. Such a study should include installation of wells to measure groundwater levels, investigation of the hydrologic connection between the creek and the groundwater, and a determination of the effect of nearby quarry pumping on groundwater levels.

In 2004, six wells were installed south and southeast of the Hercules quarry and equipped with continuous monitors to assess the influence of quarry pumping in the area. Once sufficient data are collected and a study is completed, a stream restoration project should be initiated. The restoration should include lining the stream section with a geosynthetic liner and shotcrete fill, and subsequent riparian zone restoration, as shown in Figure 4.1. Additionally, all municipalities with karst geology are encouraged to adopt Carbonate Geology, or Sinkhole, Ordinances to help prevent future problems that are commonly associated with site development and stormwater management in karst areas. A model Carbonate Geology Ordinance is included in Appendix H.

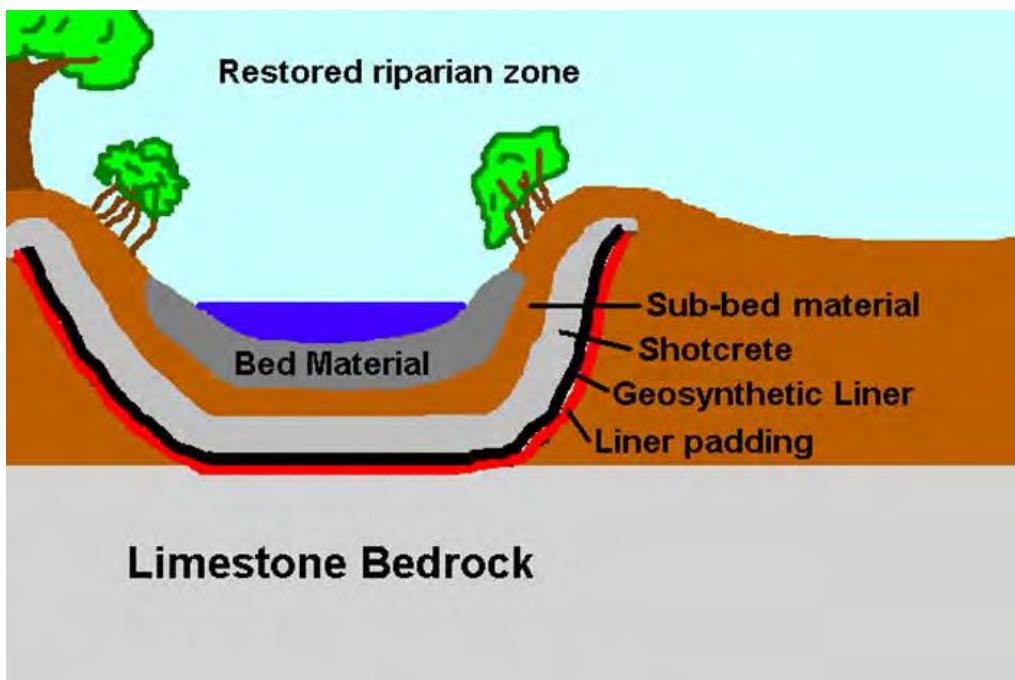


Figure 4.1 Recommended stream restoration strategy to repair and prevent sinkholes along Bushkill Creek, in conjunction with riparian zone restoration

5.0 Management Plan Implementation

5.1 Strengthen Bushkill Stream Conservancy Organizational Capacity

Because the Bushkill Stream Conservancy is the key organization for carrying out the Bushkill Creek Watershed Protection Plan, the maintenance of a strong organization is central to its ability to effectively implement the Plan. The Conservancy needs to focus direct attention to organizational development in several key areas including membership, fundraising, organizational structure, partnerships, and technical capacity. The Conservancy should develop an Organizational Development Plan to serve as a companion document to the Watershed Protection Plan that specifically addresses these needs. The following broad recommendations should be included in the Organizational Development Plan:

- Increase membership through an annual membership drive focused on the major residential communities,
- Increase the frequency of newsletter publication to quarterly for disseminating information about the organization,
- Create a sustainability plan to ensure that the Conservancy does not rely only on grants for base funding,
- Hold an annual fundraising event such as an annual dinner or banquet to increase public visibility and guarantee an annual revenue stream,
- Create a corporate membership program – directly target corporate contributions and memberships, including Binney & Smith, Waste Management, Hercules Cement, and other prominent local businesses.
- Expand and diversify the Conservancy's Board of Directors to include more representation from partnering conservation groups, community associations, and government agencies,
- Create development, monitoring, education and outreach, invasive species, land planning/ open space, and NPS implementation subcommittees within the Conservancy,
- Create a technical advisory committee to the Conservancy composed of resource professionals from a variety of fields and backgrounds,
- Identify a liaison for each subwatershed within the Bushkill Creek watershed,

- Build in-house technical capacity through enhanced volunteer training, GIS and database management training, and investing in better stream and lake monitoring equipment,
- Strengthen ties to key partners; specifically, the watershed municipalities, property owners associations, Northampton County, land trusts (Wildlands Conservancy, Heritage Conservancy), hunting and fishing groups, PA Game Commission, planning commissions, neighboring watershed associations, and funding agencies (PA DEP, U.S. EPA, William Penn Foundation, PA DCNR).
- Encourage each watershed municipality to form an Environmental Advisory Council. The Bushkill Stream Conservancy should have at least one member on each township EAC to provide a liaison between the Conservancy and municipal governance,
- Establish an office where equipment, education materials, supplies, and a computer work station will be housed.

5.2 Priority Action Plan and Timeline

The Watershed Protection Plan is not a static document – it is an evolving vision and plan for the watershed that must adapt and respond to changes in the watershed. This concept is critical to ensuring that the Watershed Protection Plan remains relevant. The Bushkill Creek Watershed Protection Plan should be reviewed on an annual basis, with minor written updates. The annual update should not be a complete revision of the plan, but a brief memorandum that summarizes the progress towards plan implementation. This “state of the plan” report should provide a critical and quantitative analysis of progress towards goals in terms of project implementation, analyze changes in resource quality, identify organizational strengths and weaknesses, upcoming needs, and opportunities, and establish interim goals for the upcoming year within the general framework of the original plan. A more comprehensive Watershed Protection Plan review and update should be undertaken every 10 years.

5.3 Funding Sources

A list of possible funding sources for implementing the Bushkill Creek Watershed Protection Plan is provided in Table 5.1. The three primary funding sources for implementing the Bushkill Creek Watershed Protection Plan are the Pennsylvania Department of Environmental Protection (PA DEP) Growing Greener Program, the EPA's 319 Nonpoint Source Program, and the Pennsylvania Department of Conservation and Natural Resources (PA DCNR) Community Conservation Partnership Program (C2P2) Grants. The Growing Greener Program provides funding to perform watershed protection projects, implement best management practices, and develop public education programs. The 319 Nonpoint Source program is administered in Pennsylvania through the Growing Greener Program, and provides funds for watershed management projects and public education programs. The PA DCNR C2P2 Grants fund parks and recreation planning, public recreation area improvements, and land acquisition of critical natural areas.

Table 5.1
Possible Funding Sources for Bushkill Creek Watershed Protection Plan

Name of Grant Program	Description of Grant Program	Administering Agency
Growing Greener	Funds watershed assessments, watershed organization development, technical assistance, watershed protection or restoration implementation, and education/outreach programs	PA DEP
319 Nonpoint Source Grants	Funds watershed management and public education projects	US EPA
C2P2 Community Conservation Grants	Funds land acquisition for public open space areas, park and recreation projects, municipal master planning, and natural area inventories.	PA DCNR
Conservation Reserve Enhancement Program (CREP)	Provides cost-share payments for installation of riparian buffers and conservation easements on farms	PACD
Wetlands Reserve Program (WREP)	Provides cost-share payments for placing wetlands under conservation easements	USDA
Community Development Block Grants (CDBG)	Can be used to fund water, sewage, and stormwater improvements or greenways in economically challenged areas	Northampton County DCED
Flood Control Grants	Flood management projects	US NRCS
Watershed Protection and Flood Prevention (Small Watershed) Grants	Funds watershed improvements (watershed protection, flood prevention, sedimentation control, habitat enhancement, and recreation planning) in watersheds less than 250,000 acres.	USDA NRCS
PA Flood Protection Programs	Funds design and construction of flood protection projects that are justifiable under state capital budget process.	PA DEP Bureau of Waterways Engineering
PA Department of Community and Economic Development Grants	Various community-based grants, including: Intermunicipal Projects Grants, Industrial Sites Reuse Program (Brownfields) Grants, Land Use Planning and Technical Assistance Program, Local Government Capital Projects Loan Program, Municipalities Financial Recovery Act Program	PA DCED
PA Infrastructure Investment Authority (PennVest) Loans	Low-interest loans for repair of on-lot septic systems, and improvement of community drinking water and wastewater facilities	Penn Vest
Act 537 Sewage Facility Planning Grants	Grants for up to 50% of the costs to prepare or update a municipal Act 537 Plan	PA DEP Bureau of Water Supply

Table 5.1
Possible Funding Sources for Bushkill Creek Watershed Protection Plan

Name of Grant Program	Description of Grant Program	Administering Agency
Act 167 Stormwater Management Grants	Funds stormwater planning and ordinances for cooperative efforts between municipalities at the watershed level	PA DEP Bureau of Watershed Conservation
Rivers, Trails, and Conservation Assistance Program	Funds conservation planning, trail development, and greenways development	National Park Service
PA Recreation Trails Funding	Programs that fund acquisition and development of recreation trails via National Recreational Trails Funding (Symms NRTA) and Rails to Trails Program	PA DCNR
Land and Water Conservation Fund	Provides matching grants to state and local governments for the acquisition and development of outdoor public recreation areas and facilities	National Park Service and PA DCNR
Nutrient Management Plan Development Incentive Program	Grants to farmers for preparing nutrient management plans; low-interest loans to implement agricultural BMPs	County Conservation District
Agricultural Conservation Easement Purchase Program	Provides funds for the purchase of development rights on farmland to ensure that land will be available for agricultural use indefinitely	PA Bureau of Farmland Preservation
Rivers Conservation Program	Funds implementation of approved conservation plan	PA DCNR
Forest Legacy Program	Federal program in cooperation with state foresters. Supports property acquisition and conservation easements in sensitive forest lands	USDA Forest Service
Stream Improvement Program	Provides design and construction assistance to eliminate imminent threats to flooding and streambank erosion	PA DEP Bureau of Waterways Engineering
William Penn Foundation Grants	Private foundation funds watershed protection and sustainable development efforts in the greater Philadelphia area	William Penn Foundation

Source: *Two Rivers Area Greenway Plan, URDC 2004*

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APPENDIX A
GLOSSARY OF WATERSHED TERMS

Acid neutralizing capacity (ANC): the equivalent capacity of a solution to neutralize strong acids. The components of ANC include weak bases (carbonate species, dissociated organic acids, alumino-hydroxides, borates, and silicates) and strong bases (primarily, OH⁻). In the National Surface Water Survey, as well as in most other recent studies of acid-base chemistry of surface waters, ANC was measured by the Gran titration procedure.

Acidic deposition: transfer of acids and acidifying compounds from the atmosphere to terrestrial and aquatic environments via rain, snow, sleet, hail, cloud droplets, particles, and gas exchange.

Adsorption: The adhesion of one substance to the surface of another: clays, for example, can adsorb phosphorus and organic molecules

Aerobic: Describes life or processes that require the presence of molecular oxygen.

Algae: Small aquatic plants that occur as single cells, colonies, or filaments. Planktonic algae float freely in the open water. Filamentous algae form long threads and are often seen as mats on the surface in shallow areas of the lake.

Alkalinity: (see *acid neutralizing capacity*).

Anaerobic: Describes processes that occur in the absence of molecular oxygen.

Anoxia: A condition of no oxygen in the water. Often occurs near the bottom of fertile stratified lakes in the summer and under ice in late winter.

Anoxic: "Without oxygen." (see *anoxia*).

Baseflow: The portion of stream flow that is not due to stormwater runoff, and is supported by groundwater seepage into a channel.

Bathymetric map: A map showing the bottom contours and depth of a lake; can be used to calculate lake volume.

Benthic: Macroscopic (seen without aid of a microscope) organisms living in and on the bottom sediments of lakes and streams. Originally, the term meant the lake bottom, but it is now applied almost uniformly to the animals associated with the substrate. Also referred to as *benthos*.

Biochemical oxygen demand (BOD): The rate of oxygen consumption by organisms during the decomposition (respiration) of organic matter, expressed as grams oxygen per cubic meter of water per hour.

Biomass: The weight of biological matter. Standing crop is the amount of biomass (e.g., fish or algae) in a body of water at a given time. Often measured in terms of grams per square meter of surface.

Biota: All plant and animal species occurring in a specified area.

Bioretention: A water quality practice that utilizes landscaping and soils to treat urban stormwater runoff.

BMP (Best Management Practice): Systems, activities, and structures that human beings can construct or practice to prevent nonpoint source pollution.

Channel: A natural stream that conveys water; a ditch or channel excavated for the flow of water.

Chemical oxygen demand (COD): Non-biological uptake of molecular oxygen by organic and inorganic compounds in water.

Chlorophyll: A green pigment in algae and other green plants that is essential for the conversion of sunlight, carbon dioxide and water to sugar (photosynthesis).

Chlorophyll a: A type of chlorophyll present in all types of algae, sometimes in direct proportion to the biomass of algae.

Cluster development: Placement of housing and other buildings of a development in groups to provide larger areas of open space

Consumers: Animals that cannot produce their own food through photosynthesis and must consume plants or animals for energy (see *producers*).

Decomposition: The transformation of organic molecules (e.g., sugar) to inorganic molecules (e.g., carbon dioxide and water) through biological and non-biological processes.

Density flows: A flow of water of one density (determined by temperature or salinity) over or under water of another density (e.g. flow of cold river water under warm reservoir surface water).

Design Storm: A rainfall event of specified size and return frequency (e.g., a storm that occurs only once every 2 years) that is used to calculate the runoff volume and peak discharge rate to a BMP.

Detention: The temporary storage of storm runoff in a stormwater practice with the goal of controlling peak discharge rates and providing gravity

settling of pollutants.

Detritus: Non-living dissolved and particulate organic material from the metabolic activities and deaths of terrestrial and aquatic organisms.

Drainage basin: Land area from which water flows into a stream or lake (see *watershed*).

Drainage lakes: Lakes having a defined surface inlet and outlet.

Dredging: The process of removing sediments from the bottom of a lake or reservoir with a large power shovel. Also known as lake deepening.

Ecology: Scientific study of relationships between organisms and their environment: also defined as the study of the structure and function of nature.

Ecosystem: A system of interrelated organisms and their physical-chemical environment. In limnology, the ecosystem is usually considered to include the lake and its watershed.

Effluent: Liquid wastes from sewage treatment, septic systems or industrial sources that are released to a surface water.

Environment: Collectively, the surrounding conditions, influences and living and inert matter that affect a particular organism or biological community.

Epilimnion: Uppermost, warmest, well-mixed layer of a lake during summertime thermal stratification. The epilimnion extends from the surface to the thermocline.

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Erosion: Breakdown and movement of land surface which is often intensified by human disturbances.

Eutrophic: From Greek for well-nourished; describes a lake of high photosynthetic activity and low transparency.

Eutrophication: The process of physical, chemical, and biological changes associated with nutrients, organic matter, silt enrichment, and sedimentation of a lake or reservoir. If the process is accelerated by man-made influences it is termed cultural eutrophication.

Fall overturn: The autumn mixing, top to bottom, of lake water caused by cooling and wind-derived energy.

Fecal coliform test: Most common test for the presence of fecal material from warm-blooded animals. Fecal coliforms are measured because of convenience; they are not necessarily harmful but indicate the potential presence of other disease-causing organisms.

Floodplain: Land adjacent to lakes or rivers that is covered as water levels rise and overflow the normal water channels.

Flushing rate: The rate at which water enters and leaves a lake relative to lake volume, usually expressed as time needed to replace the lake volume with inflowing water.

Flux: The rate at which a measurable amount of a material flows past a designated point in a given amount of time.

Food chain: The general progression of feeding levels from primary producers, to herbivores, to planktivores, to the larger predators.

Food web: The complex of feeding interactions existing among the lake's organisms.

Forage fish: Fish, including a variety of panfish and minnows, that are prey for game fish.

Groundwater: Water found beneath the soil surface; saturates the stratum at which it is located; often connected to lakes.

Hard water: Water with relatively high levels of dissolved minerals such as calcium, iron, and magnesium.

Hydrographic map: A map showing the location of areas or objects within a lake.

Hydrologic cycle: The circular flow or cycling of water from the atmosphere to the earth (precipitation) and back to the atmosphere (evaporation and plant transpiration). Runoff, surface water, groundwater, and water infiltrated in soils are all part of the hydrologic cycle.

Hypolimnion: Lower, cooler layer of a lake during summertime thermal stratification.

Hypoxia: A condition of low oxygen in the water (< 2.0 mg/L). Often occurs near the bottom of fertile stratified lakes in the summer and under ice in late winter.

Impervious Surface: Material which resists or blocks the passage of water.

Infiltration: The penetration of water through the ground surface into subsurface soil. The infiltration rate is expressed in terms of inches per hour. Infiltration rates will be slower when the soil is dense (e.g., clays) and faster when the soil is loosely compacted (e.g., sands). Can also refer to seepage of groundwater into sewer pipes through cracks and joints.

Internal nutrient cycling: Transformation of nutrients such as nitrogen or phosphorus from biological to inorganic forms through decomposition in a lake. Also refers to the release of sediment-bound nutrients into the overlying water that typically occurs within the anoxic hypolimnion of stratified, mesotrophic and eutrophic lakes.

Lake: A considerable inland body of standing water, either naturally formed or manmade.

Lake district: A special purpose unit of government with authority to manage a lake(s) and with financial powers to raise funds through mill levy, user charge, special assessment, bonding, and borrowing. May or may not have police power to inspect septic systems, regulate surface water use, or zone land.

Lake management: The practice of keeping lake quality in a state such that attainable uses can be achieved and maintained.

Lake protection: The act of preventing degradation or deterioration of attainable lake uses.

Lake restoration: The act of bringing a lake back to its attainable uses.

Lentic: Relating to standing water (versus lotic, running water).

Limnologist: One who studies limnology.

Limnology: Scientific study of fresh water, especially the history, geology, biology, physics, and chemistry of lakes. Also termed freshwater ecology.

Littoral zone: That portion of a waterbody extending from the shoreline lakeward to the greatest depth occupied by rooted plants.

Loading: The total amount of material (sediment, nutrients, oxygen-demanding material) brought into the lake by inflowing streams, runoff, direct discharge through pipes, groundwater, the air, and other sources over a specific period of time (often annually).

Macroinvertebrates: Aquatic insects, worms, clams, snails, and other animals visible without the aid of a microscope, that may be associated with or live on substrates such as sediments and macrophytes. They supply a major portion of fish diets and consume detritus and algae.

Macrophytes: Rooted and floating aquatic plants, commonly referred to as waterweeds. These plants may flower and bear seed. Some forms, such as duckweed and coontail (*Ceratophyllum*), are free-floating forms without roots in the sediment.

Mandatory property owners association: Organization of property owners in a subdivision or development with membership and annual fee required by covenants on the property deed. The association will often enforce deed restrictions on members' property and may have common facilities such as bathhouse, clubhouse, golf course, etc.

Marginal zone: Area where land and water meet at the perimeter of a lake. Includes plant species, insects and animals that thrive in this narrow, specialized ecological system.

Mesotrophic: Describes a lake of moderate plant productivity and transparency; a trophic state between oligotrophic and eutrophic.

Metalimnion: Layer of rapid temperature and density change in a thermally stratified lake. Resistance to mixing is high in this region.

Morphometry: Relating to a lake's physical structure (e.g., depth, shoreline length).

National Pollutant Discharge Elimination System (NPDES): Federal operating permits issued by EPA to industrial and municipal facilities to help them comply with the Clean Water Act.

NJ DEP: New Jersey Department of Environmental Protection. State agency in charge of protecting environmental resources in New Jersey.

Nonpoint Source (NPS) Pollution: Pollution that cannot be traced to a specific origin, but seems to flow from many different sources. NPS pollutants are generally carried off the land by stormwater or snowmelt runoff.

Nutrient: An element or chemical essential to life, such as carbon, oxygen, nitrogen, and phosphorus.

Nutrient budget: Quantitative assessment of nutrients (e.g., nitrogen or phosphorus) moving into, being retained in, and moving out of an ecosystem; commonly constructed for phosphorus because of its tendency to control lake trophic state.

Nutrient cycling: The flow of nutrients from one component of an ecosystem to another, as when macrophytes die and release nutrients that become available to algae (organic to inorganic phase and return).

Oligotrophic: "Poorly nourished," from the Greek. Describes a lake of low plant productivity and high transparency.

Ooze: Lake bottom accumulation of inorganic sediments and the partially decomposed remains of algae, weeds, fish, and aquatic insects. Sometimes called muck (see *sediment*).

Ordinary high water mark: Physical demarcation line, indicating the highest point that water level reaches and maintains for some time. Line is visible on rocks, or shoreline, and by the location of certain types of vegetation.

Organic matter: Molecules manufactured by plants and animals and containing linked carbon atoms and elements such as hydrogen, oxygen, nitrogen, sulfur, and phosphorus.

Paleolimnology: The study of the fossil record within lake sediments.

Pathogen: A microorganism capable of producing disease. They are of great concern to human health relative to drinking water and swimming beaches.

Pelagic zone: This is the open area of a lake, from the edge of the littoral zone to the center of the lake.

Perched: A condition where the lake water is isolated from the groundwater table by impermeable material such as clay.

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pH: A measure of the concentration of hydrogen ions of a substance, which ranges from very acid (pH = 1) to very alkaline (pH = 14). pH 7 is neutral and most lake waters range between 6 and 9. pH values less than 6 are considered acidic, and most life forms can not survive at pH of 4.0 or lower.

Photic zone: The lighted region of a lake where photosynthesis takes place. Extends down to a depth where plant growth and respiration are balanced by the amount of light available.

Phytoplankton: Microscopic algae and microbes that float freely in open water of lakes and oceans.

Plankton: Microscopic plants, microbes and animals floating or swimming freely about in lakes and oceans.

Point Source (PS) Pollution: Pollution discharged into water bodies from specific, identifiable pipes or points, such as an industrial facility or municipal sewage treatment plant.

Primary productivity: The rate at which algae and macrophytes fix or convert light, water and carbon dioxide to sugar in plant cells (through photosynthesis). Commonly measured as milligrams of carbon per square meter per hour.

Primary producers: Green plants that manufacture their own food through photosynthesis.

Reservoir: A manmade lake where water is collected and kept in quantity for a variety of uses, including flood control, water supply, recreation and hydroelectric power.

Residence time: Commonly called the hydraulic residence time -- the amount of time required to completely replace

the lake's current volume of water with an equal volume of new water.

Respiration: Process by which organic matter is oxidized by organisms, including plants, animals, and bacteria. The process releases energy, carbon dioxide, and water.

Retention: The amount of precipitation on a drainage area that does not escape as runoff. The difference between total precipitation and total runoff.

Retrofit: The installation of a new stormwater practice or the improvement of an existing one in a previously developed area.

Riparian: Pertaining to the land area immediately adjacent to a lake, river, reservoir, or other water body.

Riparian Forest Buffer: The area from the streambank in the floodplain to, and including, an area of trees, shrubs, and herbaceous vegetation located upslope from the body of water.

Runoff: That portion of precipitation that flows over the land carrying with it nutrient and pollutants until it ultimately reaches streams, rivers, lakes, or other water bodies.

Sand Filter: A stormwater BMP in which the first flush of runoff is diverted into a self-contained bed of sand. The runoff is then strained through the sand, collected in underground pipes and returned back to the stream or channel. Can also be used to treat wastewater.

Scour: Concentrated erosive action of flowing water in streams that removes material from the bed and banks.

Secchi depth: A measure of transparency of water obtained by lowering a black and white, or all white, disk (Secchi disk, 20 cm in diameter) into water until it is no longer visible. Measured in units of meters or feet.

Sediment: Bottom material in a lake that has been deposited after the formation of a lake basin. It originates from remains of aquatic organisms, chemical precipitation of dissolved minerals, and erosion of surrounding lands (see *ooze* and *detritus*).

Sedimentation: The process of soil and silt settling and building up on the bottom of a creek, river, lake, or wetland.

Seepage lakes: Lakes having either an inlet or outlet (but not both) and generally obtaining their water from groundwater and rain or snow.

Septic System: A conventional on-lot wastewater system where household wastewater is transported via a septic tank to a drain field (leach field) where it is treated by the soil.

Soil retention capacity: The ability of a given soil type to adsorb substances such as phosphorus, thus retarding their movement to the water.

Stakeholder: Any agency, organization, or individual that is involved in or affected by the decisions made in the development of a watershed plan.

Storm Drain (or **Storm Sewer System**): Above- and below-ground structures for transporting stormwater to streams or outfalls for flood control purposes.

Stormflow: The portion of stream flow that is due to stormwater runoff.

Stormwater Management: Programs designed to maintain or return the quality and quantity of stormwater runoff to pre-development levels.

Stormwater Runoff: Excess precipitation that is not retained by vegetation, surface depressions, or infiltration, and thereby collects on the surface and drains into a surface water body.

Stormwater Wetland: A shallow, constructed pool that captures stormwater and allows for the growth of characteristic wetland vegetation. Also known as a "constructed wetland."

Stratification: Layering of water caused by differences in water density. Thermal stratification is typical of most deep lakes during summer. Chemical stratification can also occur.

Streambank Stabilization: Methods of securing the structural integrity of earthen stream channel banks with structural supports to prevent bank slumping and undercutting of riparian trees, and overall erosion prevention. Techniques include the use of willow stakes, imbricated riprap, or brush bundles.

Swimmers itch: A rash caused by penetration into the skin of the immature stage (cercaria) of a flatworm (not easily controlled due to complex life cycle). A shower or alcohol rubdown should minimize penetration.

Thermal stratification: Lake stratification caused by temperature-created differences in water density.

Thermocline: A horizontal plane across a lake at the depth of the most rapid vertical change in temperature and density in a stratified lake (see *metalimnion*).

Topographic map: A map showing the elevation of the landscape at specified contour intervals. Can be used to delineate the watershed.

Total Suspended Solids: The total amount of particulate matter that is suspended in the water column.

Trophic state: The degree of eutrophication of a lake. Transparency, chlorophyll a levels, phosphorus concentrations, amount of macrophytes, and quantity of dissolved oxygen in the hypolimnion can be used to assess state.

US EPA: United States Environmental Protection Agency (see Environmental Protection Agency).

Voluntary lake property owners association: Organization of property owners in an area around a lake that members join at their option.

Water column: Water in the lake between the interface with the atmosphere at the surface and the interface with the sediment layer at the bottom. Idea derives from vertical series of measurements (oxygen, temperature, phosphorus) used to characterize lake water.

Water table: The upper surface of groundwater; below this point, the soil is saturated with water.

Watershed: A drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation.

Wetland: Land on which water covers the soil or is present either at or near the surface of the soil or within the root zone, all year or for varying periods of

time during the year, including during the growing season. Wetlands are identified by determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. Human-made wetlands include constructed stormwater wetlands designed to treat stormwater runoff, and artificial wetlands created to comply with mitigation requirements.

Zooplankton: Microscopic animals that float or swim freely in lake water, graze on detritus particles, bacteria, and algae, and may be consumed by fish

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APPENDIX B

MUNICIPAL ORDINANCE AUDIT RECOMMENDATIONS

Upper Nazareth Township Ordinance Review

1.0 Introduction

Upper Nazareth Township currently has the following ordinances that pertain to “watershed management and protection:”

- Subdivision and Land Development Ordinance (SALDO 1986)
- Zoning Ordinance (1995)

Each of the above ordinances has been thoroughly reviewed as part of the Bushkill Creek Watershed Protection Project, sponsored by the Bushkill Stream Conservancy through a grant by the Pennsylvania Department of Environmental Protection Growing Greener Program. The revisions and recommendations for each of the above listed ordinances are discussed in detail in the following section, by ordinance.

2.0 Review of Existing Upper Nazareth Township Ordinances

Upper Nazareth Township Subdivision and Land Development Ordinance

General Comments:

Change references of DER to DEP.

Definitions:

Definitions should be updated to include the following terms

Alluvial soil: Include definition of Alluvial Soils to read: Areas subject to periodic flooding and listed in the Soil Survey of Northampton County, Pennsylvania, U.S. Department of Agricultural Soil Conservation Service, July 1974, as amended, as being "on, or in, the flood plain" or subject to flooding. **Alluvial soils found in the township should be identified in this definition.**

Carbonate geology: Include a definition of Carbonate Geology to read: Areas of the township underlain by geology composed of rock consisting chiefly of calcium and magnesium carbonates.

Revise definition of (234)“Floodplain” to read “The area along a natural watercourse which is subject to partial or complete inundation in event of the 100 year return interval storm or has a 1% chance of being partially or completely inundated during any given year....The floodplain shall be determined...”

Hydric soil: Include a definition of hydric soils to read: Soils that are categorized as poorly drained that can support hydrophilic plants, but may not do so in many cases. For the purpose of this Ordinance, Hydric soils are general wetland indicator soils **Hydric soils found in the township should be identified in this definition.**

Karst topography: Include a definition for Karst topography to read: The relief of an area underlain by limestone that dissolves intermittently to form numerous depressions or small basins.

Riparian corridor (if adopted): An area surrounding surface water bodies, including creeks, lakes, watercourses, and wetlands that intercept surface water runoff, wastewater, subsurface flow, and/or deep groundwater flows from upland sources and function to remove or buffer the effects of associated nutrients, sediment, organic matter, pesticides, or other pollutants prior to entry into surface waters. This area may also provide wildlife habitat, control water temperature, attenuate flood flow, and provide opportunities for passive recreation.

Steep slope: Include a definition of steep slope to read: Areas where the average slope exceeds fifteen (15) percent.

Stream: Include a definition of “stream” to read: All flowing watercourses, natural or man-made, with definable “bed and bank” scenario, whether ephemeral, intermittent, or perennial.

Vernal pond: Include a definition of “vernal pond (aka vernal pool)” to read: Vernal ponds are seasonal depressional wetlands and/or ponds. They are covered by shallow water for variable periods from winter to spring, but may be completely dry for most of the summer and fall. These wetlands range in size from small puddles to shallow lakes and are usually found in a gently sloping plains. Although generally isolated, they are sometimes connected to each other by small drainages known as vernal swales. Beneath natural vernal ponds lies either bedrock or a hard clay layer in the soil that helps keep water in the ponded area. Vernal ponds are regulated as wetlands and/or waterways (as ponds which are considered “waters of the United States” and “waters of the Commonwealth of Pennsylvania”), and therefore, they are under the jurisdiction of the state and/or federal governments.

Waterway: Include the definition of “waterways” to read: Waterways include all lakes, ponds, wetlands, vernal ponds (also known as vernal pools), and streams (see definition of “stream”). All waterways are to be delineated by a qualified professional in accordance with the guidance set forth in the United States Army Corps of Engineers *1987 Wetlands Delineation Manual*.

Wetlands: Include a definition for “wetlands” to read: Wetlands are "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. Wetlands generally include swamps, marshes, bogs, certain types of vernal ponds (also known as vernal pools), and similar areas. Wetlands are to be delineated by a qualified professional in accordance with the guidance set forth in the United States Army Corps of Engineers *1987 Wetlands Delineation Manual*). or the Pennsylvania

Department of Environmental Protection Wetlands Identification and Delineation, Chapter 105, Dam Safety and Waterways Management, Rules and Regulations; or the U.S. Environmental Protection Agency Wetlands Identification Delineation Manual, Volume I, Rational, Wetland Parameters, and Overview of Jurisdictional Approach, Volume II, Field Methodology, or the most recently amended reports, will be considered a wetland for the purposes of this Ordinance. In the event the definition of a wetland accepted by the U.S. Army Corps of Engineers conflicts with the definition of a wetland-accepted by the Pennsylvania Department of Environmental Protection, or the U.S. Environmental Protection Agency, the more restrictive definition shall apply.

Woodland: Include definition of woodland to include read: The woodland shall be measured from the drip line of the outer trees. Woodlands are also a grove of trees forming one (1) canopy where twelve (12) or more trees measure at least six (6") inches diameter at breast height in dbh.

Plan submissions:

In addition to the required elements currently in the SALDO regulation, all plan submissions (sketch, preliminary and final) should have floodplains, wetlands, wetland transitions areas, watercourses (including streams, lakes, ponds, and vernal pools), Karst topography or carbonate geology, stream corridor or riparian buffer zone and steep slopes.

The location of all wells, primary drain fields, and secondary drain fields for all adjoining properties should be clearly indicated on all required maps and drawings, in addition to the existing and proposed structures on the applicant's own property.

Require a Landscape Plan for Major subdivisions showing required screening/buffer yards and plantings, street trees, tree protection areas, means for tree protection, trees to be preserved during development, and proposed planting schedule, including species, sizes, and numbers of plantings.

The Township should require a wetlands assessment by a qualified professional for all new development on parcels that contain any hydric soils areas, in accordance with the published list of hydric soils for Northampton County, Pennsylvania by the United States Department of Agriculture. The Township should maintain the right to require a Jurisdictional Determination by the United States Army Corps of Engineers, as necessary to substantiate the findings of the afore mentioned wetlands assessment.

The Township should require an Erosion and Sedimentation Pollution Control Plan, approved by the Northampton County Conservation District, for all subdivisions and for all disturbances that occur within 100 ft. of a waterway or wetland, as measured from their jurisdictional boundaries.

The Township should require a soil analysis map for all subdivisions. The map should include soil types, locations of seasonally high water table, prime agricultural soils, highly erodible soils, hydric and alluvial soils.

Sewage systems

The Township should initiate an inspection and repair program by Township Sewage Enforcement Officer for any new development that will be using a new or existing on-lot sewage disposal system.

Stormwater

The Township should adopt the provisions of the model ordinance developed for the Little Lehigh River Act 167 Plan in order to meet the requirements of the NPDES Phase II regulations. The township should adopt the provisions of the updated Bushkill Watershed Act 167 Plan as they become available.

Stream and water quality

A 50 ft. vegetative, natural buffer should be required around all waterways (lakes, ponds, vernal ponds, rivers, streams, and wetlands). This could be increased to 75 feet (each side). A two zone buffer is preferable.

The Township should require an Erosion and Sedimentation Pollution Control Plan, approved by the Northampton County Conservation District, for all disturbances that occur within 100 ft. of a waterway or wetland, as measured from their jurisdictional boundaries.

Require water quality improvements from stormwater treatment BMPs.

Adopt water conservation ordinance to protect groundwater resources in the Township.

Tree protection

Temporary wooden barricades or high-visibility fencing should be placed around existing trees and their roots to protect trees from damage and root compaction during the construction process.

Section Specific Comments:

Section 421.07: The Township should require an Erosion and Sedimentation Pollution Control Plan, approved by the Northampton County Conservation District, for all subdivisions and land development.

Section 422.17: Section should be revised to read: "All existing watercourses, wood lots, rock outcroppings, Karst topography, floodplains, wetlands, soil types and individual trees greater than six inches in diameter".

Section 422.18: Include existing wells and septic drain fields within 200 feet of property lines.

Section 432.: Final plans should include all required information from preliminary plans.

Section 511: Add performance standards to protect natural resources. Prohibit development

of wetlands. Prohibit development in floodplains. Protect additional natural resources including steep slopes, watercourses, riparian buffers and areas of Karst Topography. Reinforce SALDO ordinances with adoption of natural resource protection ordinances in zoning code. (See model ordinances).

Section 539: Delete section.

Section 741.02: For all proposed major subdivisions, a connection to any existing central sewage systems where a potential connection exists within 5,000 ft should be required.

Section 741.03: For all lots smaller than 1 acre, new on-lot sewage disposal systems should only be allowed if there is no potential connection to a community or central sewage system within 2,000 ft.

Section 772.04: Require stormwater management facilities to improve stormwater quality through design standards. The following requirements are an example of design criteria that improve water quality:

- Stormwater management facilities shall be provided to detain 1-year, 24-hour (SCS Type II) design storm using the distribution. Provisions shall be made so that 1-year storm takes 25 hours to drain from the facility from a point where the maximum volume of water captured by the facility for the 1-year storm is achieved (i.e., the maximum water surface elevation achieved in the facility).
- Release of this 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. To that end, the minimum outfall orifice diameter shall be 4-inches. Provisions must also be made for safely passing the runoff greater than that occurring from the largest design storm.
- The water quality, objective can be obtained through any applicable BMPs or combinations thereof, including infiltration, wet detention, extended day detention, etc.

Section 773.01: Address issue of stormwater runoff into lakes, ponds, vernal ponds, rivers, streams, and wetlands. Specifically state that stormwater must be directed into detention basins or to retention basins/systems (eg – retention basins, extended detention basins, constructed wetlands, bio-retention areas), or to other treatment areas rather than being allowed to drain directly into waterways.

Section 773.031: Delete (See Section 772.04)

Section 773.: Detention facility should be planted with low maintenance, non-poisonous, non-invasive vegetative groundcover.

Section 773.: Prohibit low flow channels in detention basins.

Section 774.02.: Change to read “Stormwater runoff from watersheds 10 acres or less shall be calculated using the rational method”.

Section 774.03: Change to read “Stormwater runoff from watersheds greater than 10 acres shall be calculated using the soil cover complex method...”

Section 792: Street trees should be native to Northampton County.

Upper Nazareth Township Zoning Ordinance

General Comments:

All reference of “DER” should be changed to “DEP.”

Adopt natural resource protection standards (see models provided).

Encourage use of pervious parking materials be used for overflow parking areas.

Section Specific Comments:

Section 1200.5: Fix column headers.

Section 1700: Replace with model Floodplain Conservation District ordinance.

Section 1800.9: Adopt model natural resource protection ordinances.

Section 1800.9.: Limit site disturbance of slopes greater >15% to 30% of sloped area. Prohibit disturbance of slopes >25% unless disturbance is necessary to:

- Accommodate a street, driveway or utility line when no other feasible route for such an activity exists and if the site disturbance is minimized to the greatest extent feasible or to
- Accommodate a trail or trails that are part of an existing or planned trail network and are located or constructed based on accepted best management practices for minimizing erosion
- In no case shall more than 20% of slopes >25% be disturbed.

Section 1800.9.:

- Add language indicating that presence of Hydric soils, in affected area, should require wetland delineation from professional soil scientist or other certified wetland delineator.
- b) Identify Hydric soils found in Upper Nazareth Township.

Section 1800.9.: Require setbacks from waterways. Setbacks from waterways should be

150 feet from major waterway and 100 feet from minor waterway.

Section 1800.9.: Add provisions to prevent removal of 50% of woodlands from any site.

Section 2000.1.d: Add language that allows managed natural meadow areas that have grasses and forbs greater than 8 inches in height. See model Natural landscape ordinance.

Section 2000.1.f. and 2000.2 : Require trees used in buffer and screening yards be native to Northampton County.

Section 2500.5.j.: Require 150-foot setback, plotted horizontally, from mineral extraction operation to the average high water mark of a lake, pond, or perennial stream or the edge of a natural wetland of more than 1 acre. Require a performance bond to ensure land reclamation will be completed in a timely fashion.

Section 2500.5.k.: Prohibit new gas stations from within 300 feet of public water supply wellhead. Add language requiring that these uses include appropriate preventive measures to control unintended spills or leaks of petroleum, oils or similar pollutants from areas where vehicles are fueled, serviced or repaired.

Section 2500.5.q.: Junkyard. Require a 200 foot setback between a new junkyard and any watercourse or wetland.

All Zones: Building setbacks should be 150 feet from any perennial stream, 100 feet for intermittent streams, and 50 feet from any drainage channel or swale (except for road crossings in all cases). Paving setback should be 50 ft. from all streams (perennial, intermittent, ephemeral) and drainage channels or swales.

All Zones: It should be required that whenever an existing single family dwelling is converted to a multifamily dwelling the existing sewage disposal system must be certified as being adequate to meet the new demand.

All Zones: It should be required that whenever an existing single family dwelling is converted to a daycare, bed and breakfast, or other commercial venture, the existing sewage disposal system must be certified as being as being adequate to meet the new demand.

All Zones: Clarify definition of Maximum Coverage (%) as either building coverage or impervious coverage.

All Zones: Require site plans for all development as part of SALDO.

3.0 Conclusions

Upper Nazareth Township's current ordinances provide only limited framework for resource protection. The proposed amendments, revisions, and additional ordinances will provide excellent

protection of the natural resources that serve as the basis for the quality of life in Upper Nazareth Township, while still allowing and providing for residential and economic development.

Development pressures facing Upper Nazareth require that the SALDO and Zoning ordinances be updated to offer the township's natural resources the best possible protection.

4.0 Recommendations

In addition to the amendments and revisions proposed above, the following "watershed protection" ordinances are recommended to supplement and compliment the existing township ordinances:

- Stream Buffer Conservation Zone Ordinance
- Natural Features Conservation Ordinance (encompassing many otherwise unprotected features)
- Stormwater Management Ordinance (water quality and infiltration) w/ manual explaining how to use ordinance (pushes more desirable low impact development)
- Natural Landscape Ordinance
- Noxious Weed Control Ordinance
- Forest Conservation Ordinance

These additional ordinances will provide greatly improved resource protection, above and beyond the existing township ordinances. While the existing ordinances do provide for some level of protection in each of these categories, these ordinances are more specific and comprehensive.

Incorporating them into Upper Nazareth Township's existing ordinances would be relatively easy, requiring simple amendments to the existing ordinances referencing their use for the appropriate sections. Where feasible, these ordinances should be grouped into common chapters or appendices of the zoning code to facilitate subdivision, development and zoning issue review. These ordinances can be adopted and implemented as zoning overlay districts so that resource protection requirements will be applied consistently, to all lots, throughout the township.

Plainfield Township Ordinance Review

1.0 Introduction

Plainfield Township currently has the following ordinances that pertain to “watershed management and protection:”

- Subdivision and Land Development Ordinance (SALDO 1991)
- Zoning Ordinance (2001)

Each of the above ordinances has been thoroughly reviewed as part of the Bushkill Creek Watershed Protection Project, sponsored by the Bushkill Stream Conservancy through a grant by the Pennsylvania Department of Environmental Protection Growing Greener Program. The revisions and recommendations for each of the above listed ordinances are discussed in detail in the following section, by ordinance.

2.0 Review of Existing Plainfield Township Ordinances

Plainfield Township Subdivision and Land Development Ordinance

General Comments:

Change references of DER to DEP.

Definitions:

Definitions should be updated to include the following terms

Alluvial soil: Include definition of Alluvial Soils to read: Areas subject to periodic flooding and listed in the Soil Survey of Northampton County, Pennsylvania, U.S. Department of Agricultural Soil Conservation Service, July 1974, as amended, as being "on, or in, the flood plain" or subject to flooding. **Alluvial soils found in the township should be identified in this definition.**

Carbonate geology: Include a definition of Carbonate Geology to read: Areas of the township underlain by geology composed of rock consisting chiefly of calcium and magnesium carbonates.

Revise definition of "Floodplain" to read "The area along a natural watercourse which is subject to partial or complete inundation in event of the 100 year return interval storm or has a 1% chance of being partially or completely inundated during any given year."

Hydric soil: Include a definition of hydric soils to read: Soils that are categorized as poorly drained that can support hydrophilic plants, but may not do so in many cases. For the purpose of this Ordinance, Hydric soils are general wetland indicator soils

Hydric soils found in the township should be identified in this definition.

Karst topography: Include a definition for Karst topography to read: The relief of an area underlain by limestone that dissolves intermittently to form numerous depressions or small basins.

Riparian corridor (if adopted): An area surrounding surface water bodies, including creeks, lakes, watercourses, and wetlands that intercept surface water runoff, wastewater, subsurface flow, and/or deep groundwater flows from upland sources and function to remove or buffer the effects of associated nutrients, sediment, organic matter, pesticides, or other pollutants prior to entry into surface waters. This area may also provide wildlife habitat, control water temperature, attenuate flood flow, and provide opportunities for passive recreation.

Stream: Include a definition of “stream” to read: All flowing watercourses, natural or man-made, with definable “bed and bank” scenario, whether ephemeral, intermittent, or perennial.

Steep slope: Include a definition of steep slope to read: Areas where the average slope exceeds fifteen (15) percent.

Vernal pond: Include a definition of “vernal pond (aka vernal pool)” to read: Vernal ponds are seasonal depressional wetlands and/or ponds. They are covered by shallow water for variable periods from winter to spring, but may be completely dry for most of the summer and fall. These wetlands range in size from small puddles to shallow lakes and are usually found in a gently sloping plains. Although generally isolated, they are sometimes connected to each other by small drainages known as vernal swales. Beneath natural vernal ponds lies either bedrock or a hard clay layer in the soil that helps keep water in the ponded area. Vernal ponds are regulated as wetlands and/or waterways (as ponds which are considered “waters of the United States” and “waters of the Commonwealth of Pennsylvania”), and therefore, they are under the jurisdiction of the state and/or federal governments.

Wetlands: Revise definition for “wetlands” to read: Wetlands are "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. Wetlands generally include swamps, marshes, bogs, certain types of vernal ponds (also known as vernal pools), and similar areas. Wetlands are to be delineated by a qualified professional in accordance with the guidance set forth in the United States Army Corps of Engineers 1987 *Wetlands Delineation Manual*, or the Pennsylvania Department of Environmental Protection Wetlands Identification and Delineation, Chapter 105, Dam Safety and Waterways Management, Rules and Regulations; or the U.S. Environmental Protection Agency Wetlands Identification Delineation Manual, Volume I, Rational, Wetland Parameters, and Overview of Jurisdictional Approach, Volume II, Field Methodology, or the most recently amended reports,

will be considered a wetland for the purposes of this Ordinance. In the event the definition of a wetland accepted by the U.S. Army Corps of Engineers conflicts with the definition of a wetland-accepted by the Pennsylvania Department of Environmental Protection, or the U.S. Environmental Protection Agency, the more restrictive definition shall apply.

Woodland: Include definition of woodland to include read: The woodland shall be measured from the drip line of the outer trees. Woodlands are also a grove of trees forming one (1) canopy where twelve (12) or more trees measure at least six (6") inches diameter at breast height in dbh.

Plan submissions:

In addition to the required elements currently in the SALDO regulation, all plan submissions (sketch, preliminary and final) should have wetland transitions areas, Karst topography or carbonate geology, and stream corridor or riparian buffer zone.

The location of all wells, primary drain fields, and secondary drain fields for all adjoining properties should be clearly indicated on all required maps and drawings, in addition to the existing and proposed structures on the applicant's own property.

The Township should require a wetlands assessment by a qualified professional for all new development on parcels that contain any hydric soils areas, in accordance with the published list of hydric soils for Northampton County, Pennsylvania by the United States Department of Agriculture. The Township should maintain the right to require a Jurisdictional Determination by the United States Army Corps of Engineers, as necessary to substantiate the findings of the afore mentioned wetlands assessment.

Sewage systems

The installation of "dry" sewer lines should be required for all new development, if the Board of Supervisors or Township Engineer determines that the development is likely to be expanded and/or served by an extension of an existing sewage treatment plant within the next ten years.

The Township should initiate an inspection and repair program by Township Sewage Enforcement Officer for any new development that will be using a new or existing on-lot sewage disposal system.

Stormwater

The Township should adopt the provisions of the model ordinance developed for the Little Lehigh River Act 167 Plan in order to meet the requirements of the NPDES Phase II regulations. The township should adopt the provisions of the updated Bushkill Watershed Act 167 Plan as they become available.

Stream and water quality

A 50 ft. vegetative, natural buffer should be required around all waterways (lakes, ponds, vernal ponds, rivers, streams, and wetlands). This could be increased to 75 feet (each side).

A two zone buffer is preferable.

Require water quality improvements from stormwater treatment BMPs.

Adopt water conservation ordinance to protect groundwater resources in the Township.

Section Specific Comments:

Section 4.3.B.: Require identification of woodlands on Sketch Plan Requirements.

Section 5.3.G.: Require identification of existing wells and septic drain fields within 200 feet of property lines.

Section 6.3.: Require a Landscape Plan for Major subdivisions showing required screening/buffer yards and plantings, street trees, tree protection areas, means for tree protection, trees to be preserved during development, and proposed planting schedule, including species, sizes, and numbers of plantings.

Section 10.9.A.: Require stormwater BMPs to improve stormwater quality through design standards. The following requirements are an example of design criteria that improve water quality:

- Stormwater management facilities shall be provided to detain 1-year, 24-hour (SCS Type II) design storm using the distribution. Provisions shall be made so that 1-year storm takes 25 hours to drain from the facility from a point where the maximum volume of water captured by the facility for the 1-year storm is achieved (i.e., the maximum water surface elevation achieved in the facility).
- Release of this 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. To that end, the minimum outfall orifice diameter shall be 4-inches. Provisions must also be made for safely passing the runoff greater than that occurring from the largest design storm.
- The water quality, objective can be obtained through any applicable BMPs or combinations thereof, including infiltration, wet detention, extended day detention, etc.

Section 10.9.A: Address issue of stormwater runoff into lakes, ponds, vernal ponds, rivers, streams, and wetlands. Specifically state that stormwater must be directed into detention basins or to retention basins/systems (e.g. – retention basins, extended detention basins, constructed wetlands, bio-retention areas), or to other treatment areas rather than being allowed to drain directly into waterways.

Section 10.9.B.2: Rational method should only be permitted for stormwater runoff calculations for sites 10 acres or smaller.

Section 10.9.G.5: Prohibit low flow channels in detention basins

Section 10.9.G.12: Delete this section. Entire basins should be utilized to improve water quality.

Section 10.9.M.2: Stormwater BMPs should not be deeded to individual landowners who may lack the knowledge or financial resources to properly maintain a stormwater BMP. BMPs should be deeded to homeowners associations or other responsible parties.

Section 10.10.C: For all proposed major subdivisions, a connection to any existing central sewage systems where a potential connection exists within 5,000 ft should be required. For all lots smaller than 1 acre, new on-lot sewage disposal systems should only be allowed if there is no potential connection to a community or central sewage system within 2,000 ft.

Section 10.11.C: Wells should be located no closer than 100 feet from a septic drainage field.

Section 10.19.A.1.c: Remove *Quercus acutissima* (Sawtooth Oak), from list of recommended street trees. Street trees should be native to Northampton County.

Section 10.19.C: Temporary wooden barricades or high-visibility fencing should be placed around existing trees and their roots to protect trees from damage and root compaction during the construction process.

Section 10.21: The Township should require an Erosion and Sedimentation Pollution Control Plan, approved by the Northampton County Conservation District, for all disturbances that occur within 100 ft. of a waterway or wetland, as measured from their jurisdictional boundaries.

Plainfield Township Zoning Ordinance

General Comments:

The Township should initiate sewage inspection and repair program.

Adopt woodland, wetland and riparian corridor protection standards (see models provided).

Encourage use of pervious parking materials be used for overflow parking areas.

Section Specific Comments:

Section 305.H: Reduce impervious coverage allowance to 20% in FF District.

Section 306.H: Reduce impervious coverage allowance in SR District to 30%.

Section 315.B.2: Require a 200 foot setback between manure storage and any watercourse or wetland.

Section 315.B.10 and 315.B.21: Prohibit new gas stations from within 300 feet of public water supply wellhead. Add language requiring that these uses include appropriate preventive measures to control unintended spills or leaks of petroleum, oils or similar pollutants from areas where vehicles are fueled, serviced or repaired.

Section 316.E.31: Require a 200 foot setback between a new junkyard and any watercourse or wetland.

Section 319.E.5: Require 150-foot setback, plotted horizontally, from mineral extraction operation to the average high water mark of a lake, pond, or perennial stream or the edge of a natural wetland of more than 1 acre. Require a performance bond to ensure land reclamation will be completed in a timely fashion.

Section 319.E.11: Require a 200 foot setback between a new landfill facility and any watercourse or wetland.

Section 319.E.13: Require a 200 foot setback between a new waste facility and any watercourse or wetland.

Section 404.D.3: Screening yards and buffers should require vegetation native to Northampton County.

Section 506: Identify Alluvial soils in Plainfield Township.

Article 5: Adopt woodland, wetland and riparian buffer performance standards included in model ordinances.

All Zones: Building setbacks should be 150 feet from any perennial stream, 100 feet for intermittent streams, and 50 feet from any drainage channel or swale (except for road crossings in all cases). Paving setback should be 50 ft. from all streams (perennial, intermittent, ephemeral) and drainage channels or swales.

3.0 Conclusions

Plainfield Township's current ordinances provide a solid framework for resource protection. The proposed amendments, revisions, and additional ordinances will provide excellent protection of the natural resources that serve as the basis for the quality of life in Plainfield Township, while still allowing and providing for residential and economic development.

4.0 Recommendations

In addition to the amendments and revisions proposed above, the following “watershed protection” ordinances are provided to supplement and compliment the existing township ordinances:

- Stream Buffer Conservation Zone Ordinance
- Natural Features Conservation Ordinance (encompassing many otherwise unprotected features)
- Stormwater Management Ordinance (water quality and infiltration) w/ manual explaining how to use ordinance (pushes more desirable low impact development)
- Natural Landscape Ordinance
- Noxious Weed Control Ordinance
- Forest Conservation Ordinance

These additional ordinances provide examples of resource protection efforts being successfully implemented in other municipalities in eastern Pennsylvania.

Incorporating these ordinances, in part or in their entirety, into Plainfield Township’s existing ordinances would be relatively easy, requiring simple amendments to the existing ordinances or referencing their use for the appropriate sections. Where feasible, these ordinances should be grouped into common chapters or appendices of the zoning code to facilitate subdivision, development and zoning issue review. These ordinances can be adopted and implemented as zoning overlay districts so that resource protection requirements will be applied consistently, to all lots, throughout the township.

Palmer Township Ordinance Review

1.0 Introduction

Palmer Township currently has the following ordinances that pertain to “watershed management and protection:”

- Subdivision and Land Development Ordinance (SALDO 2002)
- Zoning Ordinance (2002)

Each of the above ordinances has been thoroughly reviewed as part of the Bushkill Creek Watershed Protection Project, sponsored by the Bushkill Stream Conservancy through a grant by the Pennsylvania Department of Environmental Protection Growing Greener Program. The revisions and recommendations for each of the above listed ordinances are discussed in detail in the following section, by ordinance.

2.0 Review of Existing Palmer Township Ordinances

Palmer Township Subdivision and Land Development Ordinance

General Comments:

Change references of DER to DEP.

Definitions:

Definitions should be updated to include the following terms

Alluvial soil: Include definition of Alluvial Soils to read: Areas subject to periodic flooding and listed in the Soil Survey of Northampton County, Pennsylvania, U.S. Department of Agricultural Soil Conservation Service, July 1974, as amended, as being "on, or in, the flood plain" or subject to flooding. **Alluvial soils found in the township should be identified in this definition.**

Carbonate geology: Include a definition of Carbonate Geology to read: Areas of the township underlain by geology composed of rock consisting chiefly of calcium and magnesium carbonates.

Hydric soil: Include a definition of hydric soils to read: Soils that are categorized as poorly drained that can support hydrophilic plants, but may not do so in many cases. For the purpose of this Ordinance, Hydric soils are general wetland indicator soils
Hydric soils found in the township should be identified in this definition.

Karst topography: Include a definition for Karst topography to read: The relief of an area underlain by limestone that dissolves intermittently to form numerous depressions or small basins.

Riparian corridor (if adopted): An area surrounding surface water bodies, including

creeks, lakes, watercourses, and wetlands that intercept surface water runoff, wastewater, subsurface flow, and/or deep groundwater flows from upland sources and function to remove or buffer the effects of associated nutrients, sediment, organic matter, pesticides, or other pollutants prior to entry into surface waters. This area may also provide wildlife habitat, control water temperature, attenuate flood flow, and provide opportunities for passive recreation.

Stream: Include a definition of “stream” to read: All flowing watercourses, natural or man-made, with definable “bed and bank” scenario, whether ephemeral, intermittent, or perennial.

Vernal pond: Include a definition of “vernal pond (aka vernal pool)” to read: Vernal ponds are seasonal depressional wetlands and/or ponds. They are covered by shallow water for variable periods from winter to spring, but may be completely dry for most of the summer and fall. These wetlands range in size from small puddles to shallow lakes and are usually found in a gently sloping plains. Although generally isolated, they are sometimes connected to each other by small drainages known as vernal swales. Beneath natural vernal ponds lies either bedrock or a hard clay layer in the soil that helps keep water in the ponded area. Vernal ponds are regulated as wetlands and/or waterways (as ponds which are considered “waters of the United States” and “waters of the Commonwealth of Pennsylvania”), and therefore, they are under the jurisdiction of the state and/or federal governments.

Wetlands: Revise definition for “wetlands” to read: Wetlands are "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. Wetlands generally include swamps, marshes, bogs, certain types of vernal ponds (also known as vernal pools), and similar areas. Wetlands are to be delineated by a qualified professional in accordance with the guidance set forth in the United States Army Corps of Engineers 1987 *Wetlands Delineation Manual*, or the Pennsylvania Department of Environmental Protection Wetlands Identification and Delineation, Chapter 105, Dam Safety and Waterways Management, Rules and Regulations; or the U.S. Environmental Protection Agency Wetlands Identification Delineation Manual, Volume I, Rational, Wetland Parameters, and Overview of Jurisdictional Approach, Volume II, Field Methodology, or the most recently amended reports, will be considered a wetland for the purposes of this Ordinance. In the event the definition of a wetland accepted by the U.S. Army Corps of Engineers conflicts with the definition of a wetland-accepted by the Pennsylvania Department of Environmental Protection, or the U.S. Environmental Protection Agency, the more restrictive definition shall apply.

Woodland: Include definition of woodland to include read: The woodland shall be measured from the drip line of the outer trees. Woodlands are also a grove of trees forming one (1) canopy where twelve (12) or more trees measure at least six (6")

inches diameter at breast height in dbh.

Plan submissions:

In addition to the required elements currently in the SALDO regulation, all plan submissions (sketch, preliminary and final) should have wetland transitions areas, watercourses (including streams, lakes, ponds, and vernal pools), Karst topography or carbonate geology, and stream corridor or riparian buffer zone.

The location of all wells, primary drain fields, and secondary drain fields for all adjoining properties should be clearly indicated on all required maps and drawings, in addition to the existing and proposed structures on the applicant's own property.

The Township should require a wetlands assessment by a qualified professional for all new development on parcels that contain any hydric soils areas, in accordance with the published list of hydric soils for Northampton County, Pennsylvania by the United States Department of Agriculture. The Township should maintain the right to require a Jurisdictional Determination by the United States Army Corps of Engineers, as necessary to substantiate the findings of the afore mentioned wetlands assessment.

Sewage systems

The Township should initiate an inspection and repair program by Township Sewage Enforcement Officer for any new development that will be using a new or existing on-lot sewage disposal system.

Stormwater

The Township should adopt the provisions of the model ordinance developed for the Little Lehigh River Act 167 Plan in order to meet the requirements of the NPDES Phase II regulations. The township should adopt the provisions of the updated Bushkill Watershed Act 167 Plan as they become available.

Stream and water quality

A 50 ft. vegetative, natural buffer should be required around all waterways (lakes, ponds, vernal ponds, rivers, streams, and wetlands). This could be increased to 75 feet (each side). A two zone buffer is preferable.

Require water quality improvements from stormwater treatment BMPs.

Adopt water conservation ordinance to protect groundwater resources in the Township.

Section Specific Comments:

Section 165-63: Require stormwater BMPs to improve stormwater quality through design standards. The following requirements are an example of design criteria that improve water quality:

- Stormwater management facilities shall be provided to detain 1-year, 24-hour (SCS Type II) design storm using the distribution. Provisions shall be made so that 1-year

storm takes 25 hours to drain from the facility from a point where the maximum volume of water captured by the facility for the 1-year storm is achieved (i.e., the maximum water surface elevation achieved in the facility).

- Release of this 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. To that end, the minimum outfall orifice diameter shall be 4-inches. Provisions must also be made for safely passing the runoff greater than that occurring from the largest design storm.
- The water quality, objective can be obtained through any applicable BMPs or combinations thereof, including infiltration, wet detention, extended day detention, etc.

Section 165-63.A.: Address issue of stormwater runoff into lakes, ponds, vernal ponds, rivers, streams, and wetlands. Specifically state that stormwater must be directed into detention basins or to retention basins/systems (eg – retention basins, extended detention basins, constructed wetlands, bio-retention areas), or to other treatment areas rather than being allowed to drain directly into waterways.

Section 165-63 K.: Detention facility should be planted with low maintenance, non-poisonous, non-invasive vegetative groundcover.

Section 165-63 K.(5): Prohibit low flow channels in detention basins

Section 165-63 N.(5): Add provisions to note that bridge abutments and culverts should be aligned with stream flow and bridges and culverts with paved bottoms should have low flow channel to allow for fish passage.

Section 165-65 C.: Add provision requiring that wells be located at least 100 feet from any septic system drainage field.

Section 165-73 A.(1).(c): Remove *Acer platanoides* (Norway Maple) and *Quercus acutissima* Carruthers (Sawtooth Oak) from list of approved street trees. Street trees should be native to Northampton County.

Section 165-73 A.(1).(e): Add the following species on list of prohibited trees:

- *Paulownia tomentosa* Princess tree
- *Acer platanoides* Norway Maple
- *Pyrus calleryana* Bradford Pear
- *Quercus acutissima* Carruthers Sawtooth Oak

Section 165-76: The Township should require an Erosion and Sedimentation Pollution Control Plan, approved by the Northampton County Conservation District, for all disturbances that occur within 100 ft. of a waterway or wetland, as measured from their jurisdictional boundaries.

Palmer Township Zoning Ordinance

General Comments:

All reference of “DER” should be changed to “DEP.”

The Township should initiate sewage inspection and repair program.

Adopt wetland and riparian corridor protection standards (see models provided).

Encourage use of pervious parking materials be used for overflow parking areas.

Section Specific Comments:

Section 190-150 B.: Limit site disturbance of slopes greater >15% to 30% of sloped area. Prohibit disturbance of slopes >25% unless disturbance is necessary to:

- Accommodate a street, driveway or utility line when no other feasible route for such an activity exists and if the site disturbance is minimized to the greatest extent feasible or to
- Accommodate a trail or trails that are part of an existing or planned trail network and are located or constructed based on accepted best management practices for minimizing erosion
- In no case shall more than 20% of slopes >25% be disturbed.

Section 190-151-B.(1):

- Add language indicating that presence of Hydric soils, in affected area, should require wetland delineation from professional soil scientist or other certified wetland delineator.
- b) Identify Hydric soils found in Palmer Township.

Section 190-152 B.: Setbacks from waterways should be increased to 150 feet from major waterway and 100 feet from minor waterway.

Delete Section 190-153

Section 190-154 F.(2).(c).[2].: Identify Alluvial soils in Palmer Township.

Section 190-155 B.: Limit scope of regrading on areas with slopes >15% to no more than 30% of area. Prohibit regarding of slopes >25%.

Section 190-164: Add provisions to prevent removal of 50% of woodlands.

Section 190-194 D.(10).: Remove the non-native invasive plants from screening buffer,

especially non-native privets, honeysuckle and euonymus.

Section 190-210 B. (18).: Junkyard. Require a 200 foot setback between a new junkyard and any watercourse or wetland.

Section 190-210 B. (20).: Require 150-foot setback, plotted horizontally, from mineral extraction operation to the average high water mark of a lake, pond, or perennial stream or the edge of a natural wetland of more than 1 acre. Require a performance bond to ensure land reclamation will be completed in a timely fashion.

Section 190-210 B. (26).: Sanitary Waste facility. Require a 200 foot setback between a new waste facility and any watercourse or wetland.

Section 190-210 B. (30).: Solid Waste facility. Require a 200 foot setback between a new waste facility and any watercourse or wetland.

Section 190-210 C. Prohibit tank farms or new gas stations from within 300 feet of public water supply wellhead.

All Zones: Building setbacks should be 150 feet from any perennial stream, 100 feet for intermittent streams, and 50 feet from any drainage channel or swale (except for road crossings in all cases). Paving setback should be 50 ft. from all streams (perennial, intermittent, ephemeral) and drainage channels or swales.

All Zones: It should be required that whenever an existing single family dwelling is converted to a multifamily dwelling the existing sewage disposal system must be certified as being adequate to meet the new demand.

All Zones: It should be required that whenever an existing single family dwelling is converted to a daycare, bed and breakfast, or other commercial venture, the existing sewage disposal system must be certified as being as being adequate to meet the new demand.

3.0 Conclusions

Palmer Township's current ordinances provide a solid framework for resource protection. The proposed amendments, revisions, and additional ordinances will provide excellent protection of the natural resources that serve as the basis for the quality of life in Palmer Township, while still allowing and providing for residential and economic development.

4.0 Recommendations

In addition to the amendments and revisions proposed above, the following "watershed protection" ordinances are provided to supplement and compliment the existing township ordinances:

- Stream Buffer Conservation Zone Ordinance

- Natural Features Conservation Ordinance (encompassing many otherwise unprotected features)
- Stormwater Management Ordinance (water quality and infiltration) w/ manual explaining how to use ordinance (pushes more desirable low impact development)
- Natural Landscape Ordinance
- Noxious Weed Control Ordinance
- Forest Conservation Ordinance

These additional ordinances provide examples of resource protection efforts being successfully implemented in other municipalities in eastern Pennsylvania.

Incorporating these ordinances, in part or in their entirety, into Palmer Township's existing ordinances would be relatively easy, requiring simple amendments to the existing ordinances or referencing their use for the appropriate sections. Where feasible, these ordinances should be grouped into common chapters or appendices of the zoning code to facilitate subdivision, development and zoning issue review. These ordinances can be adopted and implemented as zoning overlay districts so that resource protection requirements will be applied consistently, to all lots, throughout the township.

Moore Township Ordinance Review

1.0 Introduction

Moore Township currently has the following ordinances that pertain to “watershed management and protection:”

- Subdivision and Land Development Ordinance (SALDO amended 2001)
- Zoning Ordinance (1997)

Each of the above ordinances has been thoroughly reviewed as part of the Bushkill Creek Watershed Protection Project, sponsored by the Bushkill Stream Conservancy through a grant by the Pennsylvania Department of Environmental Protection Growing Greener Program. The revisions and recommendations for each of the above listed ordinances are discussed in detail in the following section, by ordinance.

2.0 Review of Existing Moore Township Ordinances

Moore Township Subdivision and Land Development Ordinance

General Comments:

Change references of DER to DEP.

Definitions:

Definitions should be updated to include the following terms

Alluvial soil: Include definition of Alluvial Soils to read: Areas subject to periodic flooding and listed in the Soil Survey of Northampton County, Pennsylvania, U.S. Department of Agricultural Soil Conservation Service, July 1974, as amended, as being "on, or in, the flood plain" or subject to flooding. **Alluvial soils found in the township should be identified in this definition.**

Carbonate geology: Include a definition of Carbonate Geology to read: Areas of the township underlain by geology composed of rock consisting chiefly of calcium and magnesium carbonates.

Hydric soil: Include a definition of hydric soils to read: Soils that are categorized as poorly drained that can support hydrophilic plants, but may not do so in many cases. For the purpose of this Ordinance, Hydric soils are general wetland indicator soils **Hydric soils found in the township should be identified in this definition.**

Karst topography: Include a definition for Karst topography to read: The relief of an area underlain by limestone that dissolves intermittently to form numerous depressions or small basins.

Riparian corridor protection zone (if adopted): An area surrounding surface water bodies, including creeks, lakes, watercourses, and wetlands that intercept surface water runoff, wastewater, subsurface flow, and/or deep groundwater flows from upland sources and function to remove or buffer the effects of associated nutrients, sediment, organic matter, pesticides, or other pollutants prior to entry into surface waters. This area may also provide wildlife habitat, control water temperature, attenuate flood flow, and provide opportunities for passive recreation.

Steep slope: Include a definition of steep slope to read: Areas where the average slope exceeds fifteen (15) percent.

Stream: Include a definition of “stream” to read: All flowing watercourses, natural or man-made, with definable “bed and bank” scenario, whether ephemeral, intermittent, or perennial.

Vernal pond: Include a definition of “vernal pond (aka vernal pool)” to read: Vernal ponds are seasonal depressional wetlands and/or ponds. They are covered by shallow water for variable periods from winter to spring, but may be completely dry for most of the summer and fall. These wetlands range in size from small puddles to shallow lakes and are usually found in a gently sloping plains. Although generally isolated, they are sometimes connected to each other by small drainages known as vernal swales. Beneath natural vernal ponds lies either bedrock or a hard clay layer in the soil that helps keep water in the ponded area. Vernal ponds are regulated as wetlands and/or waterways (as ponds which are considered “waters of the United States” and “waters of the Commonwealth of Pennsylvania”), and therefore, they are under the jurisdiction of the state and/or federal governments.

Wetlands: Revise definition for “wetlands” to read: Wetlands are "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. Wetlands generally include swamps, marshes, bogs, certain types of vernal ponds (also known as vernal pools), and similar areas. Wetlands are to be delineated by a qualified professional in accordance with the guidance set forth in the United States Army Corps of Engineers 1987 *Wetlands Delineation Manual*, or the Pennsylvania Department of Environmental Protection Wetlands Identification and Delineation, Chapter 105, Dam Safety and Waterways Management, Rules and Regulations; or the U.S. Environmental Protection Agency Wetlands Identification Delineation Manual, Volume I, Rational, Wetland Parameters, and Overview of Jurisdictional Approach, Volume II, Field Methodology, or the most recently amended reports, will be considered a wetland for the purposes of this Ordinance. In the event the definition of a wetland accepted by the U.S. Army Corps of Engineers conflicts with the definition of a wetland-accepted by the Pennsylvania Department of Environmental Protection, or the U.S. Environmental Protection Agency, the more restrictive definition shall apply.

Woodland: Include definition of woodland to include read: The woodland shall be measured from the drip line of the outer trees. Woodlands are also a grove of trees forming one (1) canopy where twelve (12) or more trees measure at least six (6") inches diameter at breast height in dbh.

Revise definition of (67)“Floodplain” to read “...which is subject to partial or complete inundation in event of the 100 year return interval storm or has a 1% chance of being partially or completely inundated during any given year.

Plan submissions:

In addition to the required elements currently in the SALDO regulation, all plan submissions (sketch, preliminary and final) should have environmental resources included on the map. Mapped resources should include wetlands, wetland transitions areas, watercourses (including streams, lakes, ponds, and vernal pools), 100 year floodplain, woodlands, Karst topography or carbonate geology, and stream corridor or riparian buffer zone.

Require a Landscape Plan for Major subdivisions showing required screening/buffer yards and plantings, street trees, tree protection areas, means for tree protection, trees to be preserved during development, and proposed planting schedule, including species, sizes, and numbers of plantings.

The Township should require an Erosion and Sedimentation Pollution Control Plan, approved by the Northampton County Conservation District, for all disturbances that occur within 100 ft. of a waterway or wetland, as measured from their jurisdictional boundaries.

The location of all wells, primary drain fields, and secondary drain fields for all adjoining properties should be clearly indicated on all required maps and drawings, in addition to the existing and proposed structures on the applicant’s own property.

The Township should require a wetlands assessment by a qualified professional for all new development on parcels that contain any hydric soils areas, in accordance with the published list of hydric soils for Northampton County, Pennsylvania by the United States Department of Agriculture. The Township should maintain the right to require a Jurisdictional Determination by the United States Army Corps of Engineers, as necessary to substantiate the findings of the afore mentioned wetlands assessment.

Sewage systems

A section should be included on all applications pertaining to individual on-lot sewage disposal. Specifically stated should be setbacks from all wetlands and waterways, as well as neighboring wells and property lines.

The Township should initiate an inspection and repair program by Township Sewage Enforcement Officer for any new development that will be using a new or existing on-lot

sewage disposal system.

The installation of “dry” sewer lines should be required for all new development, if the Board of Supervisors or Township Engineer determines that the development is likely to be expanded and/or served by an extension of an existing sewage treatment plant within the next ten years.

Stormwater

The Township should adopt the provisions of the model ordinance developed for the Little Lehigh River Act 167 Plan in order to meet the requirements of the NPDES Phase II regulations. The township should adopt the provisions of the updated Bushkill Watershed Act 167 Plan as they become available.

Stream and water quality

Prohibition of development on flood fringe should be as stringent as development in floodway.

A 50 ft. vegetative, natural buffer should be required around all waterways (lakes, ponds, vernal ponds, rivers, streams, and wetlands). This could be increased to 75 feet (each side). A two zone buffer is preferable.

Require water quality improvements from stormwater treatment BMPs.

Adopt water conservation ordinance to protect groundwater resources in the Township.

Tree protection

Temporary wooden barricades or high-visibility fencing should be placed around existing trees and their roots to protect trees from damage and root compaction during the construction process.

Section Specific Comments:

Section 9.2.i.: Address issue of stormwater runoff into lakes, ponds, vernal ponds, rivers, streams, and wetlands. Specifically state that stormwater must be directed into detention basins or to retention basins/systems (eg – retention basins, extended detention basins, constructed wetlands, bio-retention areas), or to other treatment areas rather than being allowed to drain directly into waterways.

Section 9.2 i.(2): Section should be added to indicate that run-off from the site should be no greater after development than it was before the land was developed. Language from Appendix C3.b. can be added to this section for clarity.

Section 9.2 i.(2)r ii: Detention facility should be planted with low maintenance, non-poisonous, non-invasive vegetative groundcover.

Section 9.2 i.(2).r.iv: Stormwater BMPs should not be deeded to individual landowners who may lack the knowledge or financial resources to properly maintain a stormwater BMP. BMPs should be deeded to homeowners associations or other responsible parties.

Section 9.2 i.(2).r.vi: Require stormwater BMPs to improve stormwater quality through design standards. The following requirements are an example of design criteria that improve water quality:

- Stormwater management facilities shall be provided to detain 1-year, 24-hour (SCS Type II) design storm using the distribution. Provisions shall be made so that 1-year storm takes 25 hours to drain from the facility from a point where the maximum volume of water captured by the facility for the 1-year storm is achieved (i.e., the maximum water surface elevation achieved in the facility).
- Release of this 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. To that end, the minimum outfall orifice diameter shall be 4-inches. Provisions must also be made for safely passing the runoff greater than that occurring from the largest design storm.
- The water quality, objective can be obtained through any applicable BMPs or combinations thereof, including infiltration, wet detention, extended day detention, etc.

Section 10.4 b. (10).: Add provisions to note that bridge abutments and culverts should be aligned with stream flow and bridges and culverts with paved bottoms should have low flow channel to allow for fish passage.

Section 10.11: Street trees should be native to Northampton County.

Section 11.5 j.: Underground storage of fuel should be prohibited in residential developments to prevent groundwater and soil contamination.

Moore Township Zoning Ordinance

General Comments:

All reference of “DER” should be changed to “DEP.”

Review table headings of all “Maximum Land Coverage” tables. Some minimum lot requirements state acres when should read “square feet”

The Township should initiate sewage inspection and repair program.

Section Specific Comments:

Section 200-12. Ten acre zoning is not likely to be legally defensible. The Township should strengthen natural resource protection ordinances in all zones to preserve unique character of the BMC zone into the future and formulate long term preservation strategies, such as conservation easements and open space purchases of key parcels, to preserve unique characteristics of this zone.

Section 200-13 F.: Review impervious cover limits in LC District. Consider reducing to 10% for “all other uses”.

Section 200-18 E. (19).: Junkyard. Require a 200-foot setback between a new junkyard and any watercourse or wetland.

Section 200-19 D. (8).: Require 150-foot setback, plotted horizontally, from mineral extraction operation to the average high water mark of a lake, pond, or perennial stream or the edge of a natural wetland of more than 1 acre. Require a performance bond to ensure land reclamation will be completed in a timely fashion.

Article V.

Include wetland protection standards including Wetland Transition Zone to further protect wetland and water resources of the township. (See model).

Adopt Riparian Corridor Conservation District. (See model).

Section 200-31.1.: Whenever a logging operation involves a stream crossing, an erosion and sedimentation plan shall be required. No clear-cutting should be permitted within 50-feet of any lakes, ponds, streams, or wetlands. A 50-foot vegetative buffer should be left around all waterways.

Section 200-32 B: Limit scope of regarding of slopes greater >15% to 30% of sloped area. Prohibit regrading of slopes >25%.

200-34 B.(2).a.: Identify Alluvial soils in Moore Township.

Appendix A. 1.: Consider allowing greater density to encourage developers to use Planned Residential Development Option.

All Zones: Building setbacks should be 150 feet from any perennial stream, 100 feet for intermittent streams, and 50 feet from any drainage channel or swale (except for road crossings in all cases). Paving setback should be 50 ft. from all streams (perennial, intermittent, ephemeral) and drainage channels or swales.

All Zones: It should be required that whenever an existing single family dwelling is converted to a multifamily dwelling the existing sewage disposal system must be certified as

being adequate to meet the new demand.

All Zones: It should be required that whenever an existing single family dwelling is converted to a daycare, bed and breakfast, or other commercial venture, the existing sewage disposal system must be certified as being as being adequate to meet the new demand.

3.0 Conclusions

Moore Township's current ordinances provide a limited degree of resource protection. However, they will provide a solid framework, necessary for adoption of the above amendments and revisions, as well as the recommended additional "watershed protection" ordinances discussed in the next section of this document.

The proposed amendments, revisions, and additional ordinances will provide excellent protection of the natural resources that serve as the basis for the quality of life in Moore Township, while still allowing and providing for residential and economic development.

4.0 Recommendations

In addition to the amendments and revisions proposed above, the following "watershed protection" ordinances are provided to supplement and compliment the existing township ordinances:

- Stream Buffer Conservation Zone Ordinance
- Natural Features Conservation Ordinance (encompassing many otherwise unprotected features)
- Stormwater Management Ordinance (water quality and infiltration) w/ manual explaining how to use ordinance (pushes more desirable low impact development)
- Natural Landscape Ordinance
- Noxious Weed Control Ordinance
- Forest Conservation Ordinance

These additional ordinances provide examples of resource protection efforts being successfully implemented in other municipalities in eastern Pennsylvania.

Incorporating these ordinances, in part or in their entirety, into Moore Township's existing ordinances would be relatively easy, requiring simple amendments to the existing ordinances or referencing their use for the appropriate sections. Where feasible, these ordinances should be grouped into common chapters or appendices of the zoning code to facilitate subdivision, development and zoning issue review. These ordinances can be adopted and implemented as zoning overlay districts so that resource protection requirements will be applied consistently, to all lots, throughout the township.

Lower Nazareth Township Ordinance Review

1.0 Introduction

Lower Nazareth Township currently has the following ordinances that pertain to “watershed management and protection:”

- Subdivision and Land Development Ordinance (SALDO 2001)
- Zoning Ordinance (2001)
- Floodplain Protection Ordinance (2001)

Zoning and SALDO ordinances have been thoroughly reviewed as part of the Bushkill Creek Watershed Protection Project, sponsored by the Bushkill Stream Conservancy through a grant by the Pennsylvania Department of Environmental Protection Growing Greener Program. The revisions and recommendations for Zoning and SALDO ordinances are discussed in detail in the following section, by ordinance. The Floodplain Protection Ordinance was discussed with the township zoning officer and no recommendations regarding that ordinance are included in this summary.

2.0 Review of Existing Lower Nazareth Township Ordinances

General Comments:

Definitions:

Definitions should be updated to include the following terms

Alluvial soil: Include definition of Alluvial Soils to read: Areas subject to periodic flooding and listed in the Soil Survey of Northampton County, Pennsylvania, U.S. Department of Agricultural Soil Conservation Service, July 1974, as amended, as being "on, or in, the flood plain" or subject to flooding. **Alluvial soils found in the township should be identified in this definition.**

Hydric soil: Include a definition of hydric soils to read: Soils that are categorized as poorly drained that can support hydrophilic plants, but may not do so in many cases. For the purpose of this Ordinance, Hydric soils are general wetland indicator soils **Hydric soils found in the township should be identified in this definition.**

Riparian corridor: An area surrounding surface water bodies, including creeks, lakes, watercourses, and wetlands that intercept surface water runoff, wastewater, subsurface flow, and/or deep groundwater flows from upland sources and function to remove or buffer the effects of associated nutrients, sediment, organic matter, pesticides, or other pollutants prior to entry into surface waters. This area may also provide wildlife habitat, control water temperature, attenuate flood flow, and provide opportunities for passive recreation.

Stream: Include a definition of “stream” to read: All flowing watercourses, natural

or man-made, with definable “bed and bank” scenario, whether ephemeral, intermittent, or perennial.

Vernal pond: Include a definition of “vernal pond (aka vernal pool)” to read: Vernal ponds are seasonal depressional wetlands and/or ponds. They are covered by shallow water for variable periods from winter to spring, but may be completely dry for most of the summer and fall. These wetlands range in size from small puddles to shallow lakes and are usually found in a gently sloping plains. Although generally isolated, they are sometimes connected to each other by small drainages known as vernal swales. Beneath natural vernal ponds lies either bedrock or a hard clay layer in the soil that helps keep water in the ponded area. Vernal ponds are regulated as wetlands and/or waterways (as ponds which are considered “waters of the United States” and “waters of the Commonwealth of Pennsylvania”), and therefore, they are under the jurisdiction of the state and/or federal governments.

Wetlands: Revise definition for “wetlands” to read: Wetlands are "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. Wetlands generally include swamps, marshes, bogs, certain types of vernal ponds (also known as vernal pools), and similar areas. Wetlands are to be delineated by a qualified professional in accordance with the guidance set forth in the United States Army Corps of Engineers 1987 *Wetlands Delineation Manual*, or the Pennsylvania Department of Environmental Protection Wetlands Identification and Delineation, Chapter 105, Dam Safety and Waterways Management, Rules and Regulations; or the U.S. Environmental Protection Agency Wetlands Identification Delineation Manual, Volume I, Rational, Wetland Parameters, and Overview of Jurisdictional Approach, Volume II, Field Methodology, or the most recently amended reports, will be considered a wetland for the purposes of this Ordinance. In the event the definition of a wetland accepted by the U.S. Army Corps of Engineers conflicts with the definition of a wetland-accepted by the Pennsylvania Department of Environmental Protection, or the U.S. Environmental Protection Agency, the more restrictive definition shall apply.

Stormwater

The Township should adopt the provisions of the model ordinance developed for the Little Lehigh River Act 167 Plan in order to meet the requirements of the NPDES Phase II regulations. The township should adopt the provisions of the updated Bushkill Watershed Act 167 Plan as they become available.

Subdivision and Land Development Ordinances

Plan submissions:

The location of all wells, primary drain fields, and secondary drain fields for all adjoining properties should be clearly indicated on all required maps and drawings, in addition to the existing and proposed structures on the applicant's own property.

Stream and water quality

Require water quality improvements from stormwater treatment BMPs.

Adopt water conservation ordinance to protect groundwater resources in the Township. Ordinance should require building fixtures and practices meet water conservation standards.

Section Specific Comments:

Section 772: Address issue of stormwater runoff into lakes, ponds, vernal ponds, rivers, streams, and wetlands. Specifically state that stormwater must be directed into detention basins or to retention basins/systems (eg – retention basins, extended detention basins, constructed wetlands, bio-retention areas), or to other treatment areas rather than being allowed to drain directly into waterways.

Section 774: Require stormwater BMPs to improve stormwater quality through design standards. The following requirements are an example of design criteria that improve water quality:

- Stormwater management facilities shall be provided to detain 1-year, 24-hour (SCS Type II) design storm using the distribution. Provisions shall be made so that 1-year storm takes 25 hours to drain from the facility from a point where the maximum volume of water captured by the facility for the 1-year storm is achieved (i.e., the maximum water surface elevation achieved in the facility).
- Release of this 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. To that end, the minimum outfall orifice diameter shall be 4-inches. Provisions must also be made for safely passing the runoff greater than that occurring from the largest design storm.
- The water quality objective can be obtained through any applicable BMPs or combinations thereof, including infiltration, wet detention, extended day detention, etc.

Section 774.3: Prohibit low flow channels in detention basins

Section 774.36.: Detention facility should be planted with low maintenance, non-poisonous, non-invasive vegetative groundcover.

Section 774.36: Stormwater BMPs should not be deeded to individual landowners who may lack the knowledge or financial resources to properly maintain a stormwater BMP. BMPs

should be deeded to homeowners associations or other responsible parties.

Lower Nazareth Township Zoning Ordinance

General Comments:

Encourage use of pervious parking materials be used for overflow parking areas.

Review impervious coverage allowances in all zones.

Section Specific Comments:

Section 505: Review impervious cover limits in LDR District. Consider reducing building coverage to 20% and impervious limits to 30%.

Section 605: Review impervious cover limits in MDR District. Consider reducing building coverage to 30% and impervious limits to 40%.

Section 1304: Review impervious cover limits in CR District. Consider reducing building coverage to 10% and impervious limits to 15%.

Section 1404 D.3.b.: Add language that allows managed natural meadow areas that have grasses and forbs greater than 8 inches in height. See model Natural landscape ordinance.

Section 1404 D.6.b.: Remove the nonnative invasive plants *Elaeagnus angustifolia* (Russian Olive) and *Euonymus Alatus* (winged euonymus) from listed of recommended tree and shrub species. Street trees should be native to Northampton County.

Section 1502 A.6: Add provision requiring that manure storage be at least 200' from watercourse, wetland, stream or pond.

Sections 1502 A.8 & 9: Add similar language to Section 1502 A.68.f , requiring that these uses include appropriate preventive measures to control unintended spills or leaks of petroleum, oils or similar pollutants from areas where vehicles are fueled, serviced or repaired.

Section 1502 A. 46. Require minimum setback for Excavation for Mineral Extraction be 150 feet from any perennial stream or natural wetland of more than 1 acre.

Section 1600: Add provisions protecting areas of Karst topography, as per Section 794 of SALDO, from expansion of existing land uses that may not be considered subdivision or land development activities.

Section 1603: Limit site disturbance of slopes greater >15% to 30% of sloped area. Prohibit disturbance of slopes >25% unless disturbance is necessary to:

- Accommodate a street, driveway or utility line when no other feasible route

- for such an activity exists and if the site disturbance is minimized to the greatest extent feasible or to
- Accommodate a trail or trails that are part of an existing or planned trail network and are located or constructed based on accepted best management practices for minimizing erosion
- In no case shall more than 20% of slopes >25% be disturbed.

Section 1604 Adopt more clear prohibitions to development of wetlands as provided in model wetland protection standards.

Section 1604 D. Increase setback from wetlands to 50 feet.

Section 1605: Building setbacks should be 150 feet from any perennial stream, 100 feet for intermittent streams, and 50 feet from any drainage channel or swale (except for road crossings in all cases). Paving setback should be 50 ft. from all streams (perennial, intermittent, ephemeral) and drainage channels or swales.

Section 1606: Identify Alluvial soils in Lower Nazareth Township.

Section 1703 E. Allow for non-pervious pavement in addition to gravel for overflow parking for eight days per month.

3.0 Conclusions

Lower Nazareth Township's current ordinances provide a solid framework for resource protection. The proposed amendments, revisions, and additional ordinances will provide excellent protection of the natural resources that serve as the basis for the quality of life in Lower Nazareth, while still allowing and providing for residential and economic development.

4.0 Recommendations

In addition to the amendments and revisions proposed above, the following "watershed protection" ordinances are provided to supplement and compliment the existing township ordinances:

- Stream Buffer Conservation Zone Ordinance
- Natural Features Conservation Ordinance (encompassing many otherwise unprotected features)
- Stormwater Management Ordinance (water quality and infiltration) w/ manual explaining how to use ordinance (pushes more desirable low impact development)
- Natural Landscape Ordinance
- Noxious Weed Control Ordinance
- Forest Conservation Ordinance

These additional ordinances provide examples of resource protection efforts being successfully implemented in other municipalities in eastern Pennsylvania.

Incorporating these ordinances, in part or in their entirety, into Lower Nazareth Township's existing ordinances would be relatively easy, requiring simple amendments to the existing ordinances or referencing their use for the appropriate sections. Where feasible, these ordinances should be grouped into common chapters or appendices of the zoning code to facilitate subdivision, development and zoning issue review. These ordinances can be adopted and implemented as zoning overlay districts so that resource protection requirements will be applied consistently, to all lots, throughout the township.

Forks Township Ordinance Review

1.0 Introduction

Forks Township currently has the following ordinances that pertain to “watershed management and protection”:

- Subdivision and Land Development Ordinance (SALDO 2003)
- Zoning Ordinance (2001)

Each of the above ordinances has been thoroughly reviewed as part of the Bushkill Creek Watershed Protection Project, sponsored by the Bushkill Stream Conservancy through a grant by the Pennsylvania Department of Environmental Protection Growing Greener Program. The revisions and recommendations for each of the above listed ordinances are discussed in detail in the following section, by ordinance.

2.0 Review of Existing Forks Township Ordinances

Forks Township Subdivision and Land Development Ordinance

Definitions:

Definitions should be updated to include the following terms

Hydric soil: Include a definition of hydric soils to read: Soils that are categorized as poorly drained that can support hydrophilic plants, but may not do so in many cases. For the purpose of this Ordinance, Hydric soils are general wetland indicator soils
Hydric soils found in the township should be identified in this definition.

Riparian corridor (if adopted): An area surrounding surface water bodies, including creeks, lakes, watercourses, and wetlands that intercept surface water runoff, wastewater, subsurface flow, and/or deep groundwater flows from upland sources and function to remove or buffer the effects of associated nutrients, sediment, organic matter, pesticides, or other pollutants prior to entry into surface waters. This area may also provide wildlife habitat, control water temperature, attenuate flood flow, and provide opportunities for passive recreation.

Vernal pond: Include a definition of “vernal pond (aka vernal pool)” to read: Vernal ponds are seasonal depressional wetlands and/or ponds. They are covered by shallow water for variable periods from winter to spring, but may be completely dry for most of the summer and fall. These wetlands range in size from small puddles to shallow lakes and are usually found in a gently sloping plains. Although generally isolated, they are sometimes connected to each other by small drainages known as vernal swales. Beneath natural vernal ponds lies either bedrock or a hard clay layer in the soil that helps keep water in the ponded area. Vernal ponds are regulated as wetlands and/or waterways (as ponds which are considered “waters of the United States” and “waters of the Commonwealth of Pennsylvania”), and therefore, they are

under the jurisdiction of the state and/or federal governments.

Wetlands: Revise definition for “wetlands” to read: Wetlands are "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. Wetlands generally include swamps, marshes, bogs, certain types of vernal ponds (also known as vernal pools), and similar areas. Wetlands are to be delineated by a qualified professional in accordance with the guidance set forth in the United States Army Corps of Engineers 1987 *Wetlands Delineation Manual*, or the Pennsylvania Department of Environmental Protection Wetlands Identification and Delineation, Chapter 105, Dam Safety and Waterways Management, Rules and Regulations; or the U.S. Environmental Protection Agency Wetlands Identification Delineation Manual, Volume I, Rational, Wetland Parameters, and Overview of Jurisdictional Approach, Volume II, Field Methodology, or the most recently amended reports, will be considered a wetland for the purposes of this Ordinance. In the event the definition of a wetland accepted by the U.S. Army Corps of Engineers conflicts with the definition of a wetland-accepted by the Pennsylvania Department of Environmental Protection, or the U.S. Environmental Protection Agency, the more restrictive definition shall apply.

Plan submissions:

The location of all wells, primary drain fields, and secondary drain fields for all adjoining properties should be clearly indicated on all required maps and drawings, in addition to the existing and proposed structures on the applicant's own property.

The Township should require a wetlands assessment by a qualified professional for all new development on parcels that contain any hydric soils areas, in accordance with the published list of hydric soils for Northampton County, Pennsylvania by the United States Department of Agriculture. The Township should maintain the right to require a Jurisdictional Determination by the United States Army Corps of Engineers, as necessary to substantiate the findings of the afore mentioned wetlands assessment.

Require a Landscape Plan for Major subdivisions showing required screening/buffer yards and plantings, street trees, tree protection areas, means for tree protection, trees to be preserved during development, and proposed planting schedule, including species, sizes, and numbers of plantings.

Sewage systems

A section should be included on all applications pertaining to individual on-lot sewage disposal. Specifically stated should be setbacks from all wetlands and waterways, as well as neighboring wells and property lines.

The Township should initiate an inspection and repair program by Township Sewage

Enforcement Officer for any new development that will be using a new or existing on-lot sewage disposal system.

Stormwater

The Township should adopt the provisions of the model ordinance developed for the Little Lehigh River Act 167 Plan in order to meet the requirements of the NPDES Phase II regulations. The township should adopt the provisions of the updated Bushkill Watershed Act 167 Plan as they become available.

Stream and water quality

A 50 ft. vegetative, natural buffer should be required around all waterways (lakes, ponds, vernal ponds, rivers, streams, and wetlands). This could be increased to 75 feet (each side). A two zone buffer is preferable.

Require water quality improvements from stormwater treatment BMPs.

Adopt water conservation ordinance to protect groundwater resources in the Township.

Section Specific Comments:

Section 175-42.D: Prohibit building in entire flood prone area not only within floodway.

Section 175-42.H: Wells should be located no closer than 100 feet from a septic drainage field.

Section 175-56: Temporary wooden barricades or high-visibility fencing should be placed around existing trees and their roots to protect trees from damage and root compaction during the construction process.

Section 175-56.A.2(a): Remove non-native tree *Acer Platanoides* (Norway Maple) from list of approved street trees. Street trees should be native to Northampton County.

Section 175-62.E: Prohibit low flow channels in detention basins

Forks Township Zoning Ordinance

General Comments:

The Township should initiate sewage inspection and repair program.

Adopt riparian corridor protection standards (see model provided).

Change all references from DER to DEP.

Section Specific Comments:

Section 200-28 A: Require a 200 foot setback between manure storage and any watercourse or wetland.

Sections 200-28.E.4 and E.20: Prohibit new gas stations from within 300 feet of public water supply wellhead. Add language requiring that these uses include appropriate preventive measures to control unintended spills or leaks of petroleum, oils or similar pollutants from areas where vehicles are fueled, serviced or repaired.

Section 200-28.G.11: Require 150-foot setback, plotted horizontally, from mineral extraction operation to the average high water mark of a lake, pond, or perennial stream or the edge of a natural wetland of more than 1 acre. Require a performance bond to ensure land reclamation will be completed in a timely fashion.

Section 200-28.G.12: Require a 200 foot setback between a new waste facility and any watercourse or wetland.

Section 200-28.G.19: Require a 200 foot setback between a new landfill facility and any watercourse or wetland.

Section 200-34.B.4: Prohibit regrading of slopes greater than 25%.

Section 200-34.D.5(c): Prohibit structures noted in Section 200-34.D.5(b) from entire floodplain.

Section 200-34.D.6: Prohibit mobile homes from entire floodplain.

Section 200-36.A.5: Allow for alternative paving surfaces to asphalt for parking lots to encourage infiltration of stormwater from parking areas.

All Zones: Building setbacks should be 150 feet from any perennial stream, 100 feet for intermittent streams, and 50 feet from any drainage channel or swale (except for road crossings in all cases). Paving setback should be 50 ft. from all streams (perennial, intermittent, ephemeral) and drainage channels or swales.

All Zones: It should be required that whenever an existing single family dwelling is converted to a multifamily dwelling the existing sewage disposal system must be certified as being adequate to meet the new demand.

All Zones: It should be required that whenever an existing single family dwelling is converted to a daycare, bed and breakfast, or other commercial venture, the existing sewage disposal system must be certified as being adequate to meet the new demand.

3.0 Conclusions

Forks Township's current ordinances provide a solid framework for resource protection. The proposed amendments, revisions, and additional ordinances will provide excellent protection of the natural resources that serve as the basis for the quality of life in Forks Township, while still allowing and providing for residential and economic development.

4.0 Recommendations

In addition to the amendments and revisions proposed above, the following “watershed protection” ordinances are provided to supplement and compliment the existing township ordinances:

- Stream Buffer Conservation Zone Ordinance
- Natural Features Conservation Ordinance (encompassing many otherwise unprotected features)
- Stormwater Management Ordinance (water quality and infiltration) w/ manual explaining how to use ordinance (pushes more desirable low impact development)
- Natural Landscape Ordinance
- Noxious Weed Control Ordinance
- Forest Conservation Ordinance

These additional ordinances provide examples of resource protection efforts being successfully implemented in other municipalities in eastern Pennsylvania.

Incorporating these ordinances, in part or in their entirety, into Forks Township’s existing ordinances would be relatively easy, requiring simple amendments to the existing ordinances or referencing their use for the appropriate sections. Where feasible, these ordinances should be grouped into common chapters or appendices of the zoning code to facilitate subdivision, development and zoning issue review. These ordinances can be adopted and implemented as zoning overlay districts so that resource protection requirements will be applied consistently, to all lots, throughout the township.

Bushkill Township Ordinance Review

1.0 Introduction

Bushkill Township currently has the following ordinances that pertain to “watershed management and protection:”

- Subdivision and Land Development Ordinance
- Zoning Ordinance
- Bushkill Creek Act 167 Stormwater Ordinance (1993)
- Bushkill Township Weed Ordinance
- Bushkill Township Water Conservation Ordinance
- Bushkill Township Environmental Advisory Council Establishment Ordinance

Each of the above ordinances has been thoroughly reviewed as part of the Bushkill Creek Watershed Protection Project, sponsored by the Bushkill Stream Conservancy through a grant by the Pennsylvania Department of Environmental Protection Growing Greener Program. The revisions and recommendations for each of the above listed ordinances are discussed in detail in the following section, by ordinance.

2.0 Review of Existing Bushkill Township Ordinances

Bushkill Township Subdivision and Land Development Ordinance

General Comments:

Definitions:

Revise definition for “wetlands” to read: Wetlands are “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. Wetlands generally include swamps, marshes, bogs, certain types of vernal ponds (also known as vernal pools), and similar areas. Wetlands are to be delineated by a qualified professional in accordance with the guidance set forth in the United States Army Corps of Engineers *1987 Wetlands Delineation Manual*).

Revise the definition of “waterways” to read: Waterways include all lakes, ponds, wetlands, vernal ponds (also known as vernal pools), and streams (see definition of “stream”). All waterways are to be delineated by a qualified professional in accordance with the guidance set forth in the United States Army Corps of Engineers *1987 Wetlands Delineation Manual*.

Include a definition of “stream” to read: All flowing watercourses, natural or man-made, with definable “bed and bank” scenario, whether ephemeral, intermittent, or

perennial.

Include a definition of “vernal pond (aka vernal pool)” to read: Vernal ponds are seasonal depressional wetlands and/or ponds that occur throughout the Township, with especially high concentrations in the northern portion. They are covered by shallow water for variable periods from winter to spring, but may be completely dry for most of the summer and fall. These wetlands range in size from small puddles to shallow lakes and are usually found in a gently sloping plains near the foot of the Blue Ridge Mountain. Although generally isolated, they are sometimes connected to each other by small drainages known as vernal swales. Beneath natural vernal ponds lies either bedrock or a hard clay layer in the soil that helps keep water in the ponded area. Vernal ponds are regulated as wetlands and/or waterways (as ponds which are considered “waters of the United States” and “waters of the Commonwealth of Pennsylvania”), and therefore, they are under the jurisdiction of the state and/or federal governments.

Include a definition of “exotic vegetation” to read: Exotic vegetation is any plant species that is not native to Bushkill Township, Northampton County, Pennsylvania.

The Township should require a wetlands assessment by a qualified professional for all new development on parcels that contain any hydric soils areas, in accordance with the published list of hydric soils for Northampton County, Pennsylvania by the United States Department of Agriculture. The Township should maintain the right to require a Jurisdictional Determination by the United States Army Corps of Engineers, as necessary to substantiate the findings of the afore mentioned wetlands assessment.

All maps and drawings submitted to the township for review and approval should include the surveyed location of all waterways and wetlands (as delineated using the United States Army Corps of Engineers *1987 Wetlands Delineation Manual*) boundaries.

A 50 ft. vegetative, natural buffer should be required around all waterways (lakes, ponds, vernal ponds, rivers, streams, and wetlands). This could be increased to 75 feet (each side). A two zone buffer is preferable.

The Township should require an Erosion and Sedimentation Pollution Control Plan, approved by the Northampton County Conservation District, for all disturbances that occur within 100 ft. of a waterway or wetland, as measured from their jurisdictional boundaries.

The location of all wells, primary drain fields, and secondary drain fields for all adjoining properties should be clearly indicated on all required maps and drawings, in addition to the existing and proposed structures on the applicant’s own property.

For proposed industrial operations or industrial storage facilities (section P of preliminary application), a description for the potential for contamination of wetlands, waterways, and/or water supplies and an explanation of all proposed management and emergency action plans should be required by the Township.

On the minor subdivision application (Section F), a statement as to the type of water and sewer proposed should be required.

A section should be included on all applications pertaining to individual on-lot sewage disposal. Specifically stated should be setbacks from all wetlands and waterways, as well as neighboring wells and property lines.

For all lots smaller than 1 acre, new on-lot sewage disposal systems should only be allowed if there is no potential connection to a community or central sewage system within 2,000 ft.

For all proposed major subdivisions, a connection to any existing central sewage systems where a potential connection exists within 5,000 ft should be required.

Whenever possible, streets and house lots should be clustered in such a way as to provide designated open space areas within each development.

Include 50-foot vegetated buffer zone landward of shorelines or streambanks around each waterway and/or jurisdictional boundaries of each wetland (Section X - Design Standards) (this would be covered in an Open Space Ordinance, if adopted).

At the discretion of the Township, water quality monitoring may be required before, during, and after construction for new projects, as necessary to document potential project impacts to any lakes, ponds, vernal ponds, streams, and/or wetlands that occur within 500 feet of the project or which receive any direct or indirect stormwater runoff from the project. (It may be necessary to make this more definitive by adding conditions such as soil erodability, slopes, extent of total grading, etc.)

The Township should initiate an inspection and repair program by Township Sewage Enforcement Officer for any new development that will be using a new or existing on-lot sewage disposal system.

The installation of “dry” sewer lines should be required for all new development, if the Board of Supervisors or Township Engineer determines that the development is likely to be expanded and/or served by an extension of an existing sewage treatment plant within the next ten years.

The number of trees that can be cut within 35 feet of the mean high water mark of a lake, pond, vernal pond, river, or perennial stream should be limited to 30% of trees over six inches diameter at breast height over a ten year period. The amount of vegetation that can be cut within a six feet of the mean high water mark should be limited to 30%. Exceptions include diseased vegetation, exotic vegetation, rotten or damaged trees, and vegetation posing safety or health hazards.

Section Specific Comments:

Section 402.B: Plans should include the approximate location of lakes, streams, wetlands, and any other waterways present.

Section 202: This section should include definitions for “wetlands” and “waterway.”

Section 403.E: This section should refer to all types of waterways.

Section 503.C: I.1: This section should read “including, but not limited to.”

Section 1004.K.6: This section should state that alternative semi-pervious surfaces may be used if the Township Engineer reviews the plans and determines that an alternative pavement is appropriate and acceptable for the site.

Section 1006.E.2.c: This section currently reads, “such plantings shall be placed so that they do obstruct safe sight distance,” but it should read, “such plantings shall be placed so that they do not obstruct safe sight distance.”

Section 1008: Address issue of stormwater runoff into lakes, ponds, vernal ponds, rivers, streams, and wetlands. Specifically state that stormwater must be directed into detention basins or to retention basins/systems (eg – retention basins, extended detention basins, constructed wetlands, bio-retention areas), or to other treatment areas rather than being allowed to drain directly into waterways.

Section 1008.B.2: The runoff coefficient should be based on cultivated land rather than meadow.

Section 1012.A: This section should be changed to read “non-poisonous and non-invasive vegetative ground cover.”

Section 1018.A: Street trees should be required to be native species, only.

Section 1018.C: Add a provision allowing the removal or exotic vegetation with no restriction.

Section 1018.C.3.a: A sub-section should be added to require the replacement of trees removed for construction.

Section 1018.C.4.a: Temporary wooden barricades or high-visibility fencing should be placed around trees and their roots.

Bushkill Township Zoning Ordinance

General Comments:

All reference of “DER” should be changed to “DEP.”

All required Plot Plans should include the locations of all lakes, ponds, rivers, streams, and wetlands, as well as the locations of on-lot septic systems and wells.

All required Grading Plans must divert surface runoff away from all lakes, ponds, rivers, streams, and wetlands.

All required Site Plans must show all on-site waterways and slope contour lines between the site and the waterways.

Color GIS maps highlighting each zone should be included in each copy of the Zoning Ordinance so that the zones are more clearly understood.

The ordinance should make note that any alteration to a watercourse will require a PADEP and/or USACE permit in addition to any required municipal permit.

The Township should initiate sewage inspection and repair program.

Section Specific Comments:

Section 405. E: A pool shall not be located within the one hundred year floodplain, nor shall it be located within 50 feet of wetland.

Section 404.B & Section 406.A.i: Golf courses should be removed from special exception uses in Rural Conservation zone. This use does not seem to be consistent with the intended purpose of this zone. Other zones will still allow golf courses.

Section 406.A.d: Minimum lot size of single family dwellings in RC zoned areas should be increased to 3 acres. Minimum lot width should be increased to 200 ft.

Section 506.A.d: Minimum lot size of single family dwellings in RA zoned areas should be increased to 2 acres. Minimum lot width should be increased to 150 ft.

Section 506.B: The maximum impervious coverage should be reduced to 25% and 50% should be reduced to 30% for any other permitted non-residential principal use.

Section 606.A: Increase the minimum lot requirements for single family dwellings or remove exception.

Section 606.A.c: Minimum lot size of single family dwellings in RR zoned areas should be increased to 2 acres, and 1 acre if served by an approved central water AND public sewer systems. Minimum lot width should be increased to 150 ft., and 140 ft. for 1 acre lots served by central water AND public sewer systems.

Section 1800.E.1: Wholesaling and warehousing parking requirements should be changed to one parking space for each employee and one space for every two hundred and fifty square

feet of building serving clientele.

Section 1903.U: Whenever a logging operation involves a stream crossing, an erosion and sedimentation plan shall be required. No clear-cutting should be permitted near lakes, ponds, streams, or wetlands. A 50-foot vegetative buffer should be left around all waterways.

Section 1903.V: Require at least a 50-foot vegetative buffer around all waterways.

Section 1903.BB: Require a 200-foot setback between a new junkyard and any pond, lake, stream, drainage structure, or wetland.

Section 1903.DD: Require that any solid waste storage and disposal be at least 200 feet from any drainage structure. Require the installation of monitoring wells (locations based on established groundwater flow) and quarterly monitoring of water quality parameters. Minimum wetland size to qualify for setback should be 1 acre rather than 2 acres.

Section 1903.GG: Require 150-foot setback, plotted horizontally, from mineral extraction operation to the AVERAGE HIGH water mark of a lake, pond, or perennial stream or the edge of a natural wetland of more than 1 ACRE. Require a performance bond to ensure land reclamation will be completed in a timely fashion.

Section 1903.JJ: Require them to be serviced by a central sewer if in a mobile home park, and serviced by a public sewer or an adequate on-lot sewage disposal system if on an individual lot.

All Zones: For new construction on existing lots smaller than 1 acre, new on-lot sewage disposal systems should only be allowed if there is no potential connection to a community or public sewage system within 2,000 ft.

All Zones: For all proposed major subdivisions, a connection to any existing public sewage systems where a potential connection exists within 2,000 ft should be required.

All Zones: Building setbacks should be 150 feet from any perennial stream, 100 feet for intermittent streams, and 50 feet from any drainage channel or swale (except for road crossings in all cases). Paving setback should be 50 ft. from all streams (perennial, intermittent, ephemeral) and drainage channels or swales.

All Zones: It should be required that whenever an existing single family dwelling is converted to a multifamily dwelling the existing sewage disposal system must be certified as being adequate to meet the new demand.

All Zones: It should be required that whenever an existing single family dwelling is converted to a daycare, bed and breakfast, or other commercial venture, the existing sewage disposal system must be certified as being adequate to meet the new demand.

Bushkill Creek Watershed Act 167 Stormwater Ordinance (1993)

General Comments:

This ordinance may be more effective for lot and street flooding than for water quality and quantity control on a watershed-wide basis. The ordinance may actually cause higher stormflow levels in streams, and therefore, more streambank erosion and more frequent flooding in the floodplains. Stormwater management should involve the reduction of stormwater flow caused by development, the improvement of water quality, the protection of streambanks from excessive erosion and sedimentation, and the maintenance of the natural watershed and stream hydrology.

It is understood that this ordinance is currently being revised, and as such, will serve as a more comprehensive tool for water quality control and overall watershed management.

Section Specific Comments:

Section 102: This section should include a direct reference to protecting natural resources.

Section 301.F: The ordinance currently states, “When it can be shown that, due to topographic conditions, natural drainage swales on the site cannot adequately provide for drainage, open channels may be constructed conforming substantially to the line and grade of such natural drainage swales. Capacities of open channels shall be calculated using the Manning equation.” Artificial open channels may provide some relief from street and lot flooding, but they do not provide adequate water quantity or quality control. On-site detention/retention basins, water quality swales, constructed wetlands, bioretention areas and other stormwater management BMPs listed in the Pennsylvania Handbook for Best Management Practices in Developing Areas would be better for stormwater management.

Section 302: The “Stormwater Management Districts” and the related subsections should be eliminated. The subsections currently include a “Provisional No Detention District” - areas where detention facilities are not required - and “Dual Release Rate Districts” - areas where two-year post-development runoff must be controlled to 30% of pre-development runoff and 10-year, 25-year, and 100-year post-development runoff must be controlled to 60-100% (depending on location) of pre-development runoff.

Section 302.B.1: This section allows for “Provisional No Detention Districts.” All developments should be required to provide stormwater detention to avoid the negative impact of cumulative effects. Exemptions should be considered only when there will be no increase in net runoff over the long-term due to the proposed development.

In 1997, Bushkill Township amended the stormwater ordinance to add runoff coefficients and a reference to the SALDO.

Bushkill Township Weed Control Ordinance

General Comments:

The weed control ordinance, as it reads now, inhibits the natural management of stormwater and, in addition, has negative implications in terms of protecting natural communities and natural hydrology. The ordinance currently requires that lots be free of weeds or plant growth, except trees and shrubs, in excess of 10" unless the land is used for gardens or agriculture. Natural vegetation, such as tall grasses, forests, and scrub/shrub communities, promotes wildlife, provides habitat for wildlife, reduces stormwater runoff, buffers noise, and provides scenic views. Some possible alternatives include requiring landscaped or mowed front yards and encouraging growth of native plants in back and side yards particularly on sites near natural areas (i.e. near Jacobsburg Environmental Education Center).

This ordinance should be rescinded and replaced with: Natural Landscape and Noxious Weed Control Ordinances, which work in concert to promote native plant communities but prevent problem plants listed as “noxious.”

Bushkill Township Water Conservation Ordinance

General Comments:

Bushkill Township has a water conservation ordinance that is straightforward. No revisions appear necessary.

Bushkill Township Environmental Advisory Council Establishment Ordinance

Description of Ordinance:

This ordinance outlines the responsibilities of the Bushkill Township Environmental Advisory Council (EAC). Their responsibilities include identifying environmental problems, recommending plans and programs for conservation, making recommendations for use of open space, promoting community environmental programs, keeping an index of all open areas including but not limited to flood-prone areas, such as swamps and other unique natural areas, advising the Board of Supervisor in acquisition of property, and undertaking environmental tasks as requested by the Board of Supervisors.

The EAC is currently active.

General Comments:

The Township needs to utilize the EAC for its intended purposes.

The ordinance should be revised to include the ‘*review of plan submissions to the Township, at the discretion of the Township*’ as an EAC responsibility.

3.0 Conclusions

Bushkill Township’s current ordinances provide only a limited degree of resource protection. However, they will provide a solid framework, necessary for adoption of the above amendments and revisions, as well as the recommended additional “watershed protection” ordinances discussed in the next section of this document.

The proposed amendments, revisions, and additional ordinances will provide excellent protection of the natural resources that serve as the basis for the quality of life in Bushkill Township, while still allowing and providing for residential and economic development.

4.0 Recommendations

In addition to the amendments and revisions proposed above, the following “watershed protection” ordinances are recommended to supplement and compliment the existing township ordinances:

- Stream Buffer Conservation Zone Ordinance
- Steep Slopes Ordinance (can be much more detailed and structured)
- Natural Features Conservation Ordinance (encompassing many otherwise unprotected features)
- Stormwater Management Ordinance (water quality and infiltration) w/ manual explaining how to use ordinance (pushes more desirable low impact development)
- Natural Landscape Ordinance
- Noxious Weed Control Ordinance
- Forest Conservation Ordinance

These additional ordinances will provide greatly improved resource protection, above and beyond the existing township ordinances. While the existing ordinances do provide for some level of protection in each of these categories, these “stand alone” ordinances are more specific and comprehensive. Incorporating them into Bushkill Township’s existing ordinances would be relatively easy, requiring simple amendments to the existing ordinances referencing their use for the appropriate sections.

The primary benefit to having the “stand alone” ordinances is that future ordinance amendment will be more simplistic in such a modular format. For distribution, all Township ordinances could be copied and formatted into single three-ring binders, tabbed by ordinance. A table of contents listing all of the ordinances in the binder would provide ease of use and adequate organization.

As a general recommendation, the township should initiate a sewage system inspection and repair program as part of the next update to the Act 537 Wastewater Management Plan

F. X. Browne, Inc.

APPENDIX C

BUSHKILL CREEK WATERSHED NONPOINT SOURCE PROBLEM AREA INFORMATION AND MAP

Appendix C
Nonpoint Source Problem Areas in the Bushkill Creek Watershed

Bushkill Creek Watershed Inventory Map ID #	Sub-Watershed	Land Use/Ownership	Nonpoint Source Pollution Problem Area Type	Recommended Best Management Practice (BMPs)	Estimated Restoration Cost	Priority Ranking
1	Shoeneck Creek	Park	Streambank Erosion	Detention Pond/Streambank Restoration	\$50,000	HIGH
2	Schoeneck Creek	Urban	Urban Stormwater	Plant Street Trees; Install Stormwater Drainage System	\$6,000	LOW
3	Little Bushkill Creek	Urban	Roadside Stormwater	Stabilize and Re-vegetate Slope	\$6,000	MEDIUM
4	Throughout	Residential	E&S	Install E&S Controls; Create and Review E&S Ordinance	N/A	MEDIUM
5	Trib of Shoeneck	Residential	Streambank Erosion	Grade and Revegetate South Side of stream	\$25,000	HIGH
6	Trib of Shoeneck	Residential	E&S	Create and Review Stream and Lake Fill Ordinance	N/A	LOW
7	Trib of Shoeneck	Residential	Streambank Erosion	Grade and Revegetate	\$6,000	LOW
8	Trib of Shoeneck	Residential	Streambank Erosion	Revegetate Streambank	\$6,000	LOW
9	Trib of Shoeneck	Residential	Lack of Riparian Buffer	Restore Buffer	\$500	MEDIUM
10	Trib of Shoeneck	High School	Streambank Erosion	Streambank Restoration	\$25,000	HIGH
11	Trib of Shoeneck	High School	Streambank Erosion	Repair Outlet and streambed	\$25,000	HIGH
12	Trib of Little Bushkill	Agricultural	Agricultural	Streambank Restoration, Ag Waste Facility, Restore Buffer	\$36,000	HIGH
13	Little Bushkill	Residential	Streambank Erosion	Streambank Restoration, outlet protection	\$10,000	MEDIUM
14	Trib of Little Bushkill	Industrial/Commercial	Urban Stormwater	Bioretention facility	\$6,500	MEDIUM
15	Trib of Little Bushkill	Residential	Lack of Riparian Buffer	Restore Buffer	\$1,000	LOW
16	Trib of Little Bushkill	Residential	Streambank Erosion	Repair outlet, restore buffer	\$5,500	MEDIUM
17	Trib of Little Bushkill	Residential	E&S	Remove Sediment; Enforce E&S Controls	N/A	LOW
18	Trib of Little Bushkill	Bridge/Quarry	Streambank Erosion	Streambank Stabilization, Increase Buffer; Install stormwater controls between Buffer and Quarry	\$26,000	HIGH
19	Shoeneck	Commercial	Urban Stormwater	Bioretention facilities	\$13,000	MEDIUM

Appendix C
Nonpoint Source Problem Areas in the Bushkill Creek Watershed

Bushkill Creek Watershed Inventory Map ID #	Sub-Watershed	Land Use/Ownership	Nonpoint Source Pollution Problem Area Type	Recommended Best Management Practice (BMPs)	Estimated Restoration Cost	Priority Ranking
20	Shoeneck	Commercial	Urban Stormwater	Sand Filter or Bioretention Facility	\$6,000	LOW
21	Shoeneck	Residential/Commercial	Urban Stormwater	Bioretention facility	\$6,500	MEDIUM
22	Shoeneck	Residential/Commercial	Urban Stormwater	Bioretention facility	\$6,500	MEDIUM
23	Bushkill	Residential	E&S	Create and Review E&S Ordinance; Enforce E&S Controls	N/A	LOW
24	Trib of Bushkill	Residential	E&S	Install E&S Controls; Create and Review Ordinance	N/A	LOW
25	Trib of Bushkill	Bridge	Streambank Erosion	Outlet repairs, streambank restoration	\$10,000	MEDIUM
26	Trib of Bushkill	Residential/Agricultural	Streambank Erosion	Stream Restoration; Create and Review Leaf Waste Ordinance; Enforce Leaf Waste Ordinance	\$7,000	MEDIUM
27	Bushkill	Residential	Streambank Erosion	Install Rip-Rap on Side of Bridge; Create Leaf Ordinance; Stream Protection Ordinance	\$5,000	LOW
28	Bushkill	Residential	Streambank Erosion	Install Rip-Rap on Sides of Bridge	\$2,500	MEDIUM
29	Bushkill	Agricultural	Agricultural	Revegetate Slope; Improve Buffer between Corn Field and Stream; Install Ag. Waste Facility	\$32,000	MEDIUM
30	Bushkill	Park	Streambank Erosion	Revegetate Area; Install Stable Fishing Landing	\$8,000	LOW
31	Bushkill	Park	Streambank Erosion	Revegetate/Stabilize Streambank	\$5,600	LOW
32	Bushkill	Park	Streambank Erosion	Bioengineering or Revegetation	\$5,000	LOW
33	Bushkill	Park	Streambank Erosion	Repair Gullies/Stabilize Streambank	\$10,000	MEDIUM
34	Bushkill	Park	Streambank Erosion	Revegetate; Restrict Access or	\$7,500	MEDIUM

Appendix C
Nonpoint Source Problem Areas in the Bushkill Creek Watershed

Bushkill Creek Watershed Inventory Map ID #	Sub-Watershed	Land Use/Ownership	Nonpoint Source Pollution Problem Area Type	Recommended Best Management Practice (BMPs)	Estimated Restoration Cost	Priority Ranking
				Install Fishing Landing		
35	Bushkill	Park	Streambank Erosion	Revegetate/Control Access; Install Educational Kiosk	\$20,000	HIGH
36	Bushkill	Park	Streambank Erosion	Streambank stabilization	\$3,750	MEDIUM
37	Sober's Run	Park	Streambank Erosion	Stabilize Streambank;Install Stable Horse Access Point	\$10,000	MEDIUM
38	Sober's Run	Park	Streambank Erosion	Revegetation or Bioengineering	\$2,000	LOW
39	Sober's Run	Park	Streambank Erosion	Install Settling Basin below Outfall, stabilization	\$7,500	MEDIUM
40	Sober's Run	Park	Streambank Erosion	Revegetate;Restrict Access or Install Fishing Landing	\$5,000	LOW
41	Sober's Run	Park	Streambank Erosion	Revegetate	\$2,000	LOW
42	Bushkill	Park	Trail Erosion	Install 2 to 3 Check Dams along Gully	\$1,000	MEDIUM
43	Bushkill	Park	Trail Erosion	Build Stream Crossing across Ephemeral stream;Revegetate	\$5,000	MEDIUM
44	Bushkill	Park	Streambank Erosion	Stabilize and Revegetate	\$3,750	HIGH
45	Sober's Run	Park	Tail Erosion	Build Stream Crossing;Build Check Dam and Settling Basin	\$1,000	HIGH
46	Sober's Run	Park	Streambank Erosion	Stabilize bridge corners with rip-rap	\$15,000	HIGH
47	Bushkill	Park	Roadside Stormwater	Install Catch Basin and Divert Runoff into Catch Basin	\$3,000	HIGH
48	Bushkill	Park	Roadside Stormwater	Install Small Stormwater BMP (i.e. Catch Basin or Infiltration Trench)	\$6,500	HIGH
49	Bushkill	Park	Trail Erosion	Regrade Trail;Install Beams	\$1,000	LOW
50	Engler's Run	Park	Trail Erosion	Install Rip-Rap or other material to dissipate Runoff near Trail	\$1,000	MEDIUM
51	Bushkill	Commercial	Urban Stormwater	Install Bioretention Area	\$6,500	MEDIUM

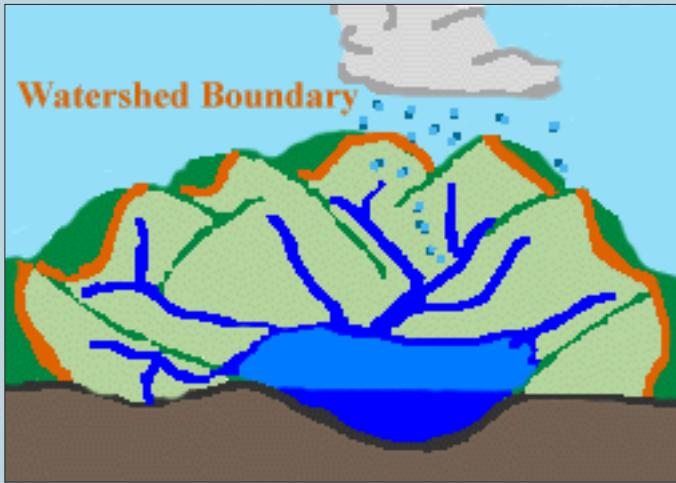
Appendix C
Nonpoint Source Problem Areas in the Bushkill Creek Watershed

Bushkill Creek Watershed Inventory Map ID #	Sub-Watershed	Land Use/Ownership	Nonpoint Source Pollution Problem Area Type	Recommended Best Management Practice (BMPs)	Estimated Restoration Cost	Priority Ranking
52	Bushkill	Commercial	Urban Stormwater	Install Bioretention Area	\$6,500	LOW
53	Bushkill	Commercial	Urban Stormwater	Install Bioretention Area	\$6,500	LOW
54	Bushkill	Commercial	Urban Stormwater	Install Bioretention Area in Parking Lot Island	\$6,500	LOW
55	Trib of Little Bushkill	Commercial	Urban Stormwater	Install Bioretention Area	\$6,500	LOW
56	Trib of Little Bushkill	Commercial	Urban Stormwater	Install Bioretention Area	\$6,500	LOW
57	Trib of Little Bushkill	Commercial	Urban Stormwater	Install Bioretention Area in Parking Lot	\$6,500	MEDIUM
58	Trib of Bushkill	Commercial	Urban Stormwater	Install Infiltration Trenches or Bioretention Area	\$6,500	LOW
59	Trib of Bushkill	Commercial	E&S	Install Erosion Controls	N/A	LOW
60	Trib of Little Bushkill	Commercial	Urban Stormwater	Install Infiltration Trenches between Parking Lot and Street	\$6,500	MEDIUM

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APPENDIX D

BUSHKILL CREEK WATERSHED EDUCATION BROCHURES



Watershed Management Principles

- Improve water quality by reducing pollutant loads (e.g. nutrients, sediment, oil and grease, and heavy metals)
- Protect and restore the ecological integrity of streams and wetlands
- Protect and restore aquatic and terrestrial habitats
- Protect and restore forest cover
- Increase public involvement
- Encourage environmentally-sound planning
- Replenish groundwater by increasing stormwater infiltration
- Develop partnerships with neighboring municipalities and organizations
- Promote economic development by creating a more desirable place to live and work

RESOURCES FOR MUNICIPALITIES

- Northampton County Conservation District: 610-746-1971
- Lehigh Valley Planning Commission: 610-264-4544
- Jacobsburg Environmental Education Center: 610-746-2801
- Pennsylvania Handbook of Best Management Practices for Developing Areas, 1998. (Contact DEP-Div. of Watershed Assistance at 717-772-5832)
- National Stormwater Best Management Practices (BMP) Database www.bmpdatabase.org
- Center for Watershed Protection www.cwp.org



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WATERSHED PROTECTION AT THE MUNICIPAL LEVEL

BENEFITS WITHIN THE BUSHKILL CREEK WATERSHED



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Watershed Management Techniques for Municipalities

Stormwater Management BMPs -

Reduce runoff volume and remove pollutants

- Detention/retention ponds
- Constructed wetlands
- Bioretention areas
- Vegetated swales with check dams
- Proper storage of de-icing materials

Streambank Restoration - Prevents erosion of streambanks and sedimentation of stream beds and lakes. Also provides a buffer to eliminate pollutants from surrounding land-uses.

- Bioengineered Restoration
- Structural - Rock and timbers
- Vegetative - Plants for stabilization and habitat



Stabilized streambank with fish habitat enhancement structures

Land Use Planning - Ensures that future development is carried out in a manner that is manageable and sustainable and protects land and water resources while allowing development

- Reduction of parking lot requirements
- Comprehensive plans
- Septic system inspections

Ordinances - Provide guidance for municipal officials, residents, and contractors and protect resources valued by the community

- Stormwater Management
- Riparian Area or Floodplain Management
- Tree Protection
- Steep Slopes
- Water Conservation

Alternative Transportation - Reduces the pollutants entering streams and lakes by reducing the number of cars on the road

- Public Transportation
- Bicycle Routes
- Car-Pool Programs

Conservation - Protects water quality and habitat and provides recreational opportunities

- Easements: in high priority areas, such as steep slopes, wetlands, riparian areas, and groundwater recharge areas
- Greenways: Habitat links for humans and wildlife



Photo of a stream in Nazareth in need of restoration

How can Environmental Advisory Councils (EACs) help?

- Provide guidance on environmental issues
- Inspect new developments for stormwater problems
- Identify impaired stream reaches
- Identify priority areas for conservation
- Locate wetlands
- Organize volunteer work days, such as stream clean-ups
- Visit proposed construction sites



Water Quality Monitoring

The Bushkill Creek Watershed, or drainage area, covers approximately 40 square miles. The Pennsylvania Department of Environmental Protection has characterized the streams within the watershed based on their water quality. According to Pennsylvania's Chapter 93 Water Quality Standards, the Bushkill Creek and the Little Bushkill Creek are high-quality, cold-water fisheries. The Shoeneck Creek, a tributary of the Bushkill Creek, is characterized as a warm water fishery.

Monitoring water quality is an important part of watershed management because it provides information necessary for decision-making. The Bushkill Creek watershed is one of the best monitored watersheds in Pennsylvania. The water is tested at various locations within the watershed for phosphorus, nitrogen, suspended solids, and other important water quality parameters. For more information on the Bushkill Creek watershed monitoring program, go to www.bushkill.org.



Photo of a stream with foam caused by detergents, fertilizer, sewage, or agricultural runoff

WHAT CAN YOU DO?

- Get involved with the Bushkill Stream Conservancy
- Maintain natural vegetation near streams and wetlands
- Inspect and pump septic tanks regularly
- Install water-saving devices such as low flow faucets, toilets, and showerheads
- Avoid using lawn fertilizer. If you use fertilizer, be sure to test your soil first to determine if fertilizer is needed or how much is needed (Contact Penn State Cooperative Extension at 610-746-1970)
- Do not spread manure on frozen ground
- Limit access of domestic animals to water bodies
- Maintain your vehicles to prevent oil leaks



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WATER QUALITY AND WATERSHED MANAGEMENT WITHIN THE BUSHKILL CREEK WATERSHED



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A watershed is the entire area of land (including roads, yards, fields, and forest) that drains to a waterbody, such as a stream, pond, or lake. A watershed may contain many smaller sub-watersheds for its individual tributary streams, creeks, brooks, and runs.

The water quality of streams, ponds, and lakes are directly impacted by the activities occurring throughout a watershed.

Watershed management is an important part of protecting water quality because it focuses on the causes rather than just the symptoms of degradation.



Photo of a eutrophic pond. Note the excessive algae, which makes the water green.

Water Quality Pollution

Threat:	Nutrient Enrichment
Result:	Causes excessive algal growth, increased temperatures, decreased dissolved oxygen levels, and fish kills
Source:	Septic systems, sewage plants, agricultural runoff, and lawn fertilizer

Threat:	Bacterial Contamination
Result:	Leads to health problems in humans and animals
Source:	Septic and sewage effluent, agricultural runoff, and pet feces

Threat:	Toxic Contamination
Result:	Leads to health and reproductive problems for all life
Source:	Road runoff (such as automobile wastes), industrial and household waste, pesticides, and herbicides

Threat:	Temperature Enhancement
Result:	Leads to elimination of cold water species
Source:	Stormwater runoff from large developments , sewage, industrial effluent, loss of forest cover



The impact of stormwater runoff is often exacerbated by roads, which redirect, channelize, and contribute additional stormwater.

Watershed Management Principles

- Reduce pollutant loads
- Protect and restore the ecological integrity of streams
- Protect and restore aquatic, riparian, and terrestrial habitats
- Protect and restore wetlands
- Protect and restore forest cover
- Increase public involvement
- Improve water quality
- Encourage environmentally-sound planning
- Increase stormwater infiltration
- Protect and restore greenways



Concrete or asphalt stormwater channels have no infiltration capability and, therefore, only move water from one place to another.

Stormwater is the primary conduit by which pollutants are transported to streams and lakes.

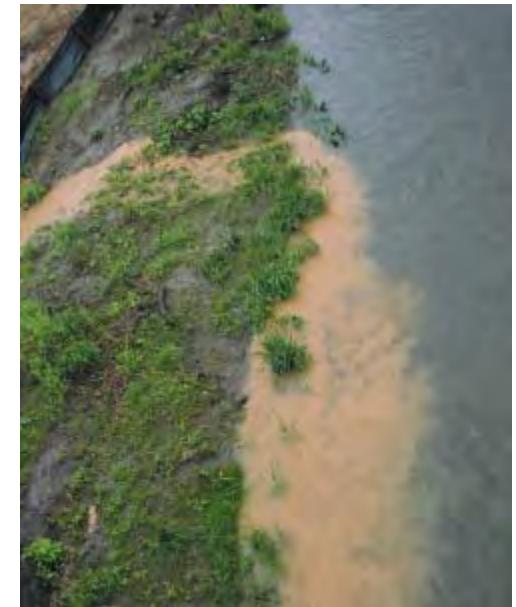
Stormwater management is the management of the runoff water resulting from a rain event and the pollutants that are picked up and carried by this runoff.

Increased stormwater leads to degraded water quality, accelerated stream widening, increased streambank and channel erosion, degraded habitat quality, and damaged roads, bridges, and other infrastructure.

However, by installing and maintaining stormwater Best Management Practices (BMPs), the impacts of stormwater runoff can be reduced.

WHAT CAN YOU DO?

- Prevent contamination. By reducing site runoff, maximizing the use of natural drainage patterns, and providing treatment of runoff, we can prevent contaminants from entering waterbodies and protect the water quality of our streams, ponds, and lakes.
- Reduce pavement by designing narrower roads, creating islands of vegetation in parking lots, and reducing parking lot size.
- Catch nutrients, sediment, and other contaminants by creating grass swales, catch basins, and stormwater "retention" facilities on developed sites
- Support and follow stormwater and land development ordinances.
- Maximize open space and undeveloped areas on all sites.
- Maintain natural features.



STORMWATER MANAGEMENT WITHIN THE BUSHKILL CREEK WATERSHED



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Stormwater Problems and Solutions

Residential Development

PROBLEMS

- Increases nutrient loads from human and pet wastes, detergents, and fertilizers
- Increases toxic chemicals from the use of drain cleaners, pesticides, herbicides, paints, and other household products

SOLUTIONS

- Maintain septic systems
- Minimize or discontinue use of lawn fertilizers, pesticides, and herbicides
- Maintain natural vegetation around houses, especially near waterbodies
- Take household hazardous waste to designated drop-off sites or have it picked up at your home (Contact your County Coordinator at 610-865-9505)
- Use environmentally-friendly cleaners (such as baking soda and vinegar) when possible
- Encourage environmentally-sound planning in your community and municipality

Roads

PROBLEMS

- Increases stormwater runoff carrying oil, grease, salt, dust, soil, and gravel
- Alters stable natural drainage patterns leading to increased erosion

SOLUTIONS

- Minimize road construction
- Install properly designed stormwater management facilities to protect the hydrology of natural channels
- Minimize the use of de-icing materials

General Construction

PROBLEMS

- Disturbs vegetation and soil, which leads to the transport of nutrients, sediment, and other constituents to downstream waterbodies during storm events
- Increases stormwater runoff due to soil compaction, impervious surfaces, and loss of vegetation

SOLUTIONS

- Minimize disturbance areas during construction activities
- Properly install erosion and sedimentation control measures
- Maintain a buffer of vegetation around the construction site
- Review development plans to incorporate erosion and sediment control practices and other Best Management Practices (BMPs)



Construction activities can lead to excessive sedimentation if proper erosion and sedimentation controls are not implemented.

Commercial Development

PROBLEMS

- Increases stormwater runoff and sediment transport due to impervious surfaces (i.e. sidewalks and parking lots)
- Increases oil and grease from parking lots
- Increases salinity of soil and water from the use of de-icing salt

SOLUTIONS

- Use alternative de-icing materials, such as calcium chloride
- Install properly designed stormwater treatment facilities, such as vegetated swales, retention ponds, infiltration trenches, and bioretention systems
- Minimize amount of impervious surfaces
- Use porous pavement in parking areas
- Encourage carpooling

Industrial Development

PROBLEMS

- Increases stormwater runoff and sediment transport due to impervious surfaces (i.e. sidewalks and parking lots)
- Increases water temperature due to warm discharges of effluent entering streams
- Potentially increases toxic contaminants (i.e. heavy metals, such as lead, mercury, and cadmium) through air and water emissions and stormwater runoff

SOLUTIONS

- Monitor industrial effluent for contaminants
- Install properly designed stormwater treatment facilities, such as vegetated swales, retention ponds, infiltration trenches, and bioretention systems
- Discharge effluent to a constructed wetland rather than a natural waterway

Plants for Riparian Areas

In order to successfully restore a riparian area, it is important to plant appropriate vegetation. Below are some native plants that can be used for riparian restoration in wet, moderate, and dry conditions.



Spicebush

In Wet Areas...

- ◆ silver maple
- ◆ sycamore
- ◆ swamp white oak
- ◆ black willow
- ◆ river birch
- ◆ black chokeberry
- ◆ silky dogwood
- ◆ winterberry
- ◆ highbush blueberry
- ◆ spicebush

In Moist Areas....

✉ red maple	✉ green ash
✉ pin oak	✉ American beech
✉ yellow birch	✉ red-osier dogwood
✉ spicebush	✉ ninebark

In Dry Areas....

✉ white pine	✉ black cherry
✉ white oak	✉ shagbark hickory
✉ sugar maple	✉ black walnut
✉ witchhazel	✉ hop-hornbeam



Witchhazel

WHAT CAN YOU DO?

- Maintain or restore riparian areas
- Avoid mowing near a streambank, lake shore, or wetland
- Minimize the removal of vegetation in riparian areas
- Minimize the placement of buildings and other impervious surfaces in riparian areas
- Promote concepts with friends and neighbors



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**RIPARIAN
CORRIDORS
AND
RIPARIAN
CORRIDOR
RESTORATION
WITHIN THE
BUSHKILL CREEK
WATERSHED**



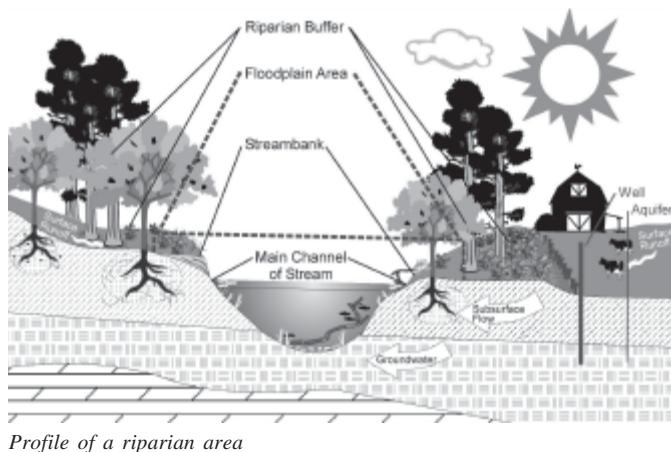
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Riparian Areas

Riparian areas are the areas of land adjacent to waterbodies. A riparian area serves as a transitional zone between terrestrial systems and aquatic systems.

Riparian areas play an important role in protecting water resources by:

- Stabilizing the soil, especially on the streambank
- Protecting streambanks
- Protecting surrounding areas from floods
- Protecting water quality by catching and retaining sediment, debris, nutrients, and heavy metals
- Providing extremely valuable wildlife habitat
- Stabilizing water temperature
- Providing aesthetic beauty
- Contributing to landscape character



Increased stormwater runoff can lead to accelerated erosion on streambanks, such as the one seen in the above photo.



Photo of a newly constructed stream restoration area. In time, the live willow and dogwood cuttings and posts will naturally stabilize the streambank and restore the riparian area.

Riparian Corridor Restoration

As development pressure increases, the need to protect and restore riparian areas increases. The goals of riparian corridor restoration are:

- to restore the natural hydrology of the area
- to reestablish a natural, vegetative corridor
- to restore instream habitat



Above is the profile of a stormwater BMP called a bioretention area. Bioretention areas can reduce stormwater volume, improve water quality, and prevent impacts to downstream waterways caused by elevated stormwater runoff.

Riparian restoration often involves grading the slope, redirecting and/or moderating the flow of water, stabilizing the bank, and protecting the graded surface from further erosion.

In addition, the health of a riparian area is often influenced by the surrounding land use. Restoration efforts may include reducing the impacts of the surrounding area by using Best Management Practices (BMPs) such as stormwater management facilities.



Groundwater Threats in the Bushkill Creek Watershed

The primary threats to our watershed are:

Increased development

- New wells place an additional demand on groundwater resources in rural areas
- Additional wastewater treatment requires more sewage treatment plants which can increase pollution in waterways
- Increased population requires more potable water for use in homes, businesses, and industries
- More buildings increases the amount of impervious surfaces which inhibits groundwater infiltration and causes stormwater runoff related problems

Increased road traffic

- More roads result in more impervious surfaces leading to increased runoff, which can have an adverse effect on groundwater recharge
- More vehicular traffic can result in increased use of road salts and increased contamination from petroleum products and other automobile waste products



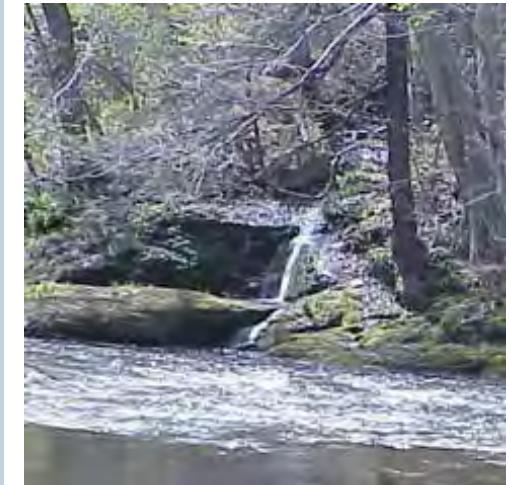
*Example of the
improper storage
of hazardous waste*

WHAT CAN YOU DO?

- Conserve water by taking shorter showers, using low flow faucets and toilets, and avoiding excessive water usage on lawns
- Properly store de-icing materials
- Properly dispose of hazardous wastes and their containers at a hazardous waste drop-off center (To schedule a pick-up call: 1-800- 449-7587)
- Limit pesticide, herbicide, and fertilizer use on lawns and around buildings
- Properly maintain septic systems
- Maintain a desirable 50- to 100-foot natural vegetative buffer around wetlands, streams, ponds, and lakes
- Recycle all suitable materials to reduce demand on landfills



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SURFACE WATER AND GROUNDWATER RESOURCES WITHIN THE BUSHKILL CREEK WATERSHED



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Land Use & Water Quality

In forested or grassy areas, water is slowed down, nutrients and other pollutants are filtered and absorbed, and cooler water temperatures are maintained.

However, when natural areas are converted to agricultural, residential, commercial, and industrial land uses, water quality is generally compromised and in some cases is severely impacted.

These land uses can pollute both surface water and groundwater with nutrients, heavy metals, bacteria, oil and grease, and toxins.

In addition, the increased impervious surfaces that accompany development prevent infiltration of water.

Potential Sources of Surface and Groundwater Contamination

- Failing on-site septic systems
- Municipal landfills
- Livestock waste
- Leaky sewer lines
- Stormwater erosion problems
- Mill tailing in mining areas
- Road salt
- Parking Areas
- Fertilizer
- Pesticides
- Herbicides



Residential developments can severely alter nearby wetlands and streams

Wetlands & Water Quality

Wetlands play an important role in protecting the quality of surface water and groundwater resources. They reduce stormwater runoff, protect downstream areas from flooding, serve as groundwater recharge sites, reduce the amount of sediment entering waterways, and take up nutrients and heavy metals.



Livestock waste can be a serious pollutant

Septic System Maintenance

Septic systems use bacteria to naturally decompose waste. However, bacteria do not completely eliminate septic waste, so the remaining solids must be removed periodically. When the septic tank is not pumped frequently enough, the system fails, leading to groundwater and surface water contamination, as well as costly repairs.

Untreated wastewater poses a health risk as a result of pathogens, and can cause eutrophication (excessive growth due to increased amounts of nutrients) in streams, ponds, and lakes.

How frequently you should pump your tank depends on the size of your tank and the number of people in your household. For instance, a 500 gallon tank used to treat the waste of four people should be pumped annually. However, a 500 gallon tank used for treating the waste of one person should be pumped every five and a half years.

You can increase the length of time between pumpings and increase the life of your septic system by conserving water, protecting your drainage field, and preventing hazardous waste from entering your septic system. Disposing of hazardous chemicals, such as household cleaners, down the drain can contaminate groundwater and can compromise the effectiveness of your septic system.

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APPENDIX E

**BUSHKILL CREEK
WATERSHED EDUCATION SEMINAR MATERIALS**

Bushkill Stream Conservancy

Education



Environment



Recreation



History



Wetlands & Water Resources



**Bushkill Stream
Conservancy**



Water Resources

- Wetlands
- Streams
- Ponds
 - Permanent
 - Vernal

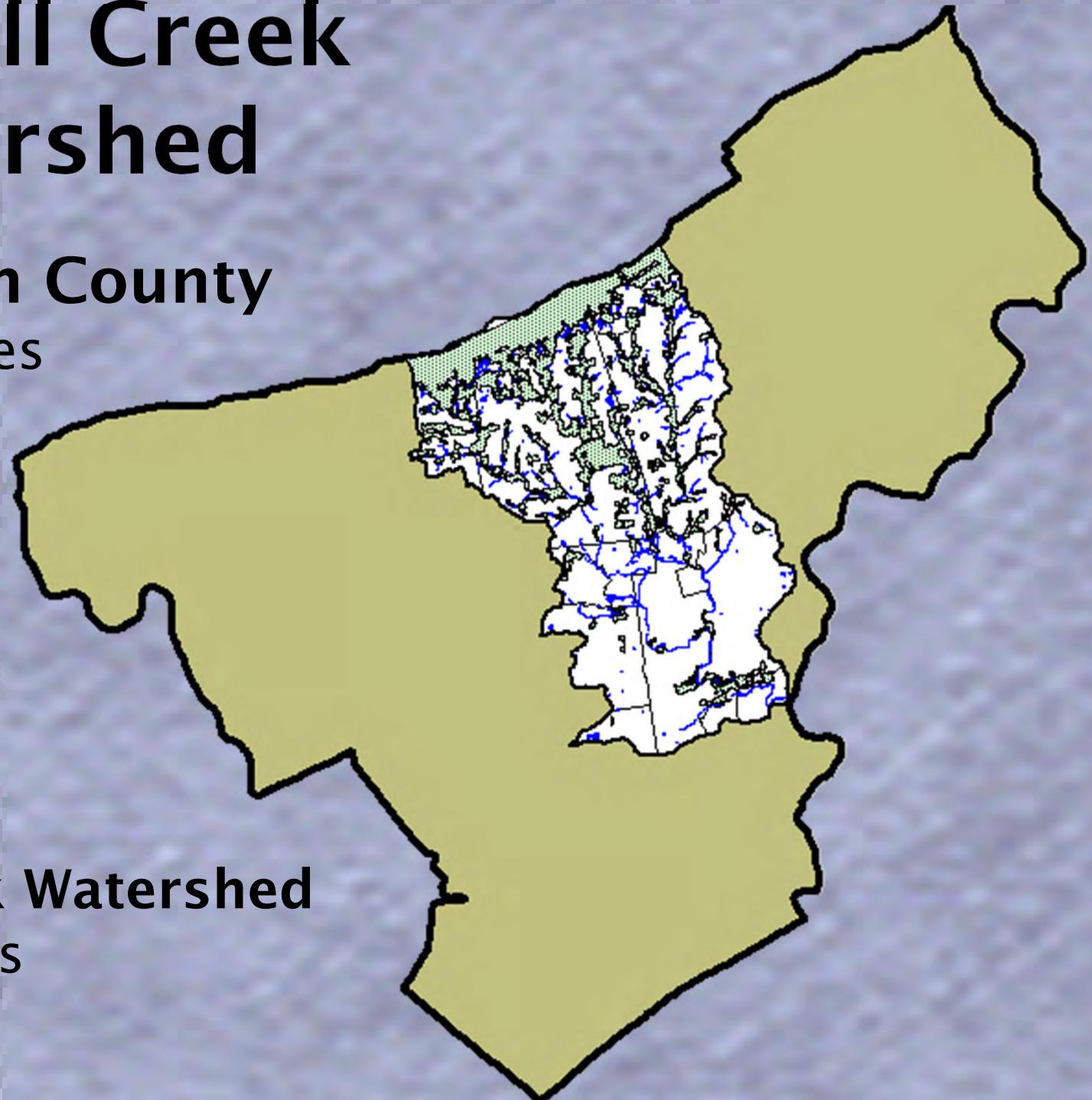


Bushkill Creek Watershed

Northampton County
377 square miles

- County
- Woodland
- Bushkill Creek Watershed
- Streams

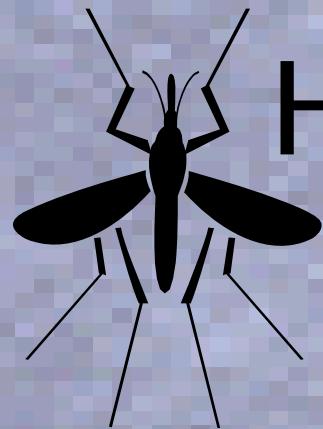
Bushkill Creek Watershed
80 square miles



Wetlands

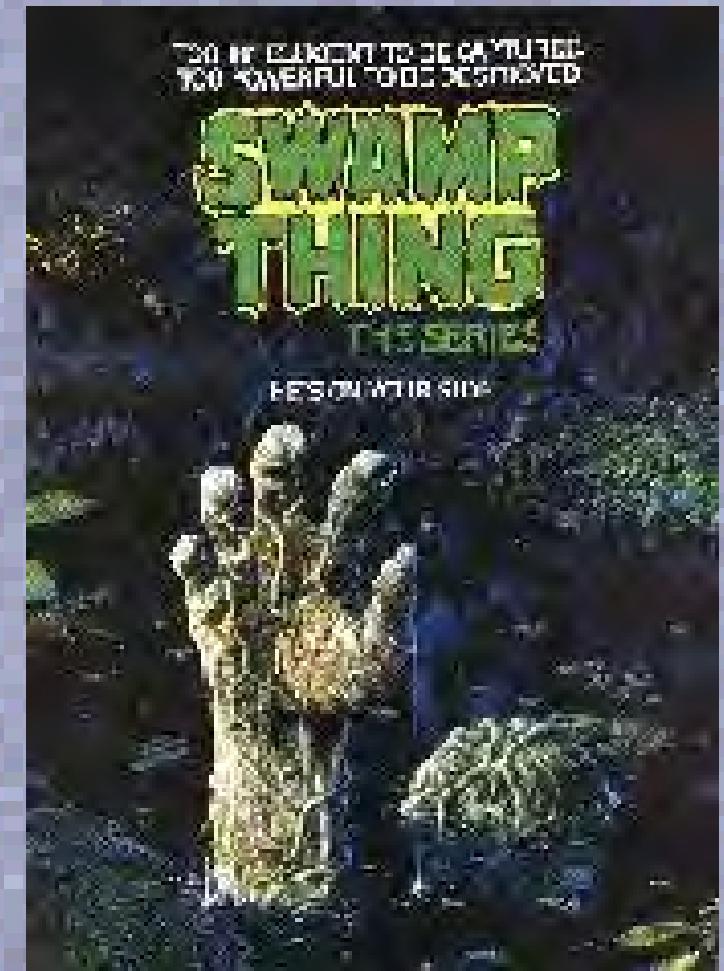
Hundreds of
acres of
wetlands
throughout the
watershed





Historical View of Wetlands

- Wetlands are “Wastelands”
- Mosquito breeding grounds
- Swamp Lands Act





The New View

- Wetlands provide vital habitat for wildlife
- Wetlands are an extremely valuable resource
- Preservation of remaining wetlands is a must



The Legal Definition

Wetlands are "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. Wetlands generally include swamps, marshes, bogs and similar areas."

- U.S. Army Corps of Engineers, 1977

Wetland Characteristics

- Hydrology
- Hydric soil
- Hydrophytic vegetation



Hydrology

The presence of water and its characteristics

- Depth
- Duration
- Frequency



Hydric Soils

- Saturated soils
- Anaerobic soil conditions
- Grey color
- Mottles



Hydrophytic Vegetation

- Indicator of wetlands
- Adapted to live in wet conditions
- Classification ranging from
 - obligate wetland plant to
 - obligate upland plant



Wetland Functions



Flood Storage

- Stores and slowly releases flood water
- Protects health, safety, and welfare



Erosion Control

- Holds soil
- Absorbs wave energy
- Reduces velocity



Runoff



Discharge



Wetland



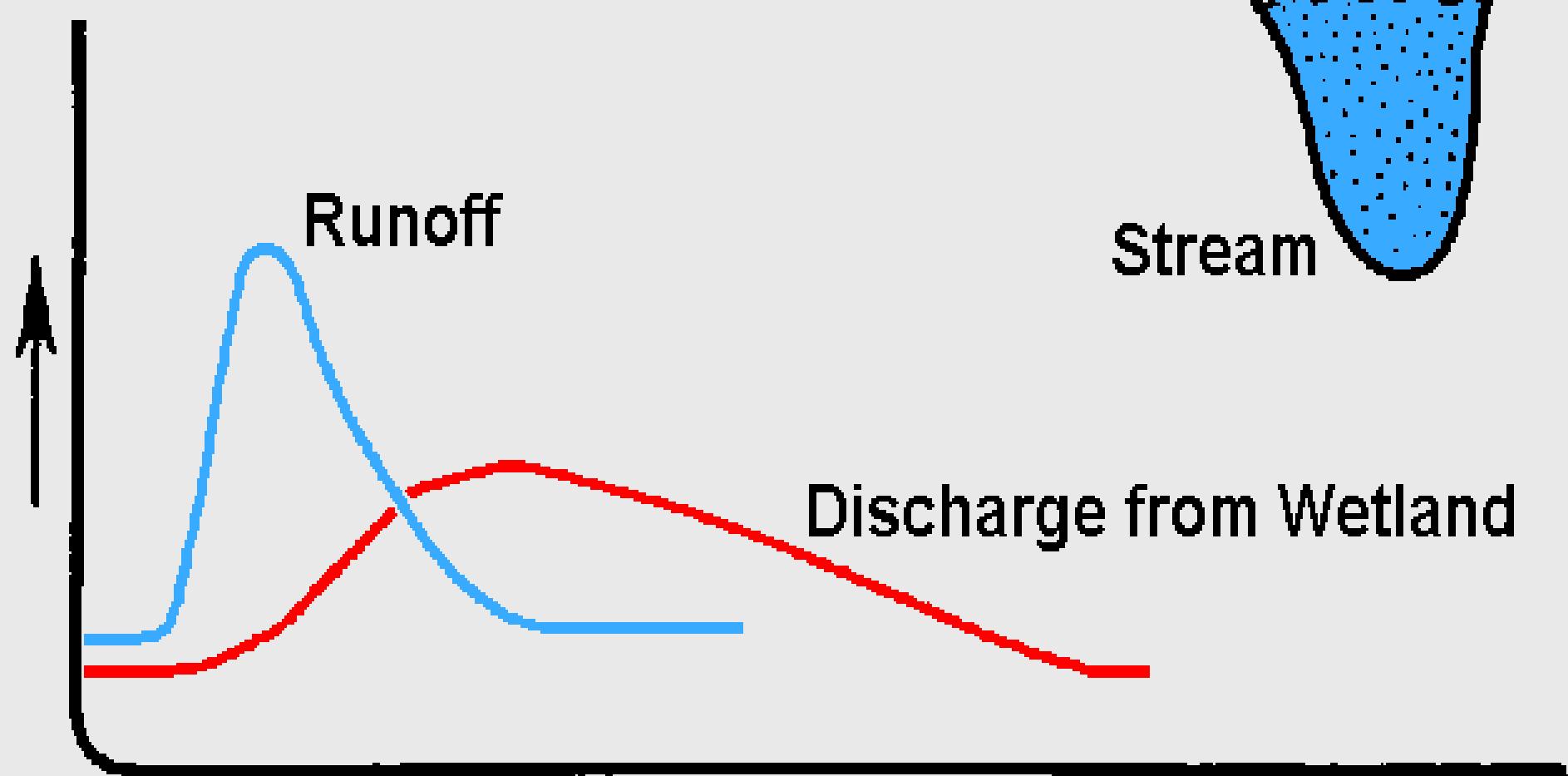
Runoff

Stream

Flow
Rate
(Vol/t)

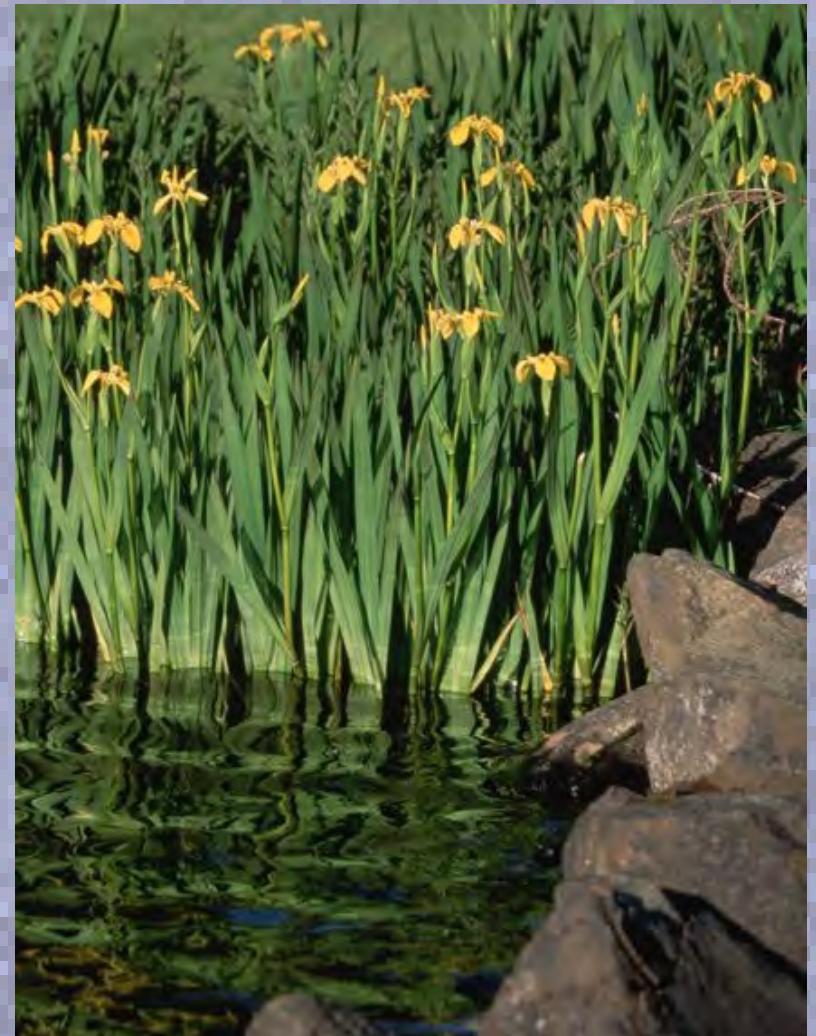
Discharge from Wetland

Time



Improvement of Water Quality

- Nutrient uptake
- Settling (sediment, nutrients, and heavy metals)
- Removes 70-90% of nitrogen
- Traps 80-90% of sediment



Ground Water Recharge

- Maintains water table levels
- Exerts control over hydraulic head
- Amount of recharge varies depending on the characteristics of the wetland

Fish, Wildlife & Plant Habitat

- Life functions
 - Breeding
 - Feeding
 - Mating
- Endangered species
- 43% of federally threatened and endangered species are dependent on wetlands (USFWS)



The Bushkill Creek Watershed is home to significant populations of and suitable habitat for the bog turtle, a federally endangered reptile.

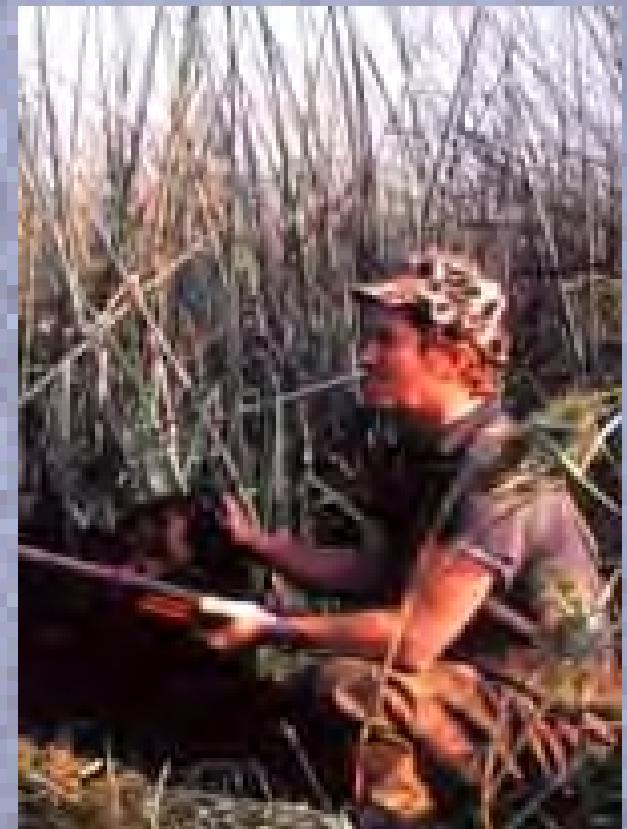


Rough-leaved Aster

©1989 Virginia M. Gee

Wetland Values

- Recreation (fishing and hunting)
- Resources (food, timber, and fur)
- Jobs (public and private)
- Education & research
- Aesthetics (sense of place)





Wetland Protection

- Section 404 of the Clean Water Act
- Chapter 105 of the Pennsylvania Code
- Municipal ordinances

Any activity in a wetland
requires a *PERMIT* from the
US Army Corps of
Engineers and the
Pennsylvania Department of
Environmental Protection.



US Army Corps
of Engineers ®





Section 404 Permit

US Army Corps of Engineers

- Size and nature determine permit type (Individual vs. General)
- Different permits issued for different activities (Ex. Minor road crossing vs. Utility line crossing)
- Issued on nationwide, regional, and/or state basis



Chapter 105 Permit

Pennsylvania Department of Environmental Protection

- PASPGP-2 grants state and federal approval
- Size and nature determine permit type (General Permit vs. Joint Permit)
- Different permits issued for different activities (Ex. Driveway crossing vs. Utility line crossing)





Municipal Ordinances

- Laws adopted by municipalities
- Can provide additional wetland protection
- Example: Natural Features Conservation Ordinance

Streams of the Bushkill Creek Watershed

- Approximately 257 miles of streams
- 4 major streams: Bushkill Creek, Little Bushkill Creek, Sobers Run, and Schoeneck Creek
- 2 minor stream: Englers Run and Spring Brook
- Designated by the state as High Quality Cold Water Fisheries (HQ-CWF)



Bushkill Creek



Little Bushkill Creek

Sober's Run





Schoeneck Creek



Engler's Run



Spring Brook

Major Drainage Basins

- 6 major river basins in Pennsylvania
- Bushkill Creek is part of the Delaware River Basin
- 12 watersheds in Northampton County
 - Lehigh River
 - Bushkill Creek
 - Monocacy Creek
 - Martins Creek

Bushkill Creek Watershed

- Watershed size: 80 square miles
- Drains most of:

Townships

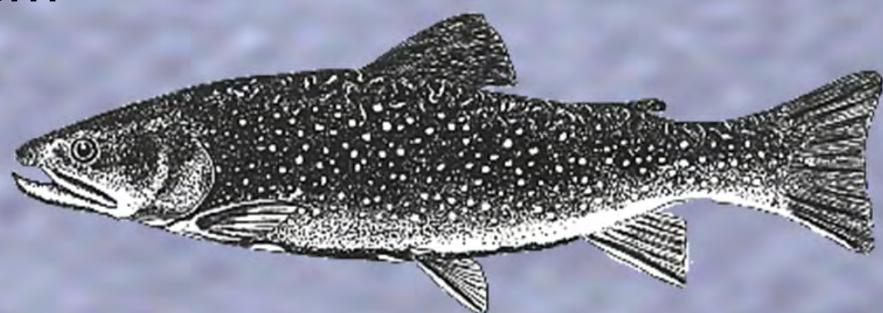
- Bushkill
- Moore
- Plainfield
- Palmer
- Forks
- Upper Nazareth
- Lower Nazareth
- Bethlehem

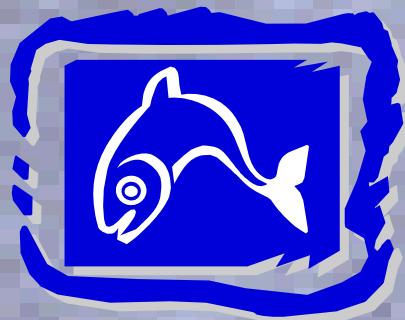
Boroughs

- Nazareth
- Stockertown
- Tatamy
- Wilson
- Wind Gap

Cities

- Easton





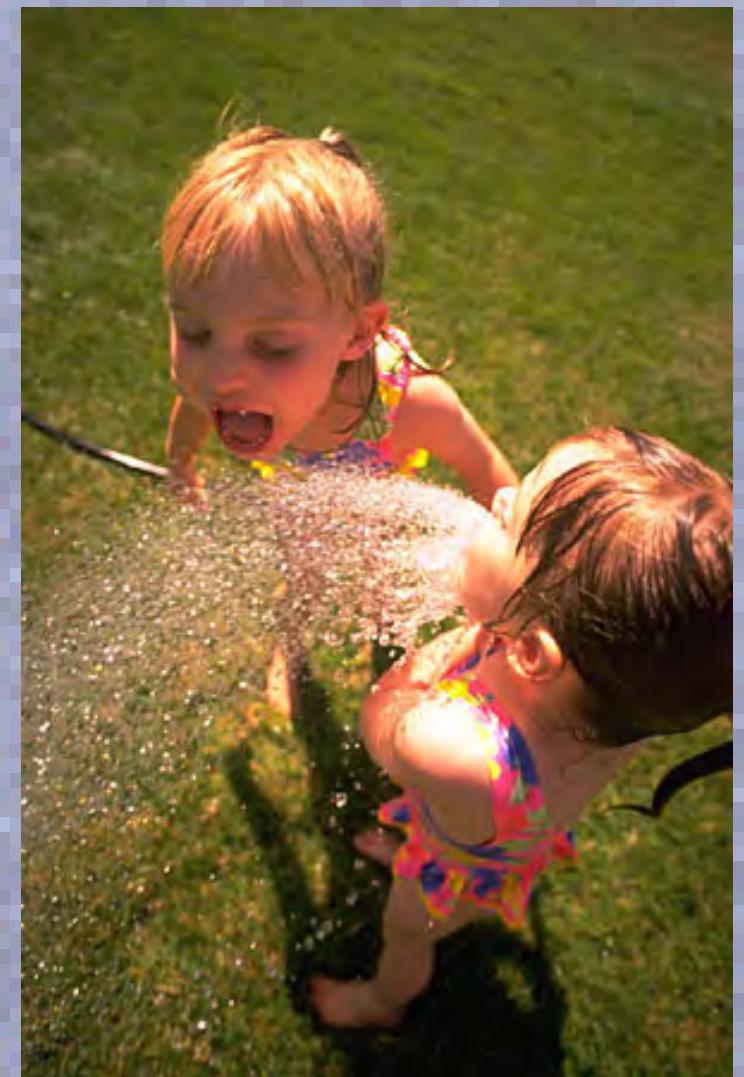
Chapter 93

Water Quality Standards

- High Quality Cold Water Fishery classification (HQ-CWF)
- Exceptional Value (EV) classification
 - Many streams within the watershed likely qualify for this designation
 - EV status provides additional protection to water resources (including wetlands)

Why are Local Streams Important?

- Drinking water
- Recreation
- Wildlife habitat
- Aesthetic value



Drinking Water

- Ground water
 - Wells
- Surface water
 - Water treatment plants
 - Distribution system

Recreation

- Fishing
- Boating
- Swimming
- Hiking
- Photography



Wildlife Habitat

- Instream
- Riparian
- Terrestrial



A photograph of a natural landscape. In the foreground, a large, mature tree with a thick, leaning trunk and sprawling branches is positioned on the left, its canopy extending over a dark, flowing river. The river's edge is lined with lush green grass and various small white flowers. The background is filled with dense green foliage and trees, creating a sense of depth and a natural, serene environment.

**Aesthetic
Value**

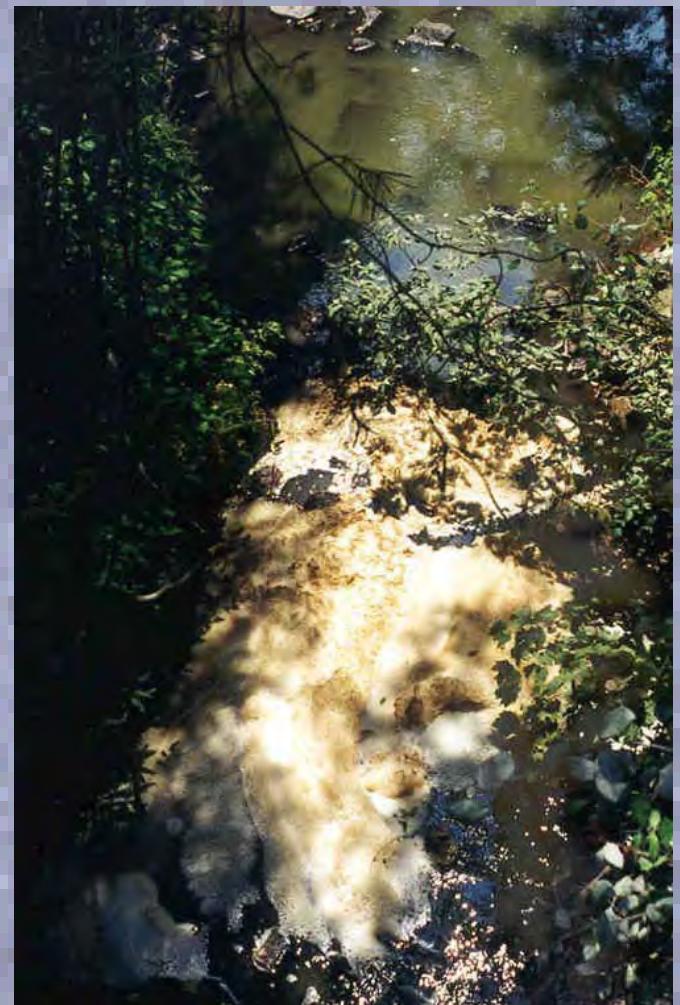
Threats to Water Resources

- Draining and filling wetlands
- Invasive plants
- Stormwater runoff (impervious surfaces)
 - Quality
 - Quantity
- Resource extraction in wetlands (peat mining)



Nonpoint Source Pollution

- Streamflow
 - High, elevated stormflows
 - Low, depleted baseflows
- Sediment
- Nutrients
- Heavy metals
- Synthetic chemicals
- Oil, grease, and salt
- Bacteria



Streamflow

- High, elevated stormflows
- Low, depleted baseflows
- Due to presence of impervious surfaces and lack of infiltration
- Causes accelerated erosion
- Degrades habitat and water quality



Sediment

- Reduces water clarity
- Degrades water quality and habitat
- Caused by:
 - Residential, commercial, and industrial development
 - Erosion
 - Construction
 - Agriculture



Nutrients

- Causes eutrophication
- Sources:
 - Residential and agricultural use of fertilizer
 - Septic system failures
 - Stormwater runoff



Heavy metals and Synthetic chemicals

- Can cause:
 - Cancer
 - Kidney problems
 - Liver problems
 - ...and more
- Sources:
 - Pesticides and herbicides
 - Household products (i.e. batteries and light bulbs)
 - Wood preservatives
 - Others

Pathogens

- Pathogens:

- Bacteria
- Viruses
- Protozoa (parasites)



- Causes gastrointestinal illness

- Sources:

- Septic systems failures
- Animal waste (livestock and wildlife)

Oil, Grease, and Salt

- Roads
- Parking lots





Point Source Pollution

- Wastewater treatment plants: nutrients, organics, increased water temperature
- Industry discharges: heavy metals, chlorine, PCB's, increased water temperature

Impacts of Pollution on Water Resources

- Eutrophication (nutrient enrichment)
- Reduction in water clarity
- Acceleration of erosion
- Increase in water temperature
- Reduction in dissolved oxygen levels
- Decrease in pH levels
- Accumulation of toxic compounds
- Increase in health problems
- Reduction of biodiversity

Monitoring Water Quality

- Chemical analysis
- Physical characteristics
- Biological characteristics





Monitoring Water Quantity

- United States Geological Survey Stations
- Manual flow monitoring as needed
 - Baseflow
 - Stormflow



Stream Flow Conditions

- Stormflow – wet weather
- Baseflow – dry weather



Monitoring Wastewater Treatment Plants

- Discharge Monitoring Reports

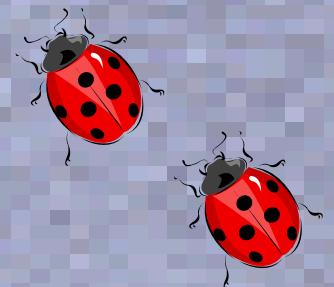


Help Protect Our Water Resources

- Become educated about local water resources and the threats to those resources
- Support local conservation groups; get Involved
- Landscape your home with native plants

Help Protect Our Water Resources

- Substitute gravel or brick paths for asphalt
- Try natural alternatives to chemical fertilizers/pesticides
- Maintain your septic system



Bushkill Stream Conservancy

- About 500 members, 30 active
- Organized around ???
- Objective: preserve the current high quality of our streams and lakes through education and monitoring
- www.bushkill.org

Bushkill Stream
Conservancy



This seminar resulted from a collaboration between Bushkill Stream Conservancy, Jacobsburg Environmental Education Center, and F.X. Browne, Inc.

Funding for this project was provided by the Pennsylvania Department of Environmental Protection Growing Greener Program



Bushkill Stream Conservancy



www.bushkill.org

**Bushkill Stream
Conservancy**



Bushkill Stream Conservancy

Education



Environment



Recreation



History



Stormwater Management



Bushkill Stream
Conservancy



Problems Associated with Stormwater

- Increased runoff
- Decreased groundwater recharge
- Degraded stream channels
- Increased flooding
- Degraded water quality
- Increased erosion

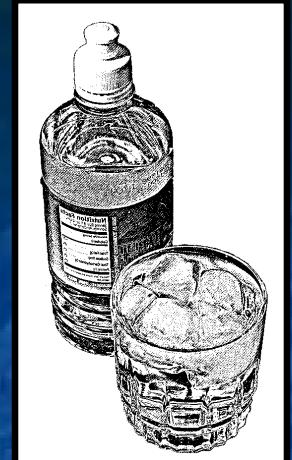


Increased Runoff

- Caused by:
 - Increased impervious surfaces
 - Compaction of soils
 - Concentration of flow
 - Insufficient retention and detention
 - Removal of vegetation
- Results in:
 - Increased erosion
 - Surface
 - Streambank and bed
 - Impacts to aquatic habitats



Decreased Groundwater Recharge



- Caused by:
 - Loss of recharge area to development
 - Increased impervious surfaces
- Results in:
 - Increased erosion by overland flows
 - Decreased recharge of groundwater
 - Less drinking water

Degradation of Stream Channels

- Caused by:
 - Increased flow
 - Lack of riparian vegetation
 - Increased sedimentation
- Results in:
 - Degraded stream habitat
 - Degraded water quality
 - Increased flooding



Increased Flooding

- Caused by:
 - Increased impervious surfaces
 - Higher storm flows
 - Higher peak flows
- Results in:
 - Pollutants from upland areas
 - Damages and economic impacts

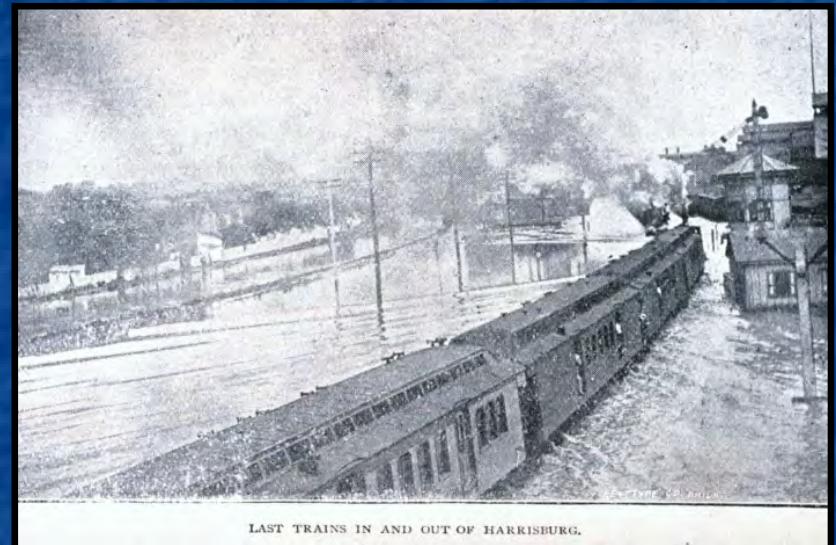


Photo of Johnstown Flood from NOAA

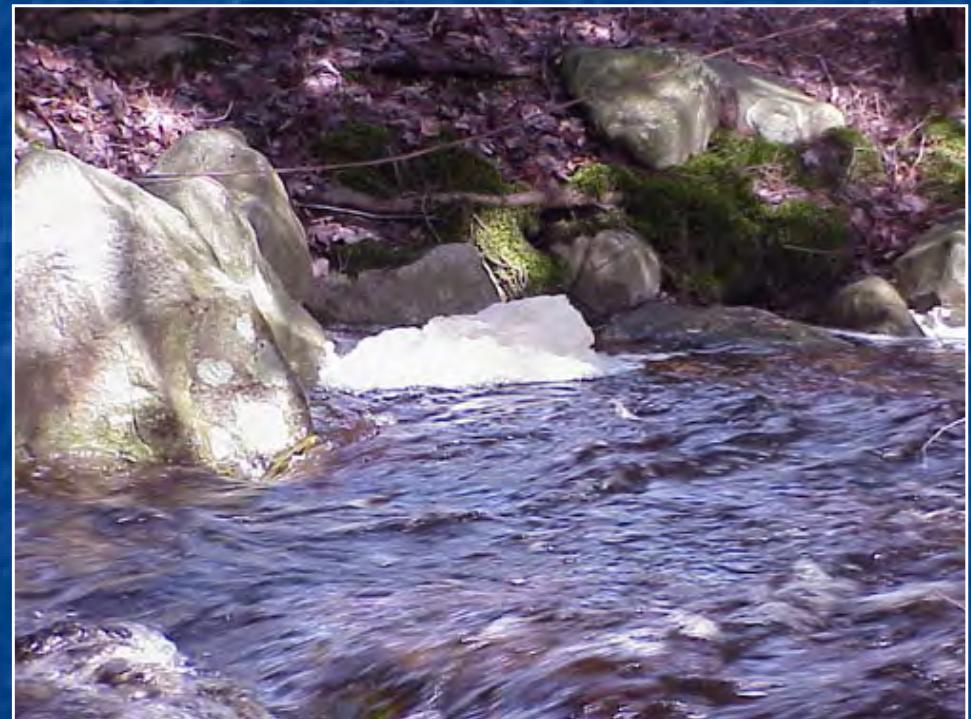
Degradation of Surface Water Quality

- Caused by:

- Eutrophication (nutrient enrichment)
- Sedimentation
- Bacterial contamination
- Temperature enrichment

- Results in:

- Aquatic habitat impacts
- Species loss
- Economic loss



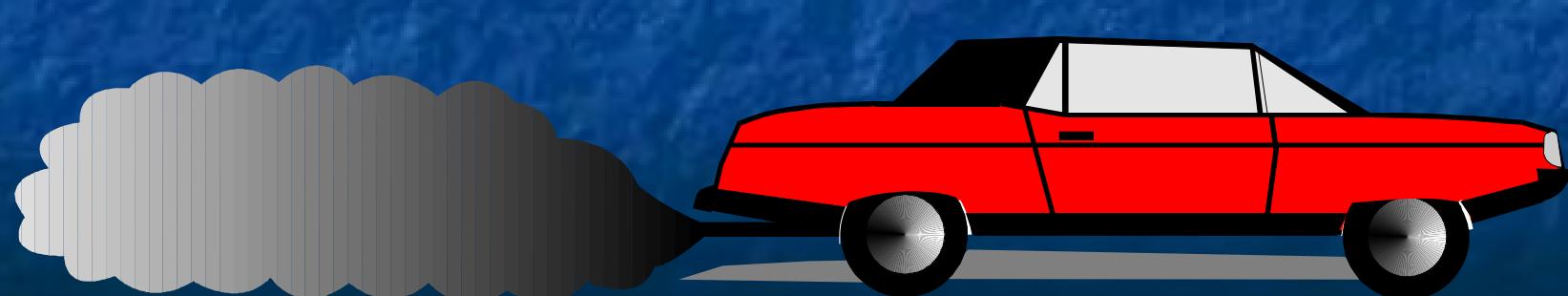
Increased Erosion

- Caused by:
 - High storm flows
 - Higher frequency of high storm flows
 - Lack of riparian vegetation
- Results in:
 - Sedimentation
 - Degraded habitat quality
 - Species loss
 - Temperature increases



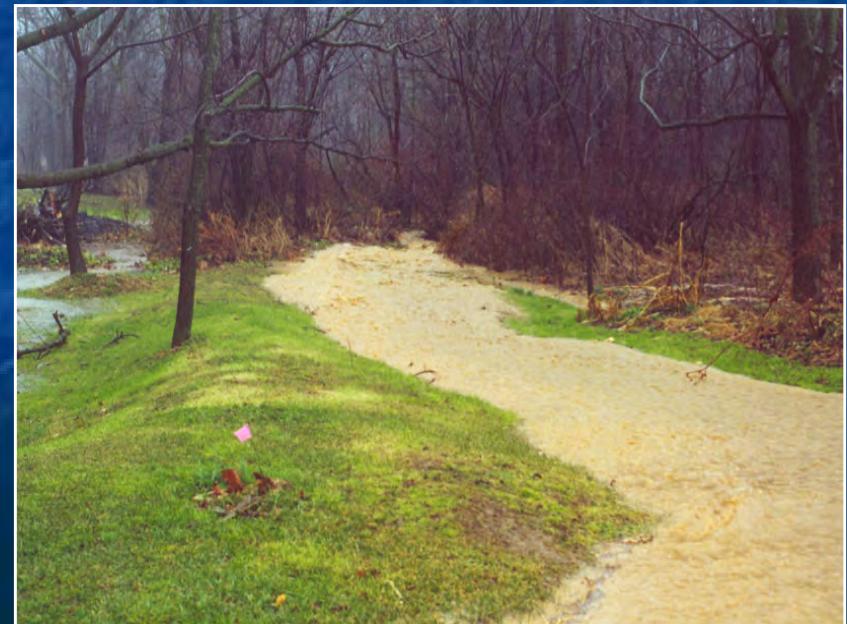
Stormwater Pollutants

- Sediments
- Nutrients
- Bacteria
- Heavy metals
- Oil & grease
- Toxic chemicals
- Chlorides
- Temperature



Sediment

- Reduces light penetration
- Destroys aquatic spawning and rearing habitat
- Clogs gills and filters of fish and aquatic organisms
- Transports other pollutants
 - Nutrients
 - Metals
 - Chemical toxins



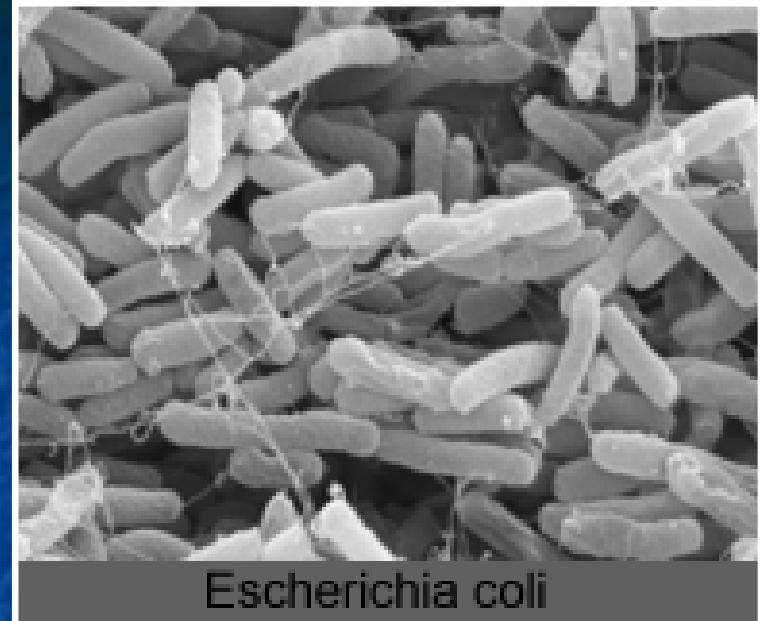
Nutrients

- Eutrophication – excessive algae and macrophytes
- Dissolved oxygen depletion
- Fish kills
- Taste and odor problems
- Increased water treatment costs
- Loss of recreational opportunities
- Decreased aesthetics
- Human health problems



Bacteria

- Often exceed health standards
 - Human health
 - Wildlife impacts
- Increased development = increased bacteria
- Older development = increased bacteria
- Measured using indicator organisms
 - Fecal coliform
 - Fecal streptococcus



Heavy Metals

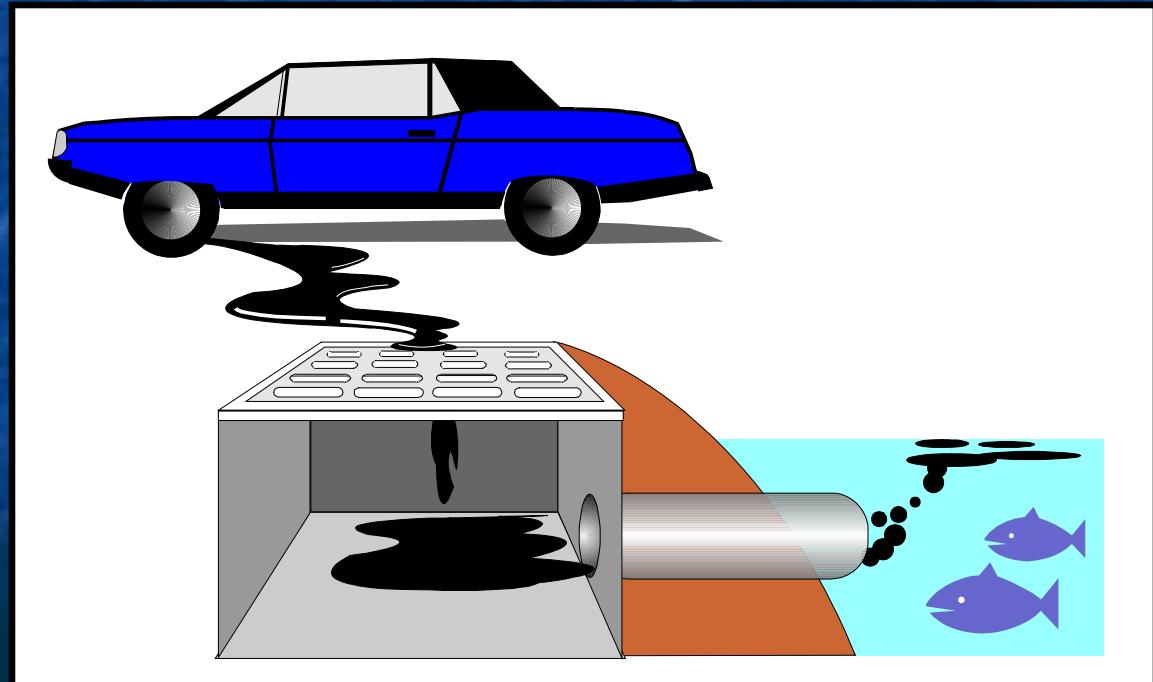
- Soluble forms are toxic to aquatic life
- Impacts drinking water
- Metals of concern
 - Lead
 - Mercury
 - Cadmium
 - Chromium
 - Arsenic



Fish Kill in Maryland

Oil & Grease

- Toxic to aquatic organisms
- Smothers benthic organisms
- Sources include:
 - Parking lots
 - Roads
 - Gas stations
 - Waste motor oil



Toxic Chemicals

- Harmful to all organisms
- Sources include:
 - Parking lots and roads
 - Gas stations
 - Industrial development
 - Pesticides
 - Old landfills and dumps
 - Others



Sodium Chloride (Road Salt)

- Toxic to aquatic organisms
- Snowmelt – 2,000 to 3,000 mg/L
- Soluble – hard to treat
- Alternatives



Temperature



- Impacts aquatic organisms
 - Fish and macroinvertebrates
 - Coldwater vs. warmwater
- Urban runoff – warmer
 - Pavement
 - Rooftops
 - Ponds and lakes
 - Detention and retention basins

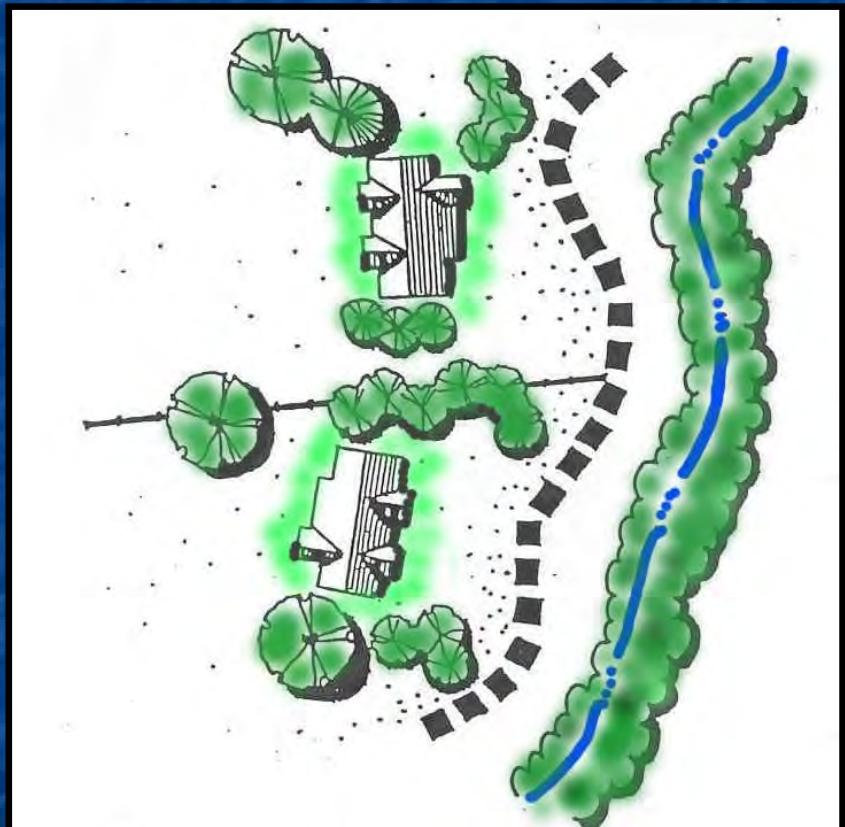
Stormwater Management Principles

- Reduce runoff
- Reduce velocity of runoff
- Treat runoff
 - Quantity control
 - Quality control



Reduce Runoff

- Minimize impervious areas
- Maximize vegetated areas
- Maximize open space
- Avoid storm sewers
- Infiltrate stormwater runoff
- Maintain natural features



Reduce Runoff Velocity

- Catch basins
- Check dams
- Grass swales
- Decreased slopes
- Decreased coverage of impervious surfaces
- Semi-pervious asphalt
- Maximize vegetation

POROUS ASPHALT COURSE

1/2" TO 3/4" AGGREGATE
ASPHALTIC MIX (1.27 - 1.91 CM.)

FILTER COURSE

1/2" CRUSHED STONE (1.27 CM.)
2" THICK (5.08 CM.)

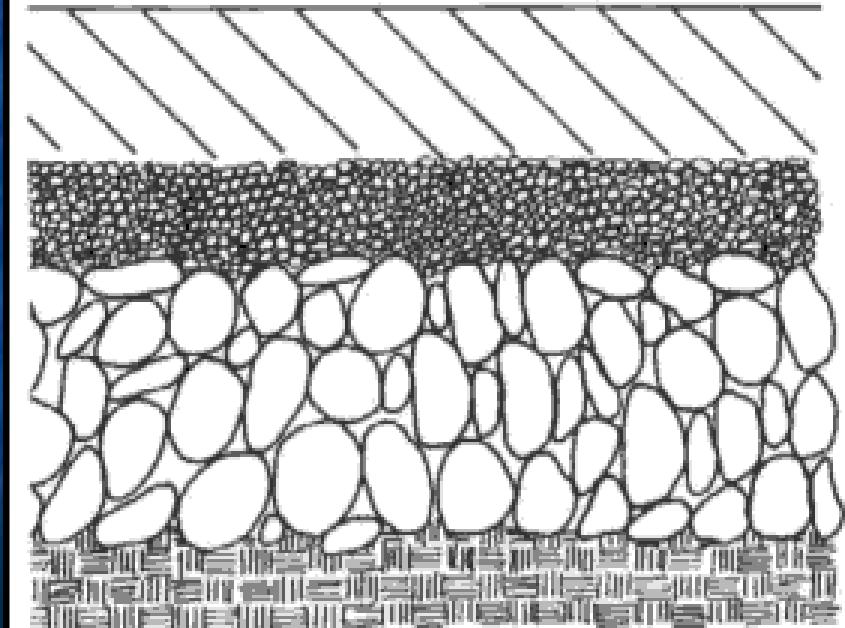
RESERVOIR COURSE

(2.54 - 5.08 CM.)
1" TO 2" CRUSHED STONE VOIDS
VOLUME IS DESIGNED FOR RUNOFF
DETENTION

THICKNESS IS BASED ON STORAGE
REQUIRED AND FROST PENETRATION.

EXISTING SOIL

MINIMAL COMPACTION TO RETAIN
POROSITY AND PERMEABILITY.

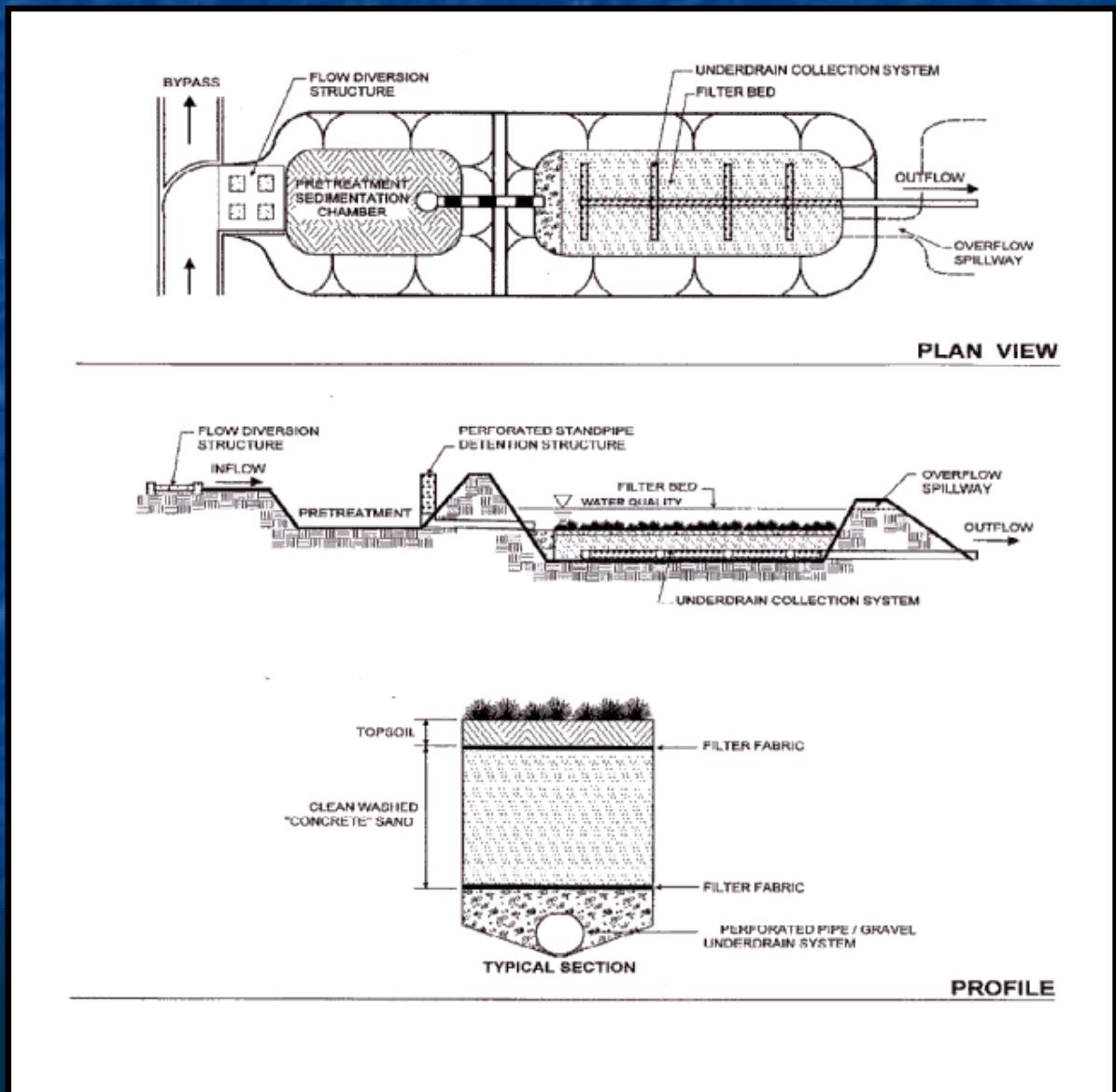


Porous asphalt guidelines from EPA

Treat Runoff

- Sediment forebay or micropool
- Vegetative component
- Grass filter strips and swales
- Catch basins
- Sediment chambers

Sediment Chamber



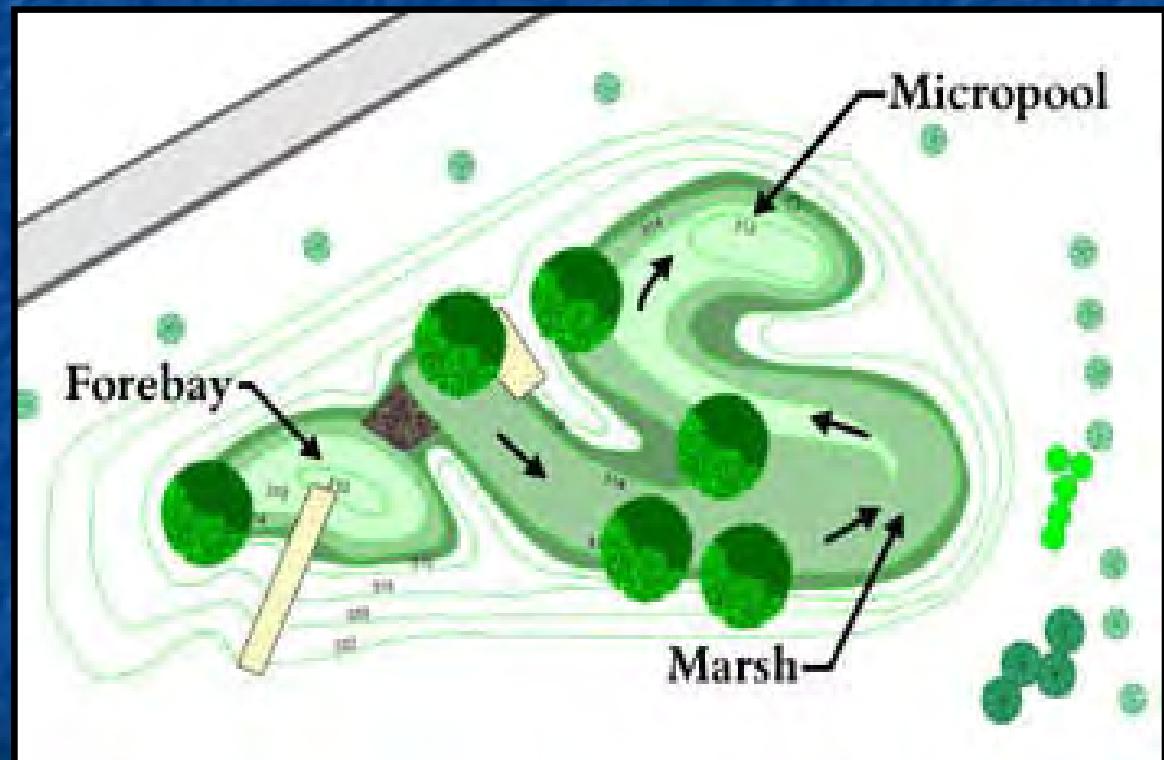
Stormwater BMPs

- Stormwater basins
 - Detention
 - Retention
- Infiltration trenches
- Constructed wetlands
- Bioretention areas
- Land-use planning
 - Ordinances
 - Comprehensive plan



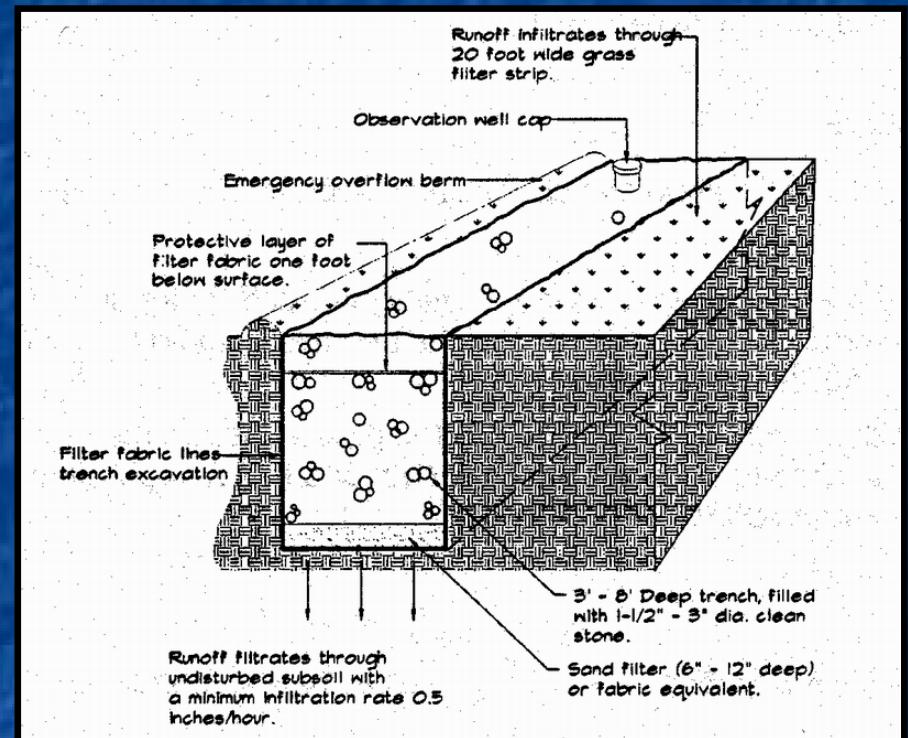
Stormwater Basins Detention & Retention

- Quantity control
- Water quality improvement
- Pollutant removal
- Wildlife habitat creation
- Aesthetic improvement
- Maintenance reduction



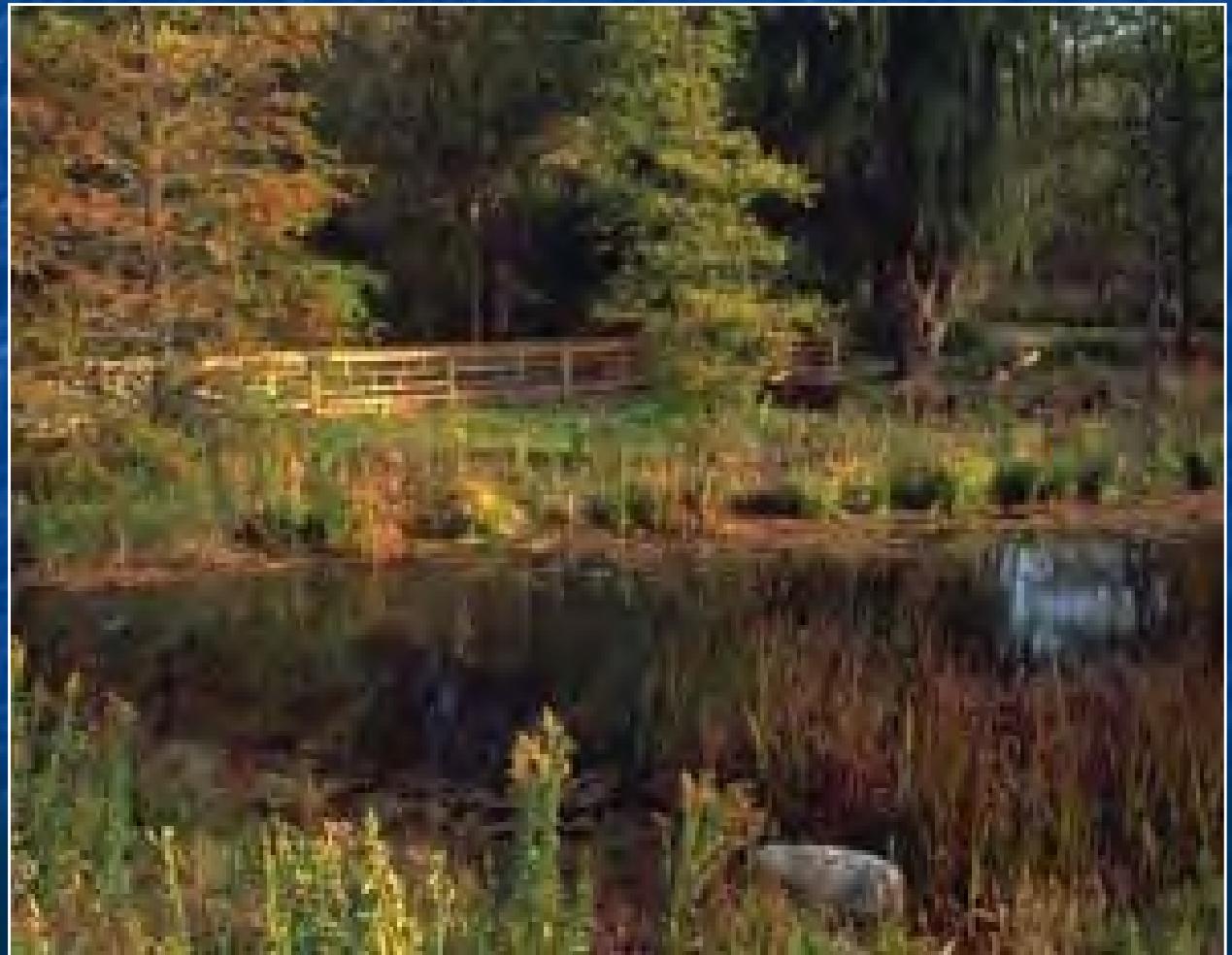
Infiltration Trenches

- Maintain hydrologic balance
- Remove pollutants
- Prevent increased downstream flows
- Recharge groundwater
- Maintain streamflows



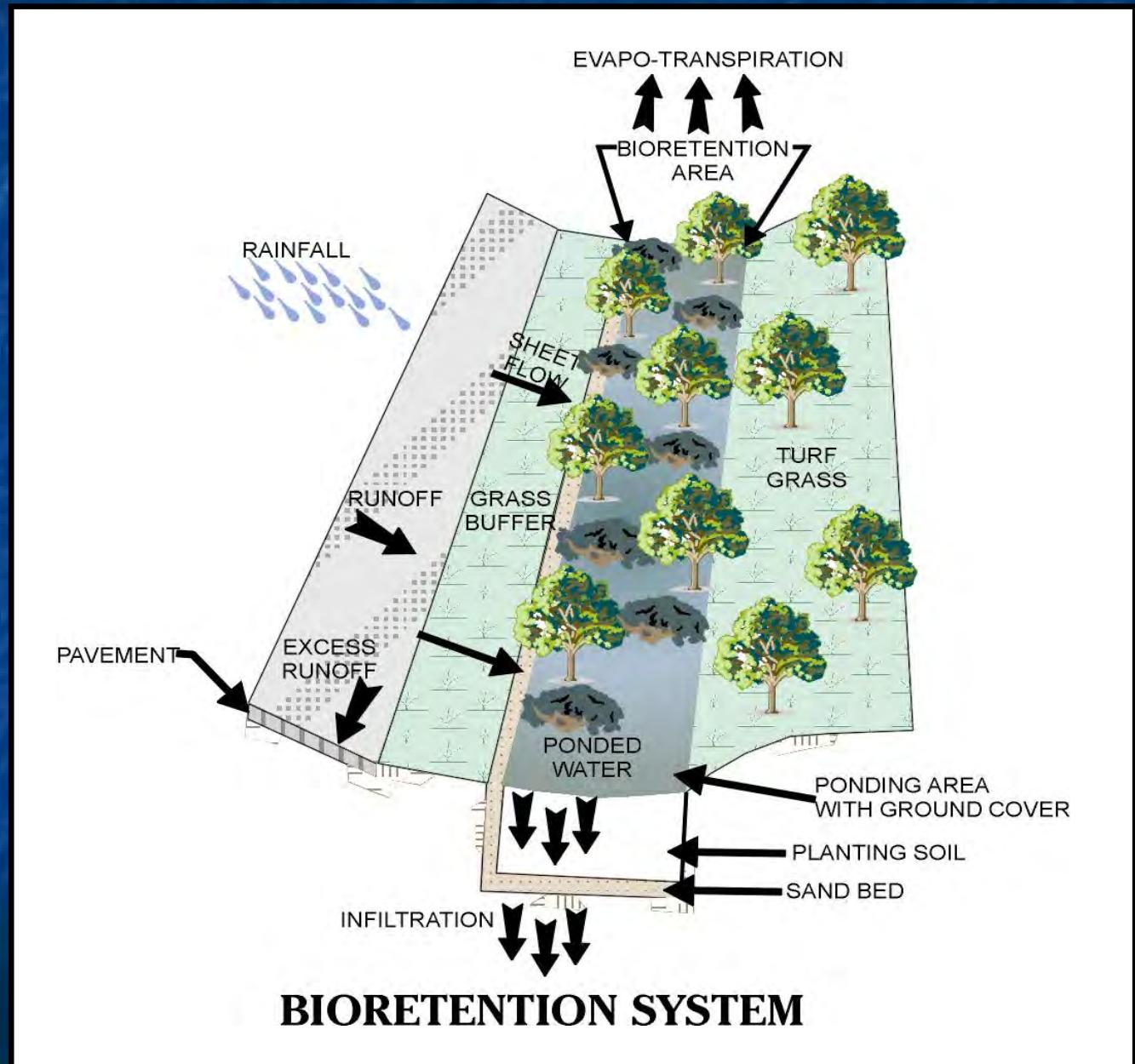
Constructed Wetlands

- Water quantity & quality control
- Water quality improvement
- Groundwater recharge
- Wildlife habitat benefits
- Landscape enhancement



Bioretention Areas

- Water quality benefits
- Some flow attenuation
- Some volume control
- Aesthetics
- Wildlife habitat benefits



Land-use Planning



- Ordinances
 - Stormwater management
 - Natural features conservation
 - Riparian corridor protection
 - Wetland protection
 - Floodplain management
 - Steep slopes
- Official map
- Comprehensive plan
- Regional planning

Available Resources

- Bushkill Stream Conservancy
 - www.bushkill.org
- The Stormwater Center
 - www.stormwatercenter.net
- The Center for Watershed Protection
 - www.cwp.org
- F.X. Browne, Inc.
 - www.fx browne.com
- EPA Watershed Page
 - www.epa.gov/owow/watershed



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**Bushkill Stream
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Education



Environment



Recreation



History



ROADWAY MAINTENANCE



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Bushkill Stream Conservancy

Roads Impact Watersheds

- Changes hydrology
- Increases nonpoint source pollution
- Creates unnatural disturbance that promotes the growth of invasive plant species



Classification of Roadways

- Interstates
- State Roads
- Township Roads
- Private Roads



Hydrologic Impacts

- Increased Impervious Surfaces Lead To...
 - Disruption of natural drainage patterns
 - Increase in stormwater runoff which leads to an increase in frequent flooding and bankfull flows, and a decrease in dry weather flows

Nonpoint Source Pollution

- As Stormwater Flows Over Impervious Surfaces It Picks Up...
 - Oils & Grease
 - Heavy Metals
 - Debris
 - Sediment
 - Road Salt



Oils & Grease

- Leak onto road surfaces from car and truck engines
- Spill at fueling stations
- Are discarded illegally
- Float on the water's surface and block sunlight needed by underwater fish and plants
- Damage aquatic habitat and sensitive spawning areas
- Cause health problems

Heavy Metals

- Sources include:
 - car and truck exhaust
 - worn tires and engine parts
 - brake linings
 - weathered paint
 - rust
- Heavy metals, like lead, zinc, and mercury, are toxic to aquatic life and humans

Debris

- Clogs inlets, catch basins, and outlets
- Leads to overflows, erosion, and unintended flooding
- Makes stormwater management devices ineffective in stormwater pollutant removal
- Harms fish and aquatic life
 - Hinders sunlight penetration
 - Interferes with fish movement and migration

Sediment

- Erosive conditions result from the clearing/disturbing of land during road and bridge construction
- Damages fish-spawning areas
- Alters habitat where bottom-dwelling organisms live and reproduce
- Interferes with fish migration
- Carries contaminants (e.g. nutrients, heavy metals) that threaten aquatic ecosystems

Road Salt

- Degrades ground and surface water quality
- Damages soil structure
- Stresses nearby trees and plants



Invasive Species

- Fill associated with grading activities is often tainted with seeds of invasive vegetation
- Invasive plants, such as phragmites, form dense colonies along highways and streets, jeopardizing the integrity of nearby plant communities



Stormwater Management Issues

- Stormwater is often directed to receiving waters without any detention or retention
- Detention/retention helps to release flow at an acceptable rate while providing some level of pollutant treatment



Stormwater Management Issues

- Most designers and engineers only address half of the problem related to stormwater – diverting it off the roads
- WHERE the stormwater is going is often not an issue



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Stormwater Management Issues

- Conveyance structures often become blocked leading to:
 - Overflows
 - Unintended flooding
 - Erosion

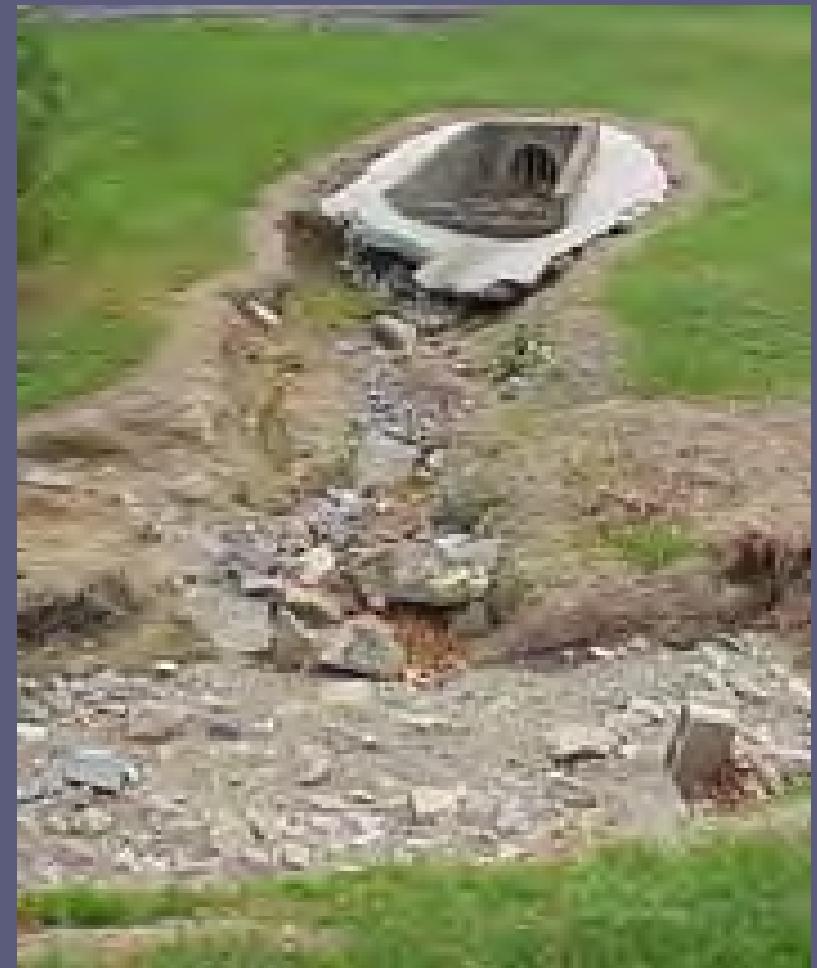


Dirt Roads

- Increase sedimentation
- Should not be located on steep slopes
- Dirt and Gravel Roads Program
 - Road grading
 - Conveyance facilities
 - Detention and retention facilities
 - Optimize drainage patterns

Decreasing the Negative Effects of Roads

- Identify problems that exist among current roads and streets and remediate
- Inspect conveyance structures regularly and remove blockage as necessary



Decreasing the Negative Effects of Roads

- Retrofit existing roads with Best Management Practices (BMPs) to help decrease watershed effects
- Examples:
 - Swales – water quality
 - Culverts
 - Larger
 - Additional
 - Better alignment
 - Construct wetlands between roadways to intercept runoff



Best Management Practices

- Construct basins or wetlands, where possible, to provide stormwater detention
- Install trash racks or trash containment devices to prevent debris from clogging outlet structures or entering downstream environments



Best Management Practices

- Where applicable, incorporate curb breaks so flow can be directed into vegetated channels



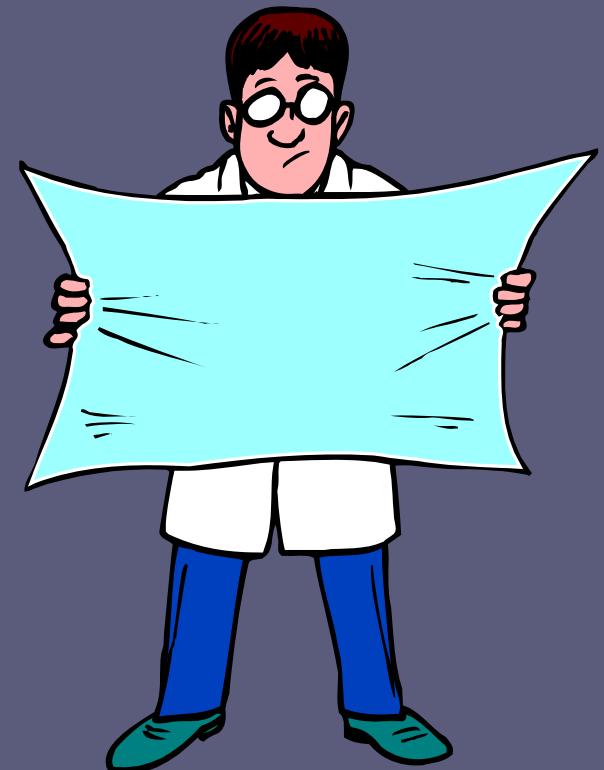
Best Management Practices

- Consider de-icing alternatives such as potassium acetate and calcium magnesium acetate



Better Roadway Design

- Design future roads mindfully
- Consider watershed effects



Better Roadway Design

- **Size culverts appropriately, the right size is worth the money**
- **Oversized culverts and crossings will convey greater than design flows**



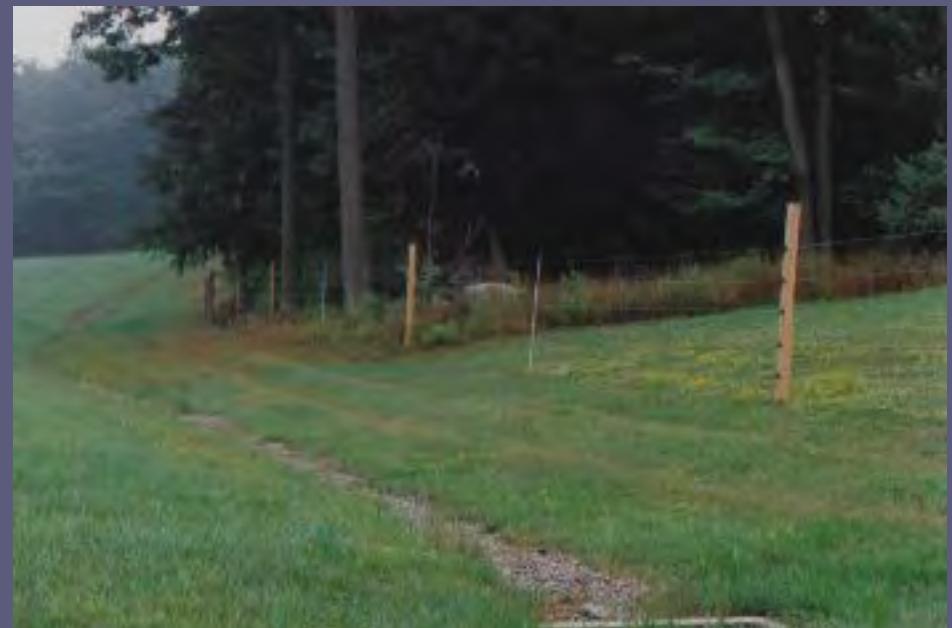
Better Roadway Design

Reduce amount of impervious surface:

- Reduce street width and total length
- Minimize required parking spaces and dimensions
- Minimize the number of cul-de-sacs and consider alternative designs (e.g. islands)
- Relax side and front setbacks

Better Roadway Design

- Avoid building curbs
 - Minimize concentration of flow
 - Maximize sheet flow off impervious surfaces
- Include curb breaks in design
- Convey stormwater through vegetated channels
- Use constructed wetlands and retention basins where possible



Better Roadway Design

**STORMWATER SHOULD NEVER BE
DISCHARGED DIRECTLY OR
WITHOUT PRE-TREATMENT INTO
NATURAL WETLANDS AND/OR
SENSITIVE NATURAL AREAS**



Conclusions

- Impervious surfaces have a negative impact on water quality
- Proper road maintenance can improve water quality
- Implementing Best Management Practices (BMPs) can reduce the impact of impervious surfaces

For More Information



- www.epa.gov/owow/nps/roads.html
- <http://h2osparc.wq.ncsu.edu/wetland/aglife/roads.html>

THANK YOU!!



www.ecy.wa.gov/programs/wq/posters/index.html

AND REMEMBER, When vehicles pollute the highway, they're not just polluting the highway

**This seminar resulted from a collaboration
between Bushkill Stream Conservancy,
Jacobsburg Environmental Education
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History



Invasive Plants. . . .

Coming Soon to a
Natural Area Near You!!!

Bushkill Stream
Conservancy

Common reed

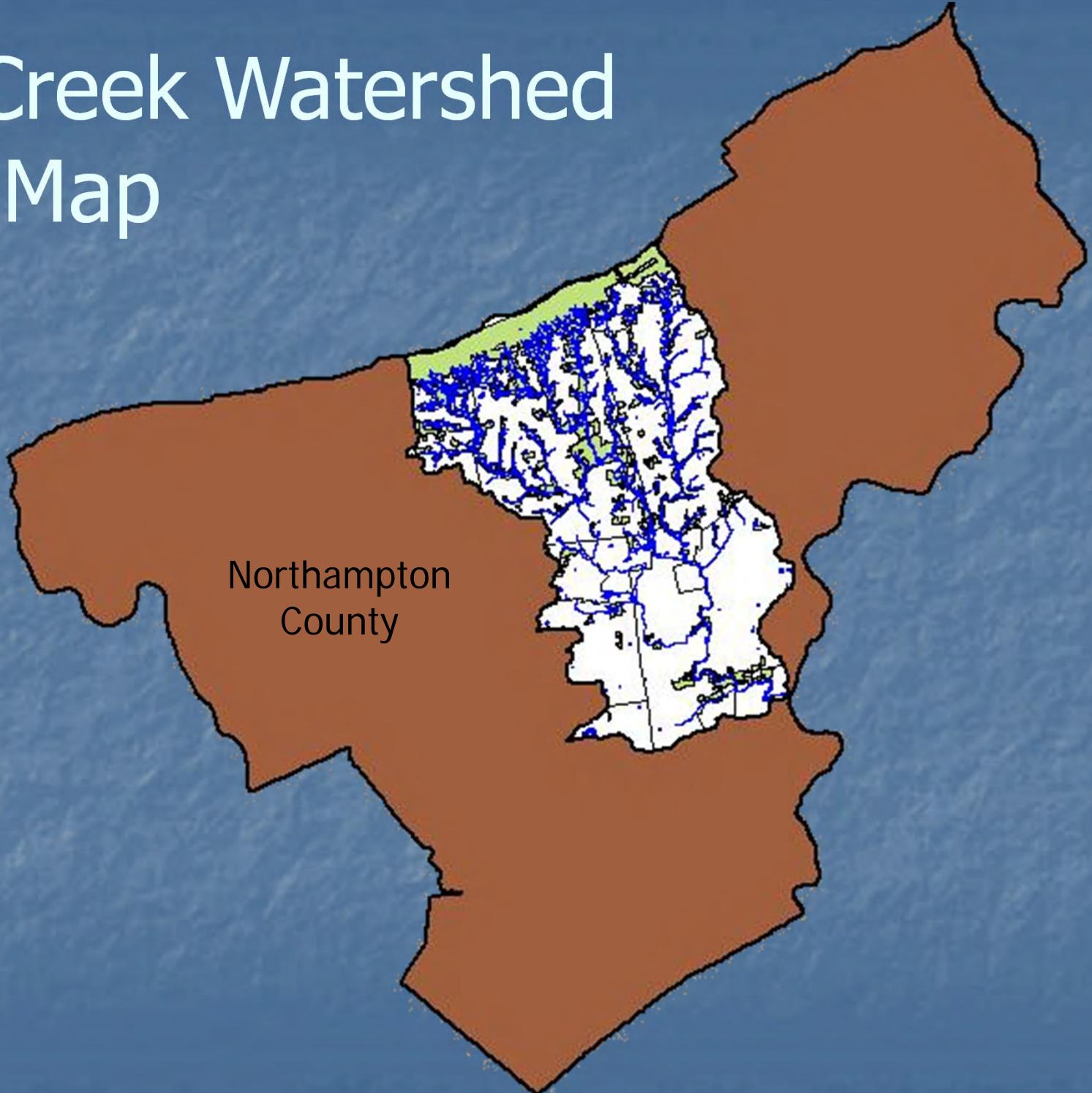
Phragmites australis
Photo by A. Murray
Copyright 2002 Univ. Florida



What is an invasive plant?

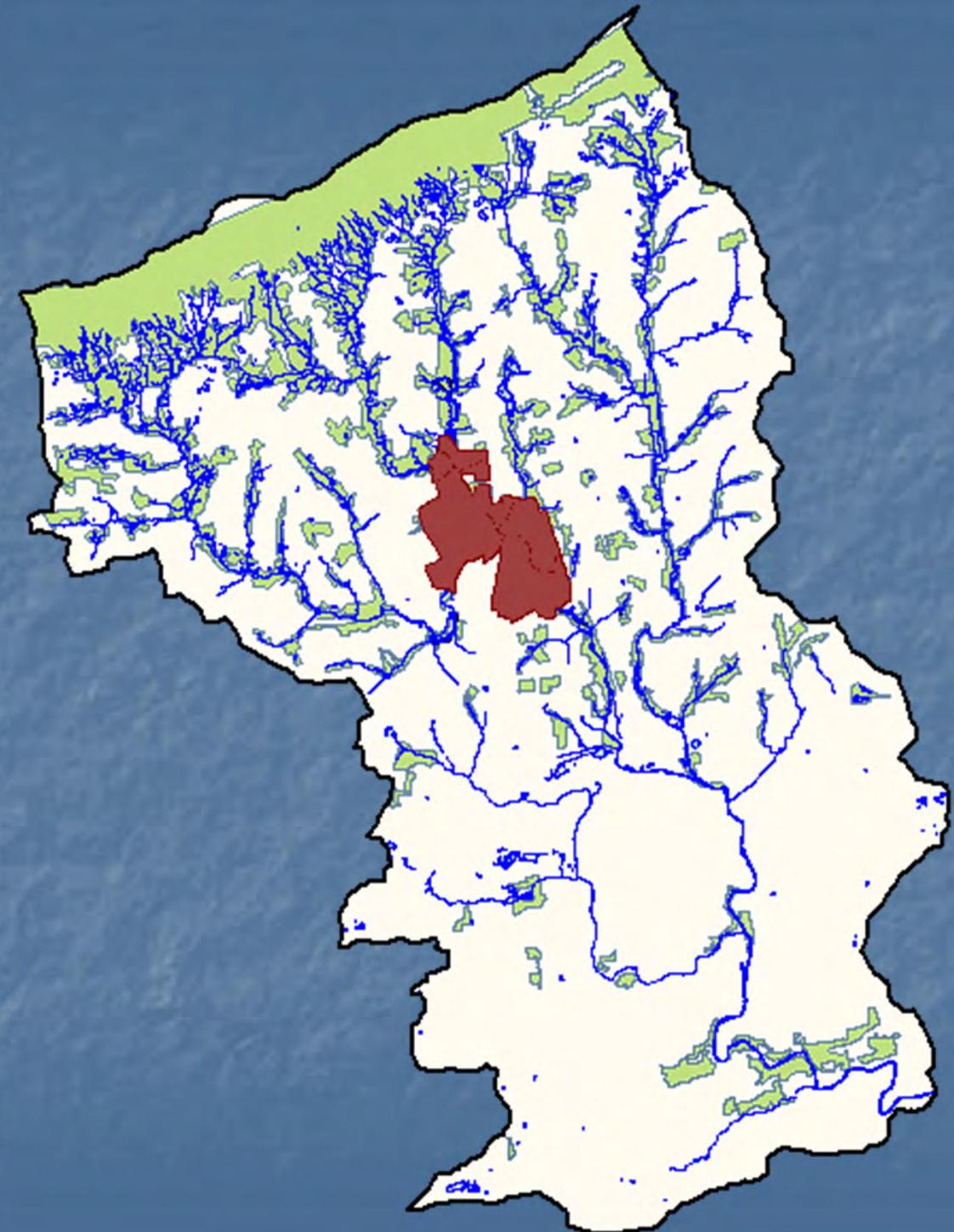
- **Invasive** – having the tendency to take-over, colonize, crowd-out
- **Exotic** – non-native to the area found

Bushkill Creek Watershed Location Map

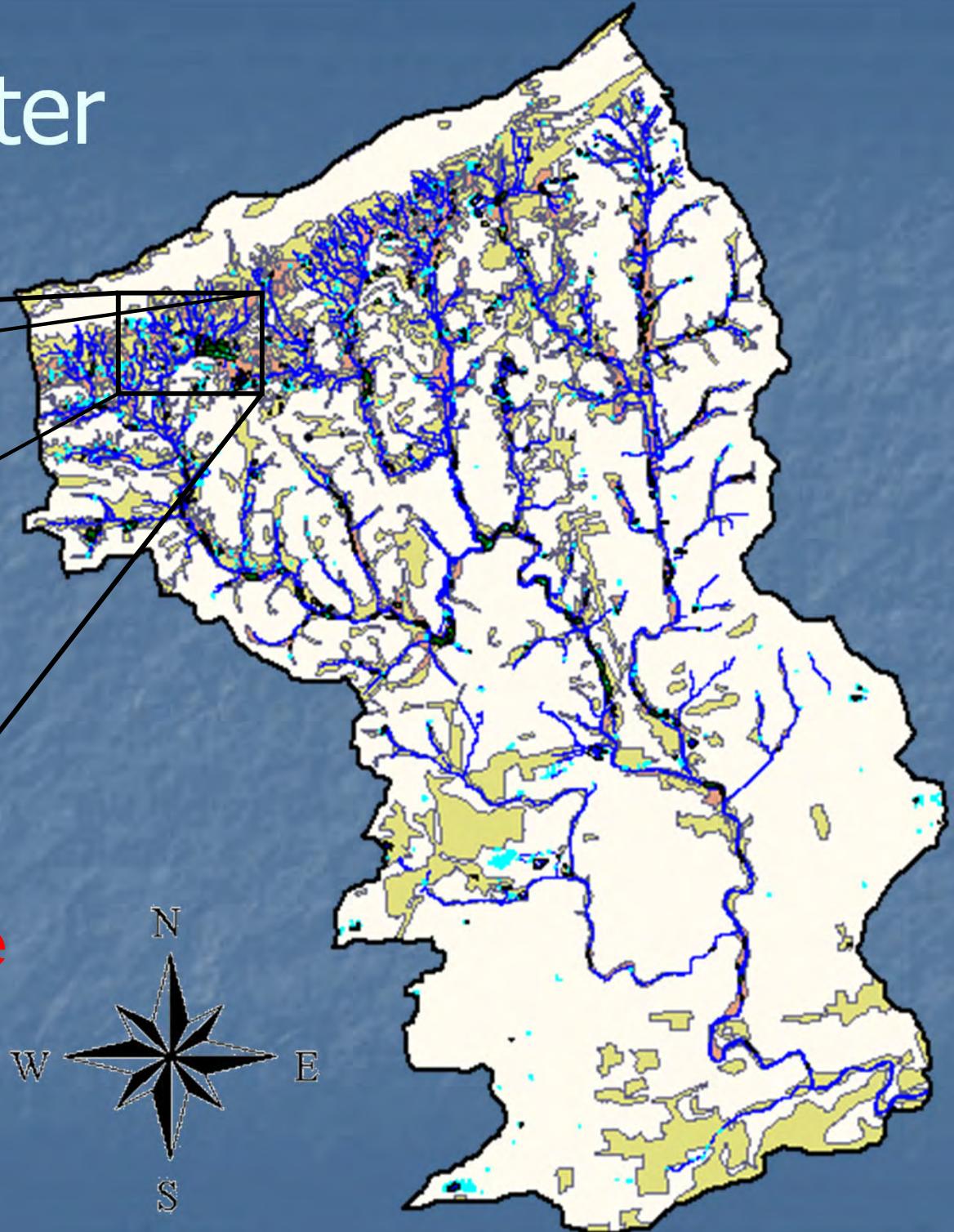
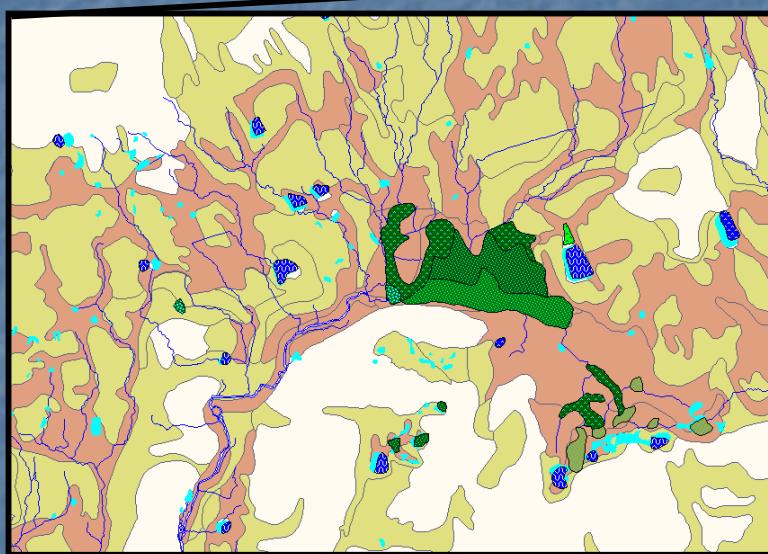


Bushkill Creek Watershed Map

80 square miles



Wetlands & Water Resources Map



Primarily High Quality
and Exceptional Value



Ecological Impacts

- Reduces or suppresses species richness & diversity
- Depletes native plant populations
- Inhibits tree growth - invasive vines (i.e. resulting from change in succession)
- Alters wildlife habitat leading to changes in wildlife assemblages
- Changes nitrogen cycling



The Role of Deer



- The increased deer population has decimated the shrub layer in PA forests
- Overpopulation has led to a change in forest succession
- Deer create a disturbed landscape, which promotes the growth of invasive plants

Controlling Invasive Plants

- Step #1: Avoid introducing invasive plants - Landscape using native plants instead
- Step #2: Limit any and all land disturbance
- Step #3: Remove invasives immediately upon their arrival
- Step #4: Consider herbicides



Methods of Control

- Hand-pulling
- Digging
- Mowing or cutting
- Solarization
- Biological controls
- Habitat manipulation
- Herbicides



Use of Herbicides



- “Hack and squirt” – making multiple cuts in the plant and then spraying an herbicide in the cuts
- Herbicides commonly used include Garlon 3a, Garlon 4, Brush-be-gone, and glyphosate (i.e. Roundup, Rodeo)
- Many other herbicides have been successful in controlling invasive plants

Common Invasive Plants

- *Ailanthus altissima*, Tree of Heaven
- *Acer platanoides*, Norway maple
- *Polygonum cuspidatum*, Japanese knotweed
- *Microstegium vimineum*, Japanese stiltgrass
- *Alliaria petiolata*, Garlic-mustard
- *Rubus phoenicolasius*, Wineberry
- *Lythrum salicaria*, Purple loosestrife
- *Phragmites australis*, Common reed
- *Myriophyllum spicatum*, Eurasian water-milfoil
- *Potamogeton crispus*, Curlyleaf pondweed
- *Hydrilla verticulata*, Hydrilla

The List Goes On...

- *Polygonum perfoliatum*, Mile-a-minute weed
- *Pueraria lobata*, Kudzu
- *Celastrus orbiculatus*, Oriental bittersweet
- *Berberis thunbergii*, Japanese barberry
- *Lonicera japonica*, Japanese honeysuckle
- *Lonicera spp.*, Bush honeysuckles
- *Rosa multiflora*, Multiflora rose
- ...and on...and on...and growing!

Tree of Heaven



Photos from The Nature Conservancy, Wildland Invasive Species Team

Tree of Heaven

Ailanthus altissima

- Found from Canada to Argentina
- Fast-growing, deciduous tree. Leaves produce toxin
- Reproduces by stump and root sprouts.
- Seen in vacant lots, near sides of buildings, disturbed forest communities



Photos from The Nature Conservancy,
Wildland Invasive Species Team

Norway Maple



Photo from Michigan State University Extension, 1996

Norway maple

Acer platanoides

- Deciduous tree
- Found throughout the United States
- Planted frequently as a street tree and has naturalized in forests



Photo from Michigan State University Extension, 1996

Japanese Stiltgrass



Virginia Tech Weed ID Guide

Japanese stiltgrass

Microstegium vimineum

- Annual grass-like that forms dense mats
- Found east of the Mississippi from Connecticut to Florida
- Found in marshes, ditches, low-land woods, floodplains, streambanks, and woodland thickets.
- A.K.A. Napalese browntop

Garlic Mustard



Photo from The Nature Conservancy, Wildland Invasive Species Team

Garlic mustard

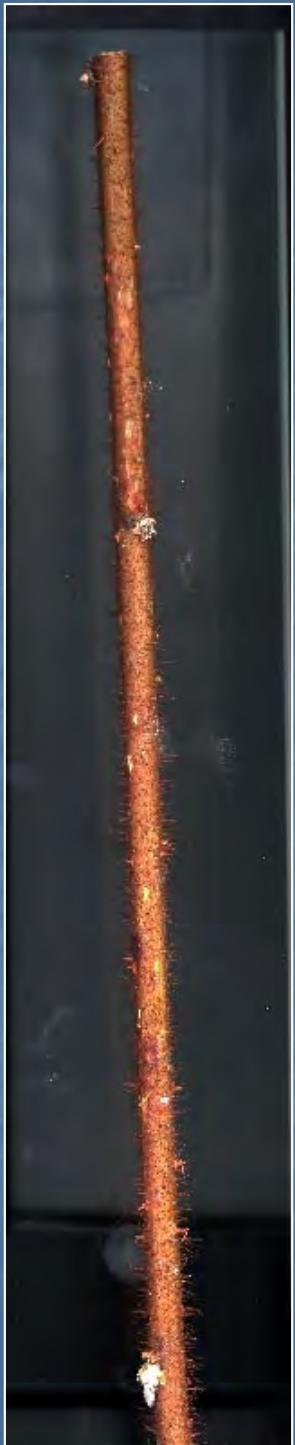
Alliaria petiolata

- A flowering herbaceous plant
- Found throughout the U.S. particularly in the Northeast
- Dispersal is believed to be related to deer movement and recreational hikers.
- Found in forest edges, roadsides, and streambanks



Wineberry





Wineberry

Rubus phoenicolasius

- Member of raspberry family
- Introduced by Thomas Jefferson
- Found throughout the United States
- Has distinctive reddish hair and small prickles and thorns throughout the stem
- Seen in forest edges, fields, meadows, and disturbed areas
- Can form thicket

Photo from Yale CyberFlora

Purple Loosestrife



Purple loosestrife

Lythrum salicaria

- Perennial, wetland plant with purple flowers
- Found in every state in the contiguous U.S. (except Florida)
- Spreads by seed dispersal, but root and stem segments can form a new plant
- Seen in wetland communities, ditches, marshes, bogs, fens, sedge meadows, streambanks, and lake shores

Phragmites



Common reed

Phragmites australis

Photo by A. Murray

Copyright 2002 Univ. Florida

Common reed

Phragmites australis

- Grass that can grow up to 20 feet
- Found throughout the United States
- Spreads by rhizomes and shoots
- May also spread by seed
- Many hybrids
- Seen in marshes, along roads, along streams, ditches, and disturbed areas. It grows well in brackish water
- Forms vast tracts as a monoculture (i.e.- Meadowlands, NJ)

Eurasian Water-milfoil



Myriophyllum spicatum
Eurasian water milfoil
Photo by Ann Murray
Copyright 2000 Univ. Florida

Eurasian water-milfoil

Myriophyllum spicatum

- Perennial, aquatic, submerged plant that forms large underwater mats
- Native to Asia, Europe, and northern Africa
- Now found in 45 of 50 states in the US, including PA
- Dispersed by fragmentation
- Found in fresh or brackish ponds, lakes, reservoirs, and slow-moving streams and canals

Curlyleaf Pondweed



Curly pondweed in Minnesota
Potamogeton crispus
Photo by Vic Ramey
Copyright 2001 Univ. Florida

Curlyleaf Pondweed

Potamogeton crispus

- Perennial, submersed aquatic plant
- Common throughout Central, South, and North America, including PA
- Found in freshwater lakes and ponds
- Grows very early in season

Hydrilla



Hydrilla
Hydrilla verticillata
Photo by Ann Murray
Copyright 1999 Univ. Florida

Hydrilla or water thyme

Hydrilla verticulata

- Submersed aquatic plant
- Resembles *elodea sp.*
- Forms very dense mats
- Found from Florida to Connecticut and west to California, including the Delaware River and Susquehanna River Watersheds
- Seen in freshwater springs, lakes, marshes, ditches, and rivers. Grows in water less than 1 foot to more than 20 feet. Tolerates a variety of conditions

Water Chestnut



Photo from the Invasive Plant Council of New York State, 2001

Photo from the Maryland DNR



Water Chestnut

Trapa natans

- Submersed aquatic plant with distinguishing nut-like seeds
- Found from Vermont to Virginia
- Seen in freshwater lakes and ponds and slow-moving rivers and streams
- Forms mats with surface leaves
- Not the edible Chinese “water chestnut”

Mile-a-minute Weed



Photo from the Plant Conservation Alliance, Alien Plant Working Group, 1999

Mile-a-minute weed

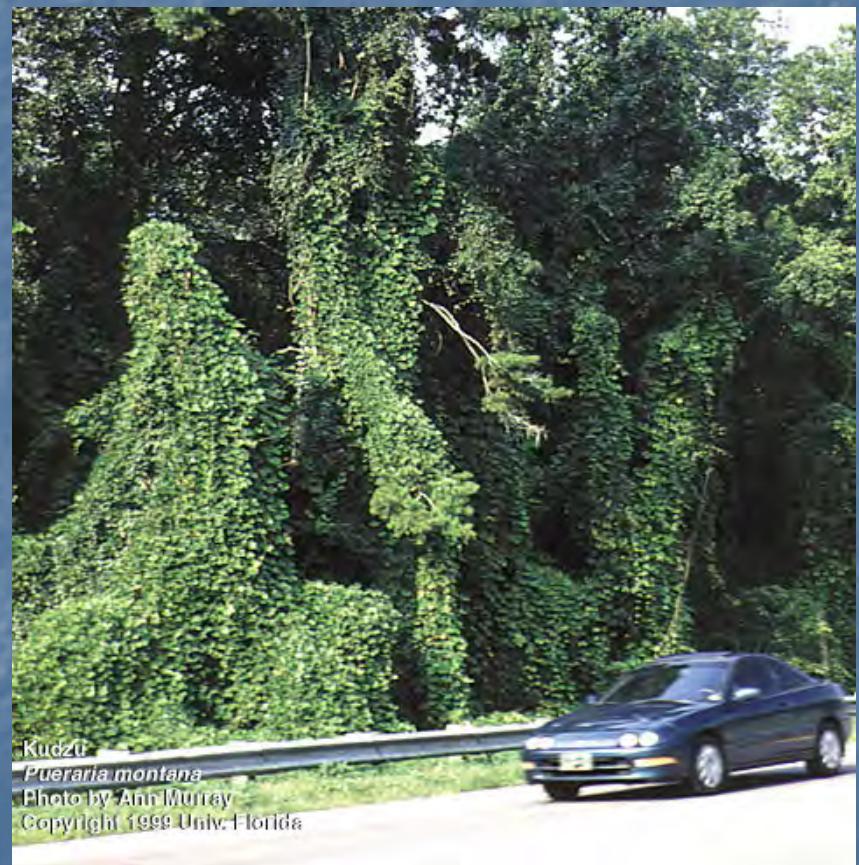
Polygonum perfoliatum

- A vine that forms tangled mats
- Spreading out from Pennsylvania, Maryland, and West Virginia
- Found along roadsides, forest edges, fields, ditches, low meadows, streambanks, and disturbed areas



Kudzu
Pueraria montana
Photo by Ann Murray
Copyright 1999 Univ. Florida

Kudzu



Kudzu
Pueraria montana
Photo by Ann Murray
Copyright 1999 Univ. Florida

Kudzu

Pueraria lobata

- A trailing and climbing vine
- Introduced to provide food for farm animals
- Found from Massachusetts to Florida and west to Texas, but particularly prevalent in the South
- Can grow in a variety of habitats including roadsides, old fields, and vacant lots

Japanese Knotweed





Japanese knotweed

Polygonum cuspidatum

- A perennial, semi-woody plant
- Very difficult to eradicate
- Has spread throughout the United States
- Reproduces primarily by rhizomes
- Found in riparian areas, roadsides, and disturbed areas

Oriental Bittersweet



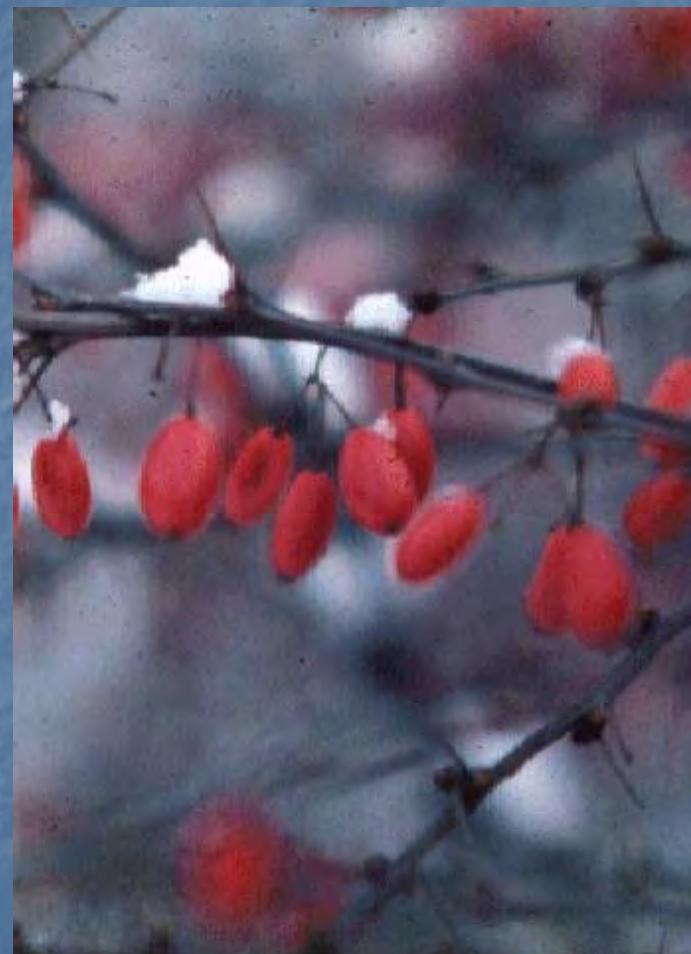
Photo from the Plant Conservation Alliance, Alien Plant Working Group, 1997

Oriental bittersweet

Celastrus orbiculatus

- Twining vine having red seeds with bright yellow seed-coat
- Spread from Maine to Georgia and west to Iowa
- Found in riparian areas, roadsides, and wooded thickets
- Commonly used in wreathes and other seasonal decorations, contributing greatly to spreading

Japanese Barberry



Photos from Michigan State University Extension, 1996

Japanese barberry

Berberis thunbergii

- Spiny, dense shrub that usually grows 2-3 feet tall
- Spread from Nova Scotia to North Carolina and west to Montana
- Seeds eaten and dispersed by animals
- Found in woodlands, fields and landscaped lawns



Japanese Honeysuckle



Japanese honeysuckle
Lonicera japonica
Photo by A. Murray
Copyright 2000 Univ. Florida

Japanese honeysuckle

Lonicera japonica

- Semi-evergreen, trailing woody vines
- Found in eastern and central United States
- Trailing vines can root when in contact with soil, increasing spreading
- Invades mature forest, roadsides, trails, fence rows, abandoned fields, and forest edges

Bush Honeysuckles



Photo by K. R. Robertson, INHS

Bush honeysuckles

Lonicera spp.

- Dense, upright, deciduous shrubs
- Found from New England to North Carolina and west to Iowa
- Spread by seed dispersal
- Lives in a variety of plant communities, particularly disturbed woodland, forest edges, roadsides, pastures, abandoned fields, and wetlands





Multiflora Rose

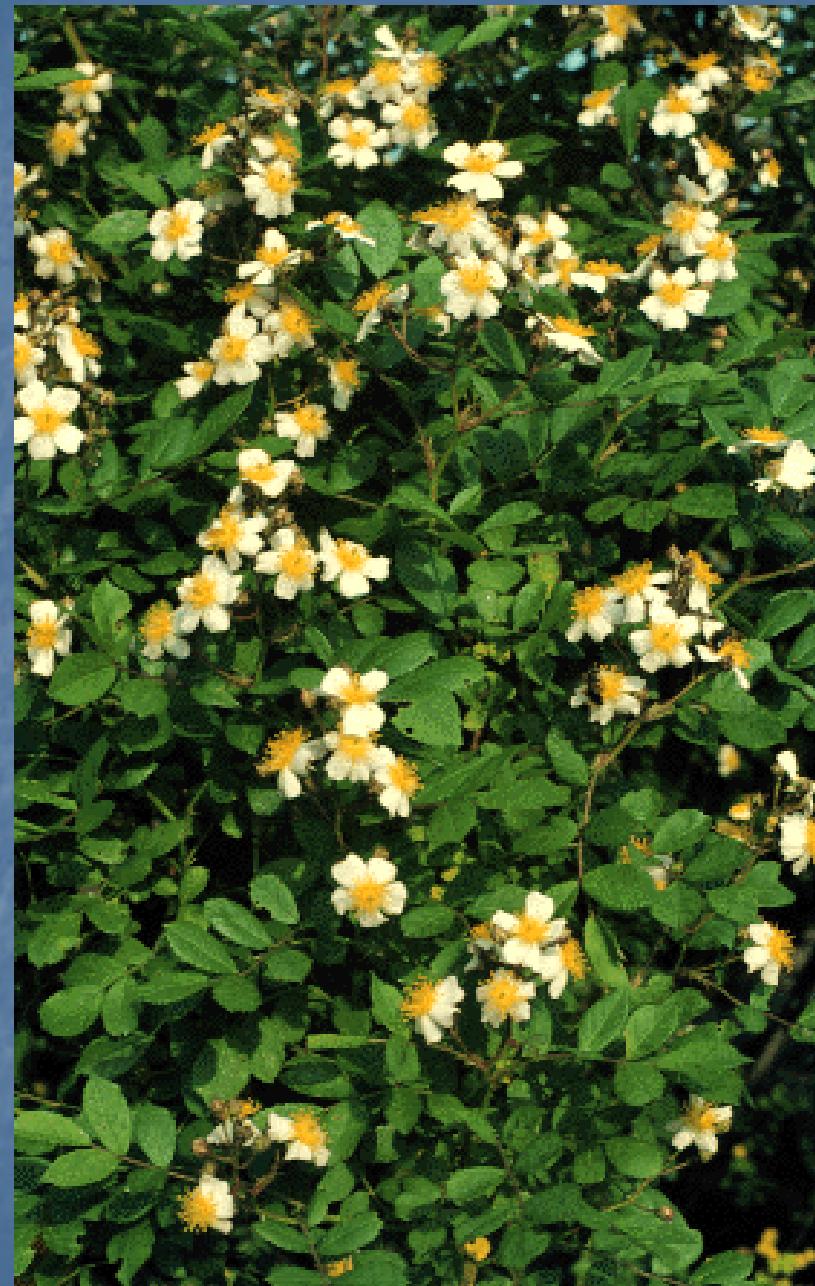


Photo by K. R. Robertson, INHS

Multiflora rose

Rosa multiflora

- Thorny, woody shrub
- Found throughout the United States (with some exceptions, such as the Rocky Mountains and southeastern coastal plains)
- Particular problem in eastern United States
- Reproduces by seed dispersal
- Invades successional fields and pastures, roadsides, dense forest, forest edges, and along streambanks

Conclusions

- Has become an “environmental crisis”
- Controlling invasive species will continue to be a high priority
- Emphasis has shifted from eradication to management
- New ways of controlling invasive species are being discovered all of the time
- Preventing the introduction of new invasive species is critical
- Volunteer programs ARE extremely effective

BSC's Role

- Develop volunteer program
 - BSC members
 - Identify species & catalogue locations – GIS
 - Treat infestations accordingly
- Work with The Nature Conservancy's Weed Watchers & Warrior Programs
 - Share information
 - Provide volunteers
 - Make presentations



SAVING THE LAST GREAT PLACES ON EARTH

Jacobsburg Environmental Education Center

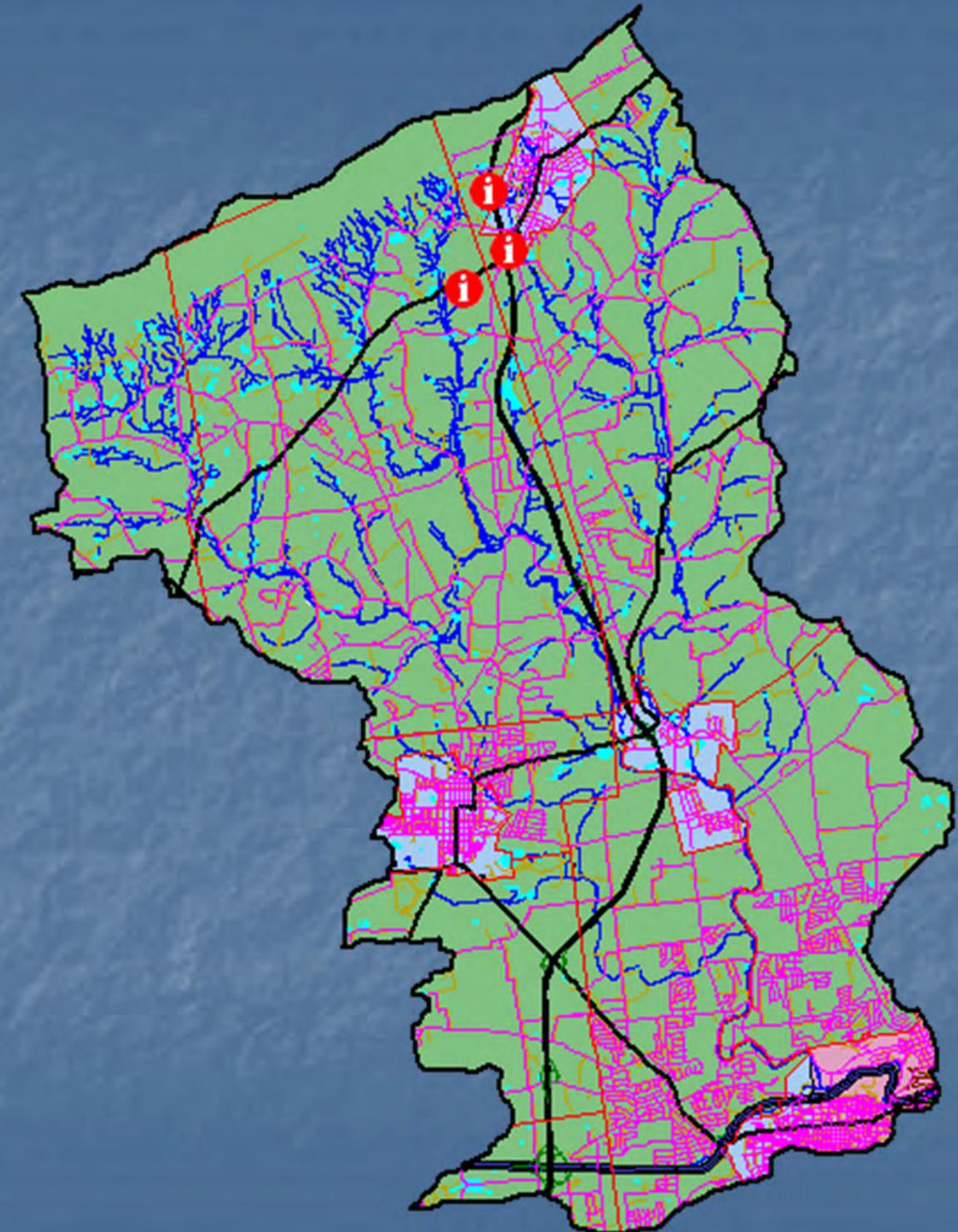
- Environmental education programs
- Events (i.e. – Earthday)
- School programs
- Internal efforts



Jacobsburg Environmental Education Center

Invasives Mapping

 **Invasive Plants**



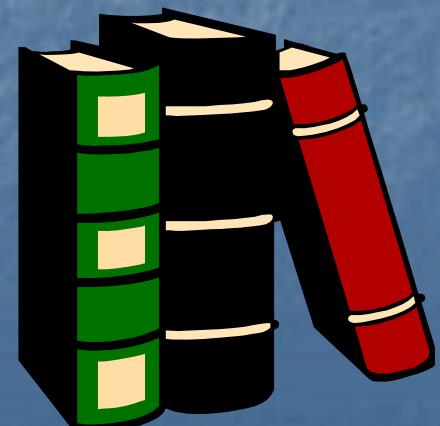
Who To Contact for Help

- Bushkill Stream Conservancy
 - Phone: 610-253-4467
- Bushkill Township Environmental Advisory Council
 - Phone: (610) 759-1250
- Jacobsburg Environmental Education Center
 - Phone: (610) 746-2801
- Northampton County Conservation District
 - Phone: 610-746-1971
- Wildlands Conservancy
 - Phone: 610-965-4397
- Penn State Cooperative Extension
 - Phone: 610-746-1970
- The Nature Conservancy
 - Phone: 570-643-7922



Where to Find More Information

- Internet
 - Plant Conservation Alliance, Alien Plant Working Group: www.nps.gov/plants/alien/fact/ceor1.htm
 - The Nature Conservancy, Wildland Invasive Species Team: <http://tncweeds.ucdavis.edu/esadocs.html>
 - University of Florida, Center for Aquatic and Invasive Plants: <http://aquat1.ifas.ufl.edu/welcome.html>



This seminar resulted from a collaboration between Bushkill Stream Conservancy, Jacobsburg Environmental Education Center, and F.X. Browne, Inc.

Funding for this project was provided by the Pennsylvania Department of Environmental Protection Growing Greener Program



**Bushkill Stream
Conservancy**



www.bushkill.org

Bushkill Stream
Conservancy



Bushkill Stream Conservancy

Education



Environment



Recreation



History





Bushkill Creek Watershed

The Heart of Northampton County

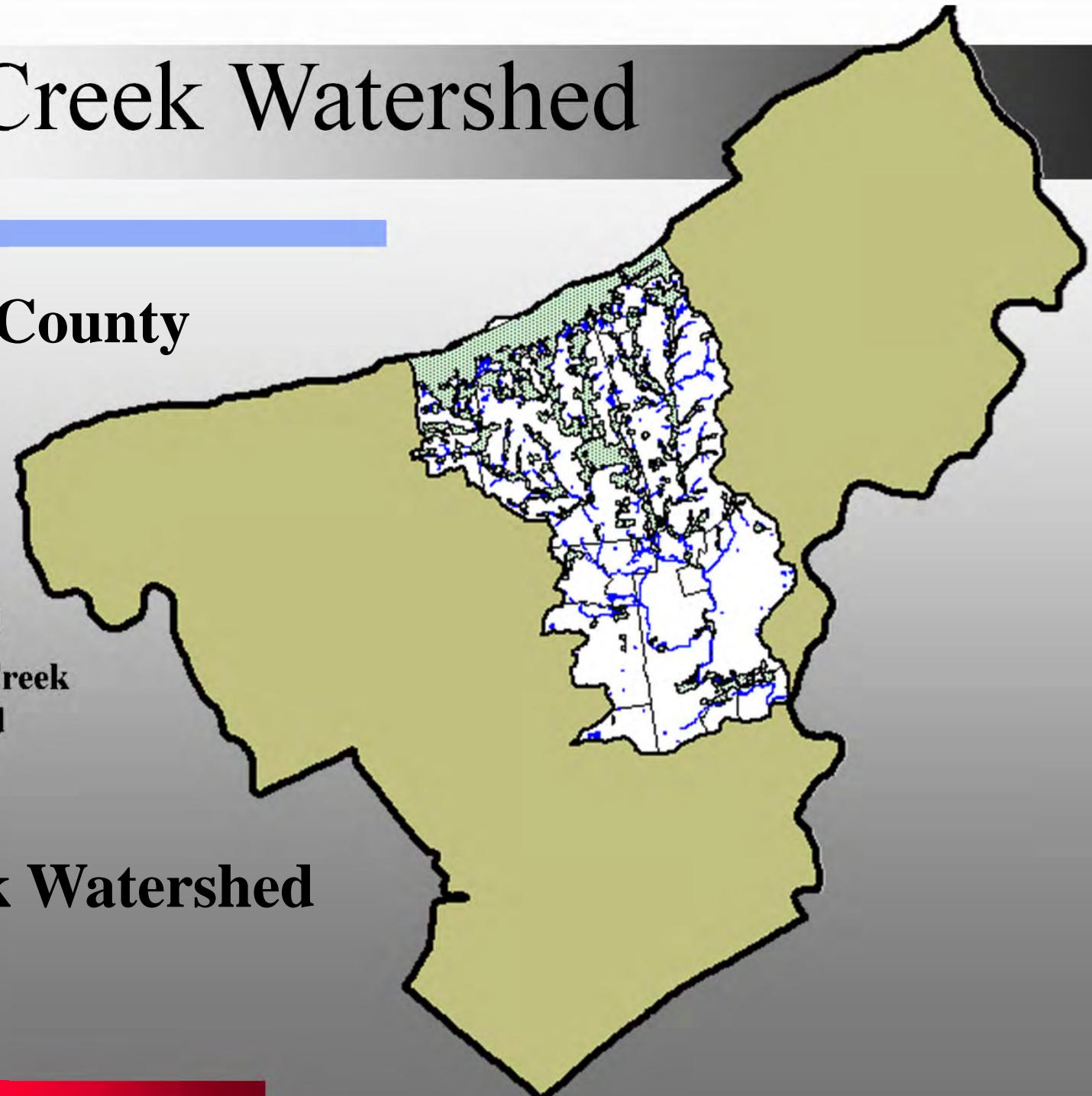


Bushkill Creek Watershed

Northampton County

377 square miles

- County
- Woodland
- Bushkill Creek Watershed
- Streams



Bushkill Creek Watershed

80 square miles

Bushkill Watershed Partnership

- **Bushkill Stream Conservancy**
- **Jacobsburg Environmental Education Center DCNR**
- **Jacobsburg Historical Society**
- **Delaware & Lehigh Canal National Heritage Corridor**
- **Trout Unlimited – Forks of the Delaware Chapter**
- **Township EACs**
- **Lafayette College**
- **Muhlenberg College**
- **Local High Schools**
- **EASI**
- **PADEP**
- **Growing Greener**
- **Northampton County Conservation District**



Why We Live Here!

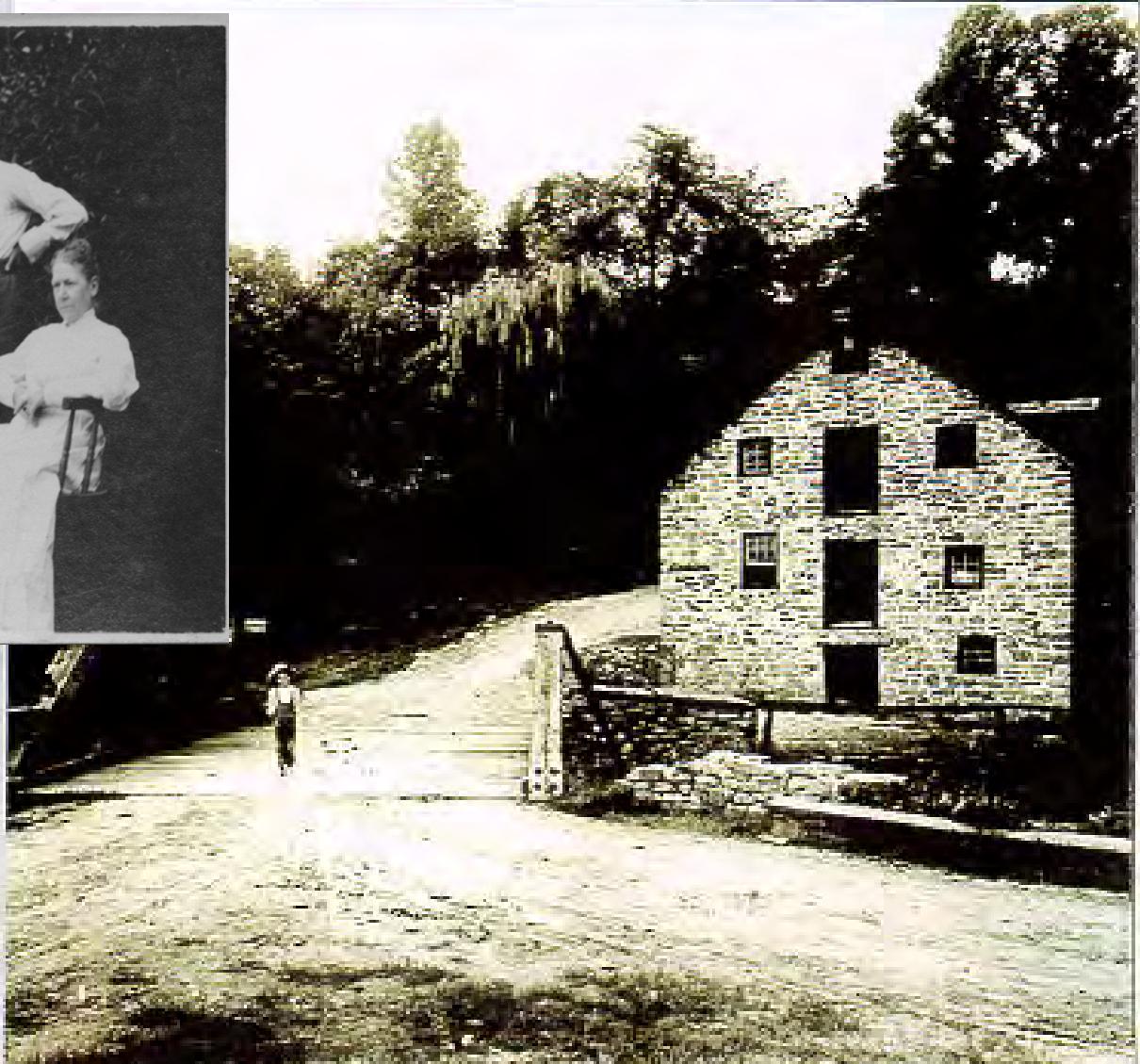
- Historic Landscape
- Natural Resources
- Bushkill Creek & High Quality of Life



Harnessing the Bushkill

DCNR

Josephine State Park
Pennsylvania Bureau of State Parks

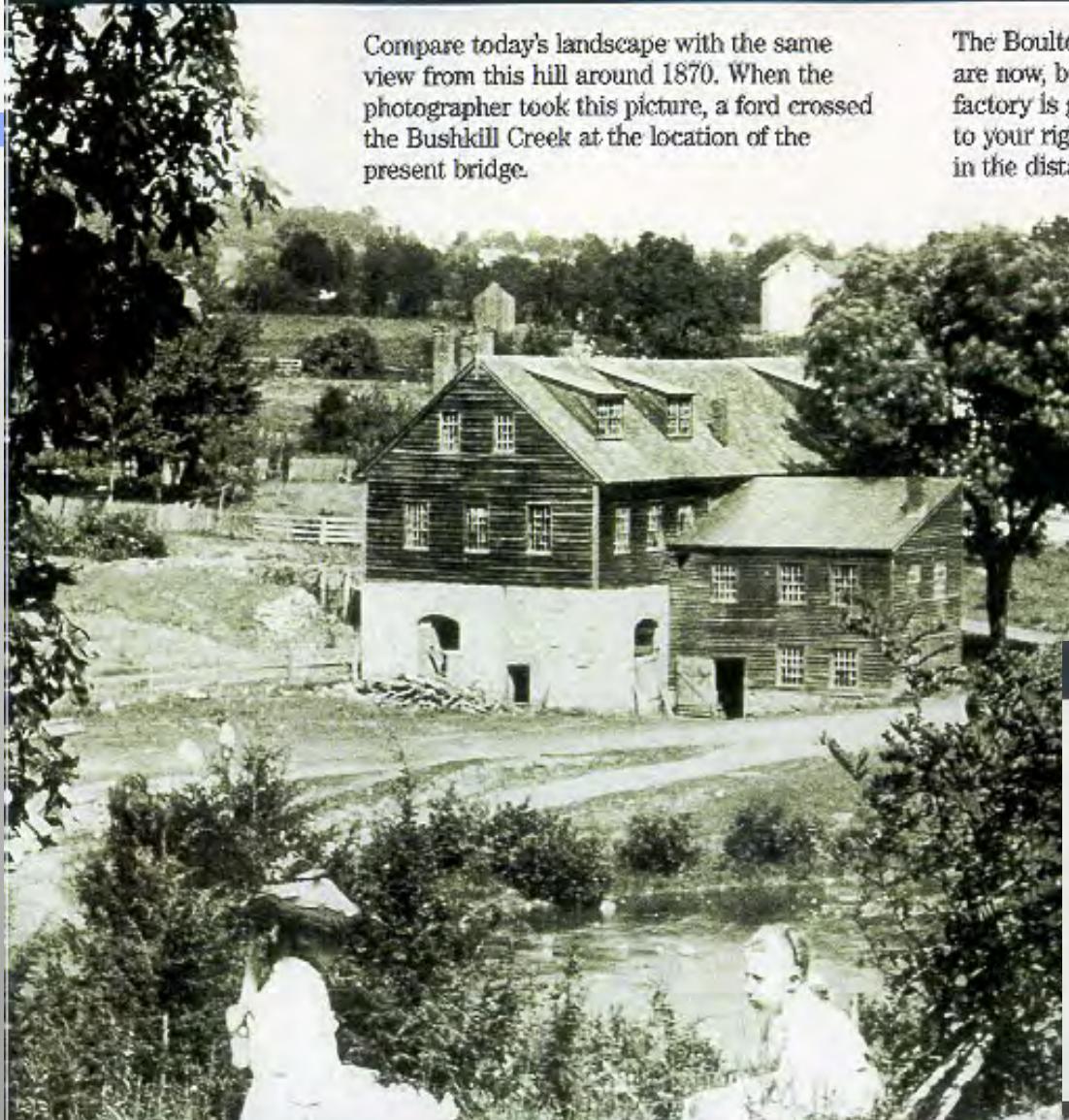


In winter, the Beagys used the Bushkill Creek for another purpose. They harvested ice from the millpond, stored it in a well-frosted icehouse and sold it for refrigeration when the weather warmed.

Then & Now

DCNR

Jenkintown State Park
Pennsylvania Bureau of State Parks



Compare today's landscape with the same view from this hill around 1870. When the photographer took this picture, a ford crossed the Bushkill Creek at the location of the present bridge.

The Boulton Gun Works stood below where you are now, beyond the Bushkill Creek. While the factory is gone, notice that the worker's house to your right, survives along with a farmhouse in the distance.



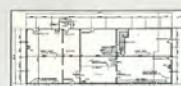
By the early 1900s, a bridgehead had been built across Bushkill Creek near the Boulton Gun Works.

Building the Business

In 1812 the nation went to war and the Henry family built a gun factory on this site. The Henrys took a unique approach, moving industrial production out of small workshops and into a specially constructed setting. Here, dozens of workers had space to concentrate on specific tasks—forging and filing gunstocks, boring gun barrels, and finally assembling the pieces into finished firearms.

Between 1832 and 1856 business thrived. At peak production as many as 80 workers labored here, in a two-and-one-half-story building, handcrafting and assembling guns for military and civilian contractors.

But the Henrys could not compete with larger and more mechanized competitors. Mass-produced firearms from companies like Winchester and Remington drove small companies like the Henrys out of business. Peaunter production stopped in 1858, although some assembly continued until 1907.



The Boulton factory measured 64 feet wide by 32 feet, high by only 18 feet. The water wheel was the only power requirement for English-style gunmaking. The Henrys had to buy their tools and firearms assembly required imported materials.



Hiking To History

1750-1895



You can hike to the sites of three Henry family industries, all located in the Jacobsburg National Historic District.

The site of the Boulton Gun Works, built in 1812, is along the Boulton Heritage walk that begins here, to your left.

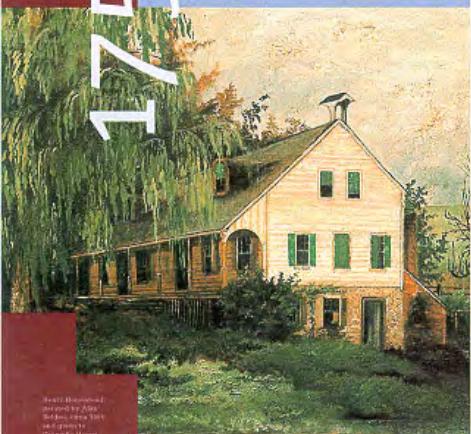
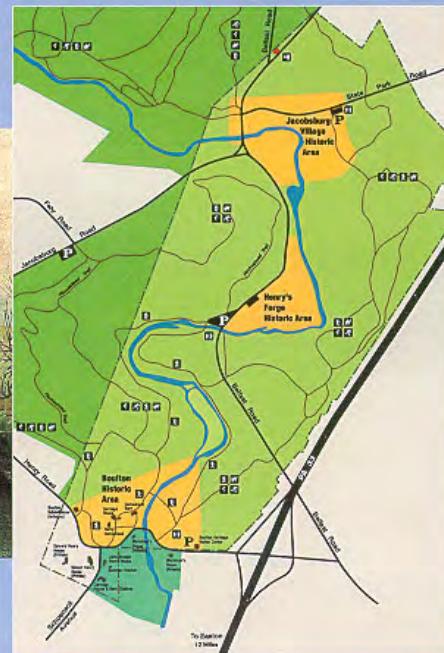
Henry's Forge, built by William II along the Bostwick Creek in 1798 and later operated by his son Matthew, supplied iron for family factories. Once 17 buildings clustered around the forge, today only two survive.



The Boulton's house still stands in the Boulton Historic Park.

The Henry's first began making firearms here in the 1790s, when William Henry I opened his factory in the tiny village of Jacobburg. In 1812, Matthew Henry added an iron furnace to the Jacobsburg landscape to supply quality iron for gunmaking tools and domestic products. Only foundations of the village and furnace complex now survive.

JACOBSBURG HISTORIC DISTRICT



Boulton House

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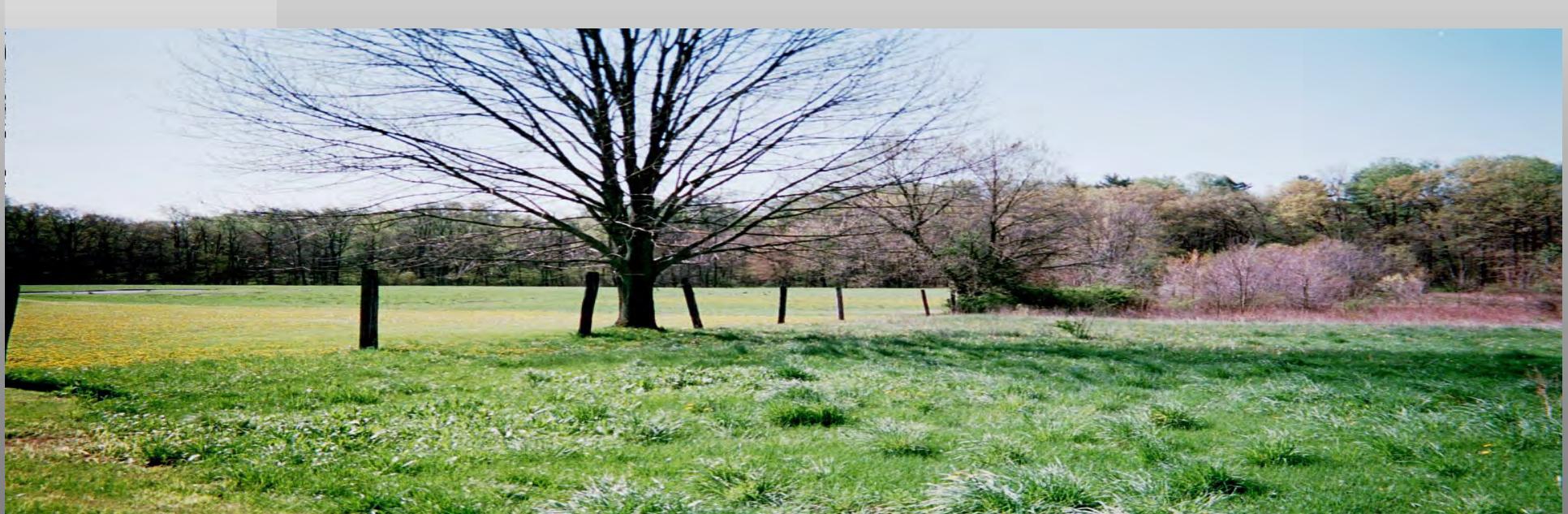
1812

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Primary Threats

- **Urban Sprawl**
- **Stormwater**
- **Groundwater**
- **Sinkholes**









Opportunities

- Open Space and Greenway Initiatives
- Economic Development
- Protection of Existing Public Lands
- Heritage Tourism Development



Learning from the Past Planning for the Future

- **Current Land Use Planning Efforts**
 - Rivers Conservation Plan/Greenways Plan
 - Joint Planning
 - Growing Greener Grants
 - **Education**



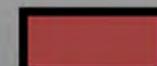
The Last Connection

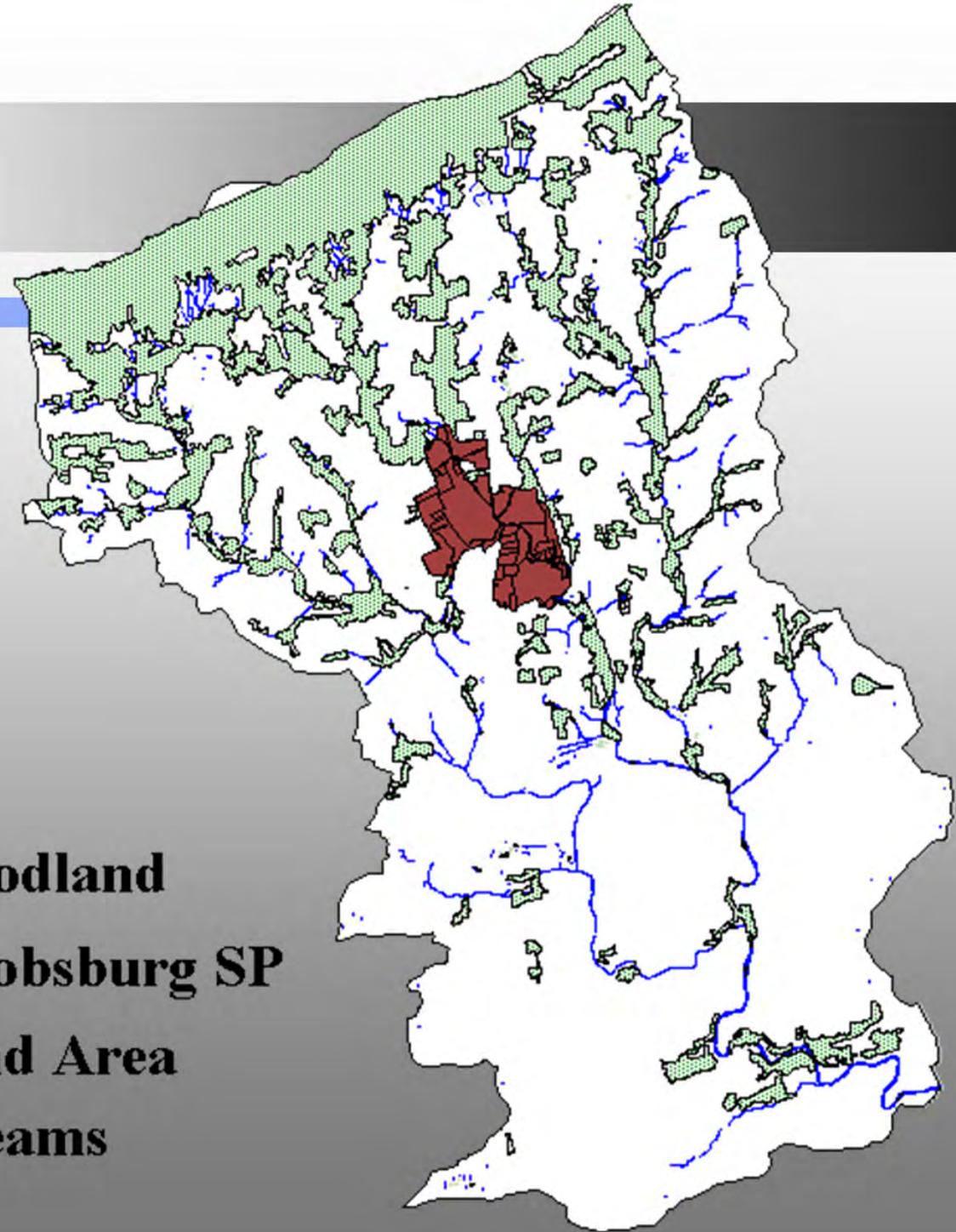
- **Upper Bushkill Creek Watershed**



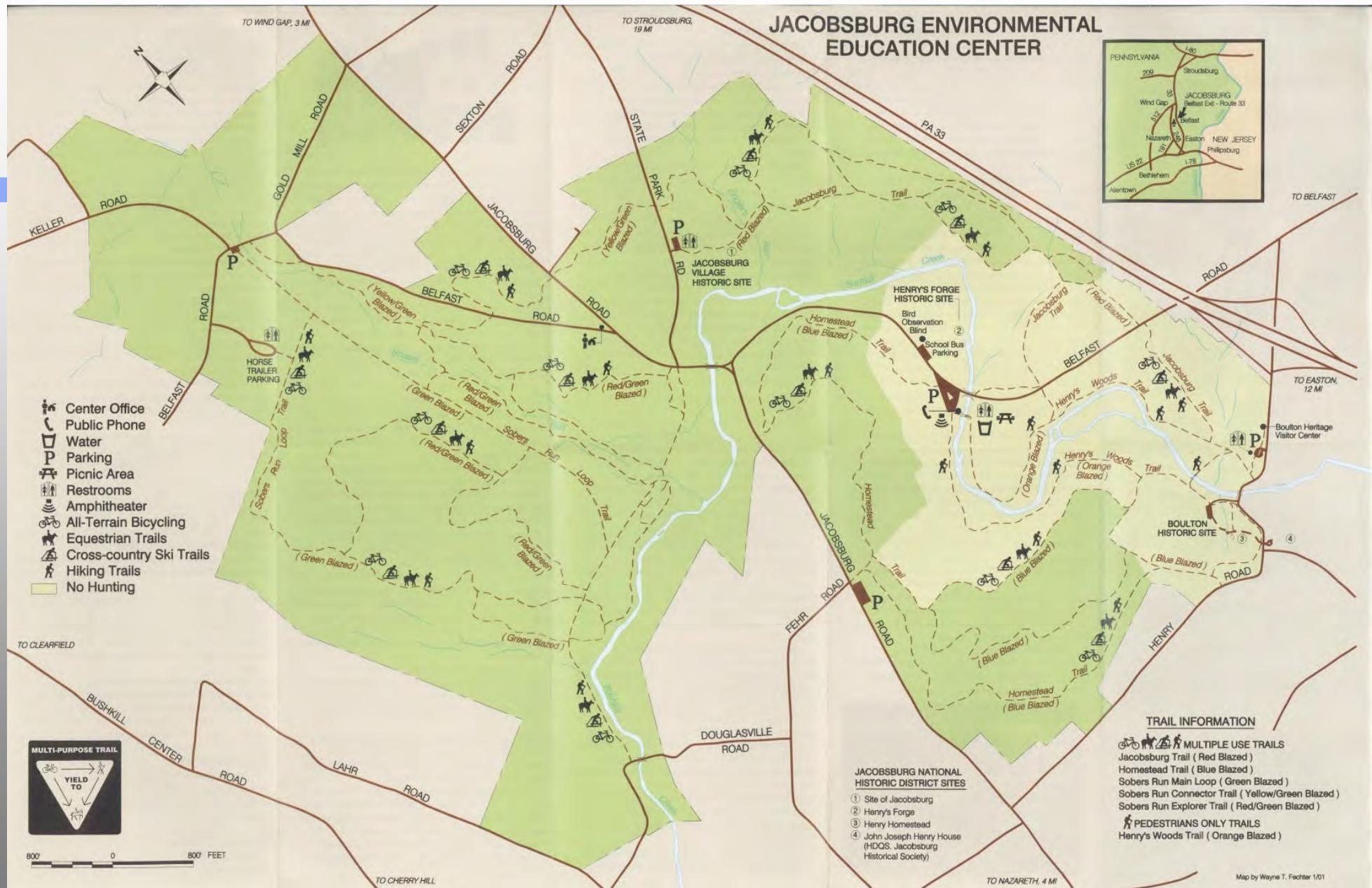
Upper Bushkill Creek Watershed

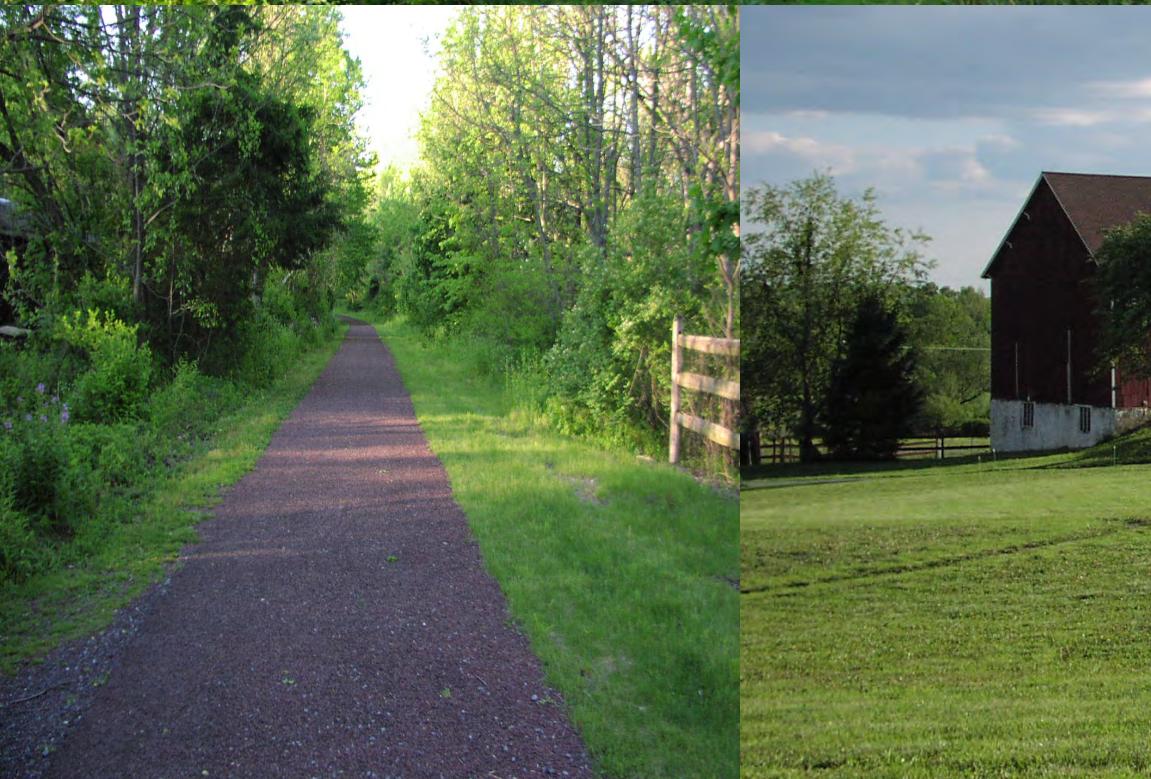


-  **Woodland**
-  **Jacobsburg SP**
-  **Land Area**
-  **Streams**



JACOBSBURG ENVIRONMENTAL EDUCATION CENTER













Partnership & Leadership

- Conservation Priorities
- Coordination of Planning and Funding



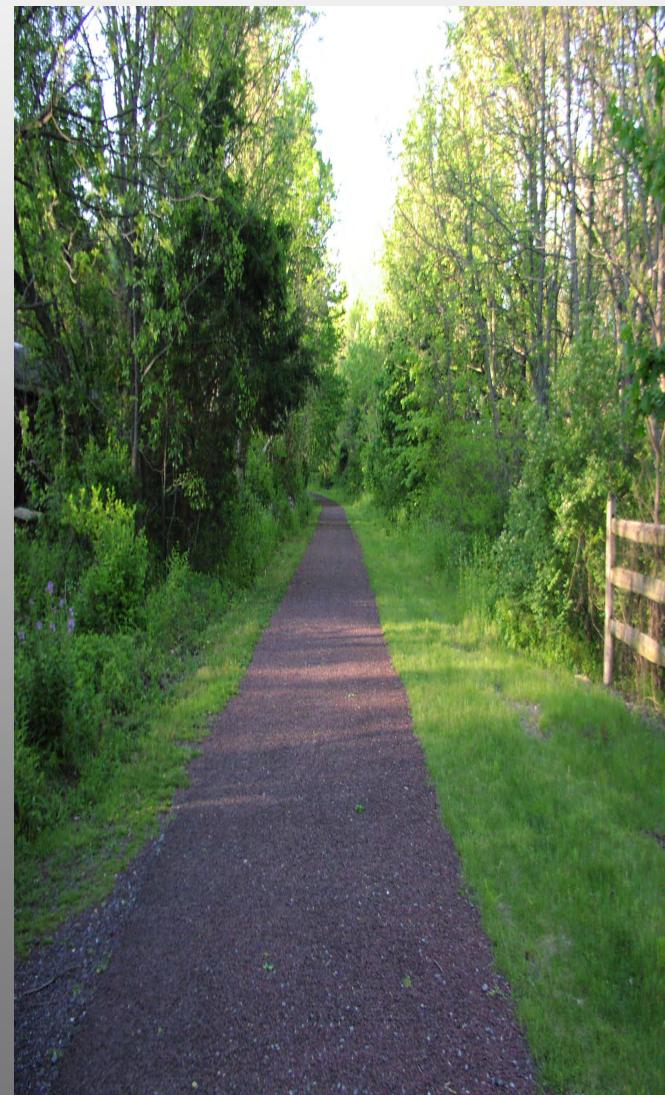
Current Projects

- **Growing Greener Grant Projects**
 - Henry's Woods Streambank Restoration
 - Watershed Protection Plan – Bushkill Township
 - Watershed Protection Plan – Other Townships
 - Watershed Assessment
- **WREN League of Women Voters**
 - Heritage Trail Brochure
- **Rivers Conservation**
 - Greenways Plan
- **Pennsylvania Environmental Council**
 - Watershed Resource Inventory



Future Initiatives

- **Stormwater Monitoring**
- **Implementation of Plans**
 - Greenways
 - Rivers Conservation
 - Watershed Protection
- **Stream Restoration**
- **Habitat Improvement**
- **Invasive Plant Program**
- **Resource Inventories**
- **Retrofitting BMPs**



*Working With You to Restore
Our Environment*



F. X. Browne, Inc.

APPENDIX F

BUSHKILL CREEK WATERSHED SIGN DESIGN LAYOUTS

ENTERING BUSHKILL CREEK WATERSHED



BUSHKILL STREAM
CONSERVANCY

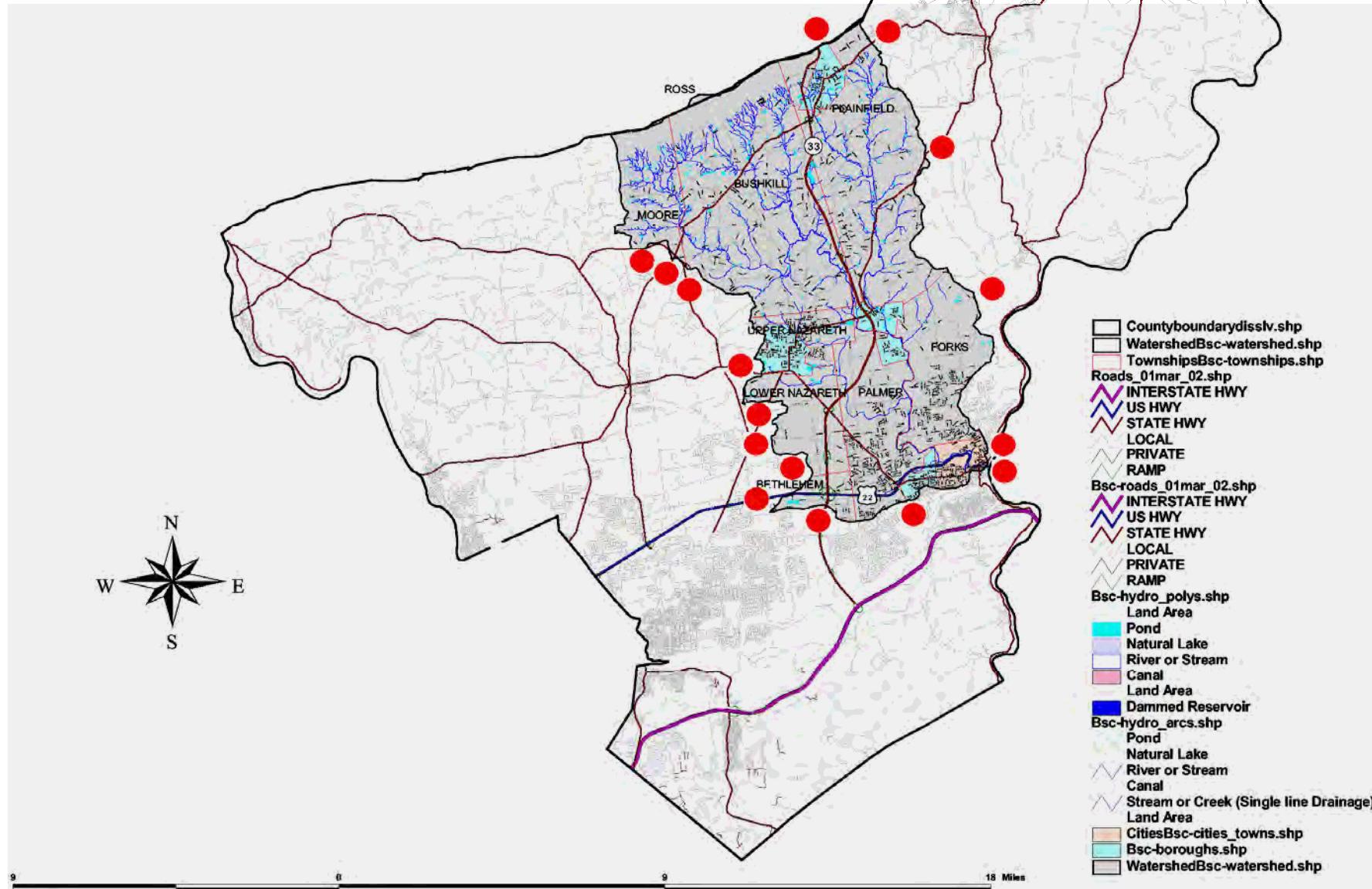


www.bushkill.org

**Bushkill Stream Conservancy
Bushkill Creek Watershed
Watershed Signs**

Rte. 33 (North)	Plainfield Township
Rte. 33 (South)	Bethlehem Township
Rte. 22 (East)	Easton
Rte. 22 (West)	Bethlehem Township
Rte. 191 (East)	Plainfield Township
Rte. 191 (West) - Nazareth Pike	Lower Nazareth Township
Rte. 512 (East)	Plainfield Township
Rte. 512 (West)	Moore Township
Rte. 248 (West)	Lower Nazareth Township
Rte. 611 (North)	Easton
Rte. 611 (South)	Easton
Rte. 946 - Community Drive	Moore Township
Rte. 946 - Nazareth Drive	Moore Township
Hecktown Road	Lower Nazareth Township
Uhler Road	Forks Township
Newburg Road	Lower Nazareth Township

Watershed Boundary Signs



Bushkill Stream Conservancy		Bushkill Creek	31
Bushkill Creek Watershed		Little Bushkill Creek	17
Stream Crossing Signs		Sobers Run	7
Forks Township		Engler's Run	1
Major Crossings	Stream Name	Schoeneck Creek	13
Stocker Mill	Bushkill Creek	Spring Brook	1
Northwood	Y		
Bushkill Park	Bushkill Creek	TOTAL Crossings	70
Edgewood	Y		
Newlins Mill Road	Bushkill Creek		
Bushkill Street	Y		
	Bushkill Creek		
	Y		
Palmer Township			
Major Crossings			
Rte. 33	Bushkill Creek	Y	
Rte. 33	Schoeneck Creek	Y	
Tatamy Road E-W	Schoeneck Creek	Y	
Hollow Road	Schoeneck Creek	Y	
Corriere	Schoeneck Creek	Y	
Van Buren	Schoeneck Creek	Y	
Tatamy Road N-S #1	Schoeneck Creek	Y	
Tatamy Road N-S #2	Bushkill Creek	Y	
East Lawn Road (Rte. 191)	Bushkill Creek	Y	
Plainfield Township			
Major Crossings			
Clyde/Gall Road	Little Bushkill Creek	Y	
Engler #1	Little Bushkill Creek	Y	
Rte. 191 #1	Little Bushkill Creek	Y	
Jones Hill	Little Bushkill Creek	Y	
Getz #1	Little Bushkill Creek	Y	
Knitters Hill #1	Little Bushkill Creek	Y	
Rasleytown Road	Little Bushkill Creek	Y	
Gum	Little Bushkill Creek	Y	
Delabole #1	Little Bushkill Creek	Y	
Abel Colony #1	Little Bushkill Creek	Y	
Church #1	Little Bushkill Creek	Y	
Sandt #1	Little Bushkill Creek	Y	
Rte. 512 #1	Little Bushkill Creek	Y	
Grand Central	Little Bushkill Creek	Y	
Lower Nazareth			
Major Crossings			
Rte. 248	Schoeneck Creek	Y	

Upper Nazareth

Major Crossings
Liberty Street
Friedenstahl
East Lawn Road (Rte. 191)

Schoeneck Creek	Y
Schoeneck Creek	Y
Schoeneck Creek	Y

Bushkill Township

Major Crossings
Filetown Road
Henry Road
Belfast Road
Jacobsburg Road
Belfast Road
Keller Road #1
Kromer #1
Rte. 512 #1
Rte. 512 #2
Rte. 512 #3
Baron Road
Douglasville Road #1
East Aluta Road
Aluta Mill #1
Creamery Road #1
Bushkill Center #1
Hahn
Clearfeld Road #1
Rte. 512 #4
State Park Road #1

Bushkill Creek	Y
Sobers Run	Y
Bushkill Creek	Y
Engler's Run	Y

Moore Township

Major Crossings
West End #1
Bushkill Center Road
Bushkill Drive

Bushkill Creek	Y
Bushkill Creek	Y
Bushkill Creek	Y

Bethlehem Township

Major Crossings
None

Tatamy Borough

Major Crossings
Main Street

Bushkill Creek	Y
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Stockertown Borough

Major Crossings

Sullivan Trail	Little Bushkill Creek	Y
Lefever Road	Little Bushkill Creek	Y

Nazareth Borough

Major Crossings		
Chestnut Street	Schoeneck Creek	Y
East Lawn Road (Rte. 191)	Schoeneck Creek	Y
Broad Street	Schoeneck Creek	Y

Easton Borough

Major Crossings		
Rte. 611	Bushkill Creek	Y
Riverside	Bushkill Creek	Y
Rte. 22 #1	Bushkill Creek	Y
Rte. 22 #2	Bushkill Creek	Y
North 13th Street	Bushkill Creek	Y
4th Street	Bushkill Creek	Y

Bethlehem Borough

Major Crossings		
None		

Wilson Borough

Major Crossings		
Hackett Avenue	Spring Brook	Y

Wind Gap Borough

Major Crossings		
Male Road	Little Bushkill Creek	Y



LITTLE BUSHKILL
CREEK

F. X. Browne, Inc.

APPENDIX G

BUSHKILL CREEK WATERSHED WATER QUALITY MONITORING PROGRAM MANUAL

Volunteer Watershed Monitoring Handbook

Introduction

A comprehensive volunteer monitoring program is a critical part of a successful watershed management program.

The volunteer monitoring program for the Bushkill Creek Watershed includes several monitoring components:

- Stream biomonitoring
- Stream habitat monitoring
- Stream chemistry monitoring
- Stream geomorphic monitoring
- Pond monitoring
- Invasive species monitoring

Stream biomonitoring

Stream biomonitoring using macroinvertebrates is an effective tool for evaluating temporal and spatial trends in stream impairment. Site should be located throughout the watershed, particularly in subwatersheds where significant development is expected. Biomonitoring is conducted during the spring of each year. Sampling should be conducted using EPA Rapid Bioassessment Protocol Metrics. These data should be entered into a macroinvertebrate monitoring MS Access table by volunteers.

Training: Stream biomonitorors should receive at least one full day of training and 1 full day of practice field data collection with a trained volunteer. Trained volunteers should be retrained and tested every three years.

Stream habitat assessment

EPA Rapid Habitat Assessment Form. Habitat assessments should be conducted at all macroinvertebrate stations. Habitat information should be entered into a habitat monitoring MS Access table by volunteers.

Training: Stream habitat assessment is highly qualitative. As such, new volunteers must be extensively trained and calibrated to the scoring interpretations used by experienced volunteers. An annual recalibration exercise should be conducted to ensure that all habitat monitors are interpreting field observations in a consistent manner.

Stream chemistry monitoring

Ambient stream chemistry monitoring should be restricted to monitoring of pH, alkalinity, temperature, dissolved oxygen, and conductivity at macroinvertebrate sampling sites. Additional stream monitoring may be conducted to assess specific problem areas as they arise throughout the watershed. Ambient stream chemistry data collection should be automated if possible to avoid excessive volunteer collection needs. All stream chemistry data should be entered into a stream chemistry MS Access database table by volunteers.

Training: Volunteers must be trained to collect stream chemistry data in a careful and consistent manner. At least four hours of basic training in field sampling protocol is recommended. Experienced monitors should receive an additional four hours of training every 3 years.

Stream geomorphic monitoring

Destabilization of stream channels (e.g., excessive lateral or vertical migration) is a common and severe consequence of land development. Volunteers should conduct a baseline geomorphic assessment and mapping study for streams within developing (threatened) subwatersheds. This study should assess the geomorphic characteristics of each stream and its valley as well as its current geomorphic condition. This information can be used to assist managers in assessing the level of vulnerability and impact to resources, which can be used to further refine land acquisition and growth control needs by subwatershed. The geomorphic study should establish monumented cross-sections on streams throughout the watershed. Resurveying cross-sections on an annual basis will help us figure which streams are actively downcutting in response to development. These data are absolutely critical for targeting and refocusing growth management efforts.

We recommend the establishment of 10 geomorphic sampling sites along a gradient of land use. The entire tributary stream system should be first classified according to its geomorphic condition according to the Rosgen or similar geomorphic classification scheme. This analysis can be accomplished using aerial photograph and GIS. Stream channels should be divided into major and minor stream segments using this classification approach. Sampling sites should be selected to represent a range of land uses and geomorphic types. Sites should be surveyed using a Rosgen Level III/IV geomorphic characterization. Sites should be resurveyed every five years to assess overall trends in geomorphic change in the watershed. Site data collection for the geomorphic sampling sites should be collected by an experienced professional fluvial geomorphologist.

In addition to the 10 reference sites, a network of monumented cross-sections should be established in threatened subwatersheds. These cross-sections should be resurveyed annually by volunteers. At these and other sites, bank pins should be installed to measure erosion rates throughout the watershed.

Training: New monitors should be required to take a short course in fluvial geomorphology plus one day of field training.

Pond monitoring

Pond monitoring is critical for assessing trends in pond water quality. The pond monitoring component of the overall water quality monitoring program should measure key pond water quality parameters at all major ponds throughout the watershed on an annual basis (relations with pond owners should be established to expand the monitoring network). One sampling station should be established at each pond. This station should be sampled once a month during the growing season for the following parameters: total phosphorus (surface waters), dissolved phosphorus (surface waters), fecal coliform (where there is swimming and other direct contact), transparency using a standard Secchi disk, chlorophyll *a* (photic zone composite), dissolved oxygen (surface to bottom), and temperature (surface to bottom). Data should be collected and analyzed by a qualified analytical laboratory. Data should be entered in a pond monitoring MS Access Database. In addition to chemical monitoring,

aquatic vegetation should be documented by species and species coverage, with immediate reporting of any exotic aquatic plant species to the Bushkill Stream Conservancy.

Training: New monitors should receive at least one full day of pond sampling training. Experienced monitors should receive an additional 4 hours of training every 3 years.

Invasive species monitoring

In addition to management and removal of existing sources of invasive species, a comprehensive monitoring program must be established to identify unknown populations of invasive species and to monitor high quality natural areas for the presence of invasive species. The following two-component monitoring program is recommended:

Phase I – Identify and map invasive plant populations

Phase I monitoring involves looking for new populations of invasive plants along road corridors and within residential developments. The Phase I monitoring should be an on-going program that seeks to monitor all road corridors and developments at least once every three years. GIS mapping should be used to track road assessments to ensure that all areas are covered. New populations should be marked using hand-held GPS units. The population size, species, and other relevant characteristics should be recorded and entered into a GIS database of known invasive species locations.

Phase II – Monitor high quality indicator sites

A network of monitoring sites within high quality wetland and riparian areas should be established to monitor the possible migration of invasive species away from developed areas into natural areas. Sites should be located in vulnerable “front-line” natural areas that are judged to be the most likely sites of invasive infestation based on an analysis of the location of known invasive populations and potential transmission vectors. We recommend the establishment of 20-30 high quality indicator sites. These sites should be monitored for the presence of invasive species populations on a semi-annual basis. If invasive species are detected at any high quality indicator site, a more exhaustive search of surrounding natural areas is recommended to identify any other invasive populations. Invasive populations that are identified should be removed immediately and monitored carefully following removal efforts. Locations of all identified populations should be entered into the GIS database. Site locations should be reevaluated on a 5-year basis as new information concerning the location of invasive species is obtained.

Training: Monitors must receive at least four hours of field training to identify the invasive species. Monitors should receive additional training if they are going to identify plants in the dormant season.

Database Management

All monitoring data are entered into a water quality database by designated data entry volunteers. These volunteers should have limited read/write access to enter new data, but should not change previously entered data in the database. A designated database administrator should be the only individual within the organization to have full read/write database access privileges. Data entry should be checked by the database administrator or other designated data QA/QC volunteer.

Back-up copies of the database should be made on a monthly basis at a minimum. Back-up copies should be stored off-site in a fire-proof container.

Reporting

An annual monitoring report should be produced on a yearly basis; this monitoring report should include copies of all raw data collected during the years, as well as standard summary tables and graphs that display summary statistics on a stream, subwatershed, and watershed basis. Trend analysis should be performed where applicable to assess shifts in quality and impairment throughout the watershed. Correlative analysis should be performed between response variables (habitat quality, geomorphic parameters etc.) with stream, riparian, and watershed characteristics. A professional watershed consultant should assist with data analysis, interpretation, and final report preparation.

Volunteer Training

Volunteer training should be mandatory and on-going even for experienced volunteers. Each volunteer should have a training record that lists the dates and types of training he/she has received. Volunteers should only conduct a particular type of monitoring if they have been trained in that specific monitoring type.

Methodology

All field and laboratory methods used should be assigned a method number. Each method should be described in detail in a method description document. A method table should be set up in MS Access to reference and catalog all methods. Hyperlinks to all method description documents should be referenced in the MS Access database method table. Each piece of monitoring data should reference a field method, laboratory method, or both. Methods should not be changed without careful evaluation of how this change will affect data comparability through time.

QA/QC Procedures

Volunteers must use strict QA/QC procedures to assure optimum data accuracy at all stages of data collection, processing, and management. Field QA/QC procedures should include careful steps to avoid contamination of sample bottles or the disturbance of the stream or lake being sampled. Chain of custody forms should be filled out and filed for all chemical sampling. Laboratory QA/QC documents should be requested and archived by volunteers.

F. X. Browne, Inc.

APPENDIX H

**WATER QUALITY DATABASE
(included on CD)**

F. X. Browne, Inc.

APPENDIX I
MODEL ORDINANCES

ORDINANCE NO. ???

AN ORDINANCE CREATING AN ENVIRONMENTAL

ADVISORY COUNCIL, PROVIDING OPERATING

PROCEDURES, AND STATING THE POWERS OF THE COUNCIL

The Board of Supervisors of ??? Township, ??? County, hereby ordains as follows:

Section 1. An advisory council to be known as the ??? Township Environmental Advisory Council, is hereby created and shall continue to function until this ordinance is revoked.

Section 2. The Environmental Advisory Council shall be composed of five residents of this municipality.

Section 3. Council members shall be appointed in accordance with the following procedures:

- (1) All council members shall be appointed by the Governing Body of the political subdivision.
- (2) Council members' terms of office shall expire on the first Monday in January following the last year of their term of office.
- (3) Duly appointed council members shall serve a term of three years, except that initial appointment shall be so staggered that the terms of approximately one-third of the membership shall expire each year.
- (4) Whenever possible, one member shall also be a member of the local planning commission.

Section 4. Council members shall receive no compensation for their services, but may be reimbursed for the expenses actually and necessarily incurred by them in the performance of their duties.

Section 5. The EAC is to be advisory to and shall coordinate its activities with the elected officials, planning commission, historical commission, and other such local governmental agencies.

Section 6. The governing body shall designate the chairman of the council.

Section 7. The Environmental Advisory Council shall have the following powers:

- (1) Identify environmental problems.

- (2) Recommend plans and programs to the appropriate agencies for the promotion and conservation of the natural resources and for the protection and improvement of the quality of the environment within the area of this municipality.
- (3) Make recommendations as to the possible use of open land areas of this municipality.
- (4) Promote a community environmental program.
- (5) Keep an index of all open areas, publicly or privately owned, including, but not limited to, flood prone areas, swamps, and other unique natural areas.
- (6) Advise the appropriate local governmental agencies in the acquisition of property, both real and personal.
- (7) To undertake such environmental tasks as requested by the governing body of this municipality.

Section 8. The Environmental Advisory Council shall keep records of its meetings and activities and shall make an annual report which shall be printed in the annual municipal report or otherwise made known and available. Minutes of each meeting shall be forwarded to the governing body.

Section 9. The governing body of this municipality may, from time to time, appropriate funds for the expenses incurred by the council.

ENACTED AND ORDAINED on this 1st day of **???**, **????**. This ordinance shall become effective five (5) days after adoption.

??? TOWNSHIP SUPERVISORS

???, Chairman

???, Vice-Chairman

???, Member

ATTEST:

???, Manager/Secretary

ARTICLE XXIX: FP - FLOODPLAIN CONSERVATION DISTRICT

Section 2900: Declaration of Legislative Intent.

In addition to the goals and objectives stated in the Declaration of Legislative Intent found in Article I. Section 101 and the Statement of Community Development Objectives found in Article I. Section 102 of the Zoning Ordinance of Horsham Township. the specific intent of this Article shall be to protect areas of floodplain subject to and necessary for the containment of flood waters, and to permit and encourage the retention of open space land uses which will be so located and utilized as to constitute a harmonious and appropriate aspect of the continuing physical development of Horsham Township. Furthermore, in light of the Township's certification as eligible for Federal Flood Insurance, it is the intent of this article to provide adequate protection for flood prone properties within Horsham. In advancing these principles and the general purpose of the Zoning Ordinance and Comprehensive Plan, the following shall be the specific objectives of the FP - Floodplain Conservation District:

- a. To combine with present zoning requirements, certain restrictions made necessary for flood prone areas to promote the general health, welfare and safety of the Township.
- b. To prevent the erection of structures in areas unfit for human usage by reason of danger from flooding, unsanitary conditions or other hazard.
- c. To minimize danger to public health by protecting the quality and quantity of surface and subsurface water supplies adjacent to and underlying flood hazard areas and promoting safe and sanitary drainage.
- d. To permit only those uses which can be appropriately located in the floodplain as herein defined and which will not impede the flow or storage of flood waters, or otherwise cause danger to life and property at, above, or below their locations along the flood plain.
- e. To protect those individuals who might choose, despite the flood dangers, to develop or occupy land on a floodplain.
- f. To protect adjacent landowners and those both upstream and downstream from damages resulting from development within a floodplain and the consequent obstruction or increase in flow of flood waters.
- g. To protect the entire Township from individual uses of land which may have an effect upon subsequent expenditures for public works and disaster relief and adversely affect the economic well being of the Township.
- h. To maintain undisturbed the ecological balance between those natural systems elements, including wildlife, vegetation, and marine life, dependent upon water courses

and water areas.

- i. To protect other municipalities within the same watershed from the impact of improper development and the consequent increased potential for flooding.
- j. To provide areas for the deposition of flood-borne sediment.
- k. To require that uses vulnerable to floods, including public facilities, be constructed so as to be protected from flood damage in accordance with the requirements of the National Flood Insurance Program, P.L. 93-234.

Section 2901: Definition and Establishment of Floodplain Conservation District.

a. The Floodplain Conservation District is defined and established as follows:

1. Those areas subject to inundation by the waters of the 100 Year Flood as delineated in the Flood Insurance Study for the Township of Horsham, Montgomery County, Pennsylvania, as prepared by the Federal Emergency Management Agency.

Said floodplains shall be comprised of three (3) subdistricts as follows:

- (a) Floodway (F1) - That portion of the Floodplain District required to carry and discharge the waters of the One Hundred (100) Year Flood without increasing the water surface elevation at any point more than one (1) foot above existing conditions, as demonstrated in the Flood Insurance Study referenced above. Within any designated Floodway area, no construction, development, use, activity, or encroachment of any kind shall be allowed except where the effect of such proposed activity on flood heights is fully offset by accompanying stream improvements.
- (b) Floodway Fringe (F2) - Those portions of land within the Floodplain District subject to inundation by the One Hundred (100) Year Flood, lying beyond the floodway in areas where detailed study data and profiles are available.
- (c) Approximated Floodplain (F3) - Those portions of land within the Floodplain District subject to inundation by the One Hundred (100) Year Flood, where a detailed study has not been performed, but where a One Hundred (100) Year Floodplain Boundary has been approximated.

2. The low area adjoining and including any water or drainage course or body of water subject to periodic flooding or overflow and delineated as alluvial soils or local alluvium by the Soil Conservation Service, United States Department of Agriculture, in the Soil Survey of Montgomery County, 1967, wherever said area is more extensive than the Floodplain as defined in a. 1. above.

b. The Floodplain Conservation District shall be delineated on the Floodplain Overlay

Map of Horsham which is hereby made a part of this Ordinance, and is available for inspection at the Township office.

- c. Any change in the Floodplain Conservation District as from time to time may be determined to be proper hereunder shall be forthwith reflected on the said Map.
- d. Studies used to establish the floodplain boundaries shall be available in the Township office for reference.

Section 2902: Overlay Concept.

The Floodplain Conservation District shall be deemed an overlay on any zoning district now or hereafter applicable to any lot.

- a. Should the Floodplain Conservation District be declared inapplicable to any tract by reason of action of (1) the Township Council in amending this Ordinance; or (2) the Zoning Officer, the Zoning Hearing Board, or any court of competent jurisdiction in interpreting the same; or (3) the Zoning Hearing Board or any court of competent jurisdiction in determining a legal effect of the same; the zoning applicable to such lot shall be deemed to be the District in which it is located without consideration of this Article.
- b. Should the zoning of any parcel or any part thereof which the Floodplain Conservation District is located be changed through any legislative or administrative actions or judicial discretion. such change shall have no effect on the Floodplain Conservation District unless such change was included as part of the original application.
- c. Except when this article prescribes a greater setback due to the boundaries of the floodplain as defined in Section 2901 herein, the minimum setback from any watercourse for a structure shall be equal to the horizontal distance from the top of the bank of the watercourse extended to a point at which the elevation is one (1) foot above the elevation of the top of the bank, as verified by the Township Engineer.

Section 2903: Permitted Uses.

- a. The following uses and no other will be permitted in a Floodplain Conservation District:
 1. Cultivation and harvesting of crops in accordance with the recognized soil conservation practices.
 2. Pasture and grazing land in accordance with recognized soil conservation practices.
 3. Outdoor plant nursery or orchard in accordance with recognized soil conservation

practices.

4. Wildlife sanctuary, woodland preserve, arboretum; and passive recreation or parks, including hiking, bicycle and bridle trails, but including no facilities subject to damage by flooding.

5. Utility transmission lines.

6. Sealed water supply wells with the approval of the Township Engineer.

7. Sanitary sewers, with the approval of the Township Engineer.

8. Front, side, or rear yards, for any District provided such yards are not to be used for on-site sewage disposal systems or for non-wire fences or any other structure.

****Webmasters Note:** The previous section has been amended as per Ordinance No. 1147.

b. The following uses shall be specifically prohibited in a Floodplain Conservation District:

1. All freestanding structures and buildings and retaining walls, with the exception of flood retention dams, culverts and bridges as approved by the Pennsylvania Department of Environmental Resources.

2. The relocation of any watercourse without approval by the Township Council of Horsham Township, which shall first have received the recommendation of the Township Planning Commission and the Soil Conservation Service, U.S. Department of Agriculture, thereon; the relocation of any watercourse without the approval of the Pennsylvania Department of Environmental Resources. In addition, abutting municipalities, the State Coordinating Office, and the Federal Insurance Administrator of the National Flood Insurance Program shall be notified prior to any alteration or relocation of any watercourse. The floodcarrying capacity of a watercourse shall not be reduced by any alteration or relocation.

3. Sanitary landfills. dumps, junkyards, outdoor storage of vehicles and materials.

4. On-site sewage disposal systems.

5. Private water supply wells.

6. The construction, enlargement or expansion of mobile homes, mobile home parks and mobile home subdivisions.

7. The construction, enlargement or expansion of hospitals (public or private).

8. The construction, enlargement or expansion of nursing homes (public or private).
9. The construction, enlargement or expansion of jails or prisons.
10. Any new or substantially improved structure which will be used for the production or storage of any of the following dangerous materials or substances or which will be used for any activity requiring the, maintenance of a supply (more than five hundred fifty (550) gallons or other comparable volume or any amount of radioactive substances) of any of the following dangerous materials or substances on the premises:
 - (a) Acetone
 - (b) Ammonia
 - (c) Benzene
 - (d) Calcium Carbide
 - (e) Carbon Disulfide
 - (f) Celluloid
 - (g) Chlorine
 - (h) Hydrochloric Acid
 - (i) Hydrocyanic Acid
 - (j) Magnesium
 - (k) Nitric Acid and Oxides of Nitrogen
 - (l) Petroleum Products (gasoline, fuel. oil. etc.)
 - (m) Phosphorus
 - (n) Potassium
 - (o) Sodium
 - (p) Sulphur and Sulphur Products
 - (q) Pesticides (including insecticides. fungicides and rodenticides)

- (r) Radioactive substances, insofar as such substances are not otherwise regulated
- (s) Any other dangerous materials or substances regulated by the appropriate Federal or State agencies.

11. Floodplain restrictions. Within any identified floodplain area, the activities described in Subsection 2903.b. above shall be prohibited and no variance shall be granted.

Section 2904: Conditional Uses Permitted.

The following conditional uses shall be allowed or denied by the Township Council after recommendations by the Planning Commission and Township Engineer pursuant to the standards set forth in this Article:

- a. Game farm, fish hatchery, or hunting and fishing preserve, for the protection or propagation of wildlife, but permitting no structures.
- b. Commercial recreation use, whether open to the public or restricted to private membership, such as parks, camps, Picnic areas, golf course, fishing, sport or boating clubs; not to include enclosed structures excepting toilet facilities but permitting piers, docks, floats, or shelters usually found in developed outdoor recreational areas. Any toilet facilities provided shall be connected to public water and sewage systems.
- c. Storm sewers

****Webmasters Note:** The previous section has been amended as per Ordinance No. 1147.

- d. Outlet installations for sewage treatment plants and sewage pumping stations, with the approval of the appropriate sewer authorities.
- e. Dams, bridges, and culverts, approved by the Commonwealth of Pennsylvania, Department of Environmental Resources.
- f. Paved roads and driveways, (parking lots) where required by the regulations for the district applicable to the lot without consideration of this Article, provided that in the case of roads and driveways no such facilities shall be permitted as a conditional use, if viable alternative alignments are feasible.

Minor grading or regrading of lands, including the deposit of top soils and the grading thereof, and the construction of retaining walls which will in no way contaminate, pollute, inhibit or increase the water flow or inhibit the water storage capacity of such areas. An application for a conditional use for such use shall also be accompanied by a plan indicating the deposition of any fill or material proposed to be deposited by the grading or regrading of land; such fill or other materials shall be protected against

erosion by rip-rap, vegetation cover or bulkheading.

g. Grading or regrading of lands, including the deposit of top soils and the grading thereof, and the construction of retaining walls. An application for a conditional use for such use shall also be accompanied by a plan indicating the deposition of any fill or material proposed to be deposited by the grading or regrading of land; such fill or other materials shall be protected against erosion by rip-rap, vegetation cover or bulkheading.

h. Forestry, lumbering, and reforestation in accordance with recognized natural resource conservation practices, but permitting no structures. Further, provided that any vehicular accessway, parking area or equipment storage area gun be buffered from adjacent residential uses residentially zoned land, in conformance with the provisions for Buffer Yards contained in Section 501 of this Ordinance.

i. Other uses similar to the above.

Section 2905: Application Procedures.

a. An application for a zoning permit shall be filed with the Zoning Officer who shall make an initial determination on the application. For a use other than those permitted in Section 2903. an application seeking approval of a conditional use or variance shall be forwarded to the Township Council or Zoning Hearing Board, as appropriate. along with required studies or information and the findings of the Zoning Officer.

b. The application for conditional use or use by variance shall be accompanied by the following:

1. Detailed engineering studies indicating the effects on drainage and streams on all adjacent properties as well as the property in question.

2. An application for amending the boundaries of the Floodplain Conservation District if the boundaries will be affected by the proposed conditional use or use by variance.

c. Prior to the issuance of any building permit. the Building Permit Officer and Township Engineer shall review the application for permit to determine if all other necessary government permits required by State and Federal laws have been obtained, such as those required by the Pennsylvania Sewage Facilities Act (Act 1966-537, as amended); the Pennsylvania Dam Safety and Encroachments Act (Act 1978-325, as amended); the Pennsylvania Clean Streams Act (Act 1937-394. as amended); the U.S. Clean Water Act, Section 404, 33. U.S.C. 1344. No permit shall be issued until this determination has been made.

Section 2906: Procedures for Consideration of a Conditional Use.

All applications for approval of conditional uses shall be considered using standards listed

in Section 2907 and in accordance with Section 2508 of this Ordinance..

Section 2906A: Procedures for Consideration of a Variance.

All applications for approval by variance shall be considered by the Zoning Hearing Board, following the same procedures outlined for the Township Council for Consideration of a Conditional Use in Section 2906, with the exception that the Zoning Hearing Board shall hold a public hearing within forty-five (45) days after an application is filed. ALL other time requirements in Section 2906 shall be followed by the Zoning Hearing Board.

Section 2907: Standards for Approval of Conditional Uses or Uses by Variance.

The Township Council and Zoning Hearing Board shall exercise discretion in allowing only those uses which are substantially in accord with the stated objectives in Section 2900 herein. The Township Council, in considering a use as a conditional use, or the Zoning Hearing Board, in considering a use by variance, shall utilize the following:

- a. The effect of the use shall not substantially alter the cross-section profile of the stream and floodplains at the location of the proposed use.
- b. Lands abutting the waterway, both upstream and downstream, shall not be adversely affected by the proposed use.
- c. The general welfare or public interest of Horsham Township or of other municipalities in the same watershed shall not be adversely affected.
- d. Any new structures or substantial improvements to existing structures permitted by conditional use or by variance shall be constructed and placed on the lot so as to offer the minimum obstruction to the flow of water, and shall be designed to have a minimum effect upon the flow and height of flood water. Such structures shall be elevated in accordance with the provisions contained in the Horsham Township Building Code, as amended.
- e. Any new structure or substantial improvement permitted as a conditional use or by variance shall also have all utilities and facilities floodproofed, in accordance with the provisions contained in the Horsham Township Building Code, as amended.
- f. Any additions to existing structures permitted as a conditional use or by variance shall be elevated to the greatest extent possible according to the provisions contained in the Horsham Township Building Code. as amended. However, any portion of the structure not so elevated shall be floodproofed, also in accordance with the Township Building Code, as amended.
- g. An affirmative decision shall not be issued by the Zoning Hearing Board or Township Council within the designated floodway if any increase in the flood levels

during the base flood discharge would result, and unless the effect of any such proposed activity on flood heights is fully offset by accompanying stream improvements.

h. The Zoning Hearing Board or Township Council shall notify the applicant in writing over the signature of community officials that:

(1) The issuance of a decision to allow construction of a structure below the base flood elevation will result in increased premium rates for flood insurance, and

(2) Such construction below the base flood elevation increases risks to life and property.

Such notification shall be maintained with a record of all decisions as required in paragraph L of this section.

i. The Zoning Hearing Board or Township Council shall:

(1) Maintain a record of all decisions including justification for their issuance, and

(2) Report such decisions issued in its annual report submitted to the Federal Insurance Administration.

j. No conditional use shall be granted by the Township Council and no variance shall be granted by the Zoning Hearing Board for any requirement pertaining to developments which may endanger human life (contained in Section 7903-b-6, 7, 8, 9 and IO of this Ordinance) in accordance with the Pennsylvania Floodplain Management Act, P.L. 851, No. 166 of 1978 as amended.

ORDINANCE ???

FOREST RESOURCE ORDINANCE

(TO BE INSERTED INTO EXISTING SUBDIVISION AND LANDUSE ORDINANCE OR AS A STAND-ALONE ORDINANCE)

1. STATUTORY AUTHORITY

???? Township is empowered to regulate these activities by the authority of the Act of (insert appropriate regulation/act).

2. APPLICABILITY

The provisions of this Chapter shall apply to all unincorporated lands within the territorial limits of the Township.

3. DEFINITIONS

(Note: May be added to definitions in zoning ordinance if forest resource model ordinance is incorporated into the zoning ordinance)

Unless specifically defined below, or in Pennsylvania's Erosion and Sediment Control Standards (P.A.C. 25:102), or Pennsylvania's Water Quality Standards (P.A.C. 25:93), words or phrases used in this ordinance shall be interpreted so as to give them the meaning they have in common usage.

Floodplain - the lands adjoining a river or stream that have been or may be expected to be inundated by floodwaters in a 100-year frequency flood.

Afforestation - the planting of trees where no or little forest exists on the site, in order to meet certain thresholds.

Intermittent streams - a stream with a drainage area of 50 acres or less and does not flow continuously through out the year in most years.

Perennial streams - a stream that flows continuously throughout the year in most years.

Reforestation - the planting of tree to replace forest which has been recently removed.

Stormwater runoff - flow on the surface of the ground, resulting from precipitation.

Wetlands - an area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a

prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation; provided, however, that in designating a wetland, the three parameter approach (that is, hydrology, soils and vegetation) enumerated in the "Federal Manual for Identifying and Delineating Jurisdictional Wetlands," and any subsequent amendments thereto shall be used.

4. PURPOSE

This Chapter is adopted with the intent that new development in the Township take place in such a way that the conservation, protection and planting of trees to produce forested areas will help accomplish the following:

- a. Stabilization of soil by the prevention of erosion and sedimentation;
- b. Reduction of stormwater runoff and the potential damage it may create;
- c. Removal of pollutants from the air and assistance in the generation of oxygen;
- d. Recreation of buffers and screens against noise pollution;
- e. Control of drainage and restoration of denuded soil subsequent to construction or grading;
- f. Creation of protected environments for birds and other wildlife;
- g. Creation of shade and shelter for people;
- h. Protection and enhancement of property values;
- i. Conservation and enhancement of the Township's physical and aesthetic appearance; and
- j. Protection of the public health and safety, as well as the general welfare.

5. GENERAL PLAN REQUIREMENTS

- a. All required plans shall be prepared by a licensed forester, licensed landscape architect, or other qualified professional.
- b. When an Applicant is proposing a minor subdivision (10 lots or less) or a site plan, a Combined Preliminary/Final Forest Conservation Plan may be submitted. Also, the Forest Stand Delineation Plan may be submitted simultaneously with the Forest Conservation Plan for all minor subdivision proposals and for any site plan proposals.
- c. A Combined Preliminary/Final Forest Conservation Plan shall contain all requirements of both the Preliminary and Final Forest Conservation Plan requirements.

6. FOREST STAND DELINEATION PLAN REQUIREMENTS

- a. A Forest Stand Delineation Plan shall be submitted simultaneously with a sketch plan, or preliminary subdivision plan, whichever is submitted first, but before a erosion and sediment control plan is submitted for the lot or parcel being developed, whichever is applicable.
- b. The delineation plan shall be used during the preliminary review process to determine the most suitable and practical areas for forest conservation and shall contain the following components:

- i. A topographic map delineating intermittent and perennial streams, and steep slopes over 25 percent;
- ii. A soils map delineating soils with structural limitations, hydric soils, or soils with a soil K value (erodibility factor) greater than 0.35 on slopes on 15 percent or more;
- iii. Forest stand maps indicating species, location, and size of trees, dominant and codominant forest types, and Natural Community Types listed by the Pennsylvania Natural Diversity Inventory (PNDI) Biota of Concern In Pennsylvania (Bocip) Lists;
- iv. 100-year floodplain as described in the Flood Insurance Rate Maps published by the Federal Emergency Management Agency and verified by field inspection; and
- v. Other information the Township determines is necessary to implement this Ordinance.

- c. If approved by the Township, a Simplified Forest Stand Delineation Plan may be submitted for an area:
 - i. When no forest cover is disturbed during a construction activity; and
 - ii. Designated to be under a long term protective agreement.
- d. The Township shall consider a Simplified Forest Stand Delineation Plan complete if it includes:
 - i. All requirements under Section 6B (1 and 5) of this article;
 - ii. A map showing existing forest cover as verified by field inspection; and
 - iii. Other information required by the Township.
- e. An approved Forest Stand Delineation Plan may remain in effect for a period not longer than 5 years.
- f. Time for Submittal.
 - i. Within 30 calendar days after receipt of the Forest Stand Delineation Plan, the Township shall notify the Applicant at its regularly scheduled public meeting as to whether the Forest Stand Delineation Plan is complete and correct. If the applicant is not notified, the plan shall be treated as complete and correct.
 - ii. The Township may require further information or extend its time for review and notification for an additional 15 calendar days under extenuating circumstances.

7. FOREST CONSERVATION PLAN REQUIREMENTS

- a. In developing a forest conservation plan, the applicant shall give priority to techniques for retaining existing forest on the site.
- b. If existing forest on the site subject to a forest conservation plan cannot be retained, the applicant shall demonstrate to the satisfaction of the Township:
 - i. How techniques for forest retention have been exhausted;
 - ii. That every effort has been made to reduce destruction of high quality habitats and natural areas, specifically,
 - (1) Those areas that correspond to Natural Community Types listed by the Pennsylvania Natural Diversity Inventory (PNDI) Biota of Concern In Pennsylvania (Bocip) Lists.
 - (2) Those areas within which Pennsylvania Endangered or Threatened Plants occur as listed within P.A.C 17:45:12 and 13.

- c. If an Applicant proposes to make a payment into the **????** Township Forest Conservation Fund instead of afforestation or reforestation, then the Applicant shall demonstrate to the satisfaction of the Township that the requirements for afforestation or reforestation cannot be reasonably accomplished on site or offsite.
- d. Wetlands. In situations where a regulated activity is proposed that occurs wholly or partly in regulated wetland and/or where reforestation or afforestation is planned:
 - i. Include an anticipated construction timetable showing the sequence for forest conservation procedures;
 - ii. Include when applicable an afforestation or reforestation plan prepared by a qualified professional, with a timetable and description of needed site and soil preparation, species, size, and spacing to be used;
 - iii. Show the planned limits of disturbance;
 - iv. Show planned stockpile areas;
 - v. Incorporate a commitment to complete all required afforestation and reforestation within 2 (two) full growing seasons or 1 (one) year after development project completion;
 - vi. Include other information the Township determines is necessary to implement this Ordinance;
 - vii. Include an explanation as to how the provisions of this ordinance have been met.

8. PRELIMINARY FOREST CONSERVATION PLAN REQUIREMENTS

- a. In cases where a major subdivision or land development is proposed, the applicant shall submit a Preliminary Forest Conservation Plan, for approval by **????** Township.
- b. The preliminary plan shall include all items set forth in Section 7.
- c. In the case of a minor subdivision or land development, a combined Preliminary and Final Forest Conservation Plan may be submitted as described in Section 9A and 5C.

9. FINAL FOREST CONSERVATION PLAN REQUIREMENTS

- a. A Final Forest Conservation Plan shall:
 - i. Be submitted with the following:
 - (1) A final subdivision plat;
 - (2) As a Combined Preliminary/Final Forest Conservation Plan with a minor subdivision plat or a site plan.
 - (3) Include a map of the site drawn at the same scale as the grading or final subdivision plan; and
 - (4) Include all the information required under Section 7, except as expressed in Subsection C of this Section.
- b. Time for submittal:
 - i. Within 45 calendar days after receipt of the Final Forest Conservation Plan, the Township shall notify the Applicant whether the Final Forest Conservation Plan is complete and approved. If the Applicant is not notified, the plan shall be treated as complete and correct.

- ii. The Township may require further information and extend its time for review and notification for an additional 15 calendar days under extenuating circumstances.
- c. The Township's review of a Final Forest Conservation Plan shall be concurrent with the review of the final subdivision plan. In the case of a major subdivision plan, (where an Applicant has an approved Preliminary Forest Conservation Plan, and no changes are made), the necessary forest easements and notes may be drawn directly on the Final Subdivision Plat and/or improvements plans in lieu of submitting a separate Final Forest Conservation Plan. These notes should include the following:
 - i. Locations and types of protective devices to be used during construction activities to protect trees and areas of forest designated for conservation;
 - ii. A binding 2-year maintenance agreement that details how the areas designated for afforestation or reforestation will be maintained to ensure protection or satisfactory establishment, including:
 - (1) Watering, and
 - (2) A reinforcement planting provision if survival rates fall below acceptable standards.
 - iii. A binding protective agreement that:
 - (1) Provides protection for areas of forest conservation, including areas of afforestation, reforestation, and retention;
 - (2) Limits uses in areas of forest conservation to those uses that are consistent with forest conservation, including recreational activities and forest management practices that are used to preserve forest; and
 - (3) Incorporates conservation easements, deed restrictions, covenants, and other agreements as necessary;
- d. If a Forest Conservation Plan is required by this Ordinance, a person may not cut, clear, or grade on the development site until the Township has approved the final plan or the person will be in violation of this chapter.
- e. The final plan cannot be altered without expressed written approval from the Township.
- f. The Township may revoke approval for a forest conservation plan if it finds that:
 - i. A provision of the plan has been violated;
 - ii. Approval of the plan was obtained through fraud, misrepresentation, a false or misleading statement, or omission of a relevant or material fact; or
 - iii. Changes in the development or in the condition of the site necessitate preparation of a new or amended plan.
- g. Prior to revoking approval of a forest conservation plan, the Township shall notify the developer in writing and provide an opportunity for a hearing before the Planning Commission.

10. RETENTION AND CONSERVATION PRIORITIES DESIGN CRITERIA

- a. The following trees, shrubs, plants, and specific areas shall be considered high priority for retention and protection and shall be left in an undisturbed condition and the Applicant must demonstrate, to the satisfaction of the Township, that reasonable efforts

have been made to protect them:

- i. Trees, shrubs, and plants located in sensitive areas including the 100-year floodplain, streams and their buffers, steep slopes (25 percent), and critical habitats, and wetlands;
- ii. Contiguous forest that connects large undeveloped or heavily vegetated tracts of land within and adjacent to the site;
- iii. Trees, shrubs, or plants identified on the list of rare, threatened, and endangered species of the United States Fish and Wildlife Service;
- iv. Trees, shrubs, or plants identified that are listed as PA Endangered or Threatened under P.A.C 17:45:12 and 13;
- v. Trees, shrubs, or plants occurring within areas that correspond to Natural Community Types listed by the Pennsylvania Natural Diversity Inventory (PNDI) Biota of Concern In Pennsylvania (Bocip) Lists;
- vi. Trees that:
 - (1) Are part of a historic site;
 - (2) Are associated with a historic structure; or
 - (3) Have been designated by the State or the Township as a national, state, county, or municipal champion tree; and
- vii. Trees having a diameter measured at 4.5 feet above the ground of:
 - (1) 30 inches or more; or
 - (2) 75 percent of the diameter, measured at 4.5 feet above the ground of the current State, County, or municipal champion tree of that species as designated by the State of Pennsylvania Department of Natural Resources, or ???? County, or the Municipality.

b. The preferred priorities for forest conservation, after techniques for retaining existing forest on the site have been exhausted, are as follows:

- i. Selective clearing and supplemental planting on site;
- ii. Onsite afforestation, or reforestation, if economically feasible, using transplanted or nursery stock that is greater than 1.5 inches diameter measured at 4.5 feet above the ground;
- iii. Onsite afforestation, or reforestation, using whip and seeding stock;
- iv. Landscaping of areas under an approved landscaping plan which establishes a forest that is at least 35 feet wide and covering 2,500 square feet of area; and/or landscape credits expressed in Section 15;
- v. Offsite afforestation, or reforestation, using transplanted or nursery stock that is greater than 1.5 inches diameter measured at 4.5 feet above the ground;
- vi. Offsite afforestation, or reforestation, using whip and seedling stock;
- vii. Natural regeneration onsite; and
- viii. Natural regeneration offsite.

c. A sequence other than the one described in Section B of this Section may be used for a specific project, if necessary, to achieve the objectives of the Township land use plan or Township land use policies, or to take advantage of opportunities to consolidate forest conservation efforts.

d. The following shall be considered a priority for afforestation and reforestation to:

- i. Establish or enhance forest buffers adjacent to intermittent and perennial streams to widths of at least 50 feet, and when afforestation occurs offsite, especially on Agriculturally zoned or used land;
- ii. Establish or enhance forested areas in 100-year floodplains, when appropriate;
- iii. Establish or increase existing forested corridors to connect existing forests within or adjacent to the site and where practical, forested corridors should be minimum of 300 feet in width to facilitate wildlife movement;
- iv. Establish or enhance forest buffers adjacent to critical habitats where appropriate;
- v. Establish plantings to stabilize slopes of 25 percent or greater and slopes of 15 percent or greater with a soil K value greater than 0.35 including the slopes of ravines or other natural depressions;
- vi. Establish buffers adjacent to areas of differing land use where appropriate, or adjacent to highways or utility rights-of-way;
- vii. Establish forest areas adjacent to existing forests to increase the overall area of contiguous forest cover, when appropriate; and
- viii. Use native plant materials for afforestation or reforestation, when appropriate.

e. Work must be completed within one (1) year or 2 growing seasons, whichever is greater, following completion of final site grading.

11. AFFORESTATION AND AFFORESTATION THRESHOLD DESIGN CRITERIA

“Afforestation” under this section means the planting of trees where no or little forest exists on the site, in order to meet certain thresholds. A person making application after the effective date of this Ordinance for subdivision approval, site plan, or a grading permit, for an area of land of 40,000 square feet or more:

- a. Shall conduct afforestation on the lot or parcel in accordance with the following:
 - i. A tract having less than 20 percent of the net tract area in forest cover shall be afforested to at least 20 percent of the net tract area for the following zoning categories:
 - (1) RU - Rural District Zones; and
 - (2) R-1 - Low Density Residential District Zones;
 - ii. A tract with less than 15 percent of its net tract area in forest cover shall be afforested up to at least 15 percent of the net tract area for the following zoning categories:
 - (1) Institutional uses in any zone;
 - (2) ND - Neighborhood Development District Zones; and
 - (3) RV - Recreational Vehicle Park District Zones.
- b. Shall comply with the following when cutting into forest cover that is currently below these afforestation percentages:
 - i. The required afforestation level shall be determined by the amount of forest existing before cutting or clearing begins; and
 - ii. Forest cut or cleared below the required afforestation level shall be reforested or afforested at a 2 to 1 ratio and added to the amount of afforestation necessary to reach the minimum required afforestation level, as determined by the amount of forest existing before cutting or clearing began.

12. REFORESTATION AND CONSERVATION THRESHOLD DESIGN CRITERIA

“Reforestation” under this section means the planting of tree to replace forest which has been recently removed.

- a. In addition to the Afforestation Threshold, there is a Forest Conservation Threshold established for each zoning category, as provided in subsection B of this Section. The Forest Conservation Threshold means the percentage of the net tract area at which the reforestation requirement changes from a ratio of $\frac{1}{4}$ acre planted for every acre removed to a ratio of 2 acres planted for every acre removed.
- b. After every reasonable effort to minimize the cutting or clearing of trees and other woody plants has been exhausted in the development of a subdivision or project plan, grading and erosion and sediment control activities, and implementation of the forest conservation plan, the forest conservation plan shall provide for reforestation, or payment into the Forest Conservation Fund, according to the formula provided in Section C of this Section and consistent with the following Forest Conservation Threshold for the applicable zoning category:

<u>Category of Use</u>	<u>Threshold Percentage</u>
(1) Agricultural and Conservation Zone	50 percent
(2) R-1 Residential Zoned areas	25 percent
(3) ND - Neighborhood Development District Zones	20 percent
(4) RV - Recreational Vehicle Park District Zones	20 percent

- c. Calculations.
 - i. If the percentage of forest cover remaining on the net tract area after cutting or clearing are completed equals or exceeds the threshold established by subsection B of this Section, the site shall be reforested at a ratio of $\frac{1}{4}$ acre planted for ever acre removed.
 - ii. Each acre of forest retained on the net tract area above the threshold shall be credited against the total number of acres required to be reforested under Subsection (1) of this Section. The Calculation of the credit shall be according to the criteria provided in the **???? Township Forest Conservation Technical Manual**.
 - iii. For all existing forest cover measured to the nearest 1/10th acre cleared on the net tract area below the applicable Forest Conservation Threshold, the area of forest removed shall be reforested at a ratio of 2 acres planted for each acre removed below the threshold.

13. RECOMMENDED TREE SPECIES

Tree species used for afforestation or reforestation shall be native to **????** County, Pennsylvania, as listed on the PPL Approved Native Species Planting List, or identified in “The Vascular Flora of Pennsylvania: Annotated Checklist and Atlas” by Rhoads, A. F., and W. M. Klein, Jr. 1993.

14. STANDARDS FOR PROTECTING TREES FROM CONSTRUCTION ACTIVITIES

- a. The Developer shall comply with the tree protection guidelines established with the Pennsylvania Handbook of Best Management Practices for Developing Areas, 1998.
- b. Before cutting, clearing, grading, or construction begins on a site for which a forest conservation plan is required by the Ordinance, the developer shall demonstrate to the Township that appropriate protective devices have been established.
- c. Clearing and grading of forests and native vegetation at a site shall be limited to a minimum amount needed to build lots, allow access, and provide fire protection.
- d. The limits of disturbance shall be clearly delineated on site by flagging or fencing.
- e. Construction access shall coincide with existing roadways whenever possible.
- f. The limit of disturbance around building pads shall be 10 ft. except when larger areas are required because of fire concerns.

15. LANDSCAPE CREDITS

Landscaping or street trees not in forest settings will be credited towards afforestation or reforestation requirements at a rate of $\frac{1}{4}$ of an acre credit for each acre of canopy cover of the landscaping or street trees at their expected 20 year growth.

16. PAYMENT IN LIEU OF REFORESTATION

There is hereby created a **???? Township Forest Conservation Fund**.

- a. An Applicant required by Section 11 or 12 of this Ordinance to conduct reforestation may make a payment to the **???? Township Forest Conservation Fund** of \$0.30 per square foot of the area of required planting upon determination by the Township, based on the Applicant's demonstration that reforestation or afforestation cannot reasonably be accomplished by the Applicant onsite or offsite.
- b. Money contributed in lieu of reforestation under this Subsection shall be paid prior to the release of other surety held by the Township for grading.
- c. The Township shall accomplish the reforestation for which the money is deposited within 2 (two) growing seasons after receipt of the money, after which any or all monies not spent shall be returned to the Applicant, upon written request.
- d. Money contributed under this Section:
 - i. May be used only for reforestation and afforestation, including site identification, acquisition, preparation, and maintenance;
 - ii. Shall be deposited in a separate forest conservation fund; and
 - iii. Shall not revert to the general fund.
- e. Sites for afforestation or reforestation using fund money will be sought in the Township and watershed in which the original project is located, but if this cannot be reasonably achieved, the monies may be used to accomplish afforestation or reforestation anywhere in the Township or the state.

17. GUARANTEE FOR REFORESTATION

- a. Persons required to conduct reforestation or afforestation under this Ordinance shall furnish to the Township surety in the form of a guarantee, an irrevocable letter of credit, or other security approved by the Township Attorney's Office. The surety shall:
 - i. Assure that the reforestation and associated management plan are conducted and maintained in accordance with the approved forest conservation plan;
 - ii. Be in the amount equal to the estimated cost, as determined by the developer; and, approved by the Township;
 - iii. Be in a form and of a content approved by the Township Attorney.
- b. If after 1 (one) complete growing season the planting associated with the reforestation meets or exceeds acceptable standards as determined by field inspected by a professional forester, 50 percent of the amount of any cash bond that has been posted shall be returned. If the surety has been given in the form of a letter of credit, or another form of surety, the Township shall notify the appropriate entity that liability has been reduced by 50 percent.
- c. If after 2 (two) complete growing seasons the planting associated with the reforestation meets or exceeds acceptable standards as determined by field inspected by a professional forester, the remaining amount of the cash bond, letter of credit, or other surety, shall be returned or released.

CHAPTER ??

GRADING AND EXCAVATING

(Sample from Coolbaugh Township, Monroe County, Pennsylvania)

PART 1

NATURAL FEATURES CONSERVATION

§101. Purpose

§102. Definitions

§103. Submission Requirements

§104. Minimum Conservation and Natural Resource Protection Standards

§105. Administration

Appendix A Application and Plan Checklist

Appendix B Application Form

Appendix C Escrow Calculation Form

§101. PURPOSE.

1. Short Title and Effective Date. This Part shall be known and may be cited as "The Coolbaugh Township Natural Features Conservation Ordinance."

2. Purpose.

A. These regulations are intended to protect the rights of the residents of Coolbaugh Township to enjoy clean air, pure water and the natural, scenic, historic and aesthetic values of the environment, set forth in the Pennsylvania Constitution and in other Commonwealth and Federal statutes. In particular, it is the Township's purpose, through this Part, to conserve the following natural features:

(1) Natural features identified as land or water resource areas, e.g., wetlands, groundwater recharge zones, springs, streams, agriculturally suited soils, woodlands, prime wildlife habitats and areas constituting high recreational and other amenity value.

(2) Natural features performing beneficial ambient air quality or micro climatic functions, e.g., vegetation, by abating glare and noise, entrapping dust and other particulate and contributing to the reduction of climatic stress and energy costs.

(3) Natural features which, if disturbed, may cause hazards or stress to life and property, e.g., steep slopes, floodplains and wetlands.

B. No provision of these regulations shall be construed to deny the right of any property owner to use his land as may be permitted by the Township's Zoning Ordinance [Chapter 27]. Rather, it is the purpose of these regulations to insure that such uses minimize disturbances to natural features and that reasonable measures are taken to mitigate any adverse impacts of such uses.

3. Statutory Authority. This Part is adopted pursuant to the authority for the Pennsylvania Municipalities Planning Code, Act of July 31, 1968, P.L. 805, No. 247, as amended by Act of December 21, 1988, P.L. No. 170 and the Second Class Township Code, 1933, May 1, P.L. 103; 1947, July 10, P.L. 1481, as amended, 53 P.S. §65101 *et seq.*, to provide for the protection and preservation of natural resources and agricultural land and activities, to promote, protect and facilitate public health; to prevent the overcrowding of land; to preserve prime agricultural and farm land; and to provide for the development of land in a manner consistent with the Comprehensive Plan of Coolbaugh Township and the

conservation and efficient use of open space to protect important natural resources.

4. Compatibility with Other Permit and Part Requirements. Permits and approvals issued pursuant to this Part do not relieve the applicant of the responsibility to secure required permits or approvals for activities regulated by any other applicable code, rule, act or ordinance. If more stringent requirements concerning regulation of stormwater or erosion and sedimentation control are contained in the other code, rule, act or ordinance, the more stringent regulation shall apply.

(Ord. 64B, 9/16/1993, Art. I)

§102. DEFINITIONS.

ACCESSORY STRUCTURE - a subordinate building, the use of which is customarily incidental to, and which is on the same lot as, the principal building. These structures shall include, but not be limited to, detached garages and storage sheds.

ADDITIONS - extensions added to the existing principal structure which increases the ground coverage of the principal structure. These extensions shall include, but not be limited to, fully enclosed rooms, attached garages, screened porches, decks and stoops.

AGRICULTURALLY SUITED SOILS - soil designated within land capability classes I and II in the soil survey of Monroe County, U.S. Department of Agriculture, Soil Conservation Service.

CONSERVATION - the planned management of a natural feature to prevent its exploitation, destruction or neglect.

CRITICAL WILDLIFE HABITAT - those areas that are necessary for the survival of an individual or group of a given species such as rookeries, occupied den sites, etc.

DBH - the diameter of a tree at breast height, usually measured 4.5 feet from the ground surface.

EARTH DISTURBANCE - any activity including, but not limited to, construction, mining, farming, timber harvesting and grubbing which alters, disturbs and exposes existing land surfaces.

ENCROACHMENT - any physical action which may jeopardize the health and longevity of a natural feature, or any structure or activity which in any manner changes the course, current or cross section of any wetland, water course or body of water.

ENDANGERED - a species or subspecies in danger of extinction throughout all or a significant portion of its range.

ENVIRONMENTALLY SENSITIVE AREAS - those areas such as wetlands, high water table areas, rare, threatened or endangered plant communities and species and steep slopes that are susceptible to environmental degradation.

EROSION - the removal of soil particles by the action of water, wind, ice or other geological agents.

FLOODPLAIN - The land adjoining a river or stream that has been or may be expected to be inundated with flood waters in a 100 year frequency flood. The floodplain areas are identified on floodplain maps available at the Coolbaugh Township Municipal Building.

GROUNDWATER RECHARGE - replenishment of a geologic structures and rock or soil interstices which have the capacity to store water.

HEDGEROW - a line of plants that may occur naturally where seeds collect and are left undisturbed, such as along fence lines, property lines or between fields, or that is specially planted or left undisturbed, e.g., to act as a windbreak or vegetative buffer along a drainage channel or water course.

HIGH WATER TABLE AREAS - areas which have a year round or seasonal high water table which comes to within 20 inches of the ground surface.

MINIMIZE - to reduce to the smallest amount possible. "Minimize" shall not mean complete

elimination, but shall require that the most substantial efforts possible under the circumstances have been taken to reduce the adverse effect of the action required to be minimized. With respect to activities, the conduct of which is adverse to the conservation of the natural features of land, the requirement to "minimize" shall include, but not be limited to, the requirement that the placement of dwellings and other structures and the location of roads, sedimentation and erosion control devices and earth disturbance activities shall be planned and designed so as to permit the adverse effect of the activity in question to be reduced to the smallest amount possible under the circumstances consistent with the otherwise permitted development.

MITIGATION - include (i) avoiding the impact altogether by not taking a certain action or parts of an action; (ii) minimizing impacts by limiting the degree or magnitude of the action or its implementation; (iii) rectifying the impact by repairing, rehabilitating or restoring the affected natural feature; (iv) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and (v) compensating for the impact by replacing or providing substitute resources.

MULTIFAMILY RESIDENTIAL BUILDING - a building containing three or more dwelling units including, but not limited to, a four family dwelling (fourplex, quadraplex), townhouse (single-family attached) or apartment building.

NATURAL FEATURE - a component of a landscape identified by Coolbaugh Township as important for conservation in §101(2) of this Part.

OLD FIELD - an upland area containing a dominance of herbaceous vegetation and recently established woody shrubs, seedlings and saplings.

OPEN SPACE - that part of a parcel not included within parking areas, areas laid out in lots or areas occupied by structures.

PRESERVATION - the maintenance of a natural resource in its original, undisturbed state.

PRIME WILDLIFE HABITAT - those areas necessary to maintain an existing population of a given species, the destruction of which will cause a significant reduction in population density.

PROTECT - to defend the integrity of a given right or natural resource.

RARE - a species or subspecies that due to unique habitat requirements or sporadic distribution may not commonly occur in a given area or region.

ROCK OUTCROPS - areas consisting of exposures of solid bedrock.

SEASONAL HIGH WATER TABLE SOILS - those soils in which the groundwater surface is no more than 20 inches from the ground surface at certain times of the year. According to the Monroe County Soil Survey, these soils are Alden, Alluvial land, Alvira, Braceville, Buchanan, Chippewa, Empeyville, Morris, Mucky peat, Norwich, Rexford, Sheffield, Shelmadine, Volusia and Wayland.

SITE DISTURBANCE - any activity which involves removal of vegetation or which causes land on a given site to be exposed to the danger of erosion, including clearing, grading, filling, plowing and other types of earthmoving.

STEEP SLOPE - any slope greater than 25%.

STEEPLY SLOPED LAND - land with a topographic gradient in excess of 12%.

STREAM - a natural drainageway having defined bed and banks that supports aquatic life including, but not limited to, fish, reptiles and macro invertebrates.

SWALE - a natural channel of other low lying stretch of land which collects or carries surface water runoff.

THREATENED - a species or subspecies which is likely to become endangered in the foreseeable future throughout all or part of its range.

WETLAND - wetlands are those areas inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and than under normal circumstances do support, a prevalence of vegetation adapted for life in saturated soil conditions. Wetlands include swamps, marshes, bogs and similar areas.

WETLAND BUFFER AREA - a land area extending from the outer limit of the delineated wetland for a distance of 10 feet.

WETLAND IMPACT AREA - a land area extending from the outer limit of the wetland in which land uses and activities, including any earth disturbance, is regulated to prevent the destruction, degradation or adverse impact on the wetland. For the purposes of this Part the wetland impact area in Coolbaugh Township is 100 feet.

WOODLAND - an area characterized by a more or less dense and extensive tree cover. More particularly, a plant community predominantly of healthy tree and other woody vegetation.
(Ord. 64B, 9/16/1993, Art. II)

§103. SUBMISSION REQUIREMENTS.

1. Applicability.

A. No person, corporation or other entity shall disturb or impact any natural feature listed below in Coolbaugh Township except in compliance with this Part.

B. The natural features intended to be conserved and protected by this Part:

- (1) Wetlands.
- (2) Steep slopes, shallow soil areas, agricultural soils.
- (3) Seasonal high water table soil areas.
- (4) Surface and groundwater resources.
- (5) Floodplains.
- (6) Prime and critical wildlife habitat.
- (7) Natural woodland communities.
- (8) Rare, threatened, endangered or unique plant communities and species.

2. Conservation Plan.

A. Any person, corporation or other entity proposing an activity listed in subsection (2)(B), below, that disturbs or impacts any natural feature listed in §103(1) of this Part, must obtain approval of a conservation plan from the Board of Supervisors of Coolbaugh Township, or the Zoning Officer as required by §105 of this Part. It shall be the responsibility of the applicant to determine whether a conservation plan is required in accordance with the provisions of this Part.

B. The following activities are subject to the requirement of an approved conservation plan showing adherence to the standards in §105 of this Part:

- (1) Building construction.
 - (a) All nonresidential buildings, excluding agricultural buildings and buildings accessory to single-family residential use.
 - (b) All multifamily residential buildings.
 - (c) Single-family homes where the construction occurs in a wetland, wetland buffer area, steep slope or floodplain area as defined in §102 or involves more than 1 acre of land area.
- (2) All subdivisions, land developments and planned residential developments.
- (3) All special exceptions and other land uses under the Zoning Ordinance [Chapter 27], that require site plan approval.
- (4) Construction of any of the following structures or facilities which exceed 5,000 square feet of earth disturbances:
 - (a) Public utility facilities and structures.
 - (b) Liquid and solid waste collection, storage, conveyance and treatment facilities, including landfills.
 - (c) Stormwater management basins and related facilities.
 - (d) Any other structure of similar character or impact as determined by the Township Planning Commission or Board of Supervisors.

(5) Construction of the following streets, parking areas, loading and storage areas, including:

- (a) All streets to be dedicated to the Township.
- (b) All private streets and driveways involving more than 5,000 square feet of earth disturbance.
- (c) Any parking area, loading and storage area or any similar area which exceeds 5,000 square feet of earth disturbance.

(6) Any construction, excavation or encroachment that occurs in a wetland area.

(7) Any site disturbance involving more than 1 acre of land area.

3. Exemptions.

A. Construction of single-family homes and attendant landscaping, except where the construction occurs in a wetland, wetland buffer area, steep slope or floodplain area as defined in §102, above, or involves more than 1 acre of land area, in which case the provisions of this Part apply.

(1) The construction of additions to single-family homes which increase the ground coverage of the home by up to 800 square feet and/or the construction of structures accessory to single-family homes with ground coverage of up to 800 square feet, when construction occurs in the wetland impact area, shall also be exempt from the requirement of an approved conservation plan if it can be demonstrated by the applicant that no disturbance of a wetland or wetland buffer area will occur.

(2) Notwithstanding the exemptions stated above, prior to the issuance of a zoning permit for the construction of a single-family home, addition or accessory structure in a wetland impact area, the property owner shall have recorded, at the Monroe County Recorder of Deeds office, a deed setting forth the plan and metes and bounds description of the wetlands delineation. Permanent pins or monuments establishing the delineation line shall be placed on the property and their location shall also be shown on the recorded deed and plan.

B. Construction of any street, road, parking area or loading and storage area involving less than 5,000 square feet of earth disturbance, except where it occurs in a wetland area.

C. Agricultural and farming activities such as, but not limited to, production of field crops, truck gardening, planting and production of nursery stock, household gardening, field maintenance by way of mowing, trimming and hedgerow-fence row management, provided such activities are conducted with the approval of the Monroe County Conservation District or the Soil Conservation Service if required by State regulations. A conservation plan must be submitted if the activity occurs in a wetland area.

D. Standard forestry management practices, provided that any timber harvesting operations are following the Department of Environmental Protection management practices in its publication "Soil Erosion and Sedimentation Control Guidelines for Forestry," are operating under an erosion and sedimentation control plan approved by the Monroe County Conservation District and are not being conducted in environmentally sensitive areas or reserved open space as defined by this Part, in which case the provisions of this Part apply and approval of a conservation plan must be obtained from the Board of Supervisors. [Ord. 97]

E. Wildlife habitat management approved by local, State or Federal agencies with appropriate jurisdiction.

4. Conservation Plan Content.

A. Prior to commencing any site disturbance, a conservation plan as described below shall be submitted to and approved by the Board of Supervisors and/or the Zoning Officer for all land use activities listed in §103(2) of this Part.

B. A conservation plan shall include the following minimum information described in subsections (4)(C) and (4)(D) of this Section. When any of this information already has been prepared as part of an application under the Coolbaugh Township Subdivision and Land Development Ordinance [Chapter 22], then it shall be duplicated and inserted, by the applicant, into the pertinent section of the conservation plan.

C. Conservation Plan Mapping.

(1) Property Base Map. A base map of the applicant's property shall meet the requirements for preliminary plan approval, as set forth in the §402 of the Township Subdivision and Land Development Ordinance [Chapter 22], with respect to: sheet size, scale, property acreage calculations, delineation of courses and distances of property boundaries, dedicated street rights-of-way and easements.

(2) Boundary and Adjoining Property Conditions. The following information shall be indicated on the property base map: names of adjoining property owners and residential and institutional structures within 100 feet of the applicant's property. A smaller scale map, drawn as an inset on the base map sheet, may be used to present information on adjoining property conditions.

(3) Existing Natural Features Inventory. The following information shall be shown or noted on the property base map:

(a) Geologic numbers, based upon the geologic and hydrologic map of Monroe County, Pennsylvania, and the approximate location and extent of rock outcrops.

(b) Topography, the contour line intervals of which shall be not more than 2 feet for land with average natural slope of 4% or less and not more than 5 feet for land with average natural slope exceeding 4%.

Location and elevation to which contour elevations refer shall be identified; where reasonably feasible, this shall be a known established bench mark. Slopes between 12% and 25% and slopes exceeding 25% shall be indicated clearly. A source list of available aerial photography is on file with the Township Board of Supervisors.

(c) The location and delineation of ponds, streams, floodplain and natural drainage swales.

(d) Soil series and phases, as mapped by the Soil Conservation Service, and accompanying data tabulated for each soil, including: its name, depth to seasonal high water table, depth to bedrock, agricultural capability class and subclass and hydrologic group.

(e) Wetlands, as delineated by a qualified wetlands scientist and surveyed by a licensed land surveyor.

(f) Vegetative cover conditions on the property according to general cover type, e.g., cultivated land; permanent grass land; old field; hedgerow; woodland; emergent, scrub-shrub and forested wetland; etc.

(g) For each general vegetative cover category, the dominant and typical species should be identified. For all woodlands, the applicant shall indicate the principal species of dominant and codominant trees and

the shrub understory. Areas dominated by trees over 24 inches dbh shall be indicated, along with the species of such trees.

(h) Identification and classification of prime and critical wildlife habitat and identification of wildlife corridors as described in §104(2)(E)(4).

(i) Location of any rare, threatened or endangered species as identified by the Pennsylvania Natural Diversity Inventory (available from the Township).

(j) If any of the natural features listed above do not occur on the property, a note to that effect shall appear on the plan.

(4) Proposed Site Alternations. The following information shall be shown on the property base map:

(a) Location of all proposed improvements.

(b) Grading plans which clearly show all proposed alternations to the property's existing topography.

D. Conservation Plan Narrative-Impact Assessment.

(1) All applicants shall assess the onsite and offsite impacts of their proposed activities and improvements on existing natural features. The assessment shall include the following:

(a) Compliance with the minimum standards set by §104 of this Part.

(b) Tabulation of the acreage of natural resources which would be disturbed utilizing the list of natural features in §103(1) of this Part.

(c) Tabulation of the dimensions or gross square foot coverage of all improvements proposed by the applicant, including any proposed impervious surfaces identified in §103(2) of this Part.

(d) Consideration of all reasonable alternatives to minimize disturbances to natural features.

(2) A copy of a wetland delineation report, the Army Corps of Engineers' verification letter or other available documentation for wetlands delineated according to subsection (C)(3)(e), shall be included in the narrative.

(3) An erosion and sedimentation control plan approved by the Monroe County Conservation District.

(4) The narrative shall include a tentative construction schedule that lists all earthmoving activities and target dates. A copy of the schedule from an erosion and sedimentation control plan approved by the Monroe County Conservation District is acceptable.

(Ord. 64B, 9/16/1993, Art. III; as amended by Ord. 97, 2/16/1999)

§104. MINIMUM CONSERVATION AND NATURAL RESOURCE PROTECTION STANDARDS.

1. Applicability. No person shall disturb any natural feature within Coolbaugh Township identified in §103(1) of this Part, except in compliance with §104 of this Part. In assessing compliance with the standards in §104, the Board of Supervisors and/or the Zoning Officer may take into account the extent to which the property owner is taking other remedial or compensatory actions which would fulfill the same basic intent as the conservation standards.

2. Site Planning.

A. Conservation of Surface and Groundwater Resources.

(1) Floodplains. Areas identified in the conservation plan as being in a floodplain area shall not be altered, regraded, filled or built upon except in conformance with Part 10 of the Coolbaugh Township Zoning Ordinance

[Chapter 27].

(2) Stream, Watercourses, Wetlands, Lakes and Ponds. Such areas shall not be altered, regraded, developed, filled, piped, excavated, diverted or built upon except in accordance with regulations of the Pennsylvania Department of Environmental Protection and the U.S. Army Corps of Engineers.

Final approval by the Township for any activity requiring a Federal or State permit shall be conditional upon obtaining such permit. All uses and activities identified in §103(2) of this Part that are proposed in wetland areas shall be regulated in the following manner: [Ord. 97]

(a) All such uses and activities shall be minimized to the extent that there will be no destruction, degradation or adverse impact on the wetland.

(b) Wells, septic systems, stormwater retention, detention and recharge basins, including ground absorption areas, shall not be located in a wetland area unless all required State and/or Federal permits are obtained and included in the conservation plan.

(3) Stormwater, Soil Erosion and Sedimentation. All site modifications shall conform with the requirements of the Coolbaugh Township Stormwater Management and Earth Disturbance Ordinance [Chapter 26, Part 2].

(4) Wetland Impact Areas. All uses and activities identified in §103(2) of this Part that are proposed in wetland impact areas shall be regulated in the following manner:

(a) In the wetland buffer area, as defined herein, absolutely no wetland impact area disturbance, as defined herein, shall occur or be allowed.

(b) Within the balance of the wetland impact area, being that land area extending from the 10 foot wetland buffer area set forth in subsection (A)(4)(a), above, to the line establishing the edge of the wetland impact area, the following types or courses of construction shall be made part of the conservation plan and be followed in the actual course of construction:

1) The depth of any excavation shall be minimized.

2) Roof runoff shall be directed to a dry well as designed by the applicant's engineer, unless the applicant's engineer demonstrates that it is not feasible or appropriate based on specific site conditions.

3) Driveways shall not be paved.

4) Driveways and required erosion control devices shall be completely installed prior to other earth disturbance on the premises.

5) No vegetation, other than for installation of a driveway, shall be removed outside of the building setbacks, unless otherwise authorized by the Township Zoning Officer.

(c) Based upon the review and recommendation for approval by the Township Engineer or consultant, the conservation plan shall be amended to show the types or courses of construction being required.

The conservation plan (amended as necessary) shall then be forwarded:

1) Under §105(1)(A) of this Part, to the Township Planning Commission for their review and recommendation, then to the Board of Supervisors for final action.

2) Under §105(1)(B) of this Part, to the Zoning Officer for final action.

(d) As a further condition to the approval of a conservation plan, the

property owner shall have recorded, at the Monroe County Recorder of Deeds office, a deed setting forth the plan and metes and bounds description of the wetlands delineation. Permanent pins or monuments establishing the delineation line shall be placed on the property and their location shall also be shown on the recorded deed and plan.

(5) High Water Table Areas. Any proposed land use which may, either directly by means of effluent discharge into the ground or indirectly through leaching of stored materials, result in the pollution of the groundwater shall be prohibited in such areas. The determination of the groundwater table shall be by the Township Sewage Enforcement Officer.

B. Conservation of Steeply Sloped Lands.

(1) No site disturbance shall be permitted on slopes exceeding 25% with the following exceptions:

(a) Grading for a portion of a driveway accessing a single-family dwelling when it can be demonstrated that no other routing which avoids slopes exceeding 25% is feasible. In such a case, the driveway access must be designed by a professional engineer so as to meet the design requirements of Coolbaugh Township Driveway Regulations [Chapter 21] and have a slope length of no more than 75 feet.

(b) Logging shall be by specific approval of the Board of Supervisors. A conservation plan shall include an approved soil erosion and sediment pollution control plan; a listing of the amounts and species of timber to be harvested, which in no case can be conducted on more than 15% of the acreage located on these slopes; and a reclamation plan for restoring the site. Precaution shall be taken to avoid destruction or injury of brush and trees.

(2) Site disturbance on slopes of between 12% and 25% shall be limited by the following restrictions:

(a) Grading or earth moving on all lands sloping between 12% and 25% shall not result in earth cuts or fills whose highest vertical dimensions exceed 10 feet, except where no alternative exists for construction of public roads, drainage structures and other public improvements in which case such vertical dimensions shall not exceed 20 feet.

Finished slopes of all cuts and fills shall not exceed 3:1, unless the applicant can demonstrate that steeper slopes can be stabilized and maintained adequately.

(b) Logging is permitted by selective cutting only. Clear cutting is prohibited. The selective cutting shall not be conducted on more than 25% of the acreage located on these slopes.

(c) For all land uses and activities identified in §103(2) of this Part, natural vegetation shall be retained or suitable new vegetation planted so that not more than 15% of the land area shall be permanently developed or regraded or stripped of vegetation.

C. Conservation of Agriculturally Suited Soils. In subdivisions where permanent open space is to be retained, the applicant shall, whenever possible and in conjunction with other applicable ordinances, include in such open space those agriculturally suited soils whose acreage, configuration and location offer future opportunity for agricultural use.

D. Conservation of Woodlands and Other Vegetation. Except in conjunction with routine property maintenance or safety precautions, the following shall be

minimized:

(1) Disturbance or removal of vegetation occupying environmentally sensitive areas shall be undertaken only when necessary and on a limited, selective basis to minimize the adverse impacts of such actions and to maintain the natural integrity of these areas. These sensitive areas shall include, but not necessarily be limited to, wetlands, floodplains, stream and pond banks, steep slopes, erodible soils, seasonal high water table soils and rare, threatened or endangered plant communities and species.

(2) Removal of vegetation with all building setbacks.

E. Conservation of Open Space. The conservation plan shall be developed in a manner that will preserve the open space character of the land area and will respect the physical and environmental limitations of the land area utilizing the following guidelines:

(1) Wherever possible, lakes, ponds and water courses shall be left as permanent open space. Environmentally sensitive areas such as land areas with high water tables, steeply sloped areas and rock outcroppings shall likewise be left as permanent open space.

(2) All wetlands and areas containing rare, threatened or endangered plant communities and species shall be left as permanent open space.

(3) With the exception of approved logging operations, only 30% of forested areas left as open space may be cleared or developed, with 70% maintained in its natural stand.

(4) Wherever possible, land areas containing prime wildlife habitat shall be left as permanent open space. All critical habitat shall be left as permanent open space. All land uses and activities described in §103(2) of this Part shall provide in the conservation plan for the need for wildlife to move from one location to another by establishing wildlife corridors in reserved open space lands. Such wildlife corridors shall include, wherever possible, contiguous environmentally sensitive areas such as wetlands, watercourses and steep slopes.

3. Site Disturbance.

A. Protection of Vegetation From Excavations.

(1) When digging trenches for utility lines or similar uses, disturbances to the root zones of all woody vegetation should be avoided.

(2) If trenches must be excavated in the root zone, all disturbed roots shall be cut as cleanly as possible. The trench shall be back filled as quickly as possible.

B. Protection of Topsoil.

(1) Removal of Topsoil From Site.

(a) No topsoil shall be removed from a site unless a sufficient amount is retained to provide at least 4 inches of topsoil cover over all of the site's exposed earth surfaces. More than 4 may be required if the Township determines that a greater amount is needed for the longterm viability of certain plantings.

(b) If topsoil is removed from the site, the applicant shall provide the Township with proof that the Pennsylvania Department of Environmental Protection, Bureau of Mining and Reclamation, has been contacted to determine the applicability of State regulation for surface mining. [Ord. 97]

(2) Topsoil removed by grading operations shall be redistributed and stabilized as quickly as possible following the completion of a project or project phase.

All exposed earth surfaces shall be stabilized by the following methods or Monroe County Conservation District approved equal:

- (a) Seeding or planting with tacked mulch at 3 tons/acre on slopes of 10% or less.
- (b) Sodding, hydro-seeding or rip-rap with tacked mulch at 3 tons/acre on slopes exceeding 10%.

C. Protection During Cleanup.

- (1) All construction debris shall be hauled away from the property unless provisions acceptable to the Board are made for the onsite disposal of such debris.
- (2) If debris is disposed onsite, the applicant shall provide the Township with proof that the Pennsylvania Department of Environmental Protection, Bureau of Solid Waste Management, has been contacted to determine the applicability of State regulation. [Ord. 97]

4. Modifications and Waivers.

A. At the discretion of the Board of Supervisors after review and recommendation from the Township Engineer, consultant and/or Planning Commission, a modification or waiver of the minimum standards contained in this Section may be granted where:

(1) Literal compliance with the mandatory provisions is shown by the applicant to be unreasonable, will cause undue hardship and an alternative standard can be shown to achieve equal or better results. The applicant shall provide evidence that no practicable alternative is available which can meet overall project purposes which would have less impact on the natural feature. In considering whether an alternative is practicable, consideration shall be given to cost, existing technology, logistics, project purposes and the restrictions imposed by other applicable Federal, State and local regulations. The applicant shall submit a mitigation plan and design, including such erosion and sedimentation control measures, construction procedures and other actions as are necessary and appropriate to reduce the risk of damage to, or destruction of, the natural feature.

B. All requests for modification or waiver shall be in writing and shall accompany and be a part of the application for conservation plan approval.

C. This request shall state in full the grounds and facts of unreasonableness or hardship and the provision or provisions of the ordinance involved and the minimum modification necessary.

D. The granting of a modification or variance is within the discretion of the Board of Supervisors and may not be contrary to the public interest or violate the intent and purpose of the Part.

(Ord. 64B, 9/16/1993, Art. IV; as amended by Ord. 97, 2/16/1999)

§105. ADMINISTRATION.

1. Conservation Plan Submittal and Review Procedures.

A. Where the site disturbance activities for which a conservation plan is required pursuant to §103(2) of this Part involves the submittal of a subdivision/land development plan pursuant to Coolbaugh Township Subdivision and Land Development Ordinance [Chapter 22], or a site development plan pursuant to Coolbaugh Township Zoning Ordinance [Chapter 27], the conservation plan shall be submitted and reviewed pursuant to the procedures outlined in those ordinances. An application form is provided as Appendix B to this Part.

- (1) The conservation plan shall be accompanied by the requisite fees as provided by §105(3) of this Part.
- (2) Five copies of the conservation plan and application must be submitted to the Township Planning Commission Secretary.
- (3) The Township Planning Commission Secretary shall forward the conservation plan and application to the following individuals or agencies for review and comment:
 - (a) Two copies to the Township Planning Commission.
 - (b) One copy to the Township Engineer or consultant.
 - (c) One copy to the Township Zoning Officer.
 - (d) One copy to the appropriate utility company if applicable.

B. Where the site disturbance activities for which a conservation plan is required pursuant to §103(2) of this Part does not require a review under the Township Subdivision/Land Development Ordinance [Chapter 22] or the Zoning Ordinance [Chapter 27], the developer shall submit a conservation plan application and conservation plan to the Township Zoning Officer accompanying the zoning permit application. The Township Zoning Officer shall review the application and plan according to the checklist found in Appendix A, and if all of the submission requirements of this Part are met, shall issue an official submission receipt to the applicant. An application form is provided as Appendix B to this Part.

- (1) The conservation plan shall be accompanied by the requisite fees as provided by §105(3) of this Part.
- (2) Three copies of the conservation plan and application must be submitted to the Zoning Officer.
- (3) The Zoning Officer shall forward the conservation plan and application to the following individuals or agencies for review and comment:
 - (a) One copy to the Township Engineer or consultant.
 - (b) One copy to the appropriate utility company if applicable.

C. The Board of Supervisors shall have a total of 90 days to review and approve or disapprove a conservation plan submitted under subsection (1)(A) of this Section, and the Zoning Officer shall have a total of 30 days to review and approve or disapprove a conservation plan submitted under subsection (1)(B) of this Section. The Board of Supervisors or the Zoning Officer may require additional information within 30 days under subsection (1)(A) and 15 days under subsection (1)(B). Failure of the conservation plan to comply with the standards set forth in §104 shall be grounds for disapproval of the plan.

D. All approved plans must be officially dated and signed by the Board of Supervisors or the Zoning Officer and the applicant prior to commencing any site disturbance. The applicant's signature shall constitute a written certification that work shall be performed in accordance with the plan.

2. Inspections.

A. No site disturbance work shall begin, or proceed to a subsequent phase, until inspected and approved by the Township representative who shall then file a report thereon with the Township.

B. The phase of construction and corresponding times of inspection shall be as follows:

- (1) Upon completion of rough grading, but prior to placing topsoil, installing permanent drainage or other site improvements, or establishing ground covers.
- (2) Upon completion of final grading, landscape improvements and other

mitigation work undertaken in accordance with the approved conservation plan.

(3) The Township representative may make random inspections as deemed necessary and appropriate. A report shall be filed with the Township after every inspection.

C. The applicant shall file a preconstruction inspection schedule with the Township Board of Supervisors and/or the Zoning Officer prior to beginning site disturbance work. This schedule shall be prepared in accordance with subsection (2)(B) of this Section and, if applicable, §§310 and 601(4) of the Coolbaugh Township Land Subdivision and Development Ordinance [Chapter 22].

D. The Township representative shall have discretion to modify or waive the otherwise applicable inspection schedule called for above. The reasons for such modifications or waivers shall be noted in a report to the Township.

E. The applicant shall notify the Township representative at least 72 hours prior to completion of each phase identified in subsection (2)(B) of this Section to schedule the required inspection. Upon receiving such notice, the Township representative shall inspect the work within 48 hours of completion and immediately notify the permittee, in writing, of its acceptability or in what respect there has been a failure to comply. Any portion of the work which does not comply shall be corrected promptly by the permittee. No work on subsequent phase shall proceed until such corrections are carried out to the satisfaction of the Township representative.

3. Fees.

A. The applicant shall agree, in writing, to reimburse the Township for all costs of administration and review of the application by the Township Engineer or consultant. The amount of the required fees shall be determined by completing the escrow fee calculation form found in Appendix C of this Part. The completed escrow fee calculation form shall be submitted along with the application and conservation plan. The number of escrow fee calculation forms to be submitted shall correspond to the number of applications and conservation plans required by §105(1) of this Part.

B. Excluding fixed administration costs, the applicant shall be charged only for time and materials actually expended and detailed in bills from the Township Engineer or consultant. Any unexpended balance of the deposit for plan review shall be returned to the applicant following approval of the conservation plan.

C. If actual time required of the Township Engineer or consultant will exceed the deposited amount, the Township shall render to the applicant a preliminary statement of time and materials expended and an additional amount must be deposited with the Township prior to plan approval.

D. Fees covering the cost of inspections shall be paid by the applicant to the Township prior to plan approval. The amounts of these inspection fees shall be fixed by resolution of the Board of Supervisors. If problems arise requiring more extensive involvement of the Township Engineer or consultant during the inspection process, any resulting costs that exceed the initial fees will be assessed to the applicant.

4. Enforcement.

A. Notice of Violation.

(1) If, at any time during inspection the Township Engineer, consultant and/or Zoning Officer determines that the site work does not conform to the approved plan, a written notice to comply shall be given to the applicant. Such notice shall set forth the nature of corrections required and the time within which corrections shall be made.

(2) The failure to comply with the notice, within the time specified, constitutes a violation of this Part and the Township shall institute enforcement actions pursuant to subsections (4)(B) and (4)(C) of this Section.

(3) The issuance of a notice of violation shall operate as a cease and desist order on all work at the site until corrections are made as required by the notice.

B. Summary Enforcement. Any person, firm or corporation who shall violate any provision of this Chapter, upon conviction thereof in an action brought before a district justice in the manner provided for the enforcement of summary offenses under the Pennsylvania Rules of Criminal procedure, shall be sentenced to pay a fine of not more than \$1,000 plus costs and, in default of payment of said fine and costs, to a term of imprisonment not to exceed 90 days. Each day that a violation of this Part continues or each Section of this Part which shall be found to have been violated shall constitute a separate offense.

C. Causes of Action. In case any natural feature defined in §103(B) of this Part is disturbed or impacted, or is proposed to be disturbed or impacted in violation of this Part, the Township may institute any appropriate action or proceeding to restrain, correct, abate or prevent said violation. Any judgment entered on behalf of the Township shall include costs and reasonable attorney's fees.

D. Restitution. If the applicant refuses or fails to complete site work as part of an approved conservation plan, then the work may be completed by the Township and the costs charged to the applicant.

[Ord. 97]

5. Appeals. All appeals from decisions hereunder shall be taken in the manner set forth in the statutory authorities in §101(3) this Part.

6. Conservation Plan Amendments.

A. Major modifications of any approved conservation plan as determined by the Township, shall be submitted to the Township and reprocessed in the same manner as the original plan. All development and land disturbances activities shall be suspended pending the approval of modified plans.

B. Field modifications of a minor nature may be approved by the Township Engineer or consultant in the form of written authorization.

(Ord. 64B, 9/16/1993, Art. V; as amended by Ord. 97, 2/16/1999)

APPENDIX A

APPLICATION AND PLAN CHECKLIST

Plan

- Property base map conforming to §402 of Subdivision Ordinance [Chapter 22].
- Names of adjacent property owners.
- Residential and institutional structures within 100 feet of site.
- Geologic members.
- Rock outcrops or note that none exist.
- Two or 5 foot contour topography.
- Slopes 12% to 25% or note that none exist.
- Ponds, streams, floodplains, swales or note that none exists.
- Soil series and phase; table indicating soil type, depth to water table, depth to bedrock, agricultural capability class/subclass, hydrologic group.
- Wetlands boundaries or note that none exists.
- Vegetative cover types; table/key indicating dominant/typical species.
- Prime and critical wildlife habitat or note that none exist.
- Species of special concern or note that none exist.
- Location of proposed improvements.
- Grading.

Narrative

- Application form.
- Tabulation of acreage of natural resources affected.
- Tabulation of all proposed improvements.
- Description of compliance with §401 and §402.
- Consideration of all reasonable alternatives to minimize disturbances to natural features.
- Documentation of wetland delineation (if available).

APPENDIX B **APPLICATION FORM**

1. Name, Address, Daytime Phone Number of Applicant:

2. Project Location (distance and direction from nearest intersection and name of subdivision, if applicable): _____

3. Type of Activity:

Nonresidential Building _____

Multi-family Building _____

Subdivision/Land Development _____

Public Utility Facility _____ Area: _____ sq. ft.

Liquid/Solid Waste Facility _____ Area: _____ sq. ft.

Stormwater Management Facility _____ Area: _____ sq. ft.

Township Street _____

Private Street _____ Area: _____ sq. ft.

Parking, Loading, Storage Area _____ Area: _____ sq. ft.

Site Disturbance greater than 1 acre. _____ Acre(s)

Any activity in environmentally sensitive area _____

4. Natural Features on Site:

Wetlands _____ Groundwater Resources _____

Steep Slopes _____ Floodplain _____

Shallow Soil Areas _____ Critical Wildlife Habitat _____

Agricultural Soils _____ Prime Wildlife Habitat _____

Seasonal High Water Table Soils _____ Woodlands _____

Surface Water Resources _____

Rare, threatened, endangered or unique plant communities _____

APPENDIX C **ESCROW FEE CALCULATION FORM**

Applicants for the review of any plans planning modules or other items required in the Coolbaugh Township ordinances or other regulations shall complete the following information and submit this form with the required escrow amount to the Township.

The undersigned hereby applies for review of the plans described below:

1. Date submitted to the Township _____

2. Name of Development _____

Location _____

Deed Book # _____ Page # _____

Zoning District _____

Tax Assessment # _____

Total Acreage _____

Number of Units (if applicable) _____

3. Name of Property Owner (s) _____

Address _____

Telephone _____

4. Name of Applicant (if other than owner)

Name _____
Address _____

Telephone Number _____
Applicants Interest _____

5. Engineer, Surveyor or other person or firm responsible for the preparation of the Plan

Name _____
Address _____

Telephone Number _____
Please check one:

Engineer _____ Surveyor
 Other (specify) _____

6. Please check all items which are applicable:

Sketch Plan
 Preliminary Plan
 Final Plan
 Planning Module
 Conservation Plan
 Drainage Plan
 Site Development Plan
 Tentative Approval Plan (PRD)

7. Please check the type of development (all which apply):

Land Development
 Major Subdivision
 Minor Subdivision
 Conditional Use
 Commercial
 Industrial
 Planned Residential Development
 Single-Family
 Multifamily
 Other _____

ESCROW ACCOUNT DESCRIPTION

Review Fees.

All engineering, legal and other appropriate consulting fees shall be paid by the applicant. To accomplish this end, for each project, the Township shall establish an escrow account. The escrow fee required for the project shall be paid to the Township Secretary at the time that the required application, plan(s) or planning module is submitted for review. The escrow account will be used to pay for expenses as they are incurred for engineering reviews, legal services and other professional consulting services which will be billed at prevailing hourly rates, plus a twenty percent administration charge.

The Township Engineer shall review the escrow fee calculation form and determine if the fee submitted is adequate. If the escrow amount is inadequate, then the applicant will be informed in writing of the additional amount required and how it was determined. The Township will consider the application incomplete and no action will be taken until the escrow amount is paid in full.

If, during the review and approval process, all of the escrow account has been billed for the

services described above because of multiple reviews, complexities in the site or other reasonable expenses, and the review is not complete, an additional escrow fee (or fees) will be requested from the applicant in order to continue processing the application. The Township will stop the review process until the additional fee (or fees) are paid in full. After the review of the plan(s) or planning module has been completed by the Township and it has been determined that there are no outstanding charges, the amount remaining in the escrow account will be returned to the applicant.

Field Inspections.

An escrow account will also be set up by the Township for all required site inspection after the final plan(s) have been approved by the Board of Supervisors. The amount required by the applicant for the inspection escrow account will be determined by the Township Engineer based on the inspection schedule, the schedule of construction and the size and complexity of the site.

Any other review or inspections required by any ordinances or regulations of Coolbaugh Township which are not specifically outlined in this form shall have a minimum escrow fee of \$500. If the Township Engineer or other professional consultant determines that this minimum fee is not adequate to properly review or inspect the project, then the additional amount required will be determined and requested from the applicant and no reviews or inspections will be initiated until the additional amount is received by the Township. If during the review or inspection process the escrow account has been depleted, then additional fee(s) will be requested from the applicant, in writing, and the review or inspection process will be stopped until the fee is received.

Required Escrow Fees (for review of submissions only)

I. Major Subdivisions and/or Multi-Unit Residential Land Developments.

Total No of units or lots _____ Total acreage _____

A. Subdivision and Land Development Ordinance.

No. Units Fee/Unit Total or lots or lot Fee

First 10 units or lots _____ \$ 250.00 _____

Next 11 to 50 units/lots _____ \$ 30.00 _____

Next 51 to 100 units/lots _____ \$ 10.00 _____

Each additional unit/lot over 100 _____ \$ 5.00 _____

Escrow Subtotal (A) _____

B. Natural Features Conservation Ordinance.

No. Acres Fee/Acre Total Fee

First 10 acres _____ \$300.00

Each additional acre over 10 _____ \$ 2.00 _____

Escrow Subtotal (B) _____

C. Stormwater Management and Earth Disturbance Ordinance.

No. Acres Fee/Acre Total Fee

First 20 acres _____ \$ 500.00 Each

Each additional acre over 20 _____ \$ 10.00 _____

Escrow Subtotal (C) _____

Subtotal for Major Subdivisions and/or Multi-Unit Residential Land Developments

Subdivision and Land Development Ordinance (A) _____

Natural Features Conservation Ordinance (B) _____

Stormwater Management and Earth Disturbance Ordinance (C) _____

Subtotal Escrow Fee Required (A + B + C) _____

II. Commercial and/or Industrial Land Developments.

Total Acreage _____

A. Subdivision and Land Development Ordinance.

No. Acre Fee/Acre Total Fee
First 10 acres _____ \$ 250.00 _____
Next 11 to 50 acres _____ \$ 30.00 _____
Next 51 to 100 acres _____ \$ 10.00 _____
Each additional acre over 100 _____ \$ 5.00 _____
Escrow Subtotal (A) _____

B. Natural Features Conservation Ordinance.

No. Acres Fee/Acre Total Fee
First 10 acres _____ \$500.00
Each additional acre over 10 _____ \$ 5.00 _____
Escrow Subtotal (B) _____

C. Stormwater Management and Earth Disturbance Ordinance.

No. Acres Fee/Acre Total Fee
First 10 acres _____ \$ 500.00
Each additional acre over 10 _____ \$ 10.00 _____
Escrow Subtotal (C) _____

Subtotal for Commercial and/or Industrial Land Developments

NOTE: Minor Subdivisions under §404(K) combining lots (with certain provisions being met) requires a \$100 flat fee including administrative charges, which is not held in escrow.

Subdivision and Land Development Ordinance (A) _____

Natural Features Conservation Ordinance (B) _____

Stormwater Management and Earth Disturbance Ordinance (C) _____

Subtotal Escrow Fee Required (A + B + C) _____

III. Minor Subdivision and all Others Requiring Natural Features or Stormwater Management and Earth Disturbance Review.

Total No of units or lots _____ Total acreage _____

A. Subdivision and Land Development Ordinance.

Minor Subdivision \$200.00

Escrow Subtotal (A) _____

B. Natural Features Conservation Ordinance.

No. Acres Fee/Acre Total Fee

First 10 acres _____ \$250.00
Each additional Acre Over 10 _____ \$ 2.00 _____

Escrow Subtotal (B) _____

C. Stormwater Management and Earth Disturbance Ordinance.

No. Acres Fee/Acre Total Fee

First 20 acres _____ \$300.00
Each additional acre over 20 _____ \$ 5.00 _____

Escrow Subtotal (C) _____

Subtotal for Minor Subdivision and all others

Subdivision and Land Development Ordinance (A) _____

Natural Features Conservation Ordinance (B) _____

Storm Water Management and Earth Disturbance Ordinance (C) _____

Subtotal Escrow Fee Required (A + B + C) _____

IV. Planning Modules.

No. of EDU's * _____

*EDU is an equivalent dwelling unit. For the purposes of calculating the fee only, one EDU will equal 262.5 gallons per day.

No. EDU's Fee/EDU Total Fee

First 50 EDU's _____ \$ 500.00
Each additional EDU over 50 _____ \$ 10.00

Escrow Subtotal _____

V. All Other Reviews and Inspections Not Included Above.

Minimum Escrow Amount \$ 500.00

SUMMARY FORM

Total Escrow Submitted

I. Major Subdivision and/or Multi-Unit Residential Land Developments _____

II. Commercial and/or Industrial Land Developments _____

III. Minor Subdivision Subdivisions and All others which require Natural Features or Stormwater Review _____

IV. Planning Modules _____

V. Other Reviews and Inspections _____

Subtotal _____

Plus 20% Administration _____

Total Amount Submitted _____

To be signed by all applicants.

The information on this form is correct to the best of my knowledge and I have read and understand the requirements of the escrow account.

Signature of Applicant

Date

To be completed by Township:

Date Received: _____ Check No. _____

Amount Received: _____ Twp. Eng. Review: _____

Received by: _____ Title: _____

ORDINANCE NO. ???

NATURAL LANDSCAPE ORDINANCE

PURPOSE: An Ordinance to promote the use of native vegetation, including native grasses and wildflowers, in managed yards and landscapes to allow the use of such plants in the preservation or restoration of natural plant communities.

TITLE: This ordinance shall be known as the **???? Township Natural Landscape Ordinance.**

LEGISLATIVE PURPOSE: It is not the intent of this legislation to allow vegetated areas to be unmanaged or overgrown when such growth provides either a direct health hazard or provides a demonstrated breeding ground for fauna known to create a safety or health hazard. The legislature recognizes that a limited number of species may be indicators of neglect, a condition which may adversely affect human health or safety. Below, the township has specifically defined certain noxious weeds recognized to be indicators of neglect.

The use of wildflowers and other native plants in managed landscape design can be economical, low-maintenance, effective in soil and water conservation, and may preclude the excessive use of pesticides, herbicides, and fertilizers. Furthermore, native vegetation and native plant communities, on a worldwide basis, are disappearing at an alarmingly rapid rate. The township recognizes the desirability of permitting and encouraging managed natural vegetation within the limits of **???? Township** while maintaining public health and safety.

DEFINITIONS:

NOXIOUS WEED – A plant that is determined to be injurious to public health, crops, livestock, agricultural land or other property. Such weeds may be included on Pennsylvania's Noxious Weed Control List. The listed noxious plant species do not come within the protection of this ordinance.

NOXIOUS WEED CONTROL LIST:

The Noxious Weed Control List, as defined in the Pennsylvania Code under section 3(b) of the Noxious Weed Control Law (3 P. S. § 255.3(b)), established by the Noxious Weed Control Committee, shall include but not be limited to the following weeds:

- (1) *Cannabis sativa*, commonly known as marijuana.

- (2) The *Lythrum salicaria* (commonly known as purple loosestrife) Complex: Any nonnative *Lythrum* including, *Lythrum salicaria* and *Lythrum virgatum*, their cultivars and any combination thereof.
- (3) *Cirsium arvense*, commonly known as Canada thistle.
- (4) *Rosa multiflora*, commonly known as multiflora rose.
- (5) *Sorghum halepense*, commonly known as Johnson grass.
- (6) *Carduus nutans*, commonly known as musk or nodding thistle.
- (7) *Cirsium vulgare*, commonly known as bull or spear thistle.
- (8) *Datura stramonium*, commonly known as jimson weed.
- (9) *Polygonum perfoliatum*, commonly known as mile-a-minute vine.
- (10) *Pueraria lobata*, commonly known as kudzu vine.
- (11) *Sorghum bicolor* cv. *drummondii*, commonly known as shattercane.
- (12) *Heracleum mantegazzianum*, commonly known as giant hogweed.
- (13) *Galega officinalis*, commonly known as goatsrue.

The term "managed" as used in this ordinance means a planned and designed yard or landscape with the intent to control, direct, and maintain the growth of natural vegetation.

MANAGED NATURAL LANDSCAPING: It shall be lawful to grow native and naturalized plants to any heights, including ferns, wildflowers, grasses, forbs, shrubs, and trees, in a managed landscape design when said plants were obtained not in violation of local, state, or federal laws. No employee of the township may undertake to damage, remove, burn, or cut vegetation on a managed natural landscape incorporating native plants, except those specifically prohibited herein, and except on order of a court of record following a hearing at which it is established that noxious weeds exist in a managed natural landscape and that a condition creating a clear and present hazard to public health or safety has arisen. An action for a court order under this subsection shall provide that the destruction, cutting, or removal of vegetation shall be selective unless general cutting, destruction, or removal is necessary to eliminate the offending conditional.

Statements of intent:

1. If a complaint is filed by a citizen or the township against a piece of property, the burden or proof lies with the complainant to establish that a health or safety hazard

in fact exists. Natural landscapes shall be assumed to be harmless, until proven otherwise.

2. The township shall not act upon anonymous complaints. The property owner shall have the right to face the accuser.
3. This and the noxious weed ordinance shall be proactively and uniformly enforced, and shall apply to all property not specifically exempted within the township limits.
4. Aesthetic judgments shall not be a consideration nor play any role in determining non-compliance or compliance with the ordinance.
5. The township shall notify the property owner of their rights of appeal.
6. It shall not be the policy of the township to enter upon private land and to destroy property thereon without due process of law.

ENACTED AND ORDAINED this ??th day of ???, ???

TOWNSHIP OF ????

BY: _____

??????, CHAIRMAN

ATTEST:

??????

ORDINANCE NO. ???

NOXIOUS WEED CONTROL ORDINANCE

PURPOSE: This ordinance is intended to encourage the control of noxious vegetation in **????** Township to reduce the amount of natural irritants and pollens in the air; to prevent any noxious weeds from spreading; and to improve the aesthetic quality of the Township.

TITLE: This ordinance shall be known as the **????** Township Noxious Weed Control Ordinance.

DEFINITIONS:

NOXIOUS WEEDS – A plant that is determined to be injurious to public health, crops, livestock, agricultural land or other property. Such weeds may be included on Pennsylvania's Noxious Weed Control List.

NOXIOUS WEED CONTROL LIST - The Noxious Weed Control List, as defined in the Pennsylvania Code under section 3(b) of the Noxious Weed Control Law (3 P. S. § 255.3(b)), established by the Noxious Weed Control Committee, shall include but not be limited to the following weeds:

- (1) *Cannabis sativa*, commonly known as marijuana.
- (2) The *Lythrum salicaria* (commonly known as purple loosestrife) Complex: Any nonnative *Lythrum* including, *Lythrum salicaria* and *Lythrum virgatum*, their cultivars and any combination thereof.
- (3) *Cirsium arvense*, commonly known as Canada thistle.
- (4) *Rosa multiflora*, commonly known as multiflora rose.
- (5) *Sorghum halepense*, commonly known as Johnson grass.
- (6) *Carduus nutans*, commonly known as musk or nodding thistle.
- (7) *Cirsium vulgare*, commonly known as bull or spear thistle.
- (8) *Datura stramonium*, commonly known as jimson weed.
- (9) *Polygonum perfoliatum*, commonly known as mile-a-minute vine.
- (10) *Pueraria lobata*, commonly known as kudzu vine.
- (11) *Sorghum bicolor* cv. *drummondii*, commonly known as shattercane.

(12) *Heracleum mantegazzianum*, commonly known as giant hogweed.

(13) *Galega officinalis*, commonly known as goatsrue.

APPLICABILITY: During any calendar year, growth of any noxious weed in excess of eighteen (18) inches on any land not actively used for agricultural purposes is hereby declared to be a nuisance and a danger to public health and shall be prohibited. Exceptions may be made for controlled fences/boundaries of properties or active natural areas for wildlife.

WEED CONTROL AREA: A municipality, geographic area, or tract of land where a noxious weed must be treated as prescribed under this ordinance.

PUBLIC NOTICE: Once each year during the period of May – June, the Board of Supervisors or their designee shall authorize to be printed in a newspaper of general circulation within the Township a notice directed to the residents advising them of the general requirements of this Ordinance, and specifically the prohibitions as to the Noxious Weeds and the penalties for violations.

NOTICE TO VIOLATORS: Upon receipt of a formal, written complaint by a bonafide resident or landowner in **????** Township, or by direct observation of a Township Official, the Board of Supervisors or their designee shall authorize a certified written notice be given to the owner of the land whereon the offending growth is found to exist. The notice shall specify the location and the type of noxious weed and require its' removal within ten (10) days of the date of the notice unless the owner of the land in question can demonstrate to the Board of Supervisors or their designate just cause as to why the offending growth cannot be removed. Failure of the landowner to comply with the requirements of such notice within ten (10) days after receipt shall be *prima facie* evidence of a violation of this Ordinance.

TOWNSHIP ACTION: In the event that the offending growth has not been removed or destroyed within the ten (10) day period after the certified notice was received, the Township or a party contracted by the Township may mow, destroy, or dispose of the offending growth in such a fashion as deemed appropriate. The owner of the property whereon the work was undertaken shall bear the cost of the work and shall be required to reimburse the Township in full upon receipt of an itemized bill.

VIOLATIONS AND PENALTIES: Any person who shall violate any of the provisions of this Ordinance shall, upon conviction thereof, in an action brought before the District Justice in the manner provided for the enforcement of summary offenses under the Pennsylvania Rule of Criminal Procedures be sentenced to pay a fine of not less than one hundred dollars (\$100.00) nor more than five hundred dollars (\$500.00) and the costs of prosecution.

REFERENCE: NOXIOUS WEED CONTROL LAW, ACT OF APRIL 7, 1982, P. L. 228, No. 74, AS AMENDED July 7, 1994.

ENACTED AND ORDAINED this ??th day of ????, ????

TOWNSHIP OF ????

BY: _____

??????, CHAIRMAN

ATTEST:

??????

**National Pollutant Discharge Elimination System (NPDES)
Stormwater Discharges
From
Municipal Separate Storm Sewer Systems (MS4s)**

**Guidance
on
MS4 Ordinance Provisions**



**COMMONWEALTH OF PENNSYLVANIA
Department of Environmental Protection**

For more information, visit DEP directly at www.dep.state.pa.us
or through the Pennsylvania homepage at www.state.pa.us

**DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WATERSHED MANAGEMENT**

DOCUMENT NUMBER: 392-0300-003

TITLE: Guidance on MS4 Ordinance Provisions
[In relation to National Pollutant Discharge Elimination System (NPDES) Stormwater Discharges Permitting Requirements From Municipal Separate Storm Sewer Systems (MS4s)]

EFFECTIVE DATE: August 2, 2003

POLICY: This guidance contains model ordinance provisions for municipalities to meet their permit obligations under the NPDES Phase II federal stormwater management regulations.

PURPOSE:

DISCLAIMER: The policies and procedures outlined in this guidance are intended to supplement existing requirements. Nothing in the policies or procedures shall affect regulatory requirements.

The policies and procedures herein are not an adjudication or a regulation. There is no intent on the part of DEP to give the rules in these policies that weight or deference. This document establishes the framework within which DEP will exercise its administrative discretion in the future. DEP reserves the discretion to deviate from this policy statement if circumstances warrant.

PAGE LENGTH: 37 pages

LOCATION: Volume 15, Tab 22

INTRODUCTION

Purpose

This guidance contains model ordinance provisions for municipalities to meet their permit obligations under the NPDES Phase II federal stormwater management regulations.

Background

New federal regulations enacted in December 1999 require municipalities in urbanized areas to implement a stormwater management program beginning in March 2003, over the next five years. *See 40 CFR §§ 122.26 – 123.35.* The regulations apply to “municipal separate storm sewer systems (MS4s),” and mandate that MS4s adopt certain local legal requirements through an ordinance, or other regulatory mechanism, to effectuate the local stormwater management program.

The regulations require MS4s to have the following legal provisions:

- Prohibition of non-stormwater discharges (with certain exceptions)
- Requirement for erosion and sediment controls
- Requirement to address post-construction runoff from new development and redevelopment, including operations and maintenance of stormwater BMPs
- Sanctions to ensure compliance with the above provisions

The department developed a draft model ordinance and published it for public comment in the *Pennsylvania Bulletin* in October 2002. The draft ordinance was based on the department’s existing model ordinance used in the program under the Stormwater Management Act, 32 P.S. §§ 680.1 *et seq.* (“Act 167”), as well as various ordinances currently in use around the state. A copy of the draft model ordinance was sent to each of the approximately 940 MS4s, requesting comments. The draft ordinance was also distributed at various public meetings held by the department during November 2002 - January 2003.

Comments were received by 24 persons or organizations. The comments addressed various technical, scientific and legal issues, and were considered in the issuance of this guidance. In addition, a number of the comments indicated that many municipalities around the state already have ordinances or other regulations addressing stormwater, and that it would be preferable to simply augment the required provisions needed to meet the additional federal regulatory requirements. The department concurs with these comments, and therefore this guidance gives municipalities three options for meeting their legal requirements, described below.

DEP Protocol for Implementation of MS4 Permit Requirements

The department issued a General Permit (“PAG-13”) for use by MS4s in meeting their permit requirements, in December 2002. The basic requirement for MS4s is to implement a program for minimizing stormwater impacts from their system over the 5-year permit term. The permit gives MS4s the option of using the department’s Stormwater Management *Protocol*—a detailed plan for implementing a stormwater management program over the five-year permit term—or developing their own program. These same options apply to Individual Permit applicants (required in Special Protection Watersheds).

The *Protocol* contains the department's preferred and recommended program for MS4s to address the six required elements contained in the federal regulations:

- Public education and outreach
- Public participation and involvement
- Illicit discharge detection and elimination
- Construction site runoff control
- Post-construction stormwater management in new development and redevelopment
- Pollution prevention and good housekeeping for municipal operations and maintenance

The *Protocol* requirements also include use of the department's model stormwater ordinance. The department will consider that aspect of the *Protocol* to have been met when an MS4 adopts any of the three options contained in this guidance document. Ordinance provisions different from these model provisions can be acceptable, subject to department approval. Further guidance on the review and approval process for those determinations will be issued later in 2003.

THREE OPTIONS FOR MS4s

To satisfy the *Protocol* requirement to adopt the department's model ordinance, MS4s have three options:

1. Augment an existing ordinance, or regulations, by adopting model provisions in four key aspects
2. Adopt a complete stormwater ordinance, focusing on water quality, using the department's model ordinance
3. Adopt an ordinance under the Act 167 program which contains MS4-related provisions

Each one of these options is described below.

OPTION 1: Use Selected Model Provisions

There are four types of provisions which must be used. These are contained in Appendices 1-4 to this guidance, and are described briefly below:

Prohibition of non-stormwater discharges (Appendix 1): These provisions contain a basic prohibition against non-stormwater discharges into the MS4, with certain exceptions. The exceptions include discharges under a state or federal permit, and discharges in 14 categories specified in the federal regulations.

Erosion and sediment control requirement (Appendix 2): These provisions apply the requirements contained in existing state regulations at 25 Pa. Code Chapters 92 and 102, including the NPDES Construction Permit program administered by DEP and County Conservation Districts. Issuance of an NPDES Construction Permit can be used to satisfy this requirement.

Requirement to address post-construction runoff from new development and redevelopment, including operations and maintenance of stormwater BMPs (Appendix 3): These provisions apply the requirements contained in existing state regulations at 25 Pa. Code Chapter 93 (Water Quality Standards), and are consistent with the NPDES Construction Permit requirements of 25 Pa. Code Chapter 92 and the Stormwater Management Planning requirements of the Stormwater Management

Act, 32 P.S. § 680.1 *et seq.* Issuance of an NPDES Construction Permit can be used to satisfy this requirement.

Sanctions to ensure compliance with the above provisions: (*Appendix 4*): The Ordinance needs to set forth sanctions for failure to comply with the above provisions in the Ordinance, and these are contained in Appendix 4.

The provisions for controls during and after construction in Appendices 2 and 3 apply to controls required for *surface water quality protection*. Municipalities may modify the provisions as shown in the Appendices to allow for use with other, related construction and post-construction control requirements of the Municipality.

OPTION 2: Adopt Complete Model Stormwater Ordinance

MS4s that wish to use a complete, comprehensive stormwater ordinance are provided a sample ordinance that can be used to meet the MS4 permit requirements. This ordinance (*Appendix 5*) contains the required provisions in Appendices 1-4, as well as other relevant provisions commonly used by municipalities in Pennsylvania to address water quality impacts of stormwater runoff.

This ordinance contains useful provisions to ensure long-term operations and maintenance of post-construction Best Management Practices (BMPs), which is required by the federal regulations.

OPTION 3: Adopt Stormwater Ordinance Containing MS4-required Provisions, as Part of Approved Act 167 Watershed Plan

Many municipalities will be using the existing Act 167 process to help meet their permit requirements. This can occur with updates of current plans, or development of new plans. This process is administered by the Bureau of Watershed Management in the department.

Under the Act 167 planning process, counties and municipalities in watersheds around the state develop watershed-based plans to address three main aspects of stormwater impacts—flooding, water quality and groundwater recharge. While flooding is not required to be addressed by the federal MS4 permit requirements, there are obvious benefits to addressing flooding.

The Act 167 model ordinance used in that program can be easily modified to contain MS4 provisions. The department will work with municipalities who wish to achieve compliance with the MS4 requirements as part of an Act 167 planning effort. Therefore, no appendix for this purpose is provided in this guidance.

APPENDIX 1

Prohibition Against Non-Stormwater Discharges

Prohibited Discharges

- A. 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 B below, and (2) discharges allowed under a state or federal permit.
- B. Discharges which may be allowed, based on a finding by the Municipality that the discharge(s) do not significantly contribute to pollution to surface waters of the Commonwealth, are:

Discharges from fire fighting activities	Uncontaminated water from foundation or from footing drains
Potable water sources including dechlorinated water line and fire hydrant flushings	Flows from riparian habitats and wetlands
Irrigation drainage	Lawn watering
Routine external building washdown (which does not use detergents or other compounds)	Pavement washwaters 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
Air conditioning condensate	Dechlorinated swimming pool discharges
Water from individual residential car washing	Uncontaminated groundwater
Springs	
Water from crawl space pumps	
- C. In the event that the Municipality determines that any of the discharges identified in Subsection B significantly contribute to pollution of waters of the Commonwealth, or is so notified by DEP, the Municipality will notify the responsible person to cease the discharge.
- D. Upon notice provided by the Municipality under subsection C, the discharger will have a reasonable time, as determined by the Municipality, to cease the discharge consistent with the degree of pollution caused by the discharge.
- E. Nothing in this Section shall affect a discharger's responsibilities under state law.

Prohibited Connections

The following connections are prohibited, except as provided in Section B above:

- A. Any drain or conveyance, whether on the surface or subsurface, which allows any non-storm water 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.

APPENDIX 2

Requirement for Erosion and Sediment Controls

Erosion and Sediment Control

- A. No Regulated Earth Disturbance activities within the Municipality shall commence until approval by the Municipality of an Erosion and Sediment Control Plan for construction activities.
- B. The Pennsylvania Department of Environmental Protection (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).
- C. In addition, under 25 Pa. Code Chapter 92, a DEP “NPDES Construction Activities” permit is required for any earth disturbance one acre or more with a point source discharge to surface waters or the Municipality’s storm sewer system, or five acres or more regardless of the planned runoff (hereinafter collectively referred to as “Regulated Earth Disturbance Activities”). This includes earth disturbance on any portion of, part of, or during any stage of, a larger common plan of development.
- D. 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. The issuance of an NPDES Construction Permit (or permit coverage under the statewide General Permit (PAG-2)) satisfies the requirements subsection A. [*]
- E. A copy of the Erosion and Sediment Control plan and any required permit, as required by DEP regulations, shall be available at the project site at all times.

* This sentence is optional -- if the municipality has additional or more stringent requirements than those in state regulations, then this sentence should not be used.

APPENDIX 3

Post-Construction Stormwater Runoff Controls for New Development and Redevelopment, Including Operations and Maintenance of Stormwater BMPs

Post-Construction Runoff Control Requirements

- A. No Regulated Earth Disturbance activities within the Municipality shall commence until approval by the Municipality of a plan which demonstrates compliance with State Water Quality Requirements after construction is complete.
- B. The BMPs must be designed to protect and maintain existing uses (e.g., drinking water use; cold water fishery use) and maintain the level of water quality necessary to protect those uses in all streams, and to protect and maintain water quality in “Special Protection” streams, as required by statewide regulations at 25 Pa. Code Chapter 93 (collectively referred to herein as “State Water Quality Requirements”).
- C. To control post-construction stormwater impacts from Regulated Earth Disturbance activities, State Water Quality Requirements can be met by BMPs, including site design, which provide for replication of pre-construction stormwater infiltration and runoff conditions, so that post-construction stormwater discharges do not degrade the physical, chemical or biological characteristics of the receiving waters. As described in the DEP Comprehensive Stormwater Management Policy (#392-0300-002, September 28, 2002), this may be achieved by the following:
 - 1. Infiltration: replication of pre-construction stormwater infiltration conditions,
 - 2. Treatment: use of water quality treatment BMPs to ensure filtering out of chemical and physical pollutants from the stormwater runoff, and
 - 3. Streambank and Streambed Protection: management of volume and rate of post-construction stormwater discharges to prevent physical degradation of receiving waters (e.g., from scouring and erosion).
- D. DEP has regulations that require municipalities to ensure design, implementation and maintenance of Best Management Practices (“BMPs”) that control runoff from new development and redevelopment (hereinafter “development”) after Regulated Earth Disturbance activities are complete. These requirements include the need to implement post-construction stormwater BMPs with assurance of long-term operations and maintenance of those BMPs.
- E. 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. The issuance of an NPDES Construction Permit (or permit coverage under the statewide General Permit (PAG-2)) satisfies the requirements subsection A. [*]

* This sentence is optional -- if the municipality has additional or more stringent requirements than those in state regulations, then this sentence should not be used.

APPENDIX 4

Sanctions

[The municipality may already have sanctions and enforcement provisions. However, the municipality must ensure that at a minimum, the provisions equivalent to the following are included to enforce the three other categories of provisions in Appendices 1-3]

Public Nuisance

- A. The violation of any provision of this ordinance is hereby deemed a Public Nuisance.
- B. Each day that a violation continues shall constitute a separate violation.

Enforcement

- A. Whenever the Municipality finds that a person has violated a prohibition or failed to meet a requirement of this Ordinance, the Municipality may order compliance by written notice to the responsible person. Such notice may require without limitation:
 - 1. The performance of monitoring, analyses, and reporting;
 - 2. The elimination of prohibited discharges;
 - 3. Cessation of any violating discharges, practices, or operations;
 - 4. The abatement or remediation of storm water pollution or contamination hazards and the restoration of any affected property;
 - 5. Payment of a fine to cover administrative and remediation costs;
 - 6. The implementation of stormwater BMPs; and
 - 7. Operation and maintenance of stormwater BMPs.
- B. Failure to comply within the time specified shall also subject such person to the penalty provisions of this Ordinance. All such penalties shall be deemed cumulative and shall not prevent the Municipality from pursuing any and all other remedies available in law or equity.

Suspension and Revocation of Permits and Approvals

Any building, land development or other permit or approval for Regulated Earth Disturbance Activities issued by the Municipality may be suspended or revoked by the governing body for:

- A. Non-compliance with or failure to implement any provision of the permit,
- B. A violation of any provision of this Ordinance, or

- C. The creation of any condition or the commission of any act during construction or development which constitutes or creates a hazard or nuisance, pollution or which endangers the life or property of others.

Penalties

- A. Any person violating the provisions of this ordinance shall be guilty of a misdemeanor, and upon conviction shall be subject to a fine of not more than \$ _____ for each violation, recoverable with costs, or imprisonment of not more than _____ days, or both. Each day that the violation continues shall be a separate offense.
- B. In addition, the Municipality, through its solicitor, may institute injunctive, mandamus or any other appropriate action or proceeding at law or in equity for the enforcement of this Ordinance. Any court of competent jurisdiction shall have the right to issue restraining orders, temporary or permanent injunctions, mandamus or other appropriate forms of remedy or relief.

APPENDIX 5

MODEL STORMWATER ORDINANCE (For MS4 Municipalities)

This is a complete model ordinance for use by municipalities that operate “municipal separate storm sewer systems (MS4s).” It is one of three options available to municipalities using the DEP Stormwater Management *Protocol*, or who otherwise wish to follow DEP guidance on implementing the new federal stormwater regulations (which are incorporated into state regulations by reference).

Therefore, this model ordinance contains the requirements under the federal regulations at 40 CFR 122.26 – 123.35

STORMWATER MANAGEMENT

ORDINANCE

ORDINANCE NO. _____

_____, _____ COUNTY, PENNSYLVANIA

Adopted at a Public Meeting Held on
_____, 2____

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APPENDICES

A: Low Impact Development Practices

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ARTICLE I - GENERAL PROVISIONS

Section 101. Short Title

This Ordinance shall be known and may be cited as the “ _____ Stormwater Management Ordinance.”

Section 102. Statement of Findings

The governing body of the Municipality finds that:

- A. Stormwater runoff from lands modified by human activities threatens public health and safety by causing decreased infiltration of rainwater and increased runoff flows and velocities, which overtax the carrying capacity of existing streams and storm sewers, and greatly increases the cost to the public to manage stormwater.
- B. Inadequate planning and management of stormwater runoff resulting from land development and redevelopment throughout a watershed can also harm surface water resources by changing the natural hydrologic patterns, accelerating stream flows (which increase scour and erosion of stream-beds and stream-banks thereby elevating sedimentation), destroying aquatic habitat and elevating aquatic pollutant concentrations and loadings such as sediments, nutrients, heavy metals and pathogens. Groundwater resources are also impacted through loss of recharge.
- C. A program of stormwater management, including reasonable regulation of land development and redevelopment causing loss of natural infiltration, is fundamental to the public health, safety, welfare, and the protection of the people of the Municipality and all the people of the Commonwealth, their resources, and the environment.
- D. 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.
- E. Public education on the control of pollution from stormwater is an essential component in successfully addressing stormwater.
- F. Federal and state regulations require certain municipalities to implement a program of stormwater controls. These municipalities are required to obtain a permit for stormwater discharges from their separate storm sewer systems under the National Pollutant Discharge Elimination System (NPDES).
- G. Non-stormwater discharges to municipal separate storm sewer systems can contribute to pollution of waters of the Commonwealth by the Municipality.

Section 103. Purpose

The purpose of this Ordinance is to promote health, safety, and welfare within the Municipality and its watershed by minimizing the harms and maximizing the benefits described in Section 102 of this Ordinance, through provisions designed to:

- A. Manage stormwater runoff impacts at their source by regulating activities that cause the problems.
- B. Provide review procedures and performance standards for stormwater planning and management.
- C. Utilize and preserve the existing natural drainage systems as much as possible.
- D. Manage stormwater impacts close to the runoff source, which requires a minimum of structures and relies on natural processes.
- E. Focus on infiltration of stormwater, to maintain groundwater recharge, to prevent degradation of surface and groundwater quality and to otherwise protect water resources.
- F. Maintain existing flows and quality of streams and watercourses.
- G. 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.
- H. Prevent scour and erosion of streambanks and streambeds.
- I. Provide for proper operations and maintenance of all permanent stormwater management BMPs that are implemented in the Municipality.
- J. Provide a mechanism to identify controls necessary to meet the NPDES permit requirements.
- K. Implement an illegal discharge detection and elimination program to address non-stormwater discharges into the Municipality’s separate storm sewer system.

Section 104. Statutory Authority

The Municipality is empowered to regulate land use activities that affect stormwater impacts by the authority of the [cite relevant sections of the applicable municipal code (e.g., 53 P.S. §§ 55101 et seq.—First Class Township Code) and/or the Municipalities Planning Code—confer with municipal solicitor].

Section 105. Applicability

- A. This Ordinance applies to any Regulated Earth Disturbance activities within the Municipality, and all stormwater runoff entering into the Municipality’s separate storm sewer system from lands within the boundaries of the Municipality.
- B. Earth Disturbance activities and associated stormwater management controls are also regulated under existing state law and implementing regulations. This Ordinance shall operate in coordination with those parallel requirements; the requirements of this Ordinance shall be no less restrictive in meeting the purposes of this Ordinance than state law.

Section 106. Repealer

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

Section 107. Severability

In the event that any section or provision of this Ordinance is declared invalid by a court of competent jurisdiction, such decision shall not affect the validity of any of the remaining provisions of this Ordinance.

Section 108. Compatibility with Other Requirements

- A. Approvals issued and actions taken under this Ordinance do not relieve the Applicant of the responsibility to secure required permits or approvals for activities regulated by any other code, law, regulation or ordinance. To the extent that this Ordinance imposes more rigorous or stringent requirements for stormwater management, the specific requirements contained in this Ordinance shall be followed.
- B. Nothing in this Ordinance shall be construed to affect any of the Municipality's requirements regarding stormwater matters which do not conflict with the provisions of this Ordinance, such as local stormwater management design criteria (e.g. inlet spacing, inlet type, collection system design and details, outlet structure design, etc.). Conflicting provisions in other municipal ordinances or regulations shall be construed to retain the requirements of this ordinance addressing State Water Quality Requirements.

ARTICLE II - DEFINITIONS

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

- A. Words used in the present tense include the future tense; the singular number includes the plural, and the plural number includes the singular; words of masculine gender include feminine gender; and words of feminine gender include masculine gender.
- B. The word "includes" or "including" shall not limit the term to the specific example but is intended to extend its meaning to all other instances of like kind and character.
- C. The words "shall" and "must" are mandatory; the words "may" and "should" are permissive.

Accelerated Erosion - The removal of the surface of the land through the combined action of human activities and the natural processes, at a rate greater than would occur because of the natural process alone.

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.

BMP (Best Management Practice) - Activities, facilities, designs, measures or procedures used to manage stormwater impacts from Regulated Earth Disturbance activities, to meet State Water Quality Requirements, to promote groundwater recharge and to otherwise meet the purposes of this Ordinance.

BMPs include but are not limited to infiltration, filter strips, low impact design, bioretention, wet ponds, permeable paving, grassed swales, forested buffers, sand filters and detention basins.

Conservation District - The _____ County Conservation District.

DEP - The Pennsylvania Department of Environmental Protection.

Developer - A person that seeks to undertake any Regulated Earth Disturbance activities at a project site in the Municipality.

Development - See "Earth Disturbance Activity." The term includes redevelopment.

Development Site - The specific tract of land where any Earth Disturbance activities in the Municipality are planned, conducted or maintained.

Earth Disturbance Activity - 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 and the moving, depositing, stockpiling, or storing of soil, rock or earth materials.

Erosion - The process by which the surface of the land, including channels, is worn away by water, wind, or chemical action.

Erosion and Sediment Control Plan - A plan for a project site which identifies BMPs to minimize accelerated erosion and sedimentation.

Groundwater Recharge - Replenishment of existing natural underground water supplies.

Impervious Surface - A surface that prevents the infiltration of water into the ground. Impervious surface includes, but is not limited to, any roof, parking or driveway areas, and any new streets and sidewalks. Any surface areas designed to initially be gravel or crushed stone shall be assumed to be impervious surfaces.

Municipality - _____, _____ County, Pennsylvania.

NPDES - National Pollutant Discharge Elimination System, the federal government's system for issuance of permits under the Clean Water Act, which is delegated to DEP in Pennsylvania.

Outfall - "Point source" as described in 40 CFR § 122.2 at the point where the Municipality's storm sewer system discharges to surface waters of the Commonwealth.

Person - An individual, partnership, public or private association or corporation, or a governmental unit, public utility or any other legal entity whatsoever which is recognized by law as the subject of rights and duties.

Point Source - any discernible, confined and discrete conveyance, including, but not limited to, any pipe, ditch, channel, tunnel, or conduit from which stormwater is or may be discharged, as defined in State regulations at 25 Pa. Code § 92.1.

Project Site - The specific area of land where any Regulated Earth Disturbance activities in the Municipality are planned, conducted or maintained.

Redevelopment - Earth Disturbance activities on land which has previously been disturbed or developed.

Regulated Earth Disturbance Activity - Earth disturbance activity one acre or more with a point source discharge to surface waters or the Municipality's storm sewer system, or five acres or more regardless of the planned runoff. This includes earth disturbance on any portion of, part, or during any stage of, a larger common plan of development. This only includes road maintenance activities involving 25 acres or more or earth disturbance.

Road Maintenance - earth disturbance activities within the existing road cross-section, such as grading and repairing existing unpaved road surfaces, cutting road banks, cleaning or clearing drainage ditches and other similar activities.

Separate Storm Sewer System - A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels or storm drains) primarily used for collecting and conveying stormwater runoff.

State Water Quality Requirements - As defined under state regulations -- protection of *designated* and *existing* uses (See 25 Pa. Code Chapters 93 and 96)--including:

- A. Each stream segment in Pennsylvania has a "designated use," such as "cold water fishery" or "potable water supply," which are listed in Chapter 93. These uses must be protected and maintained, under state regulations.
- B. "Existing uses" are those attained as of November 1975, regardless whether they have been designated in Chapter 93. Regulated Earth Disturbance activities must be designed to protect and maintain existing uses and maintain the level of water quality necessary to protect those uses in all streams, and to protect and maintain water quality in special protection streams.
- C. Water quality involves the chemical, biological and physical characteristics of surface water bodies. After Regulated Earth Disturbance activities are complete, these characteristics can be impacted by addition of pollutants such as sediment, and changes in habitat through increased flow volumes and/or rates as a result of changes in land surface area from those activities. Therefore, permanent discharges to surface waters must be managed to protect the stream bank, streambed and structural integrity of the waterway, to prevent these impacts.

Stormwater - The surface runoff generated by precipitation reaching the ground surface.

Surface 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 water, or parts thereof, whether natural or artificial, within or on the boundaries of this Commonwealth.

Watercourse - A channel or conveyance of surface water, such as a stream or creek, having defined bed and banks, whether natural or artificial, with perennial or intermittent flow.

Watershed - Region or area drained by a river, watercourse or other body of water, whether natural or artificial.

ARTICLE III - STORMWATER MANAGEMENT FOR WATER QUALITY

Section 301. General Requirements for Stormwater Management

- A. 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:
 - 1. Erosion and Sediment control during the earth disturbance activities (e.g., during construction), and
 - 2. Water quality protection measures after completion of earth disturbance activities (e.g., after construction), including operations and maintenance.
- B. No Regulated Earth Disturbance activities within the Municipality shall commence until the requirements of this Ordinance are met.
- C. Erosion and sediment control during Regulated Earth Disturbance activities shall be addressed as required by Section 303.
- D. Post-construction water quality protection shall be addressed as required by Section 304. Operations and maintenance of permanent stormwater BMPs shall be addressed as required by Article IV.
- E. 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 determined by the Municipality.
- F. Techniques described in Appendix A (Low Impact Development) of this Ordinance are encouraged, because they reduce the costs of complying with the requirements of this Ordinance and the State Water Quality Requirements.

Section 302. Permit Requirements by Other Government Entities

The following permit requirements may apply to certain Regulated Earth Disturbance activities, and must be met prior to commencement of Regulated Earth Disturbance activities, as applicable:

- A. All Regulated Earth Disturbance activities subject to permit requirements by DEP under regulations at 25 Pa. Code Chapter 102.
- B. Work within natural drainageways subject to permit by DEP under 25 Pa. Code Chapter 105.
- C. 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.

- D. 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).
- E. 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.

Section 303. Erosion and Sediment Control During Regulated Earth Disturbance Activities

- A. No Regulated Earth Disturbance activities within the Municipality shall commence until approval by the Municipality of an Erosion and Sediment Control Plan for construction activities.
- B. 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).
- C. In addition, under 25 Pa. Code Chapter 92, a DEP “NPDES Construction Activities” permit is required for Regulated Earth Disturbance activities.
- D. 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. The issuance of an NPDES Construction Permit (or permit coverage under the statewide General Permit (PAG-2) satisfies the requirements subsection 303.A. [*]

[This sentence is optional -- if the municipality has additional or more stringent requirements than those in state regulations, then this sentence should not be used.]*

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

Section 304. Water Quality Requirements After Regulated Earth Disturbance Activities Are Complete

- A. No Regulated Earth Disturbance activities within the Municipality shall commence until approval by the Municipality of a plan which demonstrates compliance with State Water Quality Requirements after construction is complete.
- B. The BMPs must be designed, implemented and maintained to meet State Water Quality Requirements, and any other more stringent requirements as determined by the Municipality.
- C. To control post-construction stormwater impacts from Regulated Earth Disturbance activities, State Water Quality Requirements can be met by BMPs, including site design, which provide for replication of pre-construction stormwater infiltration and runoff conditions, so that post-construction stormwater discharges do not degrade the physical, chemical or biological characteristics of the receiving waters. As described in the DEP Comprehensive Stormwater Management Policy (#392-0300-002, September 28, 2002), this may be achieved by the following:

1. Infiltration: replication of pre-construction stormwater infiltration conditions,
2. Treatment: use of water quality treatment BMPs to ensure filtering out of the chemical and physical pollutants from the stormwater runoff, and
3. Streambank and Streambed Protection: management of volume and rate of post-construction stormwater discharges to prevent physical degradation of receiving waters (e.g., from scouring).

D. DEP has regulations that require municipalities to ensure design, implementation and maintenance of Best Management Practices (“BMPs”) that control runoff from new development and redevelopment after Regulated Earth Disturbance activities are complete. These requirements include the need to implement post-construction stormwater BMPs with assurance of long-term operations and maintenance of those BMPs.

E. Evidence of any necessary permit(s) for Regulated Earth Disturbance activities from the appropriate DEP regional office must be provided to the Municipality. The issuance of an NPDES Construction Permit (or permit coverage under the statewide General Permit (PAG-2)) satisfies the requirements of subsection 304.A. [*]

[This sentence is optional -- if the municipality has additional or more stringent requirements than those in state regulations, then this sentence should not be used.]*

F. BMP operations and maintenance requirements are described in Article IV of this Ordinance.

ARTICLE IV – STORMWATER BMP OPERATIONS AND MAINTENANCE PLAN REQUIREMENTS

Section 401. General Requirements

A. No Regulated Earth Disturbance activities within the Municipality shall commence until approval by the Municipality of BMP Operations and Maintenance plan which describes how the permanent (e.g., post-construction) stormwater BMPs will be properly operated and maintained.

B. The following items shall be included in the BMP Operations and Maintenance Plan:

1. Map(s) of the project area, in a form that meets the requirements for recording at the offices of the Recorder of Deeds of _____ County, and shall be submitted on 24-inch x 36-inch or 30-inch x 42-inch sheets. The contents of the maps(s) shall include, but not be limited to:
 - a. Clear identification of the location and nature of permanent stormwater BMPs,
 - b. The location of the project site relative to highways, municipal boundaries or other identifiable landmarks,
 - c. Existing and final contours at intervals of two feet, or others as appropriate,
 - d. Existing streams, lakes, ponds, or other bodies of water within the project site area,
 - e. Other physical features including flood hazard boundaries, sinkholes, streams, existing drainage courses, and areas of natural vegetation to be preserved,

- f. The locations of all existing and proposed utilities, sanitary sewers, and water lines within 50 feet of property lines of the project site,
- g. Proposed final changes to the land surface and vegetative cover, including the type and amount of impervious area that would be added,
- h. Proposed final structures, roads, paved areas, and buildings, and
- i. A fifteen-foot wide access easement around all stormwater BMPs that would provide ingress to and egress from a public right-of-way.

2. A description of how each permanent stormwater BMP will be operated and maintained, and the identity of the person(s) responsible for operations and maintenance,
3. The name of the project site, the name and address of the owner of the property, and the name of the individual or firm preparing the Plan, and
4. A statement, signed by the landowner, acknowledging that the stormwater BMPs are fixtures that can be altered or removed only after approval by the Municipality.

Section 402. Responsibilities for Operations and Maintenance of BMPs

- A. The BMP Operations and Maintenance Plan for the project site shall establish responsibilities for the continuing operation and maintenance of all permanent stormwater BMPs, as follows:
 1. If a Plan includes structures or lots which are to be separately owned and in which streets, sewers and other public improvements are to be dedicated to the Municipality, stormwater BMPs may also be dedicated to and maintained by the Municipality;
 2. If a Plan includes operations and maintenance by a single ownership, or if sewers and other public improvements are to be privately owned and maintained, then the operation and maintenance of stormwater BMPs shall be the responsibility of the owner or private management entity.
- B. The Municipality shall make the final determination on the continuing operations and maintenance responsibilities. The Municipality reserves the right to accept or reject the operations and maintenance responsibility for any or all of the stormwater BMPs.

Section 403. Municipality Review of BMP Operations and Maintenance Plan

- A. The Municipality shall review the BMP Operations and Maintenance Plan for consistency with the purposes and requirements of this ordinance, and any permits issued by DEP.
- B. The Municipality shall notify the Applicant in writing whether the BMP Operations and Maintenance Plan is approved.
- C. The Municipality may require an "As-Built Survey" of all stormwater BMPs, and an explanation of any discrepancies with the Operations and Maintenance Plan.

Section 404. Adherence to Approved BMP Operations and Maintenance Plan

It shall be unlawful to alter or remove any permanent stormwater BMP required by an approved BMP Operations and Maintenance Plan, or to allow the property to remain in a condition which does not conform to an approved BMP Operations and Maintenance Plan, unless an exception is granted in writing by the Municipality.

Section 405. Operations and Maintenance Agreement for Privately Owned Stormwater BMPs

- A. The property owner shall sign an operations and maintenance agreement with the Municipality covering all stormwater BMPs that are to be privately owned. The agreement shall be substantially the same as the agreement in Appendix B of this Ordinance.
- B. Other items may be included in the agreement where determined necessary to guarantee the satisfactory operation and maintenance of all permanent stormwater BMPs. The agreement shall be subject to the review and approval of the Municipality.

Section 406. Stormwater Management Easements

- A. Stormwater management easements are required for all areas used for off-site stormwater control, unless a waiver is granted by the Municipal Engineer.
- B. Stormwater management easements shall be provided by the property owner if necessary for (1) access for inspections and maintenance, or (2) preservation of stormwater runoff conveyance, infiltration, and detention areas and other BMPs, by persons other than the property owner. The purpose of the easement shall be specified in any agreement under Section 405.

Section 407. Recording of Approved BMP Operations and Maintenance Plan and Related Agreements

- A. The owner of any land upon which permanent BMPs will be placed, constructed or implemented, as described in the BMP Operations and Maintenance Plan, shall record the following documents in the Office of the Recorder of Deeds for _____ County, within 15 days of approval of the BMP Operations Plan by the Municipality:
 1. The Operations and Maintenance Plan, or a summary thereof,
 2. Operations and Maintenance Agreements under Section 405, and
 3. Easements under Section 406.
- B. The Municipality may suspend or revoke any approvals granted for the project site upon discovery of the failure of the owner to comply with this Section.

Section 408. Municipal Stormwater BMP Operation and Maintenance Fund

- A. If stormwater BMPs are accepted by the municipality for dedication, the Municipality may require persons installing stormwater BMPs to pay a specified amount to the Municipal

Stormwater BMP Operation and Maintenance Fund, to help defray costs of operations and maintenance activities. The amount may be determined as follows:

1. If the BMP is to be owned and maintained by the Municipality, the amount shall cover the estimated costs for operations and maintenance for ten (10) years, as determined by the Municipality.
2. The amount shall then be converted to present worth of the annual series values.

B. If a BMP is proposed that also serves as a recreation facility (e.g. ball field, lake), the Municipality may adjust the amount due accordingly.

ARTICLE V-INSPECTIONS AND RIGHT OF ENTRY

Section 501. Inspections

- A. DEP or its designees (e.g., County Conservation Districts) normally ensure compliance with any permits issued, including those for stormwater management. In addition to DEP compliance programs, the Municipality or its designee may inspect all phases of the construction, operations, maintenance and any other implementation of stormwater BMPs.
- B. During any stage of the Regulated Earth Disturbance activities, if the Municipality or its designee determines that any BMPs are not being implemented in accordance with this Ordinance, the Municipality may suspend or revoke any existing permits or other approvals until the deficiencies are corrected.

Section 502. Right of Entry

- A. Upon presentation of proper credentials, duly authorized representatives of the Municipality may enter at reasonable times upon any property within the Municipality to inspect the implementation, condition, or operation and maintenance of the stormwater BMPs in regard to any aspect governed by this Ordinance.
- B. BMP owners and operators shall allow persons working on behalf of the Municipality ready access to all parts of the premises for the purposes of determining compliance with this Ordinance.
- C. Persons working on behalf of the Municipality shall have the right to temporarily locate on any BMP in the Municipality such devices as are necessary to conduct monitoring and/or sampling of the discharges from such BMP.
- D. Unreasonable delays in allowing the Municipality access to a BMP is a violation of this Article.

ARTICLE VI - FEES AND EXPENSES

Section 601. General

The Municipality may charge a reasonable fee for review of BMP Operations and Maintenance Plans to defray review costs incurred by the Municipality. The Applicant shall pay all such fees.

Section 602. Expenses Covered by Fees

The fees required by this Ordinance may cover:

- A. Administrative/clerical Costs.
- B. The review of the BMP Operations and Maintenance Plan by the Municipal Engineer.
- C. The site inspections including, but not limited to, pre-construction meetings, inspections during construction of stormwater BMPs, and final inspection upon completion of the stormwater BMPs.
- D. Any additional work required to monitor and enforce any provisions of this Ordinance, correct violations, and assure proper completion of stipulated remedial actions.

ARTICLE VII- PROHIBITIONS

Section 701. Prohibited Discharges

- A. 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 B below, and (2) discharges allowed under a state or federal permit.
- B. Discharges which may be allowed, based on a finding by the Municipality that the discharge(s) do not significantly contribute to pollution to surface waters of the Commonwealth, are:

Discharges from fire fighting activities	Uncontaminated water from foundation or from footing drains
Potable water sources including dechlorinated water line and fire hydrant flushings	Flows from riparian habitats and wetlands
Irrigation drainage	Lawn watering
Routine external building washdown (which does not use detergents or other compounds)	Pavement washwaters 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
Air conditioning condensate	Dechlorinated swimming pool discharges
Water from individual residential car washing	Uncontaminated groundwater
Springs	
Water from crawl space pumps	

- C. In the event that the Municipality determines that any of the discharges identified in Subsection B significantly contribute to pollution of waters of the Commonwealth, or is so notified by DEP, the Municipality will notify the responsible person to cease the discharge.
- D. Upon notice provided by the Municipality under subsection C, the discharger will have a reasonable time, as determined by the Municipality, to cease the discharge consistent with the degree of pollution caused by the discharge.

E. Nothing in this Section shall affect a discharger's responsibilities under state law.

Section 702. Prohibited Connections

A. The following connections are prohibited, except as provided in Section 701.B above:

1. any drain or conveyance, whether on the surface or subsurface, which allows any non-storm water 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
2. 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.

Section 703. Roof drains

- A. Roof drains shall not be connected to streets, sanitary or storm sewers or roadside ditches, except as provided in Section 703.B.
- B. When it is more advantageous to connect directly to streets or storm sewers, connections of roof drains to streets or roadside ditches may be permitted by the Municipality.
- C. Roof drains shall discharge to infiltration areas or vegetative BMPs to the maximum extent practicable.

Section 704. Alteration of BMPs

- A. No person shall modify, remove, fill, landscape or alter any existing stormwater BMP, unless it is part of an approved maintenance program, without the written approval of the Municipality.
- B. No person shall place any structure, fill, landscaping or vegetation into a stormwater BMP or within a drainage easement, which would limit or alter the functioning of the BMP, without the written approval of the Municipality.

ARTICLE VIII - ENFORCEMENT AND PENALTIES

Section 801. Public Nuisance

- A. The violation of any provision of this ordinance is hereby deemed a Public Nuisance.
- B. Each day that a violation continues shall constitute a separate violation.

Section 802. Enforcement Generally

- A. Whenever the Municipality finds that a person has violated a prohibition or failed to meet a requirement of this Ordinance, the Municipality may order compliance by written notice to the responsible person. Such notice may require without limitation:

1. The performance of monitoring, analyses, and reporting;
2. The elimination of prohibited connections or discharges;
3. Cessation of any violating discharges, practices, or operations;
4. The abatement or remediation of storm water pollution or contamination hazards and the restoration of any affected property;
5. Payment of a fine to cover administrative and remediation costs;
6. The implementation of stormwater BMPs; and
7. Operation and maintenance of stormwater BMPs.

B. Such notification shall set forth the nature of the violation(s) and establish a time limit for correction of these violation(s). Said notice may further advise that, if applicable, should the violator fail to take the required action within the established deadline, the work will be done by the Municipality or designee and the expense thereof shall be charged to the violator.

C. Failure to comply within the time specified shall also subject such person to the penalty provisions of this Ordinance. All such penalties shall be deemed cumulative and shall not prevent the Municipality from pursuing any and all other remedies available in law or equity.

Section 803. Suspension and Revocation of Permits and Approvals

A. Any building, land development or other permit or approval issued by the Municipality may be suspended or revoked by the Municipality for:

1. Non-compliance with or failure to implement any provision of the permit;
2. A violation of any provision of this Ordinance; or
3. The creation of any condition or the commission of any act during construction or development which constitutes or creates a hazard or nuisance, pollution or which endangers the life or property of others.

B. A suspended permit or approval shall be reinstated by the Municipality when:

1. The Municipal Engineer or designee has inspected and approved the corrections to the stormwater BMPs, or the elimination of the hazard or nuisance, and/or;
2. The Municipality is satisfied that the violation of the Ordinance, law, or rule and regulation has been corrected.

C. A permit or approval which has been revoked by the Municipality cannot be reinstated. The applicant may apply for a new permit under the procedures outlined in this Ordinance.

Section 804. Penalties

A. Any person violating the provisions of this ordinance shall be guilty of a misdemeanor, and upon conviction shall be subject to a fine of not more than \$ _____ for each violation, recoverable

with costs, or imprisonment of not more than _____ days, or both. Each day that the violation continues shall be a separate offense.

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

Section 805. Appeals

Any person aggrieved by any action of the Municipality or its designee, relevant the provisions of this ordinance, may appeal to the relevant judicial or administrative body according to law, within the time period allowed.

ENACTED and ORDAINED at a regular meeting of the _____ on the _____ of _____, 19___. This Ordinance shall take effect immediately.

[Name]

[Title]

ATTEST:

Secretary

I hereby certify that the foregoing Ordinance was advertised in the _____ on _____, 19___, a newspaper of general circulation in the municipality and was duly enacted and approved as set forth at a regular meeting of the municipality's governing body held on _____, 19___.

Secretary

APPENDIX A

LOW IMPACT DEVELOPMENT 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.

APPENDIX B

STORMWATER BEST MANAGEMENT PRACTICES OPERATIONS AND MAINTENANCE AGREEMENT

THIS AGREEMENT, made and entered into this _____ day of _____, 200____, by and between _____, (hereinafter the “Landowner”), and _____, _____ County, Pennsylvania, (hereinafter “Municipality”);

WITNESSETH

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

WHEREAS, the Landowner is proceeding to build and develop the Property; and
WHEREAS, the stormwater management BMP Operations and Maintenance Plan approved by the Municipality (hereinafter referred to as the “Plan”) for the property identified herein, which is attached hereto as Appendix A and made part hereof, as approved by the Municipality, provides for management of stormwater within the confines of the Property through the use of Best Management Practices (BMP’s); and

WHEREAS, the Municipality, and the Landowner, his successors and assigns, agree that the health, safety, and welfare of the residents of the Municipality and the protection and maintenance of water quality require that on-site stormwater Best Management Practices 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 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,
- 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 BMP's 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. and

NOW, THEREFORE, in consideration of the foregoing promises, the mutual covenants contained herein, and the following terms and conditions, 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 Plan.
2. The Landowner shall operate and maintain the BMP(s) 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.
3. 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 BMP(s) whenever it deems necessary. Whenever possible, the Municipality shall notify the Landowner prior to entering the property.
4. In the event the Landowner fails to operate and maintain the BMP(s) 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 BMP(s). 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.

5. In the event the Municipality, pursuant to this Agreement, performs work of any nature, or expends any funds in performance of said work for labor, use of equipment, supplies, materials, and the like, the Landowner shall reimburse the Municipality for all expenses (direct and indirect) incurred within 10 days of receipt of invoice from the Municipality.
6. The intent and purpose of this Agreement is to ensure the proper maintenance of the onsite BMP(s) 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.
7. 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 BMP(s) 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.
8. The Municipality shall inspect the BMP(s) at a minimum of once every three years to ensure their continued functioning.

This Agreement shall be recorded at the Office of the Recorder of Deeds of _____ 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 _____, 20____, do hereby certify that _____ whose name(s) is/are signed to the foregoing Agreement bearing date of the _____ day of _____, 20____, has acknowledged the same before me in my said County and State.

GIVEN UNDER MY HAND THIS _____ day of _____, 200____.

NOTARY PUBLIC

(SEAL)

**?????? TOWNSHIP
?????? COUNTY, PENNSYLVANIA
ORDINANCE 2003-??**

AN ORDINANCE OF ????? TOWNSHIP, ????? COUNTY, PENNSYLVANIA AMENDING THE ????? TOWNSHIP SUBDIVISION AND LAND DEVELOPMENT ORDINANCE TO CREATE A NEW ARTICLE XII ENTITLED SINKHOLE/CARBONATE REGULATIONS TO PROVIDE FOR REGULATIONS PERTAINING TO SUBDIVISION AND LAND DEVELOPMENT IN AREAS PRONE TO SINKHOLES AND FURTHER AMENDING THE ????? TOWNSHIP SUBDIVISION AND LAND DEVELOPMENT ORDINANCE PRELIMINARY PLAN FOR MAJOR SUBDIVISIONS OR LAND DEVELOPMENT CHECKLIST AND LIST OF SUBMITTAL REQUIREMENTS GOVERNING ALL DOCUMENTATION PERTAINING TO RELEVANT INFORMATION CONCERNING SINKHOLES WHICH MUST BE SUBMITTED WITH LAND DEVELOPMENT OR SUBDIVISION APPLICATIONS.

WHEREAS, the ????? Township Board of Supervisors believes it is necessary to promote safe development; and

WHEREAS, a substantial amount of the land in ????? Township has been found to be susceptible to the development of sinkholes (all lands mapped geologically as limestone and/or dolomite - formations present in ????? Township consist of Epler, Rickenbach, Allentown and Leithsville Formations); and

WHEREAS, the Board of Supervisors is of the belief that the susceptibility of a property to the development of sinkholes is an important issue for property owners and/or developers to address and provide relevant information pertaining to identification and remediation or problems associated with the same when filing applications for subdivision and land development approvals to the Township; and

WHEREAS, the Board of Supervisors believes it is in the best interest of the health, safety and welfare of the residents to take a proactive approach to minimize the risk of sinkhole occurrences in the areas of new development and to the lands adjacent to these developments; and

WHEREAS, said proposed ordinance has been forwarded to the Lehigh Valley Planning Commission for review and comment; and

WHEREAS, said proposed amendment has been forwarded to the ????? Township Planning Commission for review and comment; and

WHEREAS, the ????? Township Board of Supervisors has held a public hearing on

after giving appropriate public notice regarding the review and enactment of the proposed amendments to the ?????? Township Subdivision and Land Development Ordinance;

NOW THEREFORE, BE IT ENACTED AND ORDAINED, by the Township of ??????, ?????? County, Pennsylvania, by the authority vested in the ?????? Township Board of Supervisors via the act of the General Assembly of the Commonwealth of Pennsylvania known and cited as the Pennsylvania Municipalities Planning Code as amended as follows:

I. The ?????? Township Subdivision and Land Development Ordinance shall be amended to include a new Article XII entitled “Sinkhole/Carbonate Regulations”, which shall read as follows:

Article XII **Sinkhole/Carbonate Regulations**

A. Purpose

The Township’s topography may be defined as karst topography due to the presence of carbonate bedrock that generally consists of dolomite and limestone. The limestone and dolomite are divided into formations. The carbonate formations present in the Township consist of Epler, Rickenbach, Allentown, and Leithsville Formations. These formations are susceptible to the development of solution cavities and sinkhole development. Therefore, anyone considering developing property within the Township ~~bewares~~ of the potential geological hazards. The regulations ~~contained herein~~ are intended to minimize the risk of sinkhole occurrence in areas of new development and on lands adjacent to these developments.

B. Governance

The regulations established by this ordinance shall apply to all land development or subdivision applications pertaining to commercial, governmental (except those owned by the Township), ~~industrial~~/office structures, apartment complexes, and multiple single family home developments with three or more lots.

A Carbonate Ordinance Assessment Report will be required as part of the land development or subdivision project applications that are submitted to the Township for all commercial, governmental (except those owned by the Township), industrial/office structures, apartment complexes, and multiple single family home developments with three or more lots.

C. Exemptions

All single family homes and the alteration of single family homes to include detached structures such as garages, barns and swimming pools shall be exempt from the regulations established in this section.

D. Specific Carbonate Ordinance Regulations

1. All of the following specific requirements shall apply to land developments and/or subdivisions covered by this ordinance:

a. No buildings, structures, parking lots, roads, stormwater management facilities shall be placed in or over the following features if unremediated in accordance with the terms of this ordinance: sinkholes, closed depressions, lineaments, fractures, faults, ghost lakes or disappearing streams or similar topographic features. [Need for a clear and proper definition of “remediation of sinkholes and/or associated problems” to be added to this ordinance to substantiate this requirement as stated. Suggestion: “For any existing sinkhole or subsidence problems within the site boundaries, a Sinkhole Remediation Plan will be developed by the Developer/Applicant’s Professional Engineer or Professional Geologist, licensed in the Commonwealth of Pennsylvania, and shall be submitted to the Township Engineer for review and approval, as part of the Carbonate Ordinance Assessment Report. The Township reserves the right to reject any plan that in their opinion was authored by an individual or firm which does not possess the background to properly develop the Sinkhole Remediation Plan, as it relates to this ordinance. The Developer/Applicant will be responsible for implementing the Sinkhole Remediation Plan. All remediation work must be completed before final plan approval for the proposed project.” All sinkholes are different and require different types of remediation.]

b. Buildings, structures and stormwater management basins shall be located no closer than 100 feet from the rim of unremediated sinkholes, closed depressions or disappearing streams and no closer than 50 feet from lineaments, fractures or faults or similar topographic features.

c. Outflow from a stormwater management basin and/or post development stormwater flows shall not be directed to any of the following carbonate features: Sinkholes, closed depressions, lineaments, fractures, caverns, ghost lakes or disappearing streams or similar topographic features.

d. Lagoons containing substances defined as toxic and/or harmful by the Pennsylvania Department of Environmental Protection are not permitted. [Unless PADEP or local regulations do not allow such lagoons, it seems as though a properly designed and lined lagoon would be allowable, or permitted.]

e. Storage and handling areas for toxic or harmful materials must have impermeable surfaces designed to contain materials stored/handled from which they shall be directed to a predetermined collection point.

- f. The land application of harmful materials is not permitted.
- g. The underground storage of any toxic materials, except **permitted** gasoline and diesel fuel, shall be prohibited.
- h. All companies, businesses or other entities, including **governmental, handling** toxic or harmful materials shall inventory and register these materials with the Township and submit a spill contingency plan which meets state and federal environmental regulations.
- i. Groundwater monitoring devices, approved by the Township are required for all facilities handling toxic or harmful materials.
- j. Impermeable liners and all weather coverings are to be installed at all road de-icing salt facilities.
- k. Stormwater management facilities shall be designed to provide both water quantity and quality control, as required by Phase II of the National Pollution Discharge Elimination System program and in accordance with the ordinance developed for stormwater management in areas of Karst topography by the **Lehigh Valley Planning Commission.**

- 2. The Township Board of Supervisors shall not entertain requests for waivers from the requirements listed above until a Carbonate Ordinance Assessment Report, as required by **this** ordinance, has been supplied to the Planning Commission and the **Township Engineer** for their review and comment.

E. Carbonate Ordinance Assessment Report

- 1. All land developments and/or subdivisions covered by this ordinance shall be evaluated by a **Professional Engineer, licensed in the Commonwealth of Pennsylvania,** with expertise in **geotechnical engineering** and where necessary, **evaluation by** a Professional Geologist, **licensed in the Commonwealth of Pennsylvania.** A list of the engineer/geologist qualifications shall be submitted to the Township prior to the commencement of the **site** evaluation. The Township reserves the right to reject any report that in their opinion was authored by an individual or firm which does not possess the background to properly assess the site conditions as they relate to this ordinance. Further, the Carbonate Ordinance Assessment Report submitted to the Township must be signed and sealed by the **Professional Engineer, and if applicable, by the Professional Geologist.**

- 2. The format and content of the Carbonate Ordinance Assessment Report shall include, but not be limited to the following:

- a. Statement of Purpose: This section shall indicate those specific Carbonate Ordinance standards being addressed in the Report and whether the applicant is attempting to demonstrate compliance or justify non-compliance with those specific Carbonate Ordinance standards.

b. Description of Existing Conditions: This section shall present a description of existing characteristics of the property with respect to geology, topography, ground and surface water hydrology, soils, vegetation, and existing improvements and uses of property.

c. A map, at a scale no smaller than 1 inch = 100 feet and a contour interval of two feet, indicating the location of the property and all proposed improvements.

d. The Developer/Applicant shall submit information for the affected properties indicating the presence of any of the following carbonate features: depressions, fissures, lineaments, faults, fractures, ghost lakes, bedrock outcrops, sinkholes, seasonal high water levels, soil mottling, springs, surface drainage entering the ground, losing streams, disappearing lakes or streams and caverns.

e. A recommended plan for the repair or remediation of surface or subsurface features that may impact the proposed development as well as the adjacent improved or unimproved properties.

f. The Developer/Applicant shall describe in detail all stormwater management BMPs (all that convey, drain, or hold water) proposed for the project and shall justify the selection of said BMPs regarding their adequacy to prevent sinkholes and subsidence in the subsidence prone areas, both on and off-site (if off-site discharge to karst areas is proposed).

The information requested above shall be based upon field surveys which may include test borings, excavation of test pits, air-track probes, geophysical methods, and previously published data, as necessary to accurately characterize subsidence prone areas within the site boundaries. If any off-site discharge of stormwater to karst areas is proposed, similar study of those off-site areas shall be required of the Developer/Applicant.

3. In addition to the Carbonate Ordinance Assessment Report, the Developer shall also be required to provide the following information:

a. A plan indicating the existing and proposed drainage conditions, locations of all proposed private and public sewage disposal systems, and the location of existing private and public water supplies on adjoining properties.

b. Type, location and phasing of proposed site disturbance and construction, as well as proposed future ownership, utilization, and maintenance of the property and the proposed improvements.

c. Proposed measures to control potential adverse environmental impacts on groundwater quality, stormwater management, or groundwater withdrawal resulting from the development and utilization of the property.

d. Plans describing the design and construction of the proposed stormwater management facilities for the project. Descriptions of the minimum requirements are outlined below.

4. Stormwater Management:

a. All submissions for proposed developments must include a stormwater management plan prepared in accordance with adopted regulations and which limits surface water runoff and the intrusion of concentrated flow of surface water into the subsurface. Facilities that are required as part of the stormwater management plan include the collection of all runoff from building roofs into storm drains by water tight gasketed joint conduits and the collection of surface water flow on pavements into drop inlets connected to a water tight gasketed joint storm water conduit. The stormwater conduit must discharge into lined detention basins. All stormwater detention and/or retention facilities shall outlet directly to existing, stable stream channels or other areas deemed safe for discharge in the Carbonate Ordinance Assessment Report.

b. Approved stormwater conduits include HDPE, PVC, concrete, steel, and cast iron pipe all with water tight rubber gaskets at each joint. The use of corrugated metal pipe is not permitted. Construction of the piping system must follow all other applicable ordinances. Where rock is encountered at or above the planned conduit design grade the rock shall be undercut and over excavated a minimum of one foot and backfilled with a compacted fine grained soil.

c. All detention/retention basins in areas of sinkhole prone soil shall be lined. The liner used in a detention basin may consist of a clay liner, a composite synthetic and soil liner or a synthetic liner. The type of liner required shall depend on the condition of the detention basin bottom and the probability of sinkhole occurrence resulting from the construction of the detention basin. The use of low flow channels may also be required depending on the duration and frequency of stormwater discharge into the detention basin. Subsurface detention systems must properly designed with impermeable liners and other sealing methods. The Townships Engineer shall make the final determination as to what is an acceptable form of liner for the proposed detention basins.

Additional items that must be included in the stormwater management plan include details with regard to the sealing of all pavement curbs and gutters, manholes and drop inlets.

F. Review Process.

1. The Carbonate Ordinance Assessment Report must be received by the Township when a plan is submitted for preliminary land development or subdivision approval. However, the Report may be submitted at the time of sketch plan review. Four copies of the Report shall be submitted to the Township. The Report shall be reviewed by the Township Engineer and other consultants as designated by the Township. Based on this review, the Township may require additional information to be submitted if the Township concludes that such information would be instrumental in assessing the proposed development as it relates to the Carbonate Ordinance.

2. Approvals Required.

Where compliance with this section is required as part of an application for subdivision or land development approval, the Township's decision on whether compliance has been achieved shall be **made part** of its review of the subdivision or land development application.

Where the application is part of a request for zoning permit, the zoning officer shall issue no permit until he/she receives adequate written substantiation from the **Township Engineer and other** appropriate designated experts referred to **above, that the** terms of this section, and any conditions imposed upon the use of the property at the time of subdivision or land development approval are satisfied.

G. Limitations.

In carbonate areas, alteration and development of land may be hazardous with respect to foundation safety of structures, the creation of unstable land as a result of changes in drainage, and the contamination of ground and surface waters. Within the limitations of the information available at the time of the review of individual applications, the Township shall attempt to make reasonable judgments as to the applicant's compliance with the Carbonate Ordinance. Under no circumstances shall the Township or any officer or employee of the Township or Consultant to the Township assume any liability for any damages that may result from an Applicant's or any interested party's reliance upon the regulations of the Carbonate Ordinance or any decisions made by the Township in the administration of such regulations by an applicant, developer, and/or any interested party.

II. The ????????? Township Preliminary Plan for Major Subdivision or Land Development Checklist and List of Submittal Requirements shall be amended to include a new subsection "Q" entitled "Carbonate/Sinkhole Ordinance Requirements." Said subsection shall read as follows:

A. Carbonate/Sinkhole Regulation Requirements

1. **Four (4)** copies of the Carbonate Ordinance Assessment Report.
2. A plan indicating the existing and proposed private and public sewage disposal systems and the location of existing private and public water supplies on adjoining properties.
3. Type, location, and phasing of proposed disturbances and construction, as well as, proposed future ownership and maintenance of the property and the proposed improvements, **including the stormwater management facilities.**
4. Plans describing the design of the proposed stormwater management **facilities for** the project.

B. All other terms, conditions, and provisions of the aforesaid ????????? Township

Subdivision and Land Development Ordinance shall remain in full force and effect.

C. This ordinance shall take effect five days after its adoption.

ENACTED AND ORDAINED into law by the ????????? Township Board of **Supervisors** this
day of , 2003.

???????????? TOWNSHIP BOARD OF SUPERVISORS

????????????, CHAIRMAN

ATTESTED BY:

????????????????, SECRETARY
TO THE BOARD OF SUPERVISORS

ORDINANCE ???

STORMWATER MANAGEMENT MODEL ORDINANCE

1. STATUTORY AUTHORITY

???? Township is empowered to regulate these activities by the authority of the Act of October 4, 1978, P.L.864 (Act 167), the “Stormwater Management Act”.

2. FINDINGS OF FACT

It is hereby determined that:

- A. Waterbodies, roadways, structures and other property within the municipality are at times subjected to flooding;
- B. Flooding is a danger to the lives and property of the public and is also a danger to the natural resources of the municipality and the region;
- C. Land development projects and activities alter the hydrologic response of watersheds resulting in increased stormwater runoff rates and volumes, increased flooding, increased stream channel erosion, channel incision and downcutting and increased sediment and pollutant transport and deposition;
- D. Land development projects and activities result in the construction of impervious surfaces, such as roads and parking lots, from which stormwater runoff flushes particulate and dissolved contaminants into streams and wetlands;
- E. Stormwater runoff, soil erosion, stream channel erosion and nonpoint source pollution resulting from land development activities within the municipality have resulted in a deterioration of the water resources of the municipality;
- F. Soil erosion, stream channel erosion and nonpoint source pollution can be controlled and minimized by the regulation of stormwater runoff from land development projects and activities;
- G. The State of Pennsylvania’s Surface Water Quality Standards (P.A.C. 25:93) establish surface water quality standards and antidegradation policies applicable to all surface waters of the state. These standards and antidegradation policies provide reasonable guidance to Pennsylvania municipalities for the regulation of stormwater runoff for purposes of protecting surface water resources from degradation;
- H. Impervious surfaces and re-graded earth surfaces associated with land development reduce the infiltration of rainfall and the recharge of groundwater resources.

It is therefore determined that it is in the public interest to regulate stormwater runoff from land development projects and other construction activities within???? Township as provided in this ordinance in order to control and minimize increases in stormwater runoff rates and volumes, to control and minimize soil erosion, stream channel erosion, and nonpoint source pollution associated with stormwater runoff and to provide for the recharge of groundwater resources.

3. PURPOSE

It is the purpose of this ordinance to establish standards and regulations for the management and discharge of the quantity, quality, velocity, and direction of stormwater runoff from land development projects and other construction activities in order to provide protection to downstream property owners, to control soil erosion and sedimentation and to protect the public general health, safety and welfare;

- A. To reduce artificially induced flood damage to public health, life, and property;
- B. To minimize increases to stormwater runoff rates and volumes;
- C. To minimize the deterioration of existing water courses, culverts, bridges, dams and other structures that would result from increased rates of stormwater runoff;
- D. To induce water recharge into the ground wherever suitable infiltration, soil permeability, and geological conditions exist;
- E. To prevent increases in nonpoint source pollution;
- F. To maintain the integrity and stability of stream channels for their biological functions, as well as for drainage, the conveyance of floodwater, and other purposes;
- G. To control and minimize soil erosion and the subsequent transport of sediment;
- H. To minimize public safety hazards at any stormwater detention facility constructed pursuant to subdivision or site plan approval;
- I. To maintain high water quality in all streams and other surface water bodies;
- J. To protect all surface water resources from degradation;
- K. To protect groundwater resources from degradation;
- L. To encourage the use of smart site design principles and techniques; and
- M. To maximize the use of biological technologies for the treatment of stormwater quantity and quality.

4. APPLICABILITY

This ordinance shall be applicable to any major subdivision or site plan application located within **????** Township, which involves a disturbance of 1,000 square feet or more. Provisions of this ordinance pertaining to runoff from roof areas and requirements for drywells shall also apply to all applications for building permits except as otherwise provided for herein. The ordinance shall be applied to achieve its purposes to the extent reasonable and practical with respect to modifications of previously developed sites consistent with the nature and extent of such modifications.

5. DEFINITIONS

Unless specifically defined below, or in Pennsylvania's Erosion and Sediment Control Standards (P.A.C. 25:102), or Pennsylvania's Water Quality Standards (P.A.C. 25:93), words or phrases used in this ordinance shall be interpreted so as to give them the meaning they have in common usage.

Agricultural development - land uses normally associated with the production of food, fiber, and/or livestock for sale. For purposes of this ordinance, such uses shall not include the development of land for the processing or sale of food and the manufacture of agriculturally related products.

Board of supervisors - ???? Township Board of Supervisors.

Constructed wetland - a man-made freshwater wetland, designed and constructed for a specific purpose.

Detention basin - an impoundment area created by constructing an embankment, excavating a pit, or both, for the purpose of temporarily storing stormwater.

Detention facility - a detention basin or alternative structure designed to store stormwater runoff.

Floodplain - The lands adjoining a river or stream that have been or may be expected to be inundated by floodwaters in a 100-year frequency flood.

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

Freshwater wetlands - an area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation; provided, however, that in designating a wetland, the three parameter approach (that is, hydrology, soils and vegetation) enumerated in the "Federal Manual for Identifying and Delineating Jurisdictional Wetlands," and any subsequent amendments thereto shall be used.

Infiltration facility - structure or device designed to infiltrate retained water to the subsurface and which is not an injection well. These facilities may be above grade or below grade.

NRCS - the Natural Resources Conservation Service of the U.S. Department of Agriculture.

Nonpoint source pollution - pollution from any source other than from any discernible, confined, and discrete conveyances, and shall include, but not be limited to, pollutants from agricultural, silvicultural, mining, construction, subsurface disposal and urban runoff sources.

PADEP - the Pennsylvania Department of Environmental Protection.

Recharge - the replenishment of underground water reserves.

Regulatory flood - the 100-Year flood along non-delineated watercourses or the Flood Hazard Area design flood along delineated watercourses.

Retention basin - an impoundment area with a permanent pool made by constructing an embankment, or excavating a pit, or both, for the purpose of temporarily storing stormwater. A retention basin is also called a "wet basin" or "wet detention basin".

Stormwater runoff - flow on the surface of the ground, resulting from precipitation.

Treatment train - a sequence of structures or devices through which runoff passes before exiting the project site. The combined characteristics of the individual structures or devices shall satisfy the performance requirements associated with the no net increase provisions of this ordinance.

Water quality storm - the storm for which 90 percent of the total annual runoff volume will occur in storms of equal or greater magnitude.

6. TECHNICAL STANDARDS

A. No Net Increase Goals

1. No net increase in nonpoint source pollution - Stormwater control systems shall be designed to prevent the degradation of water quality in receiving watercourses from nonpoint source pollution associated with stormwater runoff. PADEP Surface Water Quality Standards, (P.A.C. 25:93), shall be used for this determination. If water quality standards set by local watershed management authorities are applicable and are more stringent than the PADEP Surface Water Quality Standards (P.A.C. 25:93) these standards shall be used for the no net increase in nonpoint source pollution determination.
2. No net increase in sediment loadings - Stormwater control systems shall be designed to reduce to the maximum extent possible, the total suspended solids (TSS) from stormwater runoff for storm events with magnitudes as high as the Water Quality Storm and to retain, as closely as possible, the pre-development hydrologic response of the site and the watershed.
3. No net increase in stormwater runoff rates and stream channel erosion - Stormwater control systems shall be designed so that, to the maximum extent possible, the post-development stormwater runoff rates from the site and at any point in the watershed between the site are no greater than pre-development rates, in order to retain as closely as possible the pre-development hydrologic response of the site and the watershed.
4. No net increase in stormwater runoff volumes - Wherever suitable infiltration, soil permeability, and geological conditions exist, stormwater control systems shall be designed so that all stormwater runoff from impervious surfaces is infiltrated into the soil for the 2.04 inch, 24 hour storm (water quality design storm) as calculated for rainfall region 5 and 90% annual volume level in Appendix F of the Pennsylvania Handbook of Best Management Practices for Developing Areas (1998).

B. Procedures for Measuring Compliance with the No Net Increase Goals of the Ordinance

1. Hydrologic/hydraulic analyses shall be prepared and submitted demonstrating that the post-development stormwater runoff rates do not exceed the standards set forth in this ordinance for the water quality storm and the 2, 10, 25, 50 and 100-year storms.
 - a. The hydrologic and hydraulic analyses shall generally conform with methods developed by the Natural Resources Conservation Service and published in National Engineering Handbook, Section 4 - Hydrology, Technical Release No. 55 and Technical Release No. 20.
 - b. For calculations involving 200 acres or less, the rational method of Kuichling (1889) may be used. If the rational method is used, methods shall conform to those outlined in the Pennsylvania Erosion and Sediment Control Manual (2001).
 - c. Rainfall - Frequency relationships shall be as shown in Technical Paper No. 40, Rainfall Frequency Atlas of the United States published by the U.S. Weather Bureau, or the Rainfall Frequency Atlas of Pennsylvania. All calculations using the rational method shall use rainfall intensities consistent with appropriate times of concentration for overland flow and return periods from the PA Department of Transportation Design Rainfall Curves (1986).
 - d. Routing Model - Routing calculations shall be performed using an acceptable routing model such as HEC-1, HEC-HMS, or Hydroplus. The Storage-Indication Method should be used for routing calculations. For drainage areas greater than 20 acres in size, the design storm hydrograph shall be computed using a calculation method that produces a full hydrograph.
2. For infiltration facilities proposed to meet the no net increase goals of this ordinance, the results of a subsurface investigation and soil tests demonstrating the suitability of the area's soils and groundwater table for infiltration and treatment of runoff shall be provided.
3. Pollutant loading shall be calculated using acceptable methods including the Universal Soil Loss Equation (Wischmeier and Smith 1965, 1978) for sediment and the Simple Method (Schueler, T. 1987) for dissolved continuants.

C. Waivers from Strict Compliance

If the natural or existing physical characteristics of the project site preclude achievement of any of the above no net increase goals, the municipality may grant a waiver from strict compliance with the specific no net increase provisions the achievement of which are precluded, provided that the applicant demonstrates to the satisfaction of the Township Engineer that the adjacent waterways will not be impacted by the:

1. Deterioration or damage of existing culverts, bridges, dams, and other structures;

2. Deterioration of their biological functions, drainage, flood water conveyance, and other purposes;
3. Streambank or streambed erosion or siltation; and
4. Increased flooding endangering public health, life and property.

Where partial compliance with a specific no net increase provision is possible, the Township Engineer will direct the applicant to satisfy a reduced performance criterion. However, those no net provisions that are not precluded by the site's physical characteristics shall be met.

If one or more of the "no net increase" goals of this ordinance cannot be met on-site, the applicant shall provide off-site mitigation subject to the approval of the Planning Board/Zoning Board prior to project commencement. Options for mitigation are as follows:

1. The acquisition of privately owned lands, preferably adjacent to state open waters, located in the municipality can be dedicated for preservation or reforestation, in equivalent size to off-set the increase in volume of the Water Quality Storm from the proposed development site.
2. Mitigation can be performed on previously developed properties, public or private, within the municipality and preferably within the same drainage basin that currently lack stormwater management facilities designed and constructed in accordance with the purposes and standards of this ordinance. If infiltration is not feasible on the subject site, a construction cost estimate of a suitable infiltration system sized for the proposed development based on the assumption that average permeability had existed on the subject property shall be prepared and submitted by the applicant's professional engineer. Upon certification by the Township Engineer that the proposed design and estimate are reasonable, the amount so determined will be the amount required to provide other mitigation measures on previously developed or undeveloped properties.
3. Stormwater related studies or regional stormwater management plans can be funded or specific projects recommended by **????** Township can be implemented to the extent of the funds estimated under the procedure described in Paragraph 2 above. This requirement shall be applied equally to all applications for development and redevelopment within the municipality. Increased stormwater runoff shall be calculated by the applicant's engineer and approved by the Township Engineer utilizing accepted engineering practices.

D. Design Standards for Detention and Retention Basins and Other Stormwater Management Measures

Design standards for detention and retention basins and other stormwater management measures are contained in the Pennsylvania Handbook of Best Management Practices for Developing Areas, 1998 and the PA Erosion and Sediment Pollution Control handbook. These design standards shall be used for the design of detention and retention basins and all other stormwater management measures.

Where ever possible, preferred BMPs shall be used in place of traditional BMPs as found

Function	Preferred BMP(s)	Traditional BMP(s)
Stormwater conveyance	Grass-lined channels Dry swales	Rock-lined channels
Parking lot runoff	On site treatment including: Bioretention facilities Dry wells Perimeter sand filters Dry swales Filter strips	Curb and gutter transport to regional stormwater basin
Rooftop runoff	On-site infiltration including: Bioretention facilities Dry Wells On-lot swales	Curb and gutter transport to regional stormwater basin
Stormwater retention/ detention	Constructed wetlands Wet ponds	Dry ponds

Where traditional BMPs are proposed, the designer must justify their use by demonstrating the particular site conditions preclude the safe and effective use of preferred BMPs.

E. Design Standards for Water Quality Control and Infiltration Measures

In most instances, the water quality control and infiltration performance requirements of this ordinance will be satisfied by multiple structures or devices (see Sections 6F and 6G of this ordinance). Furthermore, most structures or devices will achieve both a water quality control and infiltration benefit. Compliance with the no net increase provisions of the ordinance will be based on a project-wide summation of runoff characteristics. The applicant shall show how the collection of structures or devices incorporated in the stormwater management plan will jointly satisfy the performance requirements of this ordinance.

In order to meet the no net increase provisions of this ordinance with regard to stormwater runoff volumes, sediment loadings, and other nonpoint source pollutant loadings, stormwater management facilities shall provide for the control of stormwater runoff in accordance with the following basic principles:

1. Infiltration should be implemented which will retain and infiltrate all runoff generated for storms up to the water quality design storm (2.04 inch, 24-hour storm). The first 2.04 inches of all larger storms shall be retained and infiltrated.

2. Runoff shall be managed at the source whenever possible.
3. Water quality and infiltration device treatment trains shall be designed that utilize the natural qualities of the landscape.
4. Detention/retention basins are generally not suitable as infiltration facilities.

F. Dry Well Requirements for Roof Runoff and Runoff from Paved Recreation Courts

Wherever suitable infiltration, soil permeability, and favorable geological conditions exist, runoff from roof areas and paved recreation courts, such as tennis and basketball courts, and impervious patios shall be transported to dry wells for recharge of groundwater resources.

G. Planning and Design Standards for Maintenance and Repair

A goal for the planning and design of a stormwater management facility is for its operation with the least practical amount of maintenance. To accomplish this, the facility shall be developed to eliminate avoidable maintenance tasks, minimize the long term amount of regular maintenance, facilitate the performance of required maintenance tasks, and reduce the potential for extensive, difficult, and costly remedial or emergency maintenance efforts.

H. Safety Measures

Safety measures are to be incorporated in the design of all stormwater and infiltration control projects. These may include but not be limited to fencing, warning signs, staff gauges indicating depth at lowest point, and outlet structures designed to limit access.

I. Additional Requirements

1. Natural drainage courses and points of natural drainage discharge shall not be altered.
2. Stormwater or natural drainage water shall not be diverted to overload existing drainage systems, or create flooding or the need for additional stormwater management or drainage facilities on other properties without the written consent of the owners of such properties and the provision by the developer of facilities to control the stormwater or drainage.
3. Where a subdivision is traversed by a natural drainage way or channel there shall be reserved by the developer a drainage easement conforming substantially with the line of such drainage way or channel, and of such width as determined by the Township Board of Supervisors adequate to preserve the unimpeded flow of natural drainage, or for the purpose of widening, deepening, relocating, maintaining, improving or protecting such drainage facilities. A drainage easement shall also be provided for all proposed stormwater control facilities.
4. Where a subdivision is traversed by a watercourse, there shall be provided a drainage easement of not less than twenty-five (25) feet on each side of the stream from each stream bank, or such additional width as will be adequate to preserve the unimpeded flow of the watercourse. In cases where a watercourse is intermittent or carries only insignificant volumes of water, the determination of the need for the

drainage easement of the adequacy of a drainage easement of a lesser width shall be made by the Township Board of Supervisors with the advice of the Township Engineer.

5. All streets shall be so designed as to provide for discharge of surface water from their right-of-ways.
6. In no case shall any pipe system of less than eighteen (18) inches be installed underneath a street or driveway.
7. Drainage structures that are located on State Highway right-of-ways shall be approved by the Pennsylvania Department of Transportation and a letter from that agency indicating such approval shall be directed to the Township prior to final plan approval.
8. Lots shall be laid out and graded to prevent cross lot drainage and to encourage drainage away from proposed building areas.
9. Drainage easements of a minimum of ten (10) feet in width shall be provided along all side and rear lot lines; (a total of twenty (20) feet for abutting lots) and adjacent to street right-of-ways as required by the stormwater drainage and management plan.

7. REQUIREMENTS FOR A STORMWATER MANAGEMENT PLAN

A. Submission of Stormwater Management Plan

1. Whenever an applicant seeks municipal approval of major subdivision or site plan subject to this ordinance, the applicant shall submit a Stormwater Management Plan as part of the application.
2. The applicant shall demonstrate that the project meets the standards set forth in this ordinance.

B. Stormwater Management Plan Approval

The applicant's Stormwater Management Plan shall be reviewed as a part of the subdivision or site plan review process. That Board of Supervisors shall consult the engineer retained by the Board of Supervisors to determine if all of the requirements have been satisfied and to determine if the project meets the standards set forth in this ordinance.

C. Required Contents of a Stormwater Management Plan

The following information shall be required in a Stormwater Management Plan:

1. Topographic Base Map - A topographic base map of the site shall be submitted which extends a minimum of 200 feet beyond the limits of the proposed development, at a scale of 1"=200' or greater, showing 2-foot contour intervals. The map shall indicate existing surface water drainage, wetlands, pervious or vegetative surfaces, existing man-made structures, roads, property lines, and all other significant natural and man made features. The reviewing engineer may require upstream tributary drainage system information as necessary.
2. Environmental Site Analysis - A written, detailed description of the natural and manmade features of the site and its environs shall be provided. This description

should include a discussion of soil conditions, slopes, wetlands, and vegetation on the site. Particular attention should be given to unique, unusual, or environmentally sensitive features and to those that provide particular opportunities or constraints for development.

3. **Project Description and Site Plan(s)** - A written description of the proposed project shall be provided with particular emphasis on aspects of the project which relate to stormwater runoff quantity and pollutant loads, and changes to the stormwater drainage characteristics of the site compared to existing conditions. The project description should clearly describe all stormwater management practices, methods, and BMPs that will be used on the site to meet the goal of no net increase. The description should clearly indicate how the stormwater management plan will meet the goal of no net increase, as outlined in section 6 (A) of this ordinance.

A map (or maps) shall be provided at the scale of the topographical base map indicating the location of existing and proposed buildings, roads, parking areas, utilities, structural facilities for stormwater management and sediment control, and other permanent structures. The map(s) shall also clearly show areas where alterations occur in the natural terrain and cover, including lawns and other landscaping, and seasonal high groundwater elevations.

4. **Stormwater Management Facilities Plan** - The following information shall be provided and illustrated on a plan at the scale of the topographic base map, and shall include:
 - a. Total area to be paved or built upon, proposed surface contours, estimated land area to be occupied by the stormwater management facilities and the type of vegetation thereon, and details of the plan to control and dispose of surface water.
 - b. Details of all stormwater management facilities during and after construction, including discharge provisions, discharge capacity for each outlet at different levels of detention, and emergency spillway provisions with maximum discharge capacity of each spillway.
5. **Drainage Area Map** - A map showing the total drainage area and sub-drainage areas shall be provided. The map shall also show soil types and their boundaries as shown in the **???? County Soil Survey**, or as may otherwise be determined by an on-site soil investigation.
6. **Calculations**
 - a. Comprehensive hydrologic, hydraulic and pollutant load data and design calculations for the pre-development and post-development conditions for the **design storms** as specified in this ordinance shall be provided.
 - b. When the proposed stormwater management control measures (e.g., infiltration basins) depend on the hydrologic properties of soils, then a

soils report shall be submitted. The soils report shall be based on on-site boring logs or soil pit profiles. The number and location of required soil borings or soil pits shall depend upon what is needed to determine the suitability and distribution of soil types present at the location of the control measure.

7. **Maintenance and Repair Plan**

- a. The planning and design of the stormwater management facilities shall comply with Section 3G, Section 8, and the PA Erosion and Sediment Pollution Control Standards.
- b. Maintenance procedures shall be detailed and shall provide for the continuation of the intended function of the facility.
- c. Maintenance and repair plans for stormwater management facilities shall identify the parts or components of the facility that need to be maintained, and when repairs are required. Costs and sources of funds shall be identified when possible.
- d. A schedule shall be developed of when and how often maintenance will occur to maintain proper function of the stormwater management facility. To reduce the potential for extensive, difficult, and costly remedial or emergency maintenance efforts, the schedule of maintenance activities shall include inspections to ensure proper performance of the facility between scheduled clean out.
- e. Where a stormwater management facility is used for sediment control during construction, a debris and sediment disposal site shall be confirmed before the facility is constructed. The disposal site may or may not be at the site of the proposed development. Disposal site(s) shall be included in the Soil Erosion and Sediment Control Plan and shall be approved by the Township Engineer.
- f. Provisions for periodic review and evaluations to determine the overall effectiveness of the maintenance programs and the need for revised or additional maintenance procedures, personnel and equipment shall be included in the facilities maintenance and repair plan.

8. OPERATION, MAINTENANCE, REPAIR AND SAFETY

A. Applicability

Projects subject to review as specified in Section 4 of this ordinance shall comply with the requirements of Sections 8B & 8C.

B. Responsibility for Operation, Maintenance, Repair, and Safety

1. Responsibility for operation, maintenance, repair, and safety of stormwater management facilities, including periodic removal and disposal of accumulated particulate material and debris, shall remain with the property owner and all successors in title unless assumed by a governmental agency. The requirements of this section do not apply to stormwater management facilities that are dedicated to and accepted by the municipality or another governmental agency.
2. Prior to granting approval or as a condition of final subdivision or site plan approval to any project subject to review under this ordinance, the applicant shall enter into an agreement with the municipality to ensure the long term/perpetual operation, maintenance, repair, and safety of the stormwater management facility. In cases where property is subdivided and sold separately, a homeowners' association or similar permanent entity shall be established as the responsible person absent an agreement by a governmental agency to assume responsibility. It shall be demonstrated to the municipality that any proposed new responsible entity has the capability to perform the required maintenance.
3. In the event that the stormwater management facility becomes a danger to public safety or public health, or if it is in need of maintenance, the municipality shall so notify the responsible person in writing. Upon receipt of that notice the responsible person shall have fourteen (14) days to effect maintenance and repair of the facility in a manner that is approved by the Township Engineer or a designee. If for reasons of safety there is need for immediate action, the responsible person shall act forthwith to remove the danger. If the responsible person fails or refuses to perform such maintenance and repair, the municipality may immediately proceed to do so and shall be reimbursed for the cost thereof by the responsible person or entity.

C. Maintenance and Repair Procedures

1. Maintenance procedures are required to maintain the intended operation and safe condition of the stormwater management facility by reducing the occurrence of problems and malfunctions. To be effective, maintenance shall be performed on a regular basis and shall include such routine procedures as training of staff, periodic inspections, grass cutting and fertilizing, silt and debris removal and disposal, upkeep of moving parts, control of mosquitos and other insects, pond maintenance, and review of maintenance and inspection work to identify where the maintenance program could be more effective.
2. Repair procedures are required to correct a problem or malfunction at a stormwater management facility and to restore the facility's intended operation and safe condition. Based upon the severity of the problem, repairs shall be performed on an as-needed or emergency basis and include such procedures as structural repairs, mosquito control, removal of debris, sediment and trash which threaten discharge capacity, erosion repair, snow and ice removal, fence repair, and restoration of vegetation.

9. ENFORCEMENT; VIOLATIONS AND PENALTIES

A. Enforcement

This ordinance shall be enforced by the Township Engineer who is empowered to cause any stormwater management facility to be inspected and examined and to order the remedying of any condition found to exist in violation of any provision of this ordinance.

B. Violations and Penalties

Violations and penalties shall be as provided in Article ???, Section ??? and ??? of the ??? Township Zoning Ordinance.

10. COMPATIBILITY WITH OTHER PERMIT AND ORDINANCE REQUIREMENTS

Development approvals issued pursuant to this ordinance are to be considered an integral part of development approvals under the subdivision and site plan review process and do not relieve the applicant of the responsibility to secure required permits or approvals for activities regulated by other applicable code, rule, act or ordinance. In their interpretation and application, the provisions of this ordinance shall be held to be the minimum requirements for the promotion of the public health, safety, and general welfare.

This ordinance is not intended to interfere with, abrogate, or annul any other ordinance, rule or regulation, statute, or other provision of law. Where any provision of this ordinance imposes restrictions different from those imposed by any other ordinance, rule or regulation, or other provision of law, whichever provisions are more restrictive or impose higher standards shall control.

11. SEVERABILITY

If the provisions of any article, section, subsection, paragraph, subdivision or clause of this ordinance shall be judged invalid by a court of competent jurisdiction, such order of judgment shall not affect or invalidate the remainder of any article, section, subsection, paragraph, subdivision or clause of this ordinance.

12. EFFECTIVE DATE

This ordinance shall take effect upon final passage by the municipality.

ORDINANCE ???

STREAM BUFFER CONSERVATION ZONE ORDINANCE

1. LEGISLATIVE INTENT

In recognition of the fact that natural features contribute to the welfare of residents, the following regulations have been enacted to provide reasonable controls governing the restoration, conservation, disturbance, and management of existing stream buffers for all perennial and intermittent streams and all lakes and ponds in the municipality by establishing designated Stream Buffer Conservation Zones. For the purposes of this ordinance the following definitions shall apply:

Stream - a natural watercourse containing flowing water for at least part of the year.

Perennial stream - a stream that flows continuously throughout the year in most years.

Intermittent stream - a stream that does not always have water in it, that has a drainage area of 50 acres or greater, or is portrayed as a dashed line on a USDA Soil Survey Map of the most recent edition, whichever is more restrictive.

In addition, the specific purposes and intent of this article are to:

- a. Reduce the amount of nutrients, sediment, organic matter pesticides, and other harmful substances that reach watercourses, wetlands, subsurface, and surface water bodies by using scientifically-proven processes including filtration, deposition, absorption, adsorption, plant uptake, biodegradation, denitrification and by improving infiltration, encouraging sheet flow, and stabilizing concentrated flows.
- b. Improve and maintain the safety, reliability and adequacy of the water supply for domestic, agricultural, commercial, industrial and recreational uses along with sustaining diverse populations of aquatic flora and fauna.
- c. Regulate the land use, siting and engineering of all development to be consistent with the intent and objectives of this ordinance, accepted conservation practices, and to work within the carrying capacity of existing natural resources.
- d. Assist in the implementation of pertinent state laws concerning erosion and sediment control practices.
- e. Conserve the natural features important to land and water resources (e.g., headwater areas, groundwater recharge zones, floodway, floodplain, springs, streams, wetlands, woodlands, prime wildlife habitats) and other features constituting high recreational value or containing amenities that exist on developed and undeveloped land.
- f. Work with floodplain, steep slope, and other ordinances that regulate environmentally sensitive areas to minimize hazards to life, property, and stream features.
- g. Conserve natural, scenic, and recreation areas within and adjacent to stream areas for the community's benefit.

2. DEFINITIONS

Definition - The Stream Buffer Conservation Zone is defined as:

Areas surrounding municipally designated surface water bodies, including creeks, lakes and intermittent watercourses that intercept surface water runoff, wastewater, subsurface flow, and/or deep groundwater flows from upland sources and function to remove or buffer the effects of associated nutrients, sediment, organic matter, pesticides, or other pollutants prior to entry into surface waters. This area may also provide wildlife habitat, control water temperature, attenuate flood flow, and provide opportunities for passive recreation. This buffer area may or may not contain trees and other native vegetation at the time of ordinance enactment.

3. ESTABLISHMENT AND WIDTH DETERMINATION OF THE STREAM BUFFER CONSERVATION ZONE

The establishment of the Stream Buffer Conservation Zone applies to the following areas which are identified on the municipal stream buffer map:

- a. Lands adjacent to municipally designated streams within the municipality.
- b. Lands adjacent to municipally designated intermittent water courses within the municipality.
- c. Lands at the margins of municipally designated lakes.

The measurement of the Stream Buffer Conservation Zone shall extend a minimum of 100 feet from each defined edge of an identified watercourse or surface water body at bankfull flow or level, or shall equal the extent of the 100 year floodplain, whichever is greater. The District will consist of two distinct zones designated as:

- a. Zone One: This zone will begin at each edge of an identified waterway (which can include wetlands and intermittent watercourses) and occupy a margin of land with a minimum width of 50 feet measured horizontally on a line perpendicular to the edge of water at bankfull flow.

- i. Where steep slopes (in excess of 25 percent) are located within 50 feet of a municipally designated watercourse, Zone One shall extend the entire distance of this sloped area. If the distance of this sloped area is greater than 100 feet, there will be no requirement for the establishment of Zone Two. If the distance is less than 100 feet, the width of Zone Two will be adjusted so that the total buffer width (Zone One and Zone Two) will be 100 feet maximum.
- b. Zone Two: This zone will begin at the outer edge of Zone One and occupy a minimum width of 50 feet in addition to Zone One.
 - i. Where the 100-year floodplain extends greater than 100 feet from the waterway, Zone One shall remain a minimum of 50 feet wide, and Zone Two shall extend from the outer edge of Zone One to the outer edge of the 100-year floodplain.

Width Determination. The developer, applicant, or designated representative shall be responsible for the initial width determination of the stream buffer and identifying this area on any plan that is submitted to the municipality for subdivision, land development, or other improvements that require plan submissions or permits. This initial determination shall be subject to review and approval by the municipal engineer, governing body, or its appointed representative.

4. USES PERMITTED IN THE STREAM BUFFER CONSERVATION ZONE

The following uses are permitted, either by right or after review and approval by the municipality in the Stream Buffer Conservation Zone. However, within any buffer, no construction, development, use, activity, or encroachment shall be permitted unless the activity is described in the Stream Buffer Management Plan, as outlined in Section 9.

- a. Zone One
 - i. Uses Permitted by Right
 - (1) Open space uses that are primarily passive in character shall be permitted to extend into the area defined as Zone One, including:
 - (2) Wildlife sanctuaries, nature preserves, forest preserves, fishing areas, passive areas of public and private parklands, and reforestation in compliance with the guidelines of the Stream Buffer Management Plan.
 - (3) Streambank stabilization in compliance with the guidelines of the Stream Buffer Management Plan.
 - ii. Uses Requiring Municipal Review and Approval
 - (1) Buffer crossings by farm vehicles and livestock, recreational trails, roads, railroads, centralized sewer and/ or water lines, and public utility transmission lines, and public

utility transmission lines provided that any disturbance is offset by buffer improvements identified in the Stream Buffer Management Plan.

b. Zone Two

i. Uses Permitted By Right

- (1) The following uses which are primarily passive in character, shall be permitted by right to extend into the area defined as Zone Two:
 1. Open space uses including wildlife sanctuaries, nature preserves, forest preserves, passive areas of public and private parklands, and recreational trails.
- (2) Reforestation in compliance with the guidelines of the Stream Buffer Management Plan.
- (3) Minimum required front, side, and rear yards on private lots, provided that no yard may extend into Zone Two more than half the distance between the outer boundaries of Zone One and Zone Two.
- (4) Agricultural uses existing at the time of adoption of this ordinance.

ii. Uses Requiring Municipal Review and Approval

- (1) New agricultural uses.
- (2) Buffer crossings by farm vehicles and livestock, roads, railroads, centralized sewer and/or water lines, and public utility transmission lines provided that any disturbance is at a minimum, offset by buffer improvements identified in the Stream Buffer Management Plan.
- (3) Centralized sewer and/or water lines and public utility transmission lines running along the buffer, provided that any disturbance is, at a minimum, offset by buffer improvements identified in the Stream Buffer Management Plan. These lines shall be located as far from Zone One as practical.
- (4) Selective cutting of trees when removal is consistent with approved standards in the Stream Buffer Management Plan.
- (5) Areas such as camps, campgrounds, picnic areas and golf courses. Active recreation areas such as ballfields, playgrounds, and courts provided these uses are designed in a manner that will not permit concentrated flow.
- (6) Naturalized stormwater basins in compliance with the guidelines in the Stream

Buffer Management Plan. The entire basin shall be located a minimum of 50 feet from the defined edge of identified watercourses.

5. USES SPECIFICALLY PROHIBITED IN THE STREAM BUFFER CONSERVATION ZONE

Any use or activity not authorized within Section 4 shall be prohibited within the Stream Buffer Conservation Zone. By way of example, the following activities and facilities are specifically prohibited:

- a. Clear-cutting of trees and other vegetation.
- b. Selective cutting of trees and/or the clearing of other vegetation within Zone One, except where such clearing is necessary to prepare land for a use permitted under Section 4a and where the effects of these actions are mitigated by re-vegetation, as specified under Section 9.
- c. Selective cutting of trees and/or the clearing of other vegetation within Zone Two, except where such clearing is necessary to prepare land for a use permitted by Section 4b and where the effects of these actions are mitigated by re-vegetation, as specified under Section 9.
- d. Removal of trees in excess of selective cutting, except where such removal is necessary as a means to eliminate dead, diseased, or hazardous tree stands that jeopardize public safety or as part of a reforestation project, provided that the removal is in compliance with a Stream Buffer Management Plan approved by the municipal engineer, governing body, or its appointed representative.
- e. Removal or disturbance of vegetation in a manner that is inconsistent with erosion control and buffer protection.
- f. Storage of any hazardous or noxious materials.
- g. Use of fertilizers, pesticides, herbicides, and/or other chemicals in excess of prescribed industry standards or the recommendations of the ??? County Conservation District.
- h. Roads or driveways, except where permitted as buffer crossings in compliance with Sections 4a(ii)1 or 4b(ii)2.
- i. Motor or wheeled vehicle traffic in any area not designed to accommodate adequately the type and volume.
- j. Parking lots.
- k. Any type of permanent structure, including fences, except structures needed for a use permitted

permitted in Section 4.

1. Subsurface sewage disposal areas.
- m. Sod farming.

6. NONCONFORMING STRUCTURES AND USES IN THE STREAM BUFFER CONSERVATION ZONE

Nonconforming structures and uses of land within the Stream Buffer Conservation Zone shall be regulated under the provisions of Article ??? of the ??? Township Zoning Ordinance (existing nonconformance regulations). The following additional regulations also shall apply:

- a. Existing nonconforming structures or uses within Zones One or Two that are not permitted under Section 4 may be continued but shall not have the existing building footprint or uses expanded or enlarged.
- b. Discontinued nonconforming uses may be resumed any time within one year from such discontinuance but not thereafter when showing clear indications of abandonment. No change or resumption shall be permitted that is more detrimental to the Stream Buffer Conservation Zone, as measured against the intent and objectives under Section 1, than the existing or former nonconforming use.
- c. This one year time frame shall not apply to agricultural uses which are following prescribed Best Management Practices for crop rotation.

7. BOUNDARY INTERPRETATION AND APPEALS PROCEDURE

When a landowner or applicant disputes the Zone (One or Two) boundaries of the stream buffer or the defined edge of a watercourse, surface water body, the landowner or applicant shall submit evidence to the municipality that describes the boundary, presents the landowner or applicant's proposed boundary, and presents all justification for the proposed boundary change.

The municipal engineer, governing body or appointed representative shall evaluate all material submitted and shall make a written determination within 45 days, a copy of which shall be submitted to (the governing body, municipal planning board), and landowner or applicant.

Any party aggrieved by any such determination or other decision or determination under this section may appeal to the (municipality) under the provisions this ordinance. The party contesting the location of the district boundary shall have the burden of proof in case of any such appeal.

8. INSPECTION OF STREAM BUFFER CONSERVATION ZONE

Lands within or adjacent to an identified Stream Buffer Conservation Zone will be inspected by the

municipal representative when:

- a. A subdivision or land development plan is submitted.
- b. (A building permit is requested.)
- c. A change or resumption of nonconforming use is proposed.

The Stream Buffer Conservation Zone may also be inspected periodically by the municipal representatives for compliance with an approved restoration plan, excessive or potentially problematic erosion or at any time when the presence of an unauthorized activity or structure is brought to the attention of municipal officials.

9. MANAGEMENT OF THE STREAM BUFFER CONSERVATION ZONE

Stream Buffer Management Plan - Within any municipally identified buffer area, no construction, development, use, activity, or encroachment shall be permitted unless the effects of such development are accompanied by implementation of an approved Stream Buffer Management Plan, as specified within the Subdivision and Land Development Ordinance.

The landowner or developer shall submit to the municipal engineer, governing body, or its appointed representative, a Stream Buffer Management Plan prepared by a landscape architect, professional engineer or other qualified professional who fully evaluates the effects of any proposed uses on the Stream Buffer Conservation Zone. The Stream Buffer Management Plan shall identify the existing conditions (vegetation, 100-year floodplain, soils, slopes, etc.), all proposed activities, and all proposed management techniques, including any measures necessary to offset disturbances to the Stream Buffer Conservation Zone. The plan shall be approved by the municipal engineer, governing body, or appointed representative as part of the subdivision and land development process.

10. VEGETATION SELECTION

To function properly, dominant vegetation in the Stream Buffer Management Plan shall be selected from a list of plants most suited to the stream buffer. Plants not included on the lists may be permitted by the municipal engineer, governing body, or its appointed representative when evidence is provided from qualified sources certifying their suitability. The municipality may require species suitability to be verified by qualified experts in the **??? County Conservation District, PA Department of Natural Resources Conservation Service, PA Department of Environmental Protection, the U.S. Fish and Wildlife Service, or state and federal forest agencies.**

- a. In Zone One, dominant vegetation shall be composed of a variety of native stream tree, shrub species, tall grasses and appropriate plantings necessary for streambank stabilization.
- b. In Zone Two, dominant vegetation shall be composed of stream trees and shrubs, with an emphasis on native species and appropriate plantings necessary to stabilize the soil.

- c. Disturbed areas shall be re-vegetated with stream buffer plants, in compliance with an approved Stream Buffer Management Plan.
- d. Areas that cannot be re-vegetated shall be restored in compliance with an approved Stream Buffer Management Plan.

Section 521: Environmental Resource Protection

A. In addition to the Legislative Intent of Section 101, and in order to implement the objectives of the Horsham Township Comprehensive Plan and the Horsham Township Open Space Plan, the primary purpose of this Section is as follows:

1. To recognize that many undeveloped parcels in Horsham Township contain significant amounts of environmentally sensitive resources including floodplains, slopes, wetlands, streams, and woodlands.
2. To recognize that disturbance of these environmentally sensitive resources results in negative impacts to the public health, safety, and welfare by causing greater erosion, siltation and sedimentation, flooding, degradation of water quality, and other adverse effects on the environment
3. To reduce the amount of nutrients, sediment, organic matter, pesticides, and other harmful substances that reach watercourses, wetlands, subsurface, and surface water bodies.
4. To promote, protect and facilitate proper density of land use based on a site's capacity; the provisions of adequate light and air; the provision of a safe, reliable and adequate water supply for domestic, commercial agricultural or industrial use; the preservation of the natural, scenic, and historic values in the environment; and the preservation of forests, wetlands, aquifers, and floodplains.
5. To require protection of environmentally sensitive features to the greatest extent possible by minimizing disturbance of these areas.
6. To conserve natural features important to protect natural resources; recognizing that headwater areas are highly sensitive to disturbance from the impact of human activity.

B. Density Determination

1. The determination of density or intensity of land use shall apply to any subdivision or land development for any use, and include any site that contains any Protected Area.
2. The disturbance standards described in this section shall apply to all uses and activities established after the effective date of this Ordinance. Site alterations, regrading, filling, or clearing of any natural resources, not expressly permitted within this ordinance, are prohibited; provided that nothing in this section shall prohibit agricultural and forestry uses permitted by Act 133 of 1982, (Right to Farm Law).

3. In the event that two (2) or more resources overlap, the resource with the greatest protection standard shall apply.

4. Determination of Density and Intensity of Use.

a. The site's Base Site Area shall be determined by subtracting all existing and proposed public and private road and utility rights-of-way, and land shown on previously approved subdivision or land development plans as reserved for open space from the total site area.

b. The site's Protected Area shall be determined by calculating various environmentally sensitive areas, multiplying them by their respective open space ratio, and totaling the acreage to obtain the Protected Area as shown below:

c. A site's Developable Area shall be determined by subtracting the Protected Area from the Base Site Area.

d. The maximum number of lots on a site is determined by taking the site's Developable Area and dividing it by the applicable Lot Area for the zoning district in which the site is located. For districts where density determines yields, the permitted density shall be determined by taking the site's Developable Area and multiplying it by the applicable number of units per acre.

C. Steep Slope Regulations.

1. No areas of Steep Slopes shall be used without full compliance with the terms of this Section.

2. Slopes of 25% or greater shall not be altered, regraded, cleared, built upon or otherwise disturbed unless such disturbance is necessary to:

a. Accommodate a street, driveway, or utility line when no other feasible route for such an activity exists, and if the slope disturbance is minimized to the greatest extent feasible to accommodate such activity; or

b. Accommodate a trail or trails that are part of an existing or planned trail network, and are located and constructed based on accepted best management practices for minimizing erosion.

c. In no case shall more than 20% of land with slopes of 25% or greater be disturbed.

3. No more than 30% of the area of slopes greater than 15% but less than 25%, shall be altered, regraded, cleared, built upon, or otherwise disturbed.
4. **Methodology.** Steep slopes shall be determined by measuring those areas of slope on a site over three (3) or more two (2) foot contour intervals. Steep Slope areas of less than 1,000 square feet of contiguous land, not abutting other areas of steep slope may be excluded in determining areas of steep slope.
5. The Township shall exempt for manmade slopes (e.g. manmade slopes within a street right-of-way) from the provisions herein, if it is determined that alteration, regrading, clearing, construction upon such slopes will not be injurious to the health, safety and welfare of the community. It shall be the burden of the applicant to demonstrate that the steep slopes were manmade.
6. The disturbance standards described in this section shall apply to all uses and activities established after the effective date of this Ordinance. provided that residential accessory uses will be permitted on steep slopes on residential lots in existence of the effective date of this ordinance.

D. Wetland Protection Standards.

1. **Wetland Delineation.** Wetlands shall be defined in accordance with the standards specified in the definition of Wetlands. In the event the standard for determination of a wetland accepted by the U.S. Army Corps of Engineers conflicts with that accepted by the Pennsylvania Department of Environmental Protection, or. the Environmental Protection Agency, the more restrictive standard shall be used in delineating wetland areas.
2. If, after examination of the site by a Wetlands Specialist, wetlands are found to exist, a wetlands delineation study shall be prepared by a Wetlands Specialist, and copies of this study (including reports, maps, and field logs) shall be submitted by the property owner to the U.S. Army Corps of Engineers for certification and to the Township and Township Engineer for review. The Township shall have the right to inspect the site as part of its review of the wetlands delineation report. If, after examination of the site , it is determined that wetlands are not located on the site, all subdivision, and land development plans, submitted to the Township must contain the following note, signed and sealed by a Wetland Specialist: "I hereby certify that no wetlands exist on this site".
4. Wetland delineations shall be performed by Wetlands Specialists to include those persons being Certified Professional Soil Scientists as registered with the Registry of Certified Professionals in Agronomy Crops and Soils (ARCPACS); or as contained on consultant's list of Pennsylvania Association of Professional Soil Scientists (PAPSS); or as registered with the National Society of Consulting Soil

Scientists (NSCSS), or as certified by State and/or Federal certification programs; or by a qualified Biologist/Ecologist.

5. Wetlands shall not be altered, regraded, developed, filled, piped or diverted, or built upon . In the event the property owner demonstrates to the Township's satisfaction that there is no alternative, minor road crossings, utility line crossings, streambank rehabilitation, and endwalls may be permitted.

6. Wetland Transition Area

a. In order to minimize the adverse impacts of human activity; to prevent groundwater contamination; to reduce surface run-off and sedimentation; to protect the hydrology of the wetland; and to protect wildlife habitats, a Wetland Transition Area shall be established. This transition area shall be established as a buffer extending from the outer limit of the wetlands as defined in this Ordinance a distance of twenty-five (25) feet, or the extent of hydric soils extending beyond the wetland boundary, whichever is greater. Where sensitive site features warrant additional protection, the Wetland Transition Area shall be extended in accordance with the most restrictive of the following conditions:

i. Where the 300 feet of land adjacent to the outer limit of the wetlands has an average upland slope in excess of 10%, the Wetland Transition Area shall be increased by 4 feet for each degree of slope above 10%, however, in no case shall the Wetland Transition Area exceed 50 feet.

ii. Where a herbaceous vegetational community exists on land adjacent to the outer limit of the wetlands, the transition area shall be extended to not less than 50 feet.

iii. Where a scrub-shrub vegetational community exists on land adjacent to the outer limit of the wetlands, the transition area shall be extended to not less than 40 feet.

iv. Where a forested vegetational community exists on land adjacent to the outer limit of wetlands, no additional transition area is required.

b. Where in the opinion of the Township, disturbance to the shape, but not the square footage, of a Wetland Transition Area on a tract or parcel of land will result in minimal environmental impact and the modified transition area continues to serve the transition function, the Wetland Transition Area may be reduced to 50% of its required width, so long as it is compensated by increasing the transition area width in another Wetland Transition Area on the same site, and the total required Wetland Transition Area square footage is not reduced.

7. The following activities are permitted in Wetland Transition Areas:

- a. Normal property maintenance such as mowing, pruning, and planting of native vegetation, subject to compliance with the restrictions listed in Section 521 D.8.
- b. Streets and driveway crossings, if no feasible alternative alignments are available, and the crossing does not disturb more than .1 ac (one tenth of an acre) of the transition area within the tract or parcel.
- c. Underground utilities, if no feasible alternative alignments are available.

8. Wetland Transition Areas are restricted from the following activities:

- a. Removal, dumping, filling, excavation, or disturbance of the soil, other than in association with any activities identified in Section 521 D. hereof.
- b. Erection of structures or paving, other than in association with any activities identified in Section 521 D. 7 hereof.
- c. Destruction of plant life which would alter vegetation patterns.

9. Any property containing wetlands shall have included in their deed for the individual lots, or parcel, a deed restriction filed with the Montgomery County Recorder of Deeds, requiring that the wetland areas depicted on the approved subdivision or land development plan shall be maintained as wetlands in perpetuity by the owners of the land.

10. The disturbance standards described in this section shall apply to all uses and activities established after the effective date of this Ordinance, provided that residential accessory uses will be permitted in wetland transition areas on residential lots in existence as of the effective date of this Ordinance.

E. Riparian Corridor Preservation.

1. Establishment. The establishment of the Riparian Corridor Conservation District (RCCD) applies to The Stream Valley Network, Figure 5, identified in the Horsham Township Open Space Plan of 1995, including all tributaries, perennial and intermittent streams leading to those streams shown in Figure 5, and including all lakes and ponds.
2. A residential lot legally in existence as of the effective date of this ordinance, may expand the area of the principal building on the lot by not more than 25% of the ground floor area of the principal building on the property as of the effective

date of this ordinance without the provisions of the RCCD being applicable.

3. Measurement of the RCCD boundary shall extend a minimum of 75 feet from each defined edge of an identified watercourse or surface water body at the top of the bank, or shall equal the extent of the 100 year floodplain, whichever is greater. The District will consist of two distinct zones designated as:

a. Zone One: This zone will begin at each edge of an identified waterway (which can include wetlands and intermittent watercourses) and occupy a minimum width of 25 feet measured horizontally on a line perpendicular to the top of bank. The width of Zone One may be required to extend beyond the minimum 25 feet depending upon existing topography, woodlands, and other natural conditions.

Where steep slopes (in excess of 25 percent) are located within 25 feet of a Township designated watercourse, Zone One shall extend the entire distance of this sloped area. If the distance of this sloped area is greater than 75 feet, there will be no requirement for the establishment of Zone Two. If the distance is less than 75 feet, the width of Zone Two will be adjusted so that the total corridor width (Zone One and Zone Two) will be 75 feet maximum.

b. Zone Two: This zone will begin at the outer edge of Zone One and occupy a minimum width of 50 feet in addition to Zone One, unless modified herein.

c. Where the 100-year floodplain extends greater than 75 feet from the waterway, Zone One shall remain a minimum of 25 feet wide, and Zone Two shall extend from the outer edge of Zone One to the outer edge of the 100 year floodplain.

d. Width Determination: The developer, applicant, property owner or designated representative shall be responsible for the initial width determination of the riparian corridor and identifying this area on any plan that is submitted to the Township for subdivision, land development, or other improvements that require plan submissions or permits. This determination shall be subject to review by the Township Engineer.

4. Uses Permitted in the RCCD. The following uses are permitted, either by right or as a conditional use in the RCCD.

a. Zone One

i. Uses Permitted by Right. Open space uses that are primarily passive in character shall be permitted to extend into the area defined as Zone One,

including:

- (a) Wildlife sanctuaries, nature preserves, forest preserves, fishing areas, passive areas of public and private parklands, and reforestation.
- (b) Streambank stabilization..
- (c) Corridor crossings by livestock.
- (d) Property owners are permitted to remove trees as part of normal property maintenance so long as not more than 1,000 square feet of lot area is disturbed. ii. Uses Permitted by Conditional Use
 - ii. Uses permitted by Conditional Use
 - (a) Corridor crossings of recreational trails, roads, railroads, centralized sewer and/or water lines, and public utility transmission lines..
 - (b) Selective cutting of extremely high economic value trees when part of a forestry operation..
- b. Zone Two
 - i. Uses Permitted By Right. The following uses, which are primarily passive in character, shall be permitted by right to extend into the area defined as Zone Two:
 - (a) Open space uses including wildlife sanctuaries, nature preserves, forest preserves, passive areas of public and private parklands, and recreational trails conducted in compliance with methods prescribed by Chapter 102 (Erosion Control) of Title 25 of the Pennsylvania Administrative Code.
 - (b) Reforestation.
 - (c) Minimum required front, side, and rear yards on private lots, provided that no yard may extend into Zone Two more than half the distance between the outer boundaries of Zone One and Zone Two.
 - (d) Agricultural uses existing at the time of adoption of this ordinance, so long as they are conducted in compliance with methods prescribed by Chapter 102 (Erosion Control) of Title 25 of the Pennsylvania Administrative Code.
 - (e) Corridor crossings by livestock.

(f) Property owners are permitted to remove trees as part of normal property maintenance so long as not more than 1,000 square feet of lot area is disturbed. ii. Uses Permitted by Conditional Use

ii. Uses Permitted by Conditional Use

(a) New agricultural uses in compliance with methods prescribed by Chapter 102.4(b) of Title 25 of the Pennsylvania Administrative Code.

(b) Corridor crossings of roads, railroads, centralized sewer and/or water lines, and public utility transmission lines..

(c) Centralized sewer and/or water lines and public utility transmission lines running along the corridor. These lines shall be located as far from Zone One as practical.

(d) Selective cutting of trees when part of a forestry operation..

(e) Passive use areas such as camps, campgrounds, picnic areas,' and golf courses. Active recreation areas such as ballfields, playgrounds, and courts provided these uses are designed in a manner that will not permit concentrated flow.

(f) Naturalized stormwater basins.. The entire basin shall be located a minimum of 50 feet from the defined edge of identified watercourses.

5. Uses Specifically Prohibited in the RCCD

a. Any use or activity not authorized by Section 521 of this Ordinance shall be prohibited within the RCCD. By way of example, the following activities and facilities are specifically prohibited:

b. Clear-cutting of trees and other vegetation.

c.. Removal of trees in excess of selective cutting, except where such removal is necessary as a means to eliminate dead, diseased, or hazardous tree stands that jeopardize public safety or as part of a Township approved reforestation project..

d. Removal or disturbance of vegetation in a manner that is inconsistent with erosion control and corridor protection.

- e. Storage of any hazardous or noxious materials.
- f. Use of fertilizers, pesticides, herbicides, and/or other chemicals in excess of prescribed industry standards or the recommendations of the Montgomery County Conservation District.
- g. Roads or driveways, except where permitted as corridor crossings herein.
- h. Motor or wheeled vehicle traffic in any area not designated to accommodate adequately the type and volume.
- i. Parking lots.
- j. Any type of permanent structure, including fences, except structures needed for a use permitted herein.
- k. Subsurface sewage disposal areas.
- l. Sod Fanning.
- m. Top soil removal.

6. Inspection of Riparian Corridor Conservation District

- a. Lands within or adjacent to an identified Riparian Corridor Conservation District shall be inspected by the Township Engineer when:
 - i. A subdivision or land development plan is submitted.
 - ii. A building permit is requested.
 - iii. A zoning permit is requested.
 - iv. A change or resumption of a nonconforming use is proposed.
- b. The district may also be inspected periodically by the Township representatives for compliance with an approved restoration plan, excessive or potentially problematic erosion, hazardous trees, or at any time when the presence of an unauthorized activity or structure is brought to the attention of Township officials.

7. Management of the Riparian Corridor District

- a. Corridor Management Plan. Within any Township identified corridor area, no construction, development, use, activity, or encroachment in connection

with a subdivision or land development shall be permitted unless the effects of such development are accompanied by implementation of an approved Corridor Management Plan.

b. The developer, applicant or property owner shall submit to the Township Engineer, a Corridor Management Plan prepared by a landscape architect, engineer, or other qualified professional, which fully evaluates the effects of any proposed uses on the Riparian Corridor Conservation District when subdivision or land development is proposed for a property. The Corridor Management Plan shall identify the existing conditions (vegetation, 100-year floodplain, soils, slopes, etc.), all proposed activities, and all proposed management techniques, including any measures necessary to offset disturbances to the Riparian Corridor Conservation District. The plan shall be approved by Township Council as part of the subdivision and land development process.

c. Vegetation Selection. To function properly, dominant vegetation proposed to be planted in the Corridor Management Plan shall be selected from a list of plants most suited to the riparian corridor. Plants not included on the lists may be permitted when evidence is provided from qualified sources certifying their suitability.

- i. In Zone One, dominant vegetation shall be composed of a variety of native riparian tree and shrub species and appropriate plantings necessary for streambank stabilization.
- ii. In Zone Two, dominant vegetation shall be composed of riparian trees and shrubs, with an emphasis on native species and appropriate plantings necessary to stabilize the soil.
- iii. Disturbed areas shall be revegetated with riparian corridor plants, in compliance with an approved Corridor Management Plan.
- iv. Areas that cannot be revegetated shall be restored in compliance with an approved Corridor Management Plan.

8. The disturbance standards described in this section shall apply to all uses and activities established after the effective date of this Ordinance, provided that residential accessory uses will be permitted in the RCCD on residential lots in existence as of the effective date of this Ordinance.

F. Woodlands. The following standards shall apply to woodlands.

1. All paving, buildings, and other structures shall be located in such a manner so as to minimize disturbance to existing trees.

2. No more than 20% of woodlands located in floodplains, slopes over 15%, wetlands, or wetland transition areas shall be altered, regraded, cleared or built upon.
3. No more than 50% of areas of woodlands not regulated by E.I. (riparian corridor regulations) shall be altered, regraded, cleared or built upon.

****Webmaster's Note:** The previous section has been added as per Ordinance No. 1147

G. Smoke

1. No smoke shall be emitted from any chimney or other source visible gray greater than No. 1 on the Ringelmann smoke chart as published by the U.S. Bureau of Mines.
2. Smoke of a shade not darker than No. 2 on the Ringelmann chart may be emitted for not more than four (4) minutes in any thirty (30) minutes.
3. These provisions, applicable to visible gray smoke, shall also apply to visible smoke of a different color, but with an equivalent apparent capacity.

H. Dust and Dirt, Fly Ash, and Fumes, Vapors and Gases.

1. No emission shall be made which can cause any damage to health, to animals or vegetation or other forms of property or which can cause any excessive soiling at any point.
2. No emission of liquid or solid particles from any chimney or otherwise shall exceed 0.3 grains per cubic foot of the covering gas at any point.
3. For measurement of the amount of particles in gases resulting from combustion, standard correction shall be applied to a stack temperature of five hundred (500) degrees F. and fifty percent (50%) excess air.

I. Noise. At no point on the boundary of a Residential, Industrial or Commercial District shall the sound pressure level of any operation exceed the decibel levels in the designated octave bands shown below for the districts indicated.