

Chapter 7: Natural Resources Inventory

INTRODUCTION

Natural Resources have played a critical role in how the Region has developed and evolved. These resources define the quality of life and resource ethic that is cherished by the municipalities of the Region. Resource planning is nothing new to northern Chester County. The nine municipalities of the Northern Federation have adopted Open Space, Recreation, and Environmental Resources Plans (open space plans) to address the management of natural resources. These plans were prepared under the County's Heritage Parks and Open Space Municipal Grant Program and included a relatively detailed inventory of municipal natural resources organized under the broad categories of water, land, and biotic resources. These plans focus on individual communities and do not provide an analysis or inventory of resources on a regional basis.

This chapter provides a compilation of the open space plans' natural resources information at the regional level in order to form a uniform strategy for managing resources from a regional perspective. For a more detailed discussion of individual resources at the local level, the municipal open space plans can be consulted. This chapter also includes the legislation that enables municipalities and regional groups to manage and regulate natural resources for their protection and preservation.

ORGANIZATION OF CHAPTER

The inventory included in this Chapter is organized as follows:

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INVENTORY OF NATURAL RESOURCES

WATER RESOURCES

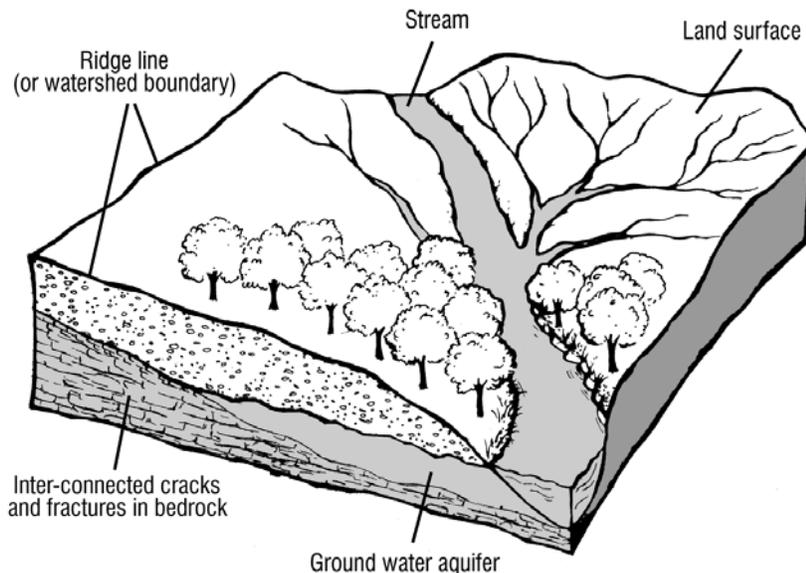
The creeks, streams, and rivers throughout Chester County have influenced development patterns and the quality of life enjoyed by residents for centuries. Proper management of water resources is necessary to meet growing demands for its use, protect it from degradation, and improve water quality wherever possible.

Watersheds of the Region serve as a source of drinking water for communities beyond its boundaries and serves as a critical life support ecosystem for the Region's rich natural diversity-diversity. Therefore, the management of water resources within the associated watersheds has far-reaching implications. Because watersheds do not follow political boundaries, water is a resource that is most appropriately managed on a watershed or regional basis.

WATERSHED

A watershed is an area of land bounded by a ridge that drains into a river or lake. The precipitation that falls within a watershed flows from surrounding ridgeline divides toward, and becomes the source of, stream flow and ground water. See Figure 7-1. Other environmental processes such as transpiration by plants and evaporation also consume a significant share of a watershed's precipitation.

Figure 7-1
Typical Watershed



Watersheds are classified based on their functionality and are subdivided into the following classes: headwater drainage areas, sub basins, watersheds, and basins. This hierarchy follows a logical progression in that several drainage areas comprise a sub basin, and several sub basins comprise a watershed, and so on. There are six watersheds that encompass the Region: the French Creek, the Brandywine Creek, the Schuylkill River Drainages, the Pigeon Creek, the Pickering Creek, and the Stony Run Watershed, as shown in Figure 7-2 and on Map 7-1: Water Resources. It is important to note that the watersheds that lie within the Region stretch well beyond its boundaries and that all the watersheds that feed the Schuylkill River are either High Quality (HQ) or Exceptional Value (EV). See Resource Designations. While all of the Region's rivers and streams eventually flow into the Delaware River, a major basin boundary divides the Region; areas within the Brandywine Creek Watershed primarily flow south through much of Chester County into the Christina River. The balance of the Region's rivers and streams primarily flow to the east and enter the Delaware River as part of the Schuylkill River. The majority of the Region is included in the Groundwater Protected Area as designated by the Delaware River Basin Commission (DRBC). See Resource Designations.

**Figure 7-2
Watersheds in the Northern Federation Region**

Watershed	Total Area (Square Miles)	Area within Region (Square Miles)	Percentage of Watershed within the Region (%)	Percentage of the Region within the Watershed (%)
French Creek	70.2	57.1	81.6	47.4
Brandywine Creek	324.5	20.1	6.2	16.7
Schuylkill River	N/A	14.8	N/A	12.3
Pigeon Creek	14.5	14.5	100.0	12.0
Pickering Creek	38.8	7.2	18.5	6.0
Stony Run	5.6	5.6	100.0	4.9

French Creek - Covering approximately fifty-seven square miles of the Region, the French Creek Watershed encompasses 47.4% of the Region's total area. The headwater areas for the creek's two main branches include the northwest portion of the Region as well as southern portions of Berks County. The French Creek collects a number of secondary tributaries as it flows across the Region. These tributaries include the South Branch, Rock Run, Beaver Run, and Birch Run.

Brandywine Creek - The second largest watershed within the Region is the Brandywine Creek Watershed, which covers 16.7% of the Region. Indian Run, Marsh Creek, Lyons Run, and Black Horse Creek are sub basins within the Region that eventually join the East Branch of the Brandywine Creek. As the table in Figure 7-2 shows, the watershed area within the Region only represents 6.2% of the Brandywine Creek Watershed, but this area is critical because it serves as the headwaters for the watershed. As a result, this area hosts a number of critical habitats such as the Great Marsh. Additionally, the Brandywine Creek serves as an important resource for public water supply to many areas in Chester County, such as Downingtown as well as New Castle County, Delaware. The need for proper regulation within the Northern Federation is compounded by significant flooding problems in areas downstream from the Region.

Schuylkill River - Areas that directly drain into the Schuylkill River cover approximately fifteen square miles (12%) of the Region. The streams that directly flow into the Schuylkill River are generally small, first or second order tributaries. A noted concern in regard to these streams is the water quality effect of the old industrial sites that line the Schuylkill River. This river also represents the spine of the Schuylkill River Heritage Corridor. See Resource Designations.

Pigeon Creek - The fifteen square mile Pigeon Creek Watershed also accounts for about 12% of the Region's total area. This small stream, which is completely within the Region, runs through portions of East Coventry, North Coventry, South Coventry, and East Vincent. The Pigeon Creek collects a series of small first and second order streams as it flows from west to east across the Region.

Pickering Creek - The southeast portion of the Region drains into the Pickering Creek Watershed which represents 6% of the Region. Portions of West Vincent Township as well as Uwchlan and Upper Uwchlan Township form the watershed's headwaters. The two small tributaries that flow into the Pickering Creek are the Pine Creek and Pigeon Run. It is important to note that this watershed serves as a major source of drinking water supply for Phoenixville borough and the surrounding vicinity. This region is served by the Pickering Creek Reservoir, located to the south of Phoenixville.

Stony Run - The Stony Run Watershed is a small watershed that runs perpendicular to the Schuylkill River before draining into the Schuylkill just to the south of Spring City.

The following water resources are elements of the watershed, the condition and treatment of these resources have a direct impact on the quality and quantity of groundwater that is within the watershed. Therefore, the management and protection of the following components is essential in promoting the stability of the associated watershed. A short statement of impact has been included for each of the following water resources that have a direct impact on the stability of watersheds.

STREAM CORRIDORS

A stream corridor can include a river, creek, brook, tributary, or other flowing surface waters within a natural channel. They can be an intermittent, perennial, or ephemeral watercourse with a defined channel which contains flow from surface and/or groundwater sources during at least a portion of an average rainfall year. There are hundreds of miles of streams in the Region that carry surface and ground water and provide habitat for local plant and wildlife and scenic and recreational opportunities. See Map 7-1.

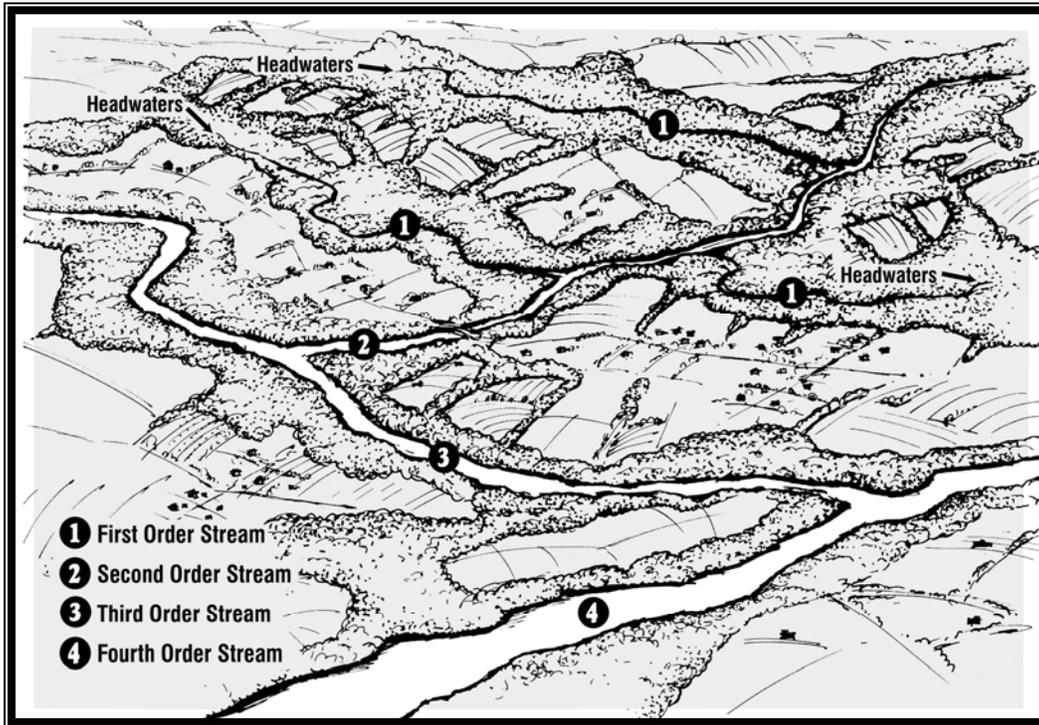
Within a watershed, "stream ordering" is the method used to classify streams and their tributaries. The smallest streams in the network have no tributaries and are called first order streams. When two first order streams join, they form a second order stream; where two second order streams converge, they create a third order stream, and so on. See Figure 7-3. Order one and two streams are important from a long range planning perspective because their drainage basins often contain the best recharge areas and ground water yields. Moreover, alterations to these drainage areas from development or other land disturbance can have serious implications on the watershed. Order four streams (and above) form the major tributaries within a watershed.

Impact on Watershed: The stability of the stream corridor and surrounding environment directly effects the quality and quantity of groundwater and surface water flowing though the associated watershed.

HEADWATERS

Headwaters and first order streams are located throughout the six watersheds that are within the boundaries of the Region. Headwater areas are land areas that both drain into first order streams and which contain springs, marshes, and intermittent streams at the uppermost terminus of a stream. Headwater areas provide stream recharge into first order streams during periods of low flow and are important for maintaining groundwater flow. The headwater areas around first order streams often contain hydric or wet soils and provide important wildlife habitat and breeding areas. Water quality in these streams is usually better than larger order streams and they are more likely to support trout and a variety of aquatic species and other wildlife. See Map 7-1 and Inset 7-1A.

Figure 7-3
Stream Hierarchy and Headwaters



Alterations to these first order streams, caused by development or other disturbance, can lead to degradation of the stream corridor. Headwater areas maintained under a forest (forested riparian buffer) or dense meadow cover yield streams with higher water quality and greater natural diversity than those that are not.

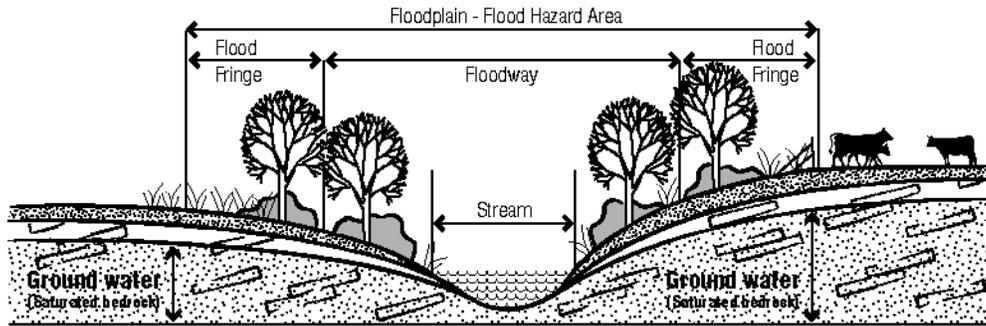
Impact on Watershed: The stability and protection of headwater areas directly impacts the quality and quantity of water that will flow as first order streams within the associated watershed.

FLOODPLAINS, ALLUVIAL SOILS, and VERNAL POOLS

The 100-year floodplain and the floodway shown on Map 7-1 are based on mapping from the Federal Emergency Management Agency (FEMA). According to FEMA, a floodplain is defined as "the flood elevation that has a 1% chance of being equaled or exceeded each year." FEMA's definition of a floodplain is subdivided into two parts: the floodway and the flood fringe. See Figure 7-4. According to FEMA, the floodway must be reserved to carry the base floodwaters without increasing the base flood elevation more than one foot. This area should be the most strictly regulated portion of the floodplain; any obstructions within the floodway that might raise the base flood elevation should be prohibited. The remainder of the 100-year floodplain beyond the floodway, known as the flood fringe, may be developed if structures are elevated or appropriately flood-proofed. However, many communities choose to prohibit all or most development within the entire 100-year floodplain.

Naturally vegetated floodplain areas, such as forested riparian buffers and grasslands, help to catch and filter sediment from floodwaters and reduce the velocity of sediment-laden water. The natural vegetation of floodplains also filters water runoff by collecting and holding nutrients, chemicals, and other natural and man-made pollutants. Floodplains left in their natural state can provide valuable wildlife habitat that contributes to the stability of the natural diversity of the Region.

**Figure 7-4
Typical Floodplain**



In addition to its important environmental functions, floodplain areas provide recreational, scenic, and open space opportunities. While floodplain land is generally narrow, it provides a valuable source of open space. Great potential exists to link existing parks and open space areas by using corridors along the many creeks and streams. However, use for passive recreation, such as hiking trails, must be balanced with other preservation and resource protection goals.

Alluvial Soils

Alluvial soils are those soils which have been eroded, transported, and deposited by flooding over time and, as a result, generally indicate a strong potential for flooding (i.e. define floodplain boundaries). Most areas of alluvial soils are narrow and found immediately adjacent to streams, largely due to the presence of very steep slopes along most of the subsequent floodways. See Map 7-1. Because few first order streams have FEMA-mapped floodplains, the presence of alluvial soils can be used to define the extent of the floodplain in these unmapped areas. Alluvial soils in the Region include: Chewacla silt loam (Ch), Congaree silt loam (Cr), Wehadkee silt loam (We), Bowmansville silt loam (Bo), and Rowland silt loam (Ro, Rp).

Vernal Pools

A vernal pool is a contained basin depression lacking a permanent above ground outlet. The pool fills with water with the rising water table of fall and winter or with the runoff of winter and spring snow and rain. Many vernal pools are covered with ice in the winter months. They contain water for a few months in the spring and early summer. By late summer, a vernal pool is generally (but not always) dry. A vernal pool, because of its periodic drying, does not support breeding populations of fish. Many organisms have evolved to use a temporary wetland which will dry but where they are not eaten by fish. These organisms are the "obligate" vernal pool species, so called because they must use a vernal pool for various parts of their life cycle.

Impact on Watershed: The protection of a floodplain directly impacts the health of the stream corridor and the stability of the associated watershed.

WETLANDS AND HYDRIC SOILS

Wetlands are unique ecosystems that provide a number of environmental benefits. These areas offer key wildlife habitat and are important storage areas for surface and groundwater recharge. The Army Corps of Engineers and the Pennsylvania Department of Environmental Protection (PaDEP) protect wetlands under Section 404 of the Clean Water Act of 1977. From a regulatory standpoint, the presence of wetland areas is determined based on the site’s soil, hydrology, and vegetation. Areas lacking any one of these three parameters are generally not considered wetlands. From a layman’s perspective, any area with periodic standing water and hosting wetland-type vegetation (including cattails, skunk cabbage, red maple, and silver maple) is likely to fall within the official definition of a wetland.

There is no comprehensive inventory of wetlands. However, the National Wetlands Inventory (NWI) identifies certain wetland areas, based on aerial photography. The NWI identified stream systems, certain marshy areas, stormwater detention areas, open excavations, and farm ponds as wetlands. While other wetlands certainly exist, they were not identified probably as a result of their limited size or specific characteristics that make them more difficult to identify from aerial photography. Site-specific wetland studies are the only clear method to completely determine the extent of wetlands in the Region.

Map 7-1 shows areas of wetlands that have been identified within the Region (NWI). The map indicates that the majority of wetlands can be found adjacent to streams or concentrations of hydric soils. The largest concentration of wetlands within the Region is the Great Marsh, which lies in East Nantmeal and Wallace Townships. In addition, there are several small concentrations of wetlands found in headwater drainage areas as well as floodplains.

Hydric Soils

Hydric or wet soils contain high amounts of moisture that accommodate anaerobic processes to thrive within the soil. These soils are typically found in low-lying areas of headwater regions, at the fringes of floodplains, and sometimes in upland depressions. Generally, hydric soils have a shallow depth to the underground water table. This makes these areas particularly sensitive to alteration and very susceptible to contamination of ground water. Areas of hydric soil serve as indicators of poor drainage. Therefore, development in these areas is generally not appropriate for on-lot sewage systems.

**Figure 7-5
Hydric Soils in the Region**

Soils with Major Hydric Components	Soils with Hydric Inclusions and Hydric Component of the Inclusions
Bowmansville (Bo)	Aldino (AsB2) - Calvert (CA)
Croton (CrA, CrB)	Chewacla (Ch) - Wehadkee (We)
Lamington (3LfA)	Congaree (Cn) - Wehadkee (We)
Thorndale (Gu)	Glenville (GnA, GnB, GnB2) - Worsham (Wo)
Towhee (3TwB)	Lehigh (LeB2, LeC3, LhB) - Croton (Cr)
Wehadkee (We)	Montalto (MoB2, MoC2, MrB, MrD) - Watchung (WaA, Wab2, WcB)
Watchung (WaA, WaB2, WcB)	Mount Lucas (MsB) - Watchung (WaA, Wab2, WcB)
Worsham (WoA, WoB, WoB2, WsB))	Readington (RdA, RdB, RdB2) - Croton (Cr)
	Rowland (Ro, Rp) - Bowmansville (Bo)
	Worsham (WoC2) - wet areas (no soil specified in source)

Concentrations of hydric soils are found lining the majority of the Region's creeks and streams, as displayed on Map 7-1. Generally, these soils are found in areas that drain into first-order streams. See Figure 7-5 for an all-inclusive list of hydric soils in the Region.

Impact on Watershed: Wetlands impact the watershed from headwater areas to the quantity of water reaching stream corridors and the quality of groundwater that is runoff and filtered through the wetland.

PONDS AND OTHER BODIES OF WATER

Farm ponds and other man-made small bodies of water that do not overlap or fall within an area identified as a floodplain or wetland have been included on Map 7-1. Although filtration of stormwater may be an element of their design, they are not part of the natural water system. In fact, these facilities were more than likely designed as irrigation or recreational facilities and primarily add to the rural or agrarian character of the Region.

Impact on Watershed: Small ponds can aid in the management of stormwater and its infiltration to groundwater.

GROUNDWATER AND SURFACE WATER

Both groundwater and surface water are valuable and indispensable resources in the Region. Continued reliance by most residents and property owners of the region on groundwater for domestic water supply dictates careful management of this resource. Most of the groundwater supplies come from individual on-site wells rather than central or community systems that use water drawn from reservoirs or community wells.

Surface water in the form of springs, marshes, wetlands, streams, ponds, or rivers supports wildlife, helps reduce flood hazards, and provides supplemental sources of water for domestic use. In addition, stream and river valleys represent valuable resources for their scenic qualities and as settings that define the rural character of the Region. As was previously discussed, several stream corridors have been designated as Scenic River Corridors and/or High Quality or Exceptional Value by the Pennsylvania Department of Environmental Protection. See Resource Designations. The value of these resources is clearly defined and further magnifies the need to provide for their management and protection.

In recognition of the value of groundwater and surface water, the Northern Federation has prepared a series of studies to protect these resources including, the *Water Resources Management Study* and the *Surface Water Runoff Study*. The studies evaluate water as a system, including precipitation, groundwater, and surface water in recognition of the fact that affects to one component influence others.

Impact on Watershed: The quality and quantity of groundwater and surface water impacts the stability of the watershed.

LAND RESOURCES

Land is a finite, non-renewable resource that can never fully recover once degraded. Land and water resources are intertwined so that whatever happens to the land will also impact water and biotic resources. Therefore, land resources should be protected not only for their production value (agriculture, forests, and meadows) but because inappropriate uses and poor maintenance practices can lead to the degradation of water resources, wildlife habitat, and plant resources.

GEOLOGY AND GEOLOGIC FEATURES

The geology of the Region influences a number of physical attributes, including slope, erosion and stability properties, and groundwater yield. The Region's geologic composition is divided into three categories: Triassic sedimentary formations, Paleozoic and Precambrian crystalline formations, and diabase.

Triassic sedimentary formations are prominent in the northeastern half of the Region. Areas containing sedimentary formations include all of North Coventry and East Coventry and portions of Warwick, South Coventry, East Vincent, West Vincent, and East Pikeland Townships. These formations were formed from the compaction of sand, mud, and calcium carbonates, resulting in soft formations such as sandstone, shale, and mudstone. The Triassic formations can be subdivided into four sub formations: the Brunswick Formation, the Stockton formation, the Hammer Creek Formation, and the Lockatong formation. The Brunswick and Stockton formations, consisting of shale, mudstone, siltstone, and sandstone, tend to be soft and susceptible to erosion. In contrast, the conglomerate formations of Hammer Creek Formation and the fine-grained shale common to the Lockatong formation are more resistant to weathering. Sedimentary formations are capable of supporting most construction activities and can be easily excavated. See Map 7-2: Land Resources.

Paleozoic and Precambrian crystalline formations are found in the southern half of the Region as well as some isolated concentrations in Warwick Township. Areas of crystalline formations include all of Wallace and East Nantmeal as well as parts of Warwick, South Coventry, West Vincent, and East Pikeland. This region of metamorphic formations is primarily comprised of several variations of gneiss and quartz monzonite. These rocks are generally more resistant to erosion than sedimentary formations, which shapes the rolling hills found in these areas. In terms of stability, crystalline formations are harder to excavate than sedimentary rock. The weather nature of the rock may also require additional excavation in order to reach bedrock suitable for constructional purposes.

A band of diabase bisects Warwick Township and runs along the borders of Warwick, South Coventry and North Coventry along the Rock Run. This very hard, igneous rock was formed when molten magma was pushed to the surface and cooled. Since this formation is very resistant to weathering, diabase boulders can usually be found on hillsides where other soils and rock formations have eroded. The hard characteristics of diabase make it very difficult to excavate, but it provides good support for heavy structures.

The geology of the Region also has significant historical and cultural importance. Mining operations in St. Peters, Hopewell, and Coventryville were once the dominant economic draw to the region. The Region is specifically unique for its concentration of diabase, also referred to as "black granite" when mined and polished. Now these areas have become historically and culturally significant. In addition, geologic formations, such as Mt. Pleasant, Thomas Hill, and

Chestnut Hill not only provide recreation opportunities, but these areas are defining characteristics of the Region. See Chapter 8: Historic Resources Inventory.

TOPOGRAPHY AND STEEP SLOPES

The Region is located within the Piedmont Plateau. This Plateau, located to the east of the Appalachian Mountains, is characterized by gently rolling foothills and gradually-sloping stream valleys. The topography of the Region was shaped by geologic uplifting and folding as well as the erosion of sedimentary deposits. Most of the Region's hills and ridgelines run from east-southeast to west-northwest. The Region's elevation ranges from over 970 ft at the top of Thomas Hill in Warwick Township to less than 85 ft above sea level in the southeast corner of East Pikeland Township where Stony Run meets the Schuylkill River.

For the purposes of this Plan, steep slopes are considered to include any land with a slope of 15-25 percent. Concurrently, very steep slopes are those of greater than 25 percent. Steep slopes in the Region are concentrated primarily along upper order stream corridors. See Map 7-2. The French Creek represents the boundary of Warwick Township and East Nantmeal Township in the western half of the Region, and the boundary of East and West Vincent Townships in the eastern half of the Region. The French Creek corridor has the highest concentration of steep slopes in the Region. The steep slopes continue south of the French Creek Corridor in East Nantmeal Township along the Beaver run, and in West Vincent along the Birch Run. Wallace Township has a concentration of steep slopes along the East Branch of the Brandywine Creek near State Route 282. Warwick Township has a concentration of steep slopes along the smaller tributaries of the French Creek near its northern boundary with Berks County.

Stream valleys are commonly bordered by steep slopes of 15 to 25 percent and more. Steep slopes have shallow soils and are very vulnerable to erosion, particularly when vegetation has been disturbed. Once erosion has begun, it is difficult and expensive to control. Erosion of steep slopes tends to spread along the side slopes, eventually threatening larger areas and multiple properties. Maintaining wooded or otherwise vegetated steep slopes provides a natural system of erosion protection, as well as a location for valuable wildlife habitat. See the Forested Riparian Buffers section on the following page.

Limiting development on steep slopes is important for preventing soil erosion, minimizing pollution of surface water resources, reducing flooding, preserving stream banks, and maintaining water flow in headwaters. Improper development of steep slopes can also lead to higher construction costs (including significant engineering), increased rates of septic system failures (as cited in PaDEP regulations governing slope limitations for septic systems), and increased stormwater runoff. The ideal condition would be to maintain steep slopes under a dense forest or meadow cover to prevent erosion, stream sedimentation, and other problems associated with their disturbance.

SOILS

There are three soil associations underlying the vast natural resources of the Region; Penn-Croton-Bucks, Glenelg–Manor-Chester, and Montalto-Watchung-Mount Lucas. The types of soils in a given location will influence the types of vegetation, the infiltration capacity, and can be an indicator for specific resources such as areas of wetland or floodplain. In addition they can signify what soils are classified as prime agricultural soils, as discussed further in Chapter 11: Agricultural Resources Inventory.

OPEN SPACE/WILDLIFE CORRIDORS

As the population of the Northern Federation communities, and Chester County as a whole, has increased, more and more of its open landscapes have been converted to residential, commercial, and other types of development. In response to this growth, municipalities, private organizations, and state and county governments have established areas of protected open space such as parks, easements, and nature preserves. Unfortunately, too many of these protected lands are represented by isolated parcels surrounded by land that is either developed, or has the potential to be developed. The key to reducing the isolation of open space areas is to link those areas into an integrated municipal and regional network.

Although a number of the municipal Open Space Plans touch on the need for the connection of these areas of open space through the inclusion of trail corridors, the concept of linking open space areas for continuity and wildlife migration has not yet been realized. *Linking Landscapes, A Plan for the Preserved Open Space Network in Chester County, PA*, provides criteria for the establishment of these Corridors.

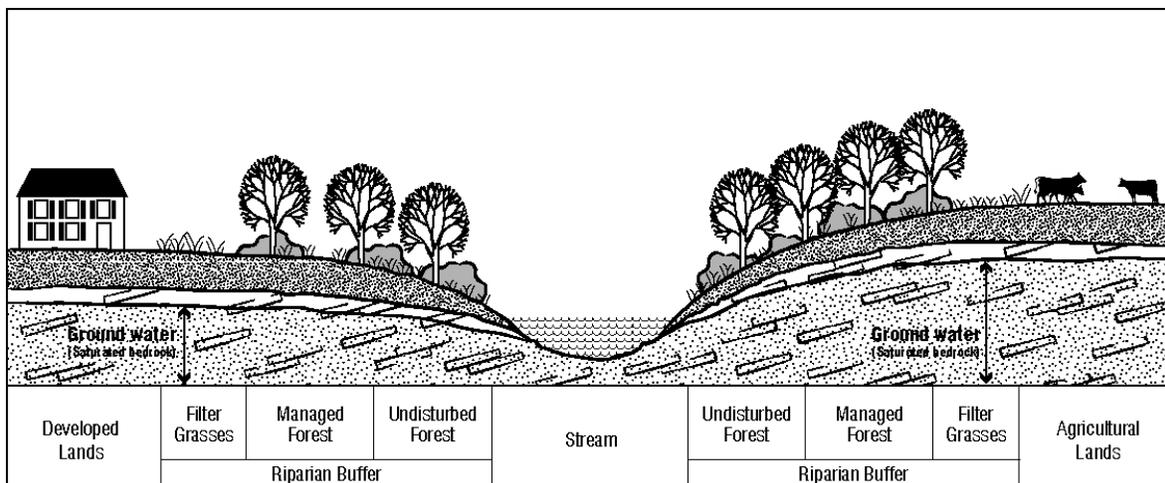
BIOTIC RESOURCES

Biotic refers to the plant and animal life of the Region, and their habitats. This section discusses the importance of maintaining natural diversity and describes major habitat areas in the Region.

FORESTED RIPARIAN BUFFERS

The preservation of an undisturbed forest along a stream corridor, known as a forested riparian buffer, has many benefits to a stream's overall condition. While forested riparian buffers may be considered a biotic resource, these areas host a complex ecosystem that influences and benefits water resources as well. The benefits of forested riparian buffers include: prevention of erosion and sedimentation, filtration of nutrients and other chemicals, habitat preservation, protection of water quality, provision of open space and areas for recreation, enhancement of property values, and temperature moderation. As Figure 7-6 depicts, the structure of a forested riparian buffer can be divided into three parts: the undisturbed forest, managed forest, and filter (grasses) zone. The preservation of forested riparian buffers is vital along areas of agricultural, residential, or industrial uses where activity and disturbance along the stream corridor is generally quite significant.

**Figure 7-6
Forested Riparian Buffer**



Unlike wetlands or floodplains, riparian buffers are not a mapped resource with an accepted coverage or designated boundary. Riparian buffers are calculated based on the size, order, and condition of a given stream corridor and regulated (in terms of required size and limits of disturbance) through a municipality’s zoning ordinance. Areas that can be designated as riparian buffers are located throughout the Region adjacent to every natural body of water within the Region’s boundaries: first, second and third order streams, wetlands, and ponds. Riparian buffers along first order streams should be given special consideration based on the attributes of these headwater areas.

WOODLANDS

There are several significantly wooded areas scattered throughout the Region. See Map 7-3: Biotic Resources. Concentrations of undisturbed woodland are located throughout the western half of the Region in the following townships:

- East Nantmeal: In the central portion of the township along the Beaver Run.
- North Coventry: In the southwestern portion of the township adjacent to Berks County and Warwick Township.
- Wallace: Along the northern border with East Nantmeal Township and the area in and around Marsh Creek State Park.
- Warwick: To the north of Route 23 in the area of the state game lands, Warwick County Park, and French Creek State Park.

Chester County is located in the eastern deciduous forest biome, a large ecological community. Within this biome, the forests of the Region, and the wider Chester County region, are part of the oak-hickory association forest. This forest association produces large amounts of mast (nuts) and is exemplified by the species shown in the table in Figure 7-7. Not all species included in Figure 7-7 are recommended species. Please refer to Appendix 6: Recommended Plant Materials.

**Figure 7-7
Typical Trees and Shrubs of the Region**

	Canopy Trees	Understory Trees and Shrubs
Deciduous Trees in Upland Areas	Red, White, Black, Scarlet, Chestnut Oaks; Mockernut, Bitternut, Pignut, and Shagbark Hickories; American Beech; White Ash; Tulip Poplar; Black Locust; Black Birch.	Flowering Dogwood; Sassafras; Ironwood; Spicebush; and Blackhaw, Mapleleaf, and Arrowwood Vibernums; Pumplonium; Palonium
Deciduous Trees In Riparian Zones	Red, Silver, and Norway Maples; Sweet and Black Gum; Red Ash; Eastern Sycamore; American Basswood; Black Willow; River Birch	Silky Dogwood; Box Elder; Common Witch Hazel; Spicebush; and Northern Arrowwood Viburnum; Osage Orange; Honeysuckle; Poison Ivy
Evergreens	Douglas Fir; Hemlock; Virginia (Scrub) Pine	

Woodlands of the Region are highly varied in composition, maturity, and species. The more mature woodlands occur in greater size and offer the best opportunity for wildlife habitat. In general, the older, more mature woodlands are found on the steep slopes while younger forests are more common in lowland areas.

Plant Species based on Soil Type - The following specifies the type of vegetation that is generally present in a given landscape based on soil type:

Penn-Croton-Bucks - Forests are dominated by Oak species, with Red Maple, Hickory and occasionally Dogwood. Soils support Mayapple. Exotic Plants grow in smaller woodlands.

Glenelg-Manor-Chester - Forests contain Beech, Tulip Poplar, Hickory and Oak, and Red Maple and Red Elm in wet areas. Soils support Hepatica, Horse Balm, Indian Cucumber, and Wild Ginger. Hemlock is dominant on north slopes.

Montalto-Watchung-Mount Lucas - The Diabase rock underlying these soils provides rich nutrients that support a wide variety of species.

Woodlands in the Region also fall completely, or partially within the following resource designations: The Big Woods, the Pennsylvania Highlands, and Penn's Woods.

Hedgerows - Hedgerows are one of the most important features in the agricultural landscape and, judging by the general decrease in quality and quantity, are one of the least



understood. Hedgerows, or thickets, are typically found along and define property lines, lining roads, protecting small streams and drainageways, and defining pastures and fields in the interior of a single property. See image to the left. Hedgerows function as windbreaks which help to impede erosion of adjacent agricultural lands and stabilize stream banks. The townships of East Vincent, East Pikeland, and North Coventry estimated they have nearly 100 miles (93) of hedgerows in their communities.

Native Vegetation - Native or indigenous vegetation refers to vegetation that currently or previously inhabited or grew in a specified location, and which was not introduced to that location as a result of human activity. Native species are adapted to environmental conditions of an area such as climate, soils, topography, winds, precipitation, wildlife, and other living organisms. A plant species that is native has already developed a series of cultural requirements to survive in these local conditions such as: hardiness, soil requirements, and resistance to biological disorders, drought, and flood conditions. Although there are native invasive plant species, their growth rate is considerably limited as compared to non-native invasive plant species as the native wildlife has adapted to become a natural control mechanism.

As is the case in much of Chester County, woodlands are being overrun by aggressive, introduced non-native or exotic plant species. Characteristics of these exotic plant species include a rapid growth rate, adaptability, high reproduction rate, and a lack of control mechanisms in the local environment. Species including the Norway Maple, Multiflora Rose, Autumn Olive, Oriental Bittersweet, Japanese Honeysuckle, and Mile-a-Minute Weed are overrunning the existing native species and becoming a dominant species throughout the County and region. While they provide cover and food for some wildlife, introduced exotic

species have displaced much of the native vegetation, resulting in a reduction of plant and wildlife diversity.

Native plants have several benefits over exotic species and they include: adaptation to local temperature, humidity, and precipitation; less susceptibility to local insect and disease problems; encouragement of natural diversity; and biological processes among living organisms.

Locally Significant/Important Vegetation - Locally important vegetation may be considered to include those types of resources that add character, beauty, and a sense of history to the Region. This designation may include historic specimen trees or hedgerows that define an area or provide a focal point or sense of community for a municipality or Region. Specimen trees or other types of significant vegetation are discussed in detail in the individual Open Space, Recreation and Environmental Resources Plans. The protection of these scenic and/or historic resources can be accomplished through the same strategies that protect woodlands and native vegetation.

RESOURCE DESIGNATIONS

The Pennsylvania Department of Environmental Protection (PaDEP) and other state and federal regulatory organizations have put programs into effect that promote the identification of specific resources as high priority for protection and preservation. These designations provide criteria for qualification of and steps to follow to ensure the appropriate management of that resource.

SPECIAL PROTECTION WATERS

Chapter 93 of the Clean Streams Law designates some of Pennsylvania's streams as Special Protection Waters. The Region is fortunate to host a number of stream corridors that have been designated as "high quality" (HQ) or "exceptional value" (EV) by the PaDEP. These designations are used to increase protection measures along the designated watercourses. Map 7-1: Water Resources shows that watersheds of "high quality" include portions of the Brandywine Creek and Pickering Creek watersheds within the Region, the entire Pigeon Creek and Stony Run watersheds, the middle section of the French Creek including Beaver Run, and portions of the Schuylkill River drainages. There are five sub basins within the French Creek watershed that have been designated as "exceptional value." These sub basins include the French Creek, Pine Creek, South Branch, Rock Run, and Birch Run and represent the largest area of EV designation in Chester County.

High Quality (HQ) - Streams or watersheds with excellent quality waters, and environmental or other features that require special water quality protection.

Exceptional Value (EV) - Streams or watersheds with outstanding ecological or recreation value that must be protected so that they maintain their existing quality.

WILD AND SCENIC RIVER CORRIDORS

The National Wild and Scenic Rivers Act of 1968 (Public Law 90-542) established a national system to protect selected free flowing rivers with outstanding natural, cultural, and recreational features. The Schuylkill River and French Creek have been designated as "Wild and Scenic Rivers" by the PaDEP. The Schuylkill River represents the northern boundary of the townships of North Coventry, East Coventry, East Vincent, and East Pikeland. Portions of the French

Creek are located in the townships of Warwick, East Nantmeal, South Coventry, East Vincent, West Vincent, and East Pikeland.

SCHUYLKILL RIVER HERITAGE AREA - DCNR

The Schuylkill River Heritage (national and state) Area is an historic, recreational, and cultural designation located along and focused upon the Schuylkill River. The Corridor spans a large and diverse area from Pottsville, Berks County to the City of Philadelphia all connected by the "Revolutionary River." The Heritage Area is divided into ten areas of interest that include: Coal Country, The Blue Mountains, East Penn Valley, Western Berks, Greater Reading, Oley Valley, French and Pickering Valleys, Perkiomen Valley, Skippack Valley, and Philadelphia.

A description of each of these interest areas and links to additional information can be found at www.schuylkillriver.org/default.aspx

GROUND WATER PROTECTED AREA - DRBC

The Ground Water Protected Area (GWPA) is an area within the Delaware River Basin that is regulated by the Delaware River Basin Commission to prevent depletion of ground water and protect the interests and rights of lawful users of the water source, as well as balance and reconcile alternative and conflicting uses of limited water resources in the region.

The regulations require detailed hydrogeologic studies, pump test analyses, and evaluation of potential impacts on adjacent wells for withdrawals that exceed 10,000 gallons per day based on average 30-day use.

The regulations also set a two-tiered system of water withdrawal limits. The first tier serves as a warning that a subbasin is "potentially stressed". In potentially stressed subbasins, applicants for new or expanded ground water withdrawals are now required to implement one or more programs to mitigate adverse impacts of additional ground water withdrawals. Acceptable programs include: conjunctive use of ground water and surface water, expanded water conservation programs, programs to control ground water infiltration, and artificial recharge and spray irrigation. The second tier serves as the maximum withdrawal limit. Under the regulations, ground water withdrawals cannot exceed that limit.

Additionally, the regulations allow counties or municipalities to have more stringent regulations if desired.

PENNSYLVANIA RIVERS CONSERVATION PROGRAM

The Pennsylvania Rivers Conservation Program has been developed to conserve and enhance river resources through preparation and accomplishment of locally initiated plans. The program provides technical and financial assistance to municipalities and river support groups to carry out planning, implementation, acquisition and development activities. A registry is established to recognize local river conservation efforts. This program is administered by the Pennsylvania Department of Conservation and Natural Resources and more information regarding the program can be found at their website: <http://www.dcnr.state.pa.us/rivers/>.

The initial step within the Rivers Conservation Program is to prepare a Rivers Conservation Plan (RCP) for the watershed. This plan is prepared by local groups that best understand local needs and opportunities. Some issues typically found in a RCP include:

- Background information including: 1) brief history of planning activities, 2) the steering committee and the roles played, and 3) the processes used to gather and evaluate resource data;
- A map of the planning area;
- An inventory of resources gathered;
- An analyses of the appropriate resources;
- Listing of issues, concerns, opportunities and threats to river values; Management options (issues, opportunities and concerns solution); and
- Other appropriate information.

For the Pickering Creek watershed a rivers conservation plan has been prepared by the Green Valleys Association (dated April 4, 1998). The DCNR identification number is RCP 1995-08. This plan includes the French Creek watershed as well.

For the Stony Run watershed a rivers conservation plan has been prepared by the Green Valleys Association (dated June 14, 2003). This plan includes the Pigeon Creek watershed as well. The DCNR identification number is RCP 1995-05.

PENNSYLVANIA NATURAL DIVERSITY INDEX (PNDI) SITES AND NATURAL AREAS INVENTORY

The Pennsylvania Natural Diversity Inventory (PNDI) provides site-specific information describing significant natural resources of the Commonwealth. The inventory locates and identifies the most unique natural features that create Pennsylvania's natural diversity. This inventory contains information on the locations of rare and threatened, and endangered species and of the highest quality natural areas in the county. The inventory further provides general management recommendations for the protection of the identified species. Exact locations and the species are not identified for their protection; however, this additional information can be obtained from the Pennsylvania Science Office of the Nature Conservancy upon request by the municipality or landowner. Map 7-3 does provide an approximate location of Managed and At Risk/PNDI Sites.

HOPEWELL BIG WOODS

The Hopewell Big Woods is a vast area of forested land that encompasses portions of Berks, Montgomery, and Chester Counties that was identified for conservation by the Natural Lands Trust (NLT) in 1998. See Map 7-3: Biotic Resources. The Hopewell Big Woods is comprised of three zones: 1) the forest zone, 2) the watershed zone, and 3) the greenway zone. The boundaries of the Big Woods area include or are within the boundaries of seven of the nine municipalities in the Northern Federation. These include the townships of East Coventry, East Nantmeal, East Vincent, North Coventry, South Coventry, Warwick, and West Vincent. Warwick Township is the only community whose borders lie entirely within the boundaries of the designated area of the Big Woods.

In November 2003, the *Hopewell Big Woods Landscape Conservation Plan* was completed. This plan includes a thorough inventory and analysis of the Big Woods and provides implications that lead to recommendations for the preservation of 15,000 acres of unbroken forest (including 4,000 acres of old-growth forest) and the streams of the upper reaches of the French Creek and the Hay Creek Watersheds.

PENNSYLVANIA HIGHLANDS

The Pennsylvania Highlands Region is a section of the Appalachian Mountains located in Eastern Pennsylvania frequently cited as a candidate for extensive ecological preservation. The heavily forested region is seen as ecologically significant because, among other things, its dense forests serve to protect and supply clean drinking water to more than 15 million people, including large portions of both New Jersey and New York. The Pennsylvania Highlands also have even been recognized by the U.S. Forest Service as a "landscape of national significance." The designated "Highlands" area includes eight of the nine Municipalities of the Northern Federation: East Coventry, East Nantmeal, East Vincent, North Coventry, South Coventry, Wallace, Warwick, and West Vincent Townships.

WILDLIFE HABITAT/NATURAL DIVERSITY

Native ecosystems along the East Coast, including wetlands, stream corridors, and woodlands, are facing increasing fragmentation and various negative impacts as a result of human encroachment. One serious impact of this encroachment is the loss of natural diversity. Natural diversity is the total variety and variability of living organisms and the ecological habitats in which they occur. Human activities that involve the modification and adaptation of the natural environment decrease natural diversity. For protection of the diverse communities of species and habitats native to the Region to be effective depends on knowledge of their extent and diversity, their locations, their habitat requirements, and their interrelationships as part of the natural ecosystem in which they exist.

Undeveloped lands can be roughly classified into three categories: open field, forest, and wetlands. To continue the sustainability of a healthy and diverse landscape, it is especially critical to reserve sufficient areas of each of these habitats as interconnected habitat networks throughout the Region.

Habitat pertains to a region or area where a plant or animal naturally grows or lives. There are several major habitats found in this general area of the county. The need for natural diversity is reflected in the summaries provided below.

Streams and Wetlands - Stream corridors and wetland areas have a very high habitat value, as they feature the largest total amount of living organic material. The variety of trees, shrubs, and herbs which grow naturally along stream corridors and in floodplain and wetland areas provide structural complexity, cover, and an assortment of food sources immediately adjacent to water. These characteristics taken in combination make the stream and wetland ecosystem an extremely valuable habitat for many species of plants and wildlife native to the Region. Since riparian areas are typically undeveloped and interconnected, they serve a critical function as important wildlife corridors through which wildlife can pass unharmed and reach other habitat areas. Due to their importance to water quality and wildlife, any disturbance of these areas should be avoided wherever possible or minimized and mitigated when disturbance must occur.

Wooded Stream Corridors (Forested Riparian Buffers) - Many streams in the Region are bordered by woodlands. In addition to important habitat, Forested riparian buffers provide important environmental functions such as shading and cooling stream water; functioning as a natural filtering system by slowing the flow of water, allowing sediment and polluting nutrients to settle out of stream water; and helping to prevent erosion by acting to hold streambank soils in place. Stretches of streams that are not adjacent to woodlands are considered vulnerable areas within the system.

Woodlands - Woodlands are a critical component in maintaining the natural diversity of the Region and provide vital habitat for native vegetation and wildlife. Large and mature forest stands, though greatly modified by human activities over time, are likely to support a large variety of species which would not occur in other habitats. In some cases, a healthy forest ecosystem is critical in the survival of certain species of forest plants and wildlife. Several species of songbirds, such as the colorful warblers, are specifically adapted to forest interior conditions and will not nest in any other location. In addition, various species of wildflowers will only bloom on the rich, moist soils that make up the forest floor.

Open Lands - Open lands, including fields, meadows, and pastures, are also an important habitat for plants and animals. Though they are the only habitats created by regular maintenance, they add to the diversity of the Region as a whole. Open lands, which are managed as meadows, are often abundant in native grass, sedge, and wildflower species. This rich vegetation provides food consisting of seeds, herbaceous material, and insects for local wildlife. Where situated next to forests, the edge between both habitat types provides a unique combination of food and cover for wildlife.

Agricultural lands, including field crops, orchards, gardens, pastures, and hayfields, provide food not only for humans and livestock but also food and habitat for wildlife. Meadows and hayfields provide an additional habitat to the overall ecosystem. These areas provide a food source for browsers, rodents, and several species of seed eating birds. Tall meadow provides suitable habitat and nesting sites for birds (pheasant and numerous songbirds) and small rodents, a base element in the food chain. Prior to harvest, crops are consumed by wildlife whenever possible. However, the more important element in the process follows harvest, when many species of wildlife pick over the remains of field crops in search of leftover seeds and grains. This is a particularly important source of food in the fall and winter, when other sources of food are scarce, for several species of game birds including pheasant, Canada Geese, and several other species of waterfowl.

Hedgerows - Hedgerows provide a variety of fruits, buds, and insects, and provide nesting sites and a means of escape from predators for animals that normally feed in adjacent open fields and meadows. Fields and meadows with hedgerows tend to support a more numerous and varied population of wildlife than those that lack hedgerows.

LEGAL BASIS FOR NATURAL RESOURCE PROTECTION

The Pennsylvania Constitution, state legislation, and case law provide a solid foundation for regulating and protecting natural resources at the municipal level. The highlights of these supportive documents are summarized below.

PENNSYLVANIA CONSTITUTION

The “Environmental Amendment” of the Pennsylvania Constitution states, “The people have a right to clean air, pure water, and to the preservation of the natural, scenic, historic, and aesthetic values of the environment. Pennsylvania’s natural resources are the common property of all the people, including generations yet to come. As trustees of these resources, the Commonwealth shall conserve and maintain them for the benefit of all people.”¹

¹ Article I, Section 27 of the Pa. Constitution, adopted May 18, 1971.

PENNSYLVANIA MUNICIPALITIES PLANNING CODE (Act 247 of 1968, as amended)

The Municipalities Planning Code (MPC) is the legislation that empowers municipalities to plan their development through the use of comprehensive planning, ordinances, and official maps. While the comprehensive plan provides the policy basis for protecting resources, the zoning ordinance and subdivision and land development ordinance are the two primary means of regulating and protecting natural resources at the municipal level.

Specific provisions in the Article VI, *Zoning*, of the MPC that support the protection of natural resources include:

- Section 603(b) states that, except as preempted by specific acts, zoning ordinances may “permit, prohibit, regulate, restrict, and determine...protection and preservation of natural and historic resources and prime agricultural land and activities.”
- Section 604(1) states, in part, that zoning ordinance provisions “shall be designed to promote, protect, and facilitate...[the] preservation of the natural, scenic, and historic values in the environment and preservation of forests, wetlands, aquifers, and floodplains.”
- Section 605 allows additional zoning classifications to be created specifically for “the regulation, restriction, or prohibition of uses and structures at, along, or near:... (ii) natural or artificial bodies of water, boat docks, and related facilities; (iii) places of relatively steep slope or grade, or other areas of hazardous geological or topographic features;...(vii) floodplain areas, agricultural areas, sanitary landfills, and other places having a special character or use affecting and affected by their surroundings.”

Specific natural resource protection provisions for subdivision and land development regulations are more limited in the MPC than those pertaining to zoning. This fact indicates that the zoning ordinance is the more appropriate vehicle for most resource protection measures. The following two sections of Article V, *Subdivision and Land Development*, of the MPC that address natural resources pertain to the permitted contents of the ordinance:

- Section 503(2)(v) allows for provisions that ensure that “land which is subject to flooding, subsidence, or underground fires shall be made safe for the purpose for which such land is proposed to be used, or that such land shall be set aside for uses which shall not endanger life or property or further aggravate or increase the existing menace.”
- Section 503(10) allows “provisions and standards for insuring that new developments incorporate adequate provisions for a reliable, safe, and adequate water supply to support intended uses within the capacity of available resources.”

Other relevant sections of the MPC that support the consideration and protection of natural resources through local ordinances and planning decisions include:

- Sections 609.1(c)(3) and (4) which require the governing body, in the consideration of curative amendments, to consider “the suitability of the site for the intensity of the use proposed by the site’s soils, slopes, woodlands, wetlands, flood plains, aquifers, natural resources, and other natural features;” and “the impact of the proposed use on the site’s soils, slopes, woodlands, wetlands, flood plains, natural resources and natural features, the degree to which these are protected or destroyed, the tolerance of the resources to development and any adverse environmental impacts.”
- Section 916.1 requires the zoning hearing board decision to consider the same environmental issues as outlined above when deliberating on a challenge to the validity of an ordinance.

OTHER STATE LEGISLATION

In addition to the provisions of the MPC, there are other state legislative acts that provide clear support for the protection of natural resources. Major pieces of legislation include the following:

Clean Streams Act (1937) - This act regulates discharges to the state's waters and was intended to preserve and improve the purity of the waters of the Commonwealth.

Flood Plain Management Act (1978) - This act is intended to limit loss of life and property damage due to flooding. In order to qualify for national flood insurance, municipalities must enact floodplain management regulations to control development in the 100-year floodplain.

Dam Safety and Waterway Encroachment Act (1978) - This act regulates the construction, operation, modification, and maintenance of dams, reservoirs, and structures that encroach and alter a waterbody.

Conservation and Natural Resources Act (1995) - This act created the Pennsylvania Department of Conservation and Natural Resources (PaDCNR) as a cabinet level advocate for state parks, forests, rivers, trails, greenways, and community recreation and heritage conservation programs. The mission of the PaDCNR is to maintain, improve, and preserve state parks for their long-term sustainability; provide information on the state's ecological and geologic resources, and administer grant and technical assistance programs that will benefit rivers conservation, trails and greenways, local recreation, regional heritage conservation, and environmental education programs across Pennsylvania.

RELEVANT CASE LAW SUPPORTING RESOURCE PROTECTION

The first two cases discussed below² specifically support the ability of municipalities to protect natural resources through ordinance regulation. The third case, while not specifically about natural resource protection, does discuss pertinent natural resource protection issues in regards to "fair share."

Reimer v. Upper Mt. Bethel Township, 615 A.2d 938, Pa. Cmwlth. 1992 - In this case, the Commonwealth Court concluded that minimum lot size requirements based upon slope, soil, and water table characteristics were a valid exercise of municipal regulatory power. This case supports the concept of determining the appropriate intensity of use of land based on the natural resources present on the site. It also supports the concept of "net-out" of natural resources when determining density, assuming the base lot size is reasonable (i.e., not too large) before the resources on the site are deducted.

Jones v. McCandless Zoning Hearing Board, 578 A.2d 1369, Pa. Cmwlth. 1990. - In this case, a portion of the town had been rezoned to create a new district that used performance standards (i.e., presence of site constraints) for determining the potential number of lots and density permitted on the site. Standards were also established for the protection of sensitive natural resources (e.g., woodlands, streams, steep slopes). A property owner wishing to develop his property challenged the ordinance standards as unreasonable, arbitrary, and denying him the use of his property. The court upheld the ordinance concluding that 1) the challenged ordinance provisions were substantially related to legitimate interest in maintaining ecological balance, and

² Case summaries are adapted from *Bucks County Natural Resources Plan*, Bucks County Planning Commission, Doylestown, PA, 1999.

2) the ordinance did not deprive the property owner of viable use of his property by restricting permissible density of development.

Appeal of Dolington Land Group and Toll Bros, Inc., J-129-2003, find law, Pa. Dec. 30, 2003. - While this case did not deal specifically with natural resource protection, it includes several points supportive of the Northern Federation Region's current efforts.³ The Pennsylvania Supreme Court's analysis recognizes the Commonwealth's desire to use sound multi-municipal land use policies as a means to address environmental issues. This desire was made particularly apparent through the state's adoption of Act 67 in 2000. The Court further recognized "an increased awareness of the environmental sensitivity and public value of undisturbed wetlands, floodplains, slopes, and woodlands..." since 1977 when the *Surrick*⁴ case was decided. The discussion clearly supports the protection of environmental resources as a legitimate public purpose for municipal regulations.

CONCLUSION

The natural resources described in this chapter both accommodate essential environmental processes, and define the rural character of the Region. The overall goal for regional resource protection is to establish a common approach that each municipality can employ for the consistent management of resources. To this end, Chapter 2: Natural Resources Plan analyzes existing municipal measures currently in each municipality's zoning and subdivision and land development ordinances. The purpose of this analysis is to determine where gaps in protection measures may exist at the regional level. Further, Chapter 2 includes recommendations for addressing these gaps and determining what additional measures may be needed to protect natural resources on a regional basis.

Figure Sources

Figure 7-1: *Chester County, Pennsylvania Water Resources Compendium*. Chester County Water Resources Authority, 2001.

Figure 7-2: Chester County Planning Commission, 2004.

Figure 7-3: Chester County Planning Commission, 2000.

Figure 7-4: Chester County Planning Commission, 2006.

Figure 7-5: Hydric - Soil Survey Geographic Database for Chester County, Pa, U.S. Department of Agriculture, Natural Resources Conservation Service, 1997. Soils with Hydric inclusions - United States Department of Agriculture, Soil Conservation Service, Interim List, 1987.

³ *Dolington* dealt more specifically with providing for land uses and "fair share" of multi-family houses on a regional basis.

⁴ The *Dolington* analysis frequently refers to *Surrick v. ZHB of the Township of Upper Providence*, Pa. 382 A.2d 105 (1977), the principal case in addressing fair share issues in Pennsylvania.

Figure Sources continued

Figure 7-6: Chester County Planning Commission, 2006.

Figure 7-7: Chester County Planning Commission, 2004.

Photograph Sources

Page 7-13: Chester County Planning Commission, 2005.