Organization of Chapter

Introduction and Goal and Objectives

The Oxford Region is rich in natural resources that stretch across the Region connecting the stream valleys of the Octoraro and Big Elk Creeks. Natural resources are an essential element in maintaining a healthy, safe, and pleasant environment for residents living in the Region. This chapter provides an inventory of those resources, an analysis of their importance to the Region, and recommendations for the consistent management and protection of natural resources in the communities that make up the Region, in accordance with the following Regional Goal:

> *Protect, restore, and maintain natural resource features and landscapes to sustain the Region's economy, maintain watersheds, ecosystems, and public health, and to continue its rural character and quality-of-life.*

Plan Objectives

This Plan Chapter focuses on how best to achieve the following Objectives:

12-A Protect and restore stream valleys and regional watersheds and maintain the quantity of groundwater and pursue measures to maintain and, where possible, improve water quality.

12-B Limit the disturbance of land resources such as steep slopes and woodlands to prevent increased runoff and degradation of stream valleys and headwater areas.

12-C Promote innovative stormwater management (best management practices) and wastewater disposal policies that emphasize the recharge of groundwater and water balance.

12-D Preserve and protect areas that provide wildlife habitat and natural diversity including stream valleys, steep slopes, floodplains, woodlands, wetlands, and hedgerows.

12-E Preserve and protect woodland resources to maintain the Region's rural character, wildlife habitat, and natural diversity.

12-F Support sustainable land use practices within the Region and ensure that proposed development respects the existing site conditions.

12-G Enhance municipal zoning and subdivision ordinances where necessary in the Region to improve their effectiveness in preserving and protecting natural resources and to implement consistent resource protection standards in the Region.

12-H Encourage innovative and creative techniques to effectively address natural resource protection issues to maintain the Region's agricultural heritage rural character and dark skies.

Natural Resource Inventory Criteria

This chapter provides an inventory of natural resources at the regional level in order to develop a uniform strategy for their preservation and management. The six municipalities of the Oxford Region have adopted Open Space, Recreation, and Environmental Resources Plans (open space plans) to address the management of resources[1]. However, those plans focus on individual communities and do not provide an analysis or inventory of resources from a broader, regional perspective.

The natural resources referenced in this Chapter are organized under the broader categories of water, land, and biotic resources in accordance with the open space plans.

[1] East Nottingham - 2002; Elk - 1995; Lower Oxford - 1993; Upper Oxford - 1994; West Nottingham - 1996; Oxford Borough - 2002.

Minimum Recommended Protection Criteria – Disturbance Limitations

The establishment of specific disturbance limitations is of particular importance in protecting natural resources. In the case of some resources, the recommended allowance for disturbance is zero percent or no disturbance. In other cases there is some allowance for disturbance, but an upper limit is established. Disturbance limitations should be reasonable and directly linked to protection of the resource which, in turn, should be clearly linked to health, safety, and welfare issues as they are implemented through the municipal zoning and/or subdivision and land development ordinance.

Striking a proper balance between protection of the resource and allowing for reasonable use of the land is key in establishing an effective municipal or regional resource protection program.

Resource protection regulations cannot take all legitimate use of the land away from a property owner, leaving a municipality vulnerable to a "takings" challenge. For that reason, there are only a limited number of resources that allow for no disturbance and they are generally linked to state or federal mandates for their protection (i.e., floodplains and wetlands).

A prohibition of disturbance means the protected resource cannot be regraded, filled, built upon, or otherwise altered or disturbed.

The Recommended standards or disturbance limitations are included with each of the associated resources, as necessary, and are delineated in Appendix 12-A.

Relationship Between Resources

It is important to understand the inter-relationship between the Region's natural resources. For example, the disturbance of an area of woodland on a steep slope will have a direct impact on the associated slope and the stream corridor at the bottom of the slope. The removal of vegetation will severely reduce the underlying soil's holding capacity, increasing erosion and sedimentation and significantly reducing the soil's infiltration capacity and the quality and recharge of surface water to groundwater.

Although not always physically connected, the status or condition of land, water, and biotic resources will impact the status or condition of related resources.

Soil erosion along a stream

Water Resources

The creeks, streams, and rivers throughout southwestern Chester County have influenced development patterns and the quality of life enjoyed by residents of the Oxford Region for centuries. Watersheds of the Region serve as the source of drinking water for communities beyond its boundaries. Proper management of water resources is necessary to meet growing demands for its use, protect it from degradation, and sustain and/or improve water quality wherever possible. Water resources within the associated watersheds have far-reaching implications and are most appropriately managed on a regional basis. Water resources discussed in this chapter include: watersheds, ground and surface water, stream corridors, headwaters, floodplains, and wetlands.

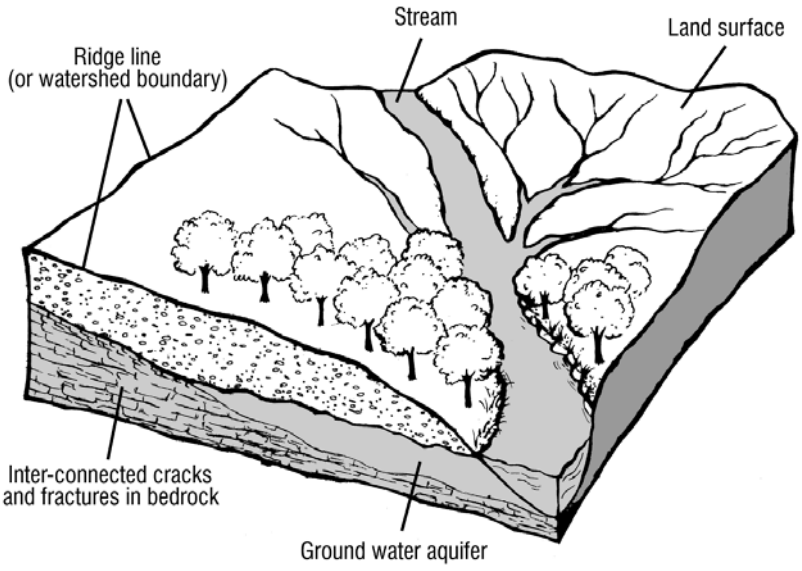
"Clean water is the cornerstone of healthy communities. It is impossible to overstate the value and importance of clean water for people, fish and wildlife. Our health, quality of life, economy and ecosystem depend on it."

American Rivers

Watershed

As indicated in the Water Resources Authority's *Watersheds* Plan (May 2002), a watershed can be defined as 1) an area of land that drains into a particular river or body of water; usually divided by topography or ridgelines or 2) the total area of land above a given point on a waterway that contributes surface runoff and ground water to the flow at that point. The precipitation that falls within a watershed flows from surrounding ridgeline divides toward, and becomes the source of, stream flow and groundwater. See Figure 12-A. Other environmental processes such as transpiration by plants and evaporation also consume a significant share of a watershed's precipitation.

Figure 12-A: Typical Watershed



Source: *Watersheds*, Chester County Water Resources Authority, 2001

Watershed Classifications

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 headwater drainage areas combine to create a sub basin, and several sub basins combine to create a watershed, and so on. There are four watersheds and ten sub-basins in the Oxford Region, from West to East: the Octoraro Creek, the Northeast Creek, the Little Elk Creek, and the Big Elk Creek, as shown in Figure 12-B below. The Octoraro Creek drains into the Susquehanna River Basin and the Northeast Creek and Little and Big Elk Creeks drain into the Chesapeake Bay Basin.

Figure 12-B: Watersheds of the Oxford Region

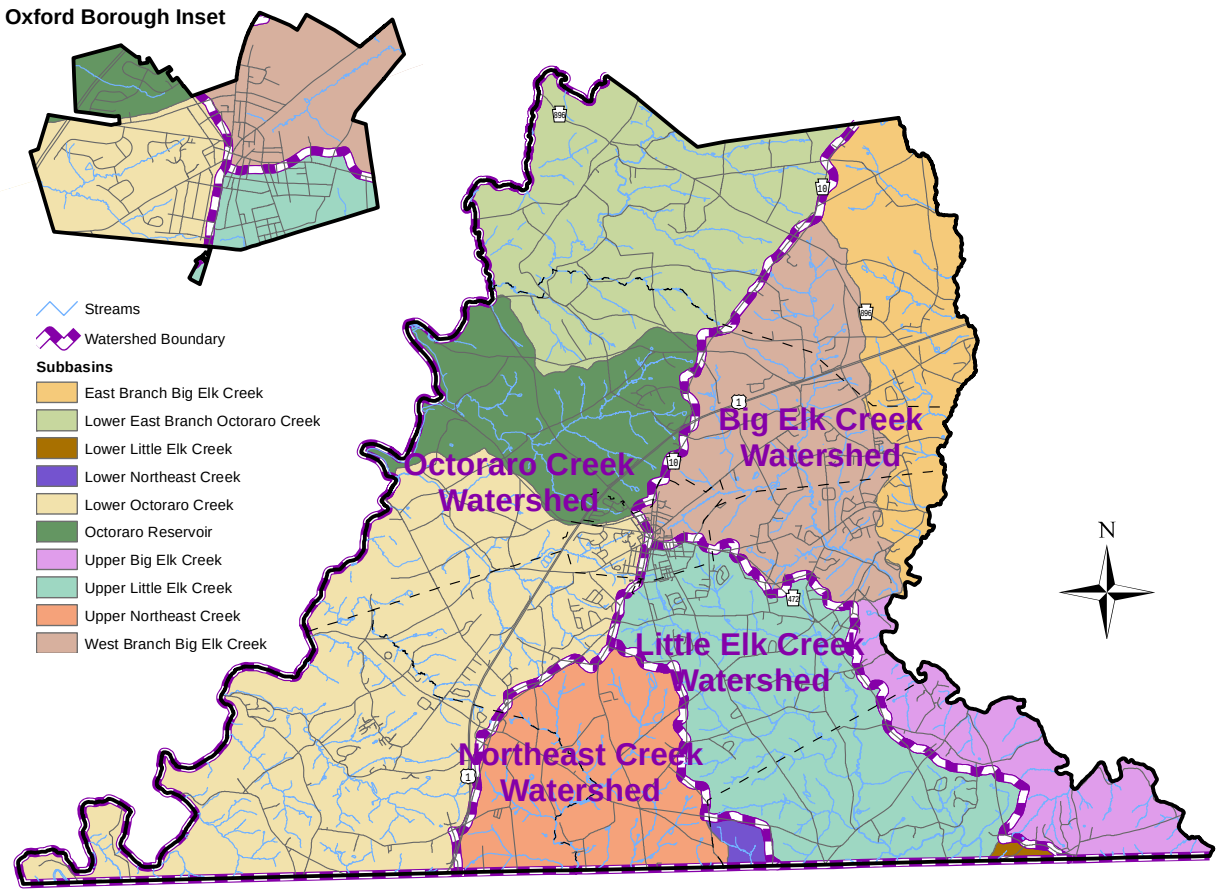


Figure 12-C: Watershed Characteristics

Watershed	Octoraro	Northeast	Little Elk	Big Elk
Square Miles in Region	39.02	7.95	12.41	22.02
Percent of region	47.9%	9.8%	15.2%	27.1%
Total Square Miles of Watershed	186.79	55.71	36.08	60.54

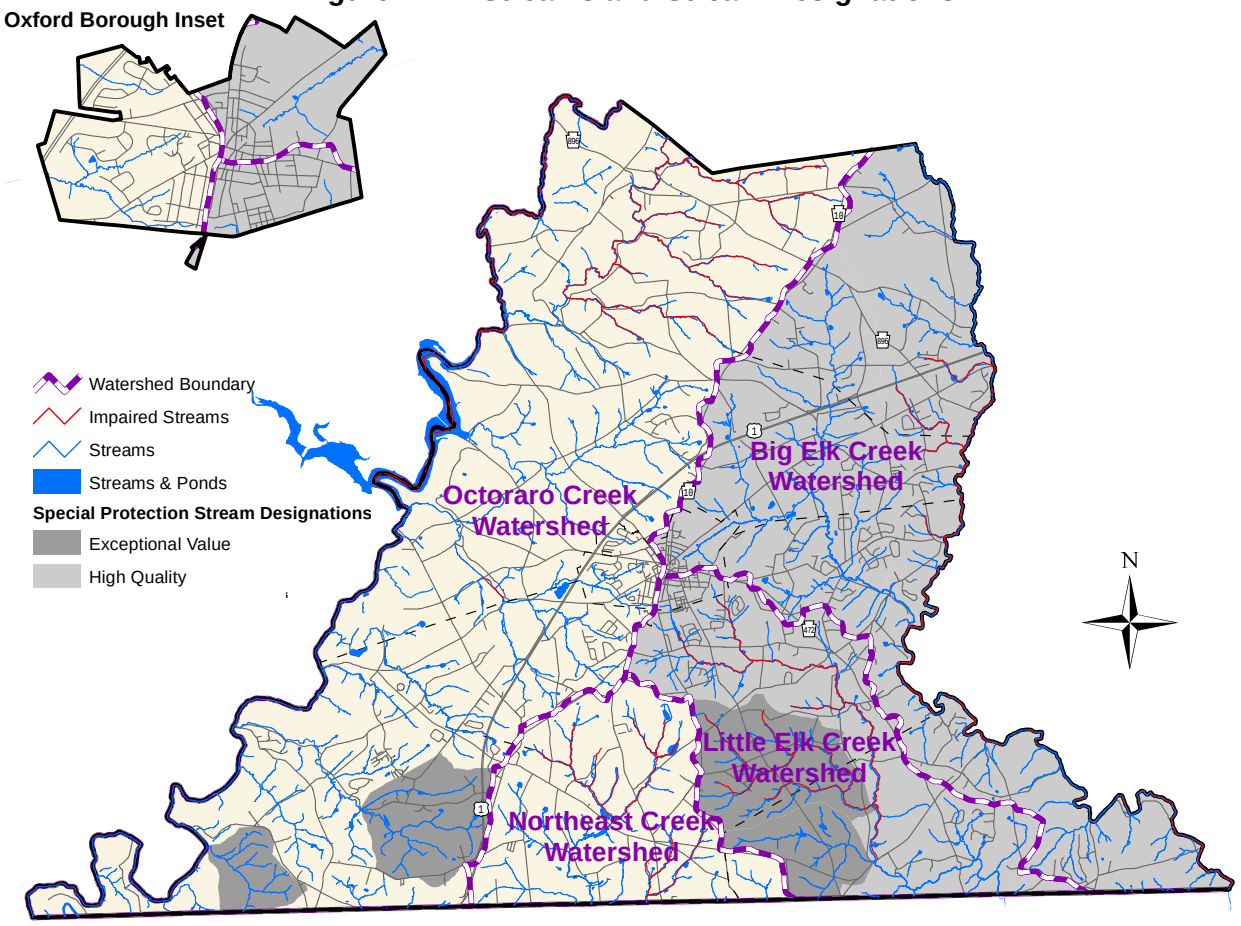
Source: Watersheds, Sub-basins - Chester County GIS, 2005

Water Resource Designations and Strategies

State and federal regulatory organizations have put programs into effect that promote the classification of specific water resources as high priority for protection and preservation. These designations provide criteria for the identification of and steps to follow to ensure the appropriate management of these resources. The following designations apply to water resources in the Oxford Region:

Special Protection Waters: Chapter 93 of the Clean Streams Law designates some of Pennsylvania's streams as Special Protection Waters. The Region hosts a number of stream corridors that have been designated as "high quality" (HQ) or "exceptional value" (EV) by the Pennsylvania Department of Environmental Protection (PaDEP). These designations are used to increase protection measures along the designated watercourses. See Figure 12-D below for watersheds that contain Special Protection Waters.

Figure 12-D: Streams and Stream Designations



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.

Pennsylvania Cold Water Fish Protected Use Designation: This designation protects the stream for the maintenance or propagation (or both) of fish species and additional flora and fauna which are indigenous to a cold water habitat. The Octoraro Creek Watershed has been designated a habitat for cold water fish species.

Pennsylvania Scenic Rivers System: This program is administered by the Pennsylvania Department of Conservation and Natural Resources (DCNR) to classify rivers that meet certain criteria as Scenic, Wild, Pastoral, or Recreational. In 1983, the Octoraro Creek was designated as a Scenic (12.25 miles) and Pastoral (24.25 miles) river system under the DCNR's guidelines. These areas should, therefore, be considered as high priority areas for minimum flow and water quality requirements. As such, a management plan titled *Octoraro Creek Corridors, Issues, and Management Recommendations* was prepared in 1986 by the Octoraro Creek Task Force.

Impaired Streams: Impaired streams, as designated by the PaDEP, are sections of watercourses that do not meet Pennsylvania water quality standards (in regard to sediment and nutrient load) and are shown in red on Figure 12-D. Unlike the previously listed water resource designations that identify the positive attributes of a water resource, impaired streams identify streams (or sections thereof) that are in crisis as a result of pollution and/or sedimentation. The Brandywine Valley Association, which is active in the Brandywine Watershed, has a program called "Red Streams Blue" whose goal is to "ensure that all the streams in a watershed meet Pennsylvania water quality standards." This plan chapter includes plan recommendations that will help to reach a similar goal. See Figure 12-D for threatened streams in the watersheds of the Oxford Region. The Brandywine Valley Association's website for more information on their Red Streams Blue Program: www.brandywinewatershed.org/2008/redstreamsblue/index.asp

Chesapeake Bay Strategic Plan: The Chesapeake Bay Agreement and Strategic Plan will have far-reaching effects on the protection of the streams, creeks, and rivers that eventually drain into the Chesapeake Bay. The strategy includes regulations to restore clean water, implement new conservation practices, conserve millions of acres of undeveloped land, and rebuild the oyster population in twenty tributaries of the Bay. The Region will need to monitor the status of the Strategic Plan and consider implementation of regulations set forth as a result of the Plan (federal, state, and/or local level).

On May 12, 2010 the Environmental Protection Agency (EPA) issued its final *Strategy for Protecting and Restoring the Chesapeake Bay Watershed*

☑ RECOMMENDATION FOR CONSISTENCY WITH CHESAPEAKE BAY POLICY

Action 12-1 Continue to monitor the status and implementation of the ***Strategy for Protecting and Restoring the Chesapeake Bay Watershed*** and revise individual municipal regulations as necessary or required.

✓This action addresses all Objectives

Related Plans and Studies

Watersheds: An Integrated Water Resources Plan for Chester County, Pennsylvania and Its Watersheds was prepared by the Chester County Water Resources Authority and includes municipal implementation strategies as shown in Figure 12-E.

Figure 12-E: Twelve Categories of Watersheds Strategies for Municipal Implementation

1.	Involving the Public in Watershed Stewardship
2.	Providing Water-Based Recreation and Cultural Resources
3.	Establishing Networks of Forested Riparian Buffers
4.	Using Conservation (Low Impact) Development Designs
5.	Protecting Natural Resources through Land Preservation
6.	Protecting Ground Water Quality
7.	Protecting Sources of Public Drinking Water Supplies
8.	Agricultural and Landscape Management
9.	Reducing Stormwater and Flooding Impacts
10.	Natural Stream Restoration and Stabilization
11.	Protecting Ground Water Balances and Stream Baseflow
12.	Integrated Water Resources Planning

Source: CCWRA, 2002

Watersheds is a good source of information regarding water resource planning and protection strategies and is available to review on the web at: http://dsf.chesco.org/water/site/default.asp

Groundwater and Surface Water

Ground and surface water are valuable and indispensable resources in the Region. Ground water is water that occurs in the subsurface (aquifer) and occupies the porous openings, fractures, and fissures of underground soils and rock units. Groundwater becomes surface water when it is exposed to the atmosphere in creeks, rivers, and lakes. Continued reliance by most residents and property owners of the Region on groundwater for domestic water supply dictates careful management of these resources. 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.

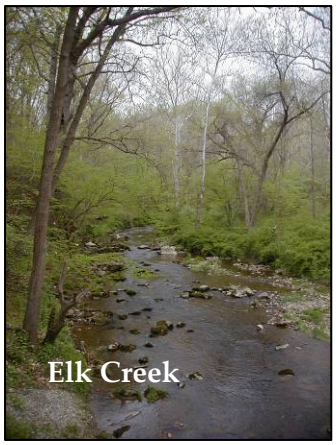
Groundwater was identified as the highest priority for protection by the Planning Committee

Natural Resources Survey

Why are groundwater and surface water important?

- ✓ Support wildlife
- ✓ Source of water for domestic use and agriculture (irrigation)

Stream Corridors



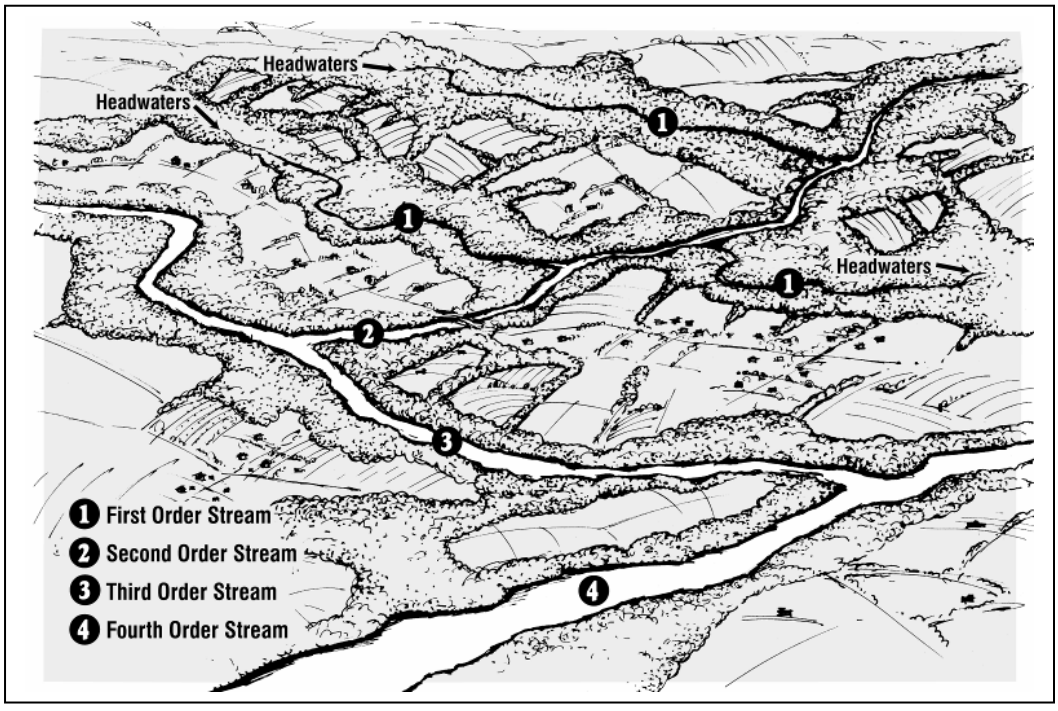
A stream corridor can include a river, creek, brook, tributary, or other flowing surface waters within a natural channel. It can be an **intermittent**, **perennial**, or **ephemeral** watercourse which contains flow from surface and/or groundwater sources during at least a portion of an average rainfall year. There are approximately 350 linear miles of streams in the Region that carry surface and ground water and provide habitat for local plant and wildlife. (See Figure 12-D)

Why are stream corridors important?

- ✓ Provide stream recharge into first order streams during periods of low flow
- ✓ Provide important wildlife habitat and breeding areas
- ✓ Provide conveyance for ground and surface water

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 12-F) Fourth Order streams form the major tributaries (Octoraro and Elk Creeks) within a watershed.

Figure 12-F: Stream Hierarchy and Headwaters



Source: CCPC, 2004

Headwaters

More than 50% of the Region's watersheds are identified as first order drainage areas. First order drainage areas or headwaters 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.

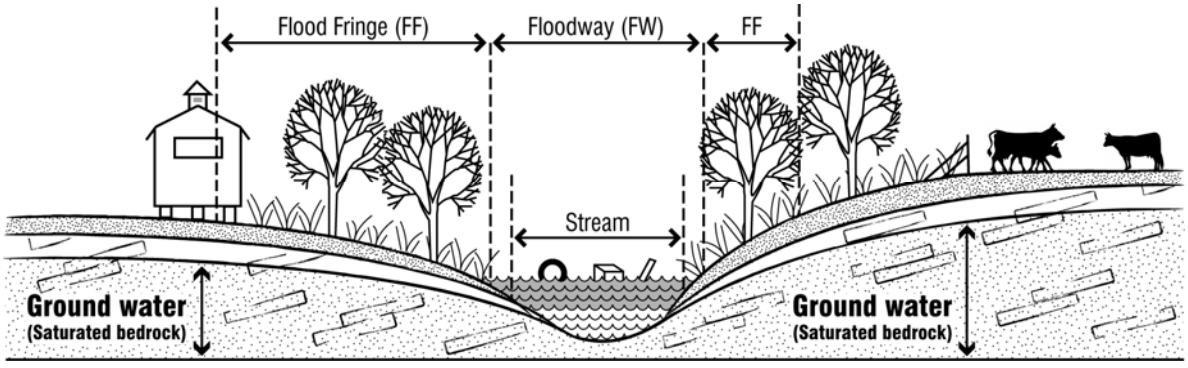
Why are headwaters important?

- ✓ Provide stream recharge into first order streams during periods of low flow
- ✓ Provide important wildlife habitat and breeding areas
- ✓ Provide better water quality than larger order streams
- ✓ Provide the best recharge areas and groundwater yields (of all stream classifications)
- ✓ Maintain groundwater surface flow
- ✓ Protect downstream properties

Floodplains

The 100-year floodplain shown on Figure 12-H is 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 12-G) 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. While it is not recommended, 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.

Figure 12-G: Typical Floodplain



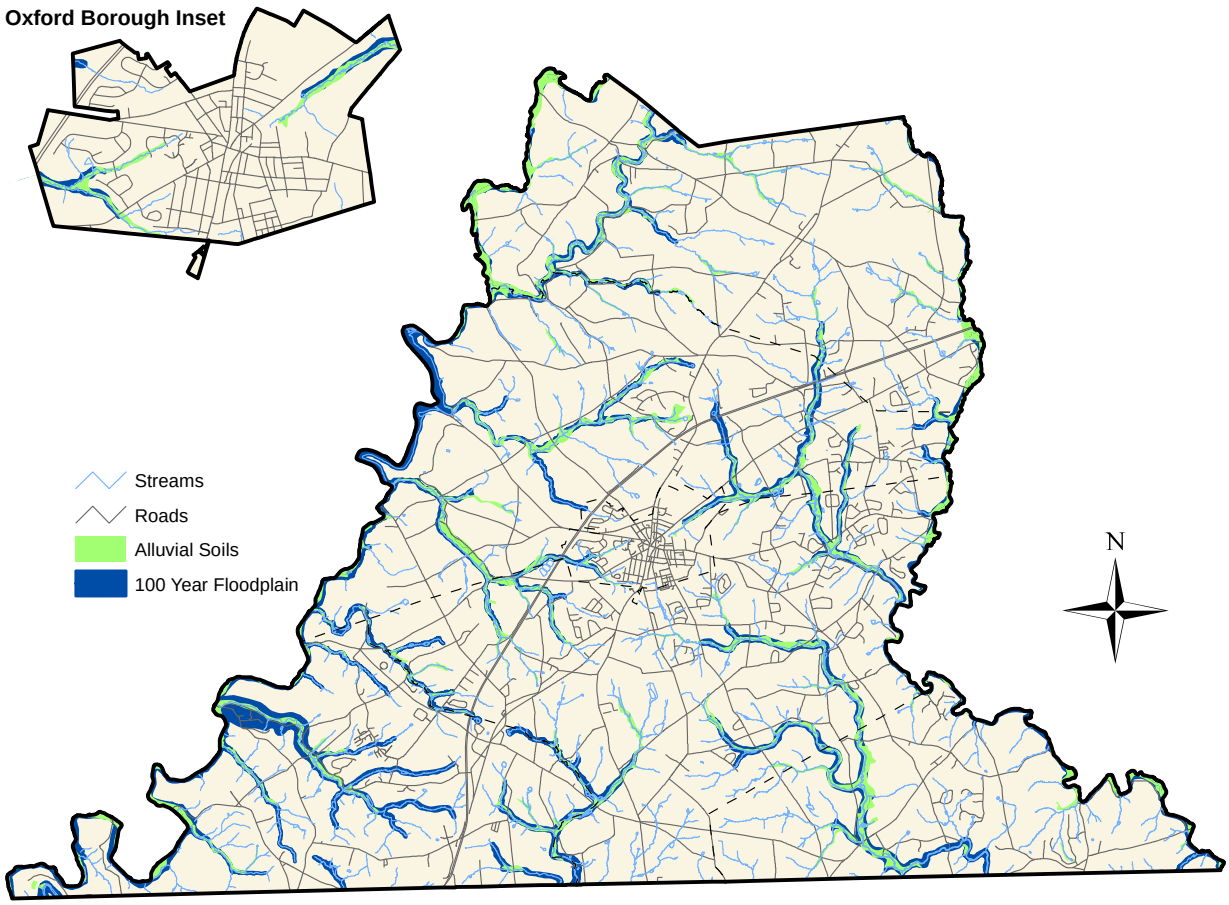
Source: CCPC, 2007

Why are floodplains important?

- ✓ Provide habitat for wildlife and conditions for wildlife diversity
- ✓ Carry floodwaters during flood events directing water away from property
- ✓ Maintain the stability of the watershed

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. (See Chapter 15)

Figure 12-H: Floodplains and Alluvial Soils



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 Figure 12-H) 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.

☑ RECOMMENDATION FOR THE PROTECTION OF STREAM CORRIDORS AND FLOODPLAINS

Action 12-2 Protect regulated floodplains from encroachment, and ensure the safe conveyance of 100-year flood flows to protect public safety and reduce public costs from flood damages.

✓This action addresses Objectives 12-A, B, and D

⌦ Minimum Standards: Floodplain

A municipality's floodplain standards must be consistent with (and be reviewed against) FEMA Standards or any other state or Federal standards that may be necessary. In order to further prevent damage to personal property in the Region and down river, municipal officials should consider restricting development and structures in any designated area of the floodplain, including the flood fringe.

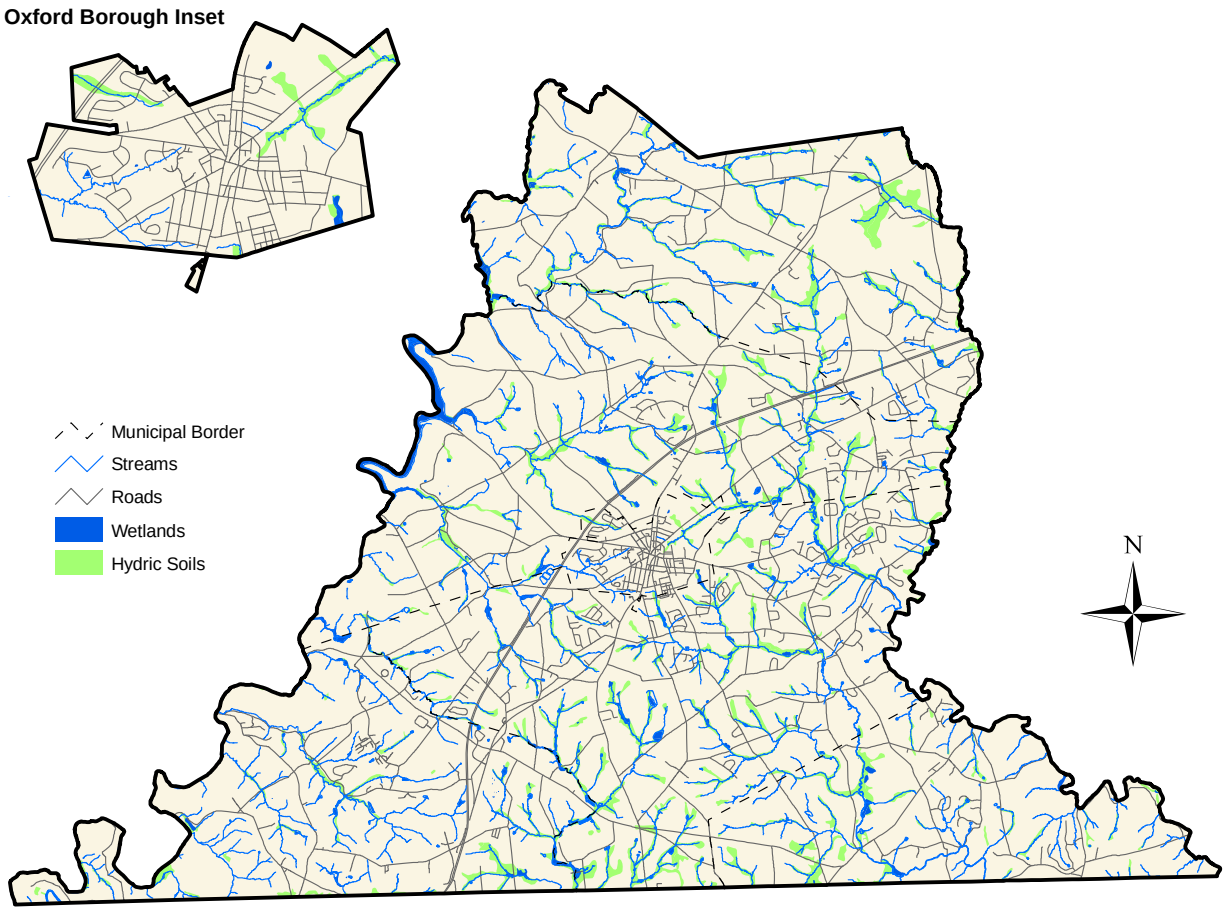
Wetlands and Hydric Soils

There are nearly 660 acres of wetlands in the Oxford Region, about 1.25% of the land area. (See Figure 12-I) Wetlands are low-lying areas inundated or saturated by water at a frequency and duration sufficient to support wetland vegetation. The Army Corps of Engineers and the 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 type of 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.


Wetland Vegetation

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 reliable method to completely determine the extent of wetlands in the Region.

Figure 12-I: Wetlands and Hydric Soils



Hydric Soils

Hydric or wet soils contain high amounts of moisture that allow 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 characteristic makes hydric soil 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.

Why are wetlands and hydric soils important?

- ✓ Provide important storage areas for surface and groundwater recharge.
- ✓ Provide area for wildlife habitat
- ✓ Serve as indicators of wet soils or poor drainage (hydric soils)

☑ RECOMMENDATION FOR THE PROTECTION OF WETLANDS

Action 12-3 Protect and manage wetlands for their hydrological and ecological functions by amending municipal zoning ordinance regulations, where necessary, to meet and/or exceed State wetland regulations in accordance with the minimum standards recommended by the Region.

✓This action addresses Objectives 12-A, D, and G

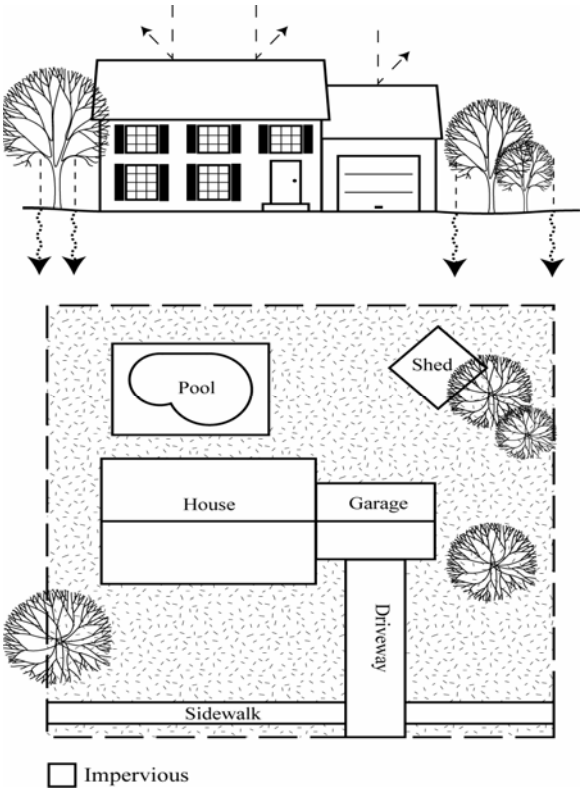
⌦ Minimum Standards: Wetlands

Wetlands should be protected from encroachment in their entirety, unless disturbance is authorized by the PaDEP. Municipalities should consider further protecting this important resource by implementing protection standards for the area that surrounds the wetlands commonly known as the wetlands margin.

Impervious Coverage

Impervious coverage refers to areas or structures that restrict the infiltration of stormwater as shown in Figure 12-J. For example, an asphalt driveway or storage shed restricts the infiltration of stormwater promoting additional runoff while a garden or wildflower meadow slows stormwater runoff while accommodating infiltration to groundwater.

Figure 12-J: Examples of Impervious Coverage



Source: CCPC, 2006

Porous Paving Options

The use of porous paving facilities can further reduce the need for additional impervious surfaces. There are two forms of porous or pervious paving:

1) A permeable paving material, comprised of an arrangement of interlocking, prefabricated, perforated blocks, laid on a soil base and providing a stable pervious surface for low-volume vehicular use. This type of paving can be utilized in overflow parking situations, areas requiring only emergency access, and driveways.


Willowdale Porous Parking Lot

2) Porous pavement, which is a type of pavement that looks and performs similarly to standard asphalt or concrete, allows rain and snowmelt to pass through it reducing runoff from the site and surrounding area. Porous pavement can and has been used in parking areas and other low speed vehicular facilities such as driveways. Unlike standard asphalt or other impervious paving materials, porous pavement requires regular maintenance to ensure that the porosity of the paving material has not been damaged or compromised by pollutants or debris associated with vehicular facilities.

☑ Recommendations for the Reduction of Impervious Coverage

Action 12-4 Reduce the amount of impervious surfaces, where appropriate, while increasing the amount of infiltration area associated with subdivision and land development.

Action 12-5 Allow the use of porous paving and other pervious surfaces in certain applications to promote the use of this alternative to standard asphalt paving.

✓These actions address Objectives 12-A, F, and G

⌦ Minimum Standards: Impervious Coverage

The percentage of impervious coverage permitted for specific uses (residential, commercial, institutional, or industrial) should be limited to the amount necessary to accommodate facilities such as driveways, primary structures, and accessory structures in order to avoid unnecessary additional impervious surfaces.

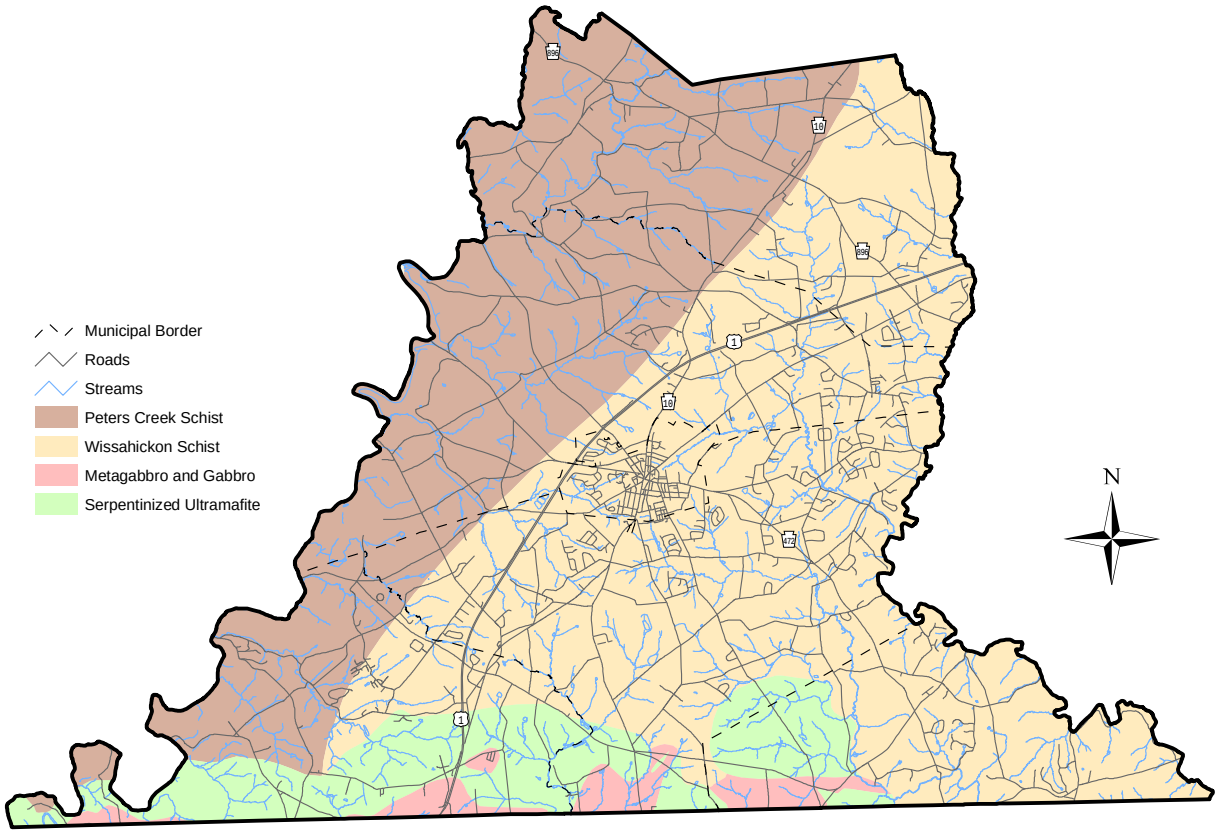
Land Resources

Land is a finite, non-renewable resource that can never fully recover once degraded. 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 and biotic resources. Land Resources discussed in the Chapter include geology, topography and steep slopes, and agricultural soils.

Geology and Geologic Features

The geology of the Region influences a number of physical attributes, including slope, erosion and stability properties, and groundwater yield. An aquifer is the underground area where fresh water is stored in voids within soil and rock and the cracks, fractures, and solution channels in bedrock. The geology and precipitation of an area largely determine the water-producing capability of an aquifer. Because many residents in the Oxford Region continue to be dependent on on-lot wells that draw from groundwater, the protection of this resource is critical.

Figure 12-K: Geology



The Region's geologic composition is divided into three categories: Late Cambrian to Middle Ordovician (Peters Creek Schist), Lower Paleozoic to Upper Precambrian (Gabbro and Metagabbro and Wissahickon Schist), and Lower Paleozoic (Serpentinized Ultramafite). There

are key distinctions between each of these geologic formations in regard to 1) the methods of access to underlying groundwater and 2) the capacity to utilize lands for construction or other types of development as described in Figure 12-L.

Figure 12-L: Characteristics of Oxford Region Geology

Geologic Formation	Domestic Well Yields (gal/min)		Foundation Suitability
	Range	Median	
Peters Creek Schist	0-312	11.3	Good for heavy structures
Wissahickon Schist	0-350	10.5	Good; should be excavated to sound material
Metagabbro	n/a	20	Good; should be excavated to Bedrock
Gabbro	n/a	20	Good; should be excavated to sound material
Serpentinized Ultramafite	4-80	18	Excellent for heavy structures

Source: Engineering Characteristics of the Rocks of Pennsylvania, Pennsylvania Geological Survey, 4th Series, Harrisburg. Geology, Hydrology, and Groundwater Quality of Chester County, Pennsylvania, CCWRA, Water resource Report 2. U.S. Geological Survey, 1994.

Serpentine is a unique geologic formation and the portions included in the Oxford Region represent the largest occurrence of serpentine barrens in the eastern United States. "The Nottingham Park Serpentine Barrens support unique serpentine grasslands, pitch pine, and open savanna communities that are especially adapted to the shallow and highly metallic soils and are maintained by frequent fires and other disturbances. The site contains many rare and endemic species, including one of the northernmost occurrences of fame flower and one of the largest populations in the world of the serpentine aster" *National Registry of Natural Landmarks.* The Serpentine Barrens were designated as a National Natural Landmark in 2009.


Landmark Ceremony, 2009

Topography and Steep Slopes

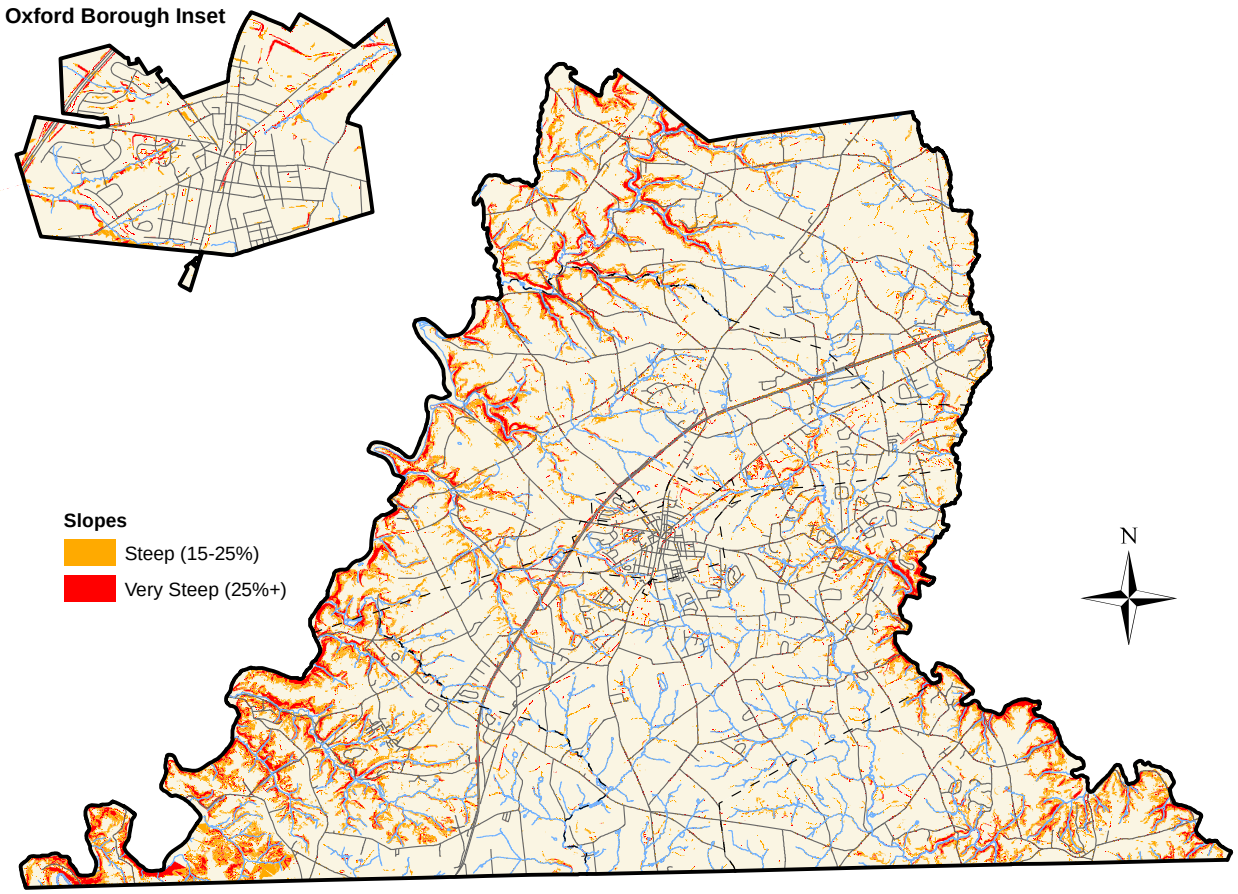
The Region is located within the Piedmont Plateau. This Plateau, located to the east of the Appalachian Mountains, is characterized by gently rolling foothills and gradually-sloping stream valleys. The topography of the Region was shaped by geologic uplifting and folding as well as the erosion of sedimentary deposits. Most of the Region's hills and ridgelines run from east-southeast to west-northwest. The Region's elevation ranges from about 66 feet above sea level at the Region's southwestern tip to about 646 feet in the Russellville area.

Steep Slopes

The steep slopes in the Region are concentrated primarily along lower order stream corridors.

For the purposes of this Plan, steep slopes are considered to include any land with a slope of 15-25%. Very steep slopes are those of greater than 25%. There are approximately 7,100 acres of steep slopes in the Region (about 13.6% of the Region's land area) and of those, very steep slopes represent about 2,500 acres. (See Figure 12-M) The Octoraro Creek represents the western boundary of the Oxford Region and the highest concentration of steep slopes in the Region are located along its banks and the banks of its tributaries. There is also a concentration of steep slopes along the southeastern boundary of the Region along the banks of the Big Elk Creek and its tributaries.

Figure 12-M: Steep Slopes



Stream valleys are commonly bordered by steep slopes of 15 to 25% 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 riparian buffers discussion under Biotic Resources)

In addition to an increase of erosion and sedimentation, if a steep slope is disturbed, development of steep slopes can 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.

Why is the protection of steep slopes important?

✓Prevention of soil erosion
✓Minimizing pollution of surface water resources
✓Reducing flooding by controlling surface water sheetflow
✓Preserving stream banks

☑ RECOMMENDATION FOR THE PROTECTION OF EXISTING TOPOGRAPHICAL FEATURES

Action 12-6 Delineate ridgelines and outcroppings and protect, enhance, and restore (where possible) vegetated steep slopes to protect soil stability by revising municipal steep slope regulations to include specific disturbance limitations in accordance with (at least) the minimum standards recommended by the Region.

✓This action addresses Objectives 12-B, D, E, F, and G.

⌦ Minimum Standards: Steep Slopes

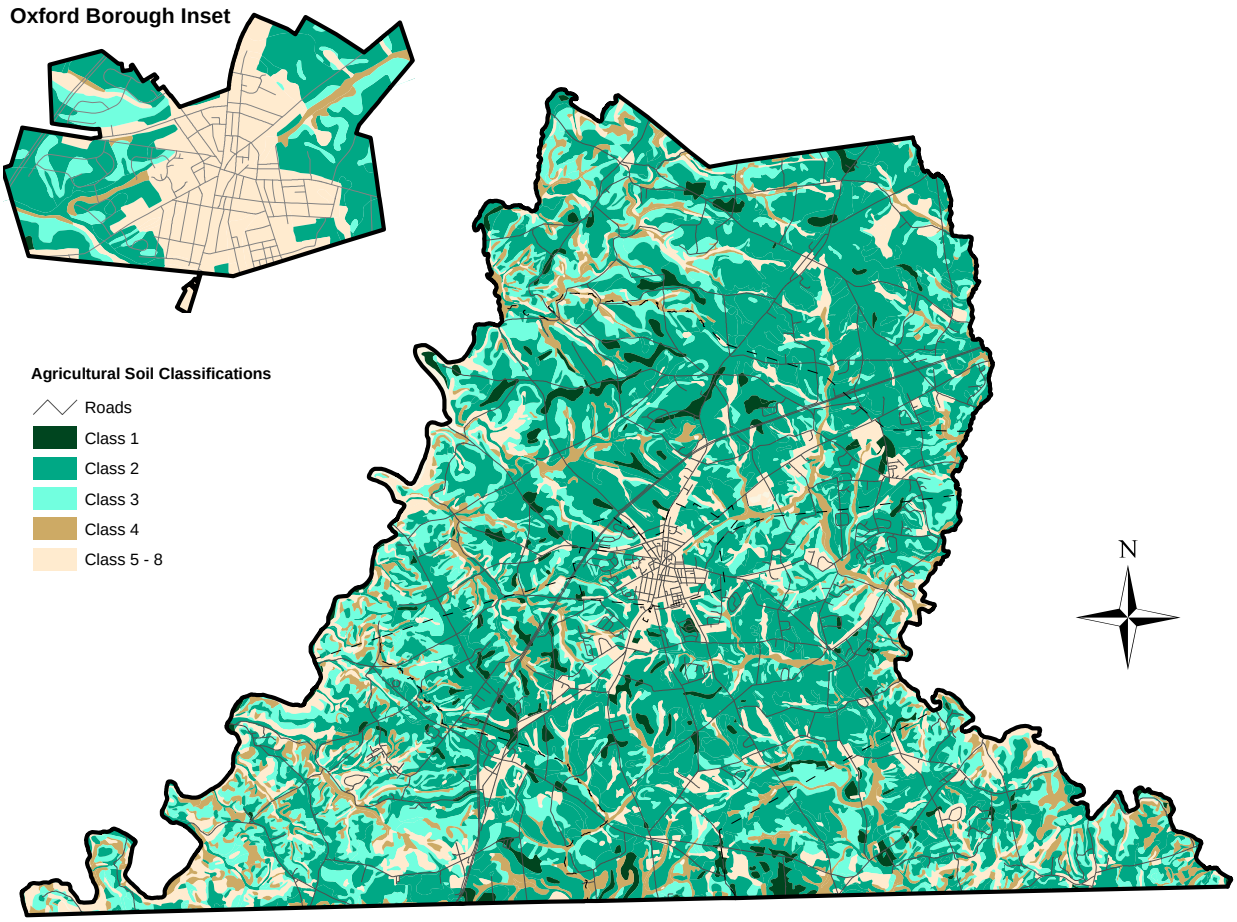
Steep slopes, especially those that exceed 25%, should be protected from disturbance. If very steep slopes are proposed for disturbance, municipalities should impose conditions (including slope stabilization practices) to ensure that resulting erosion and sedimentation is minimized. Very steep slopes should be included in the group of resources/constraints that are subtracted out from the land area as part of a density calculation (net-out).

Prime Agricultural Soils

Prime agricultural soil classifications have been established by the United States Department of Agriculture (USDA) as Capability Units 1, 2, and 3. About 77% of the Region's soils have been identified as prime agricultural soils. The predominance of prime agricultural soils in the Region is evident as shown above and on Figure 12-N. The characteristics that make soils suitable for agriculture also make it attractive to build upon. This is discussed in further detail in Chapter 11: Agricultural Resources Inventory and Plan.

Loss of Prime Farmland was identified as a significant threat to the Oxford Region
Natural Resources Survey

Figure 12-N: Prime Agricultural Soils



Characteristics of Prime Agricultural Soils:

Why are Agricultural Soils important?

- ✓ Produce the highest crop yields
- ✓ Require minimal input of energy and economic resources (less irrigation)
- ✓ Have better natural drainage than other soil types

Erosion and Sedimentation Control

Best Management Practices (Discussed in detail in Chapter 8: Community Facilities and Services) or BMP's accommodate a reduction in soil erosion and sedimentation during and after the construction phase. If they have not already done so, municipalities in the Region should amend their individual subdivision and land development ordinances with provisions that address erosion and sedimentation control.

Chester County Conservation District Reviews

The Chester County Conservation District (CCCD) provides a review service for any project that disturbs one or more acres of land during the life of the subdivision or land development. To further protect against soil erosion and sedimentation, municipalities can enter into a memorandum of understanding with the Conservation District that enables them to review erosion and sedimentation controls proposed on smaller development sites. The Conservation District can also review municipal erosion and sedimentation standards to ensure they are comprehensive and effective.

☑ Recommendations for Soil Resources and Erosion and Sedimentation Control

Action 12-7 Protect hydric and environmentally-sensitive soils from disturbance and development in accordance with the minimum standards recommended by the Region.

Action 12-8 Protect Agricultural soils (Class I, II, and III) that support economically sustainable agricultural practices including field crops, livestock, orchards, and nursery operations.

See Chapter 11: Agricultural Inventory and Plan

Action 12-9 Encourage a continued partnership with the Chester County Conservation District (CCCD) and bring soil erosion and sedimentation regulations into compliance with CCCD recommendations and/or standards.

✓These actions address Objectives 12-B, D, F, and G

⌦ Minimum Standards: Agricultural Soils

See Chapter 11: Agricultural Inventory and Plan.

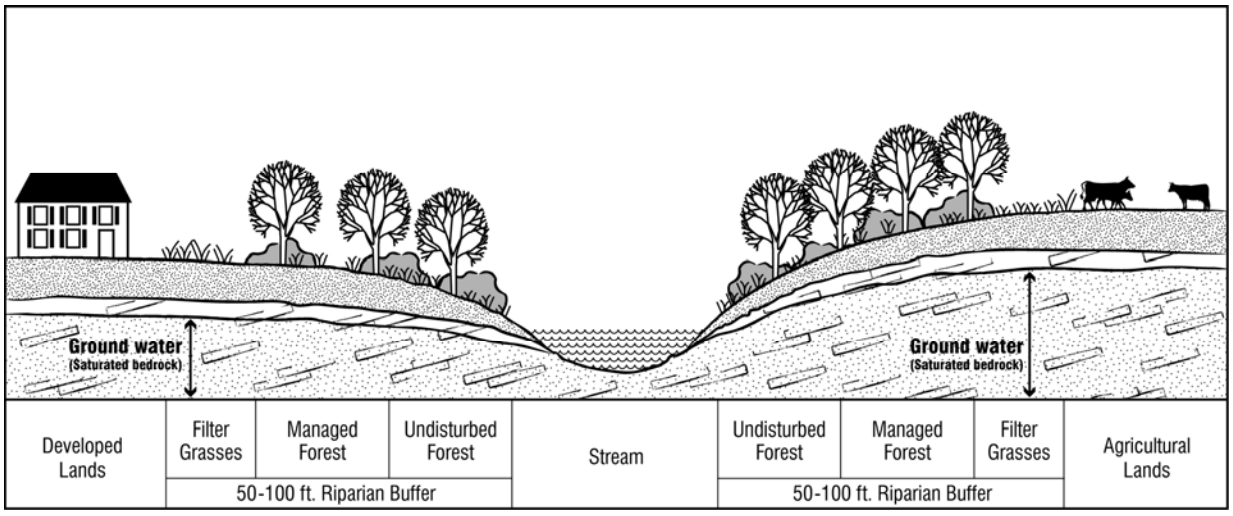
Biotic Resources

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. Biotic Resources discussed in the Chapter include riparian buffers and woodlands.

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. A riparian buffer is an area of trees, shrubs and other vegetation adjacent to a body of water which is managed to maintain the integrity of stream channels and shorelines. While forested riparian buffers may be considered a biotic resource, these areas host a complex ecosystem that influences and benefits water resources as well. As Figure 12-O depicts, the structure of a forested riparian buffer can be divided into three parts: the undisturbed forest, managed forest, and filter (grasses) zone.

Figure 12-O: Forested Riparian Buffer

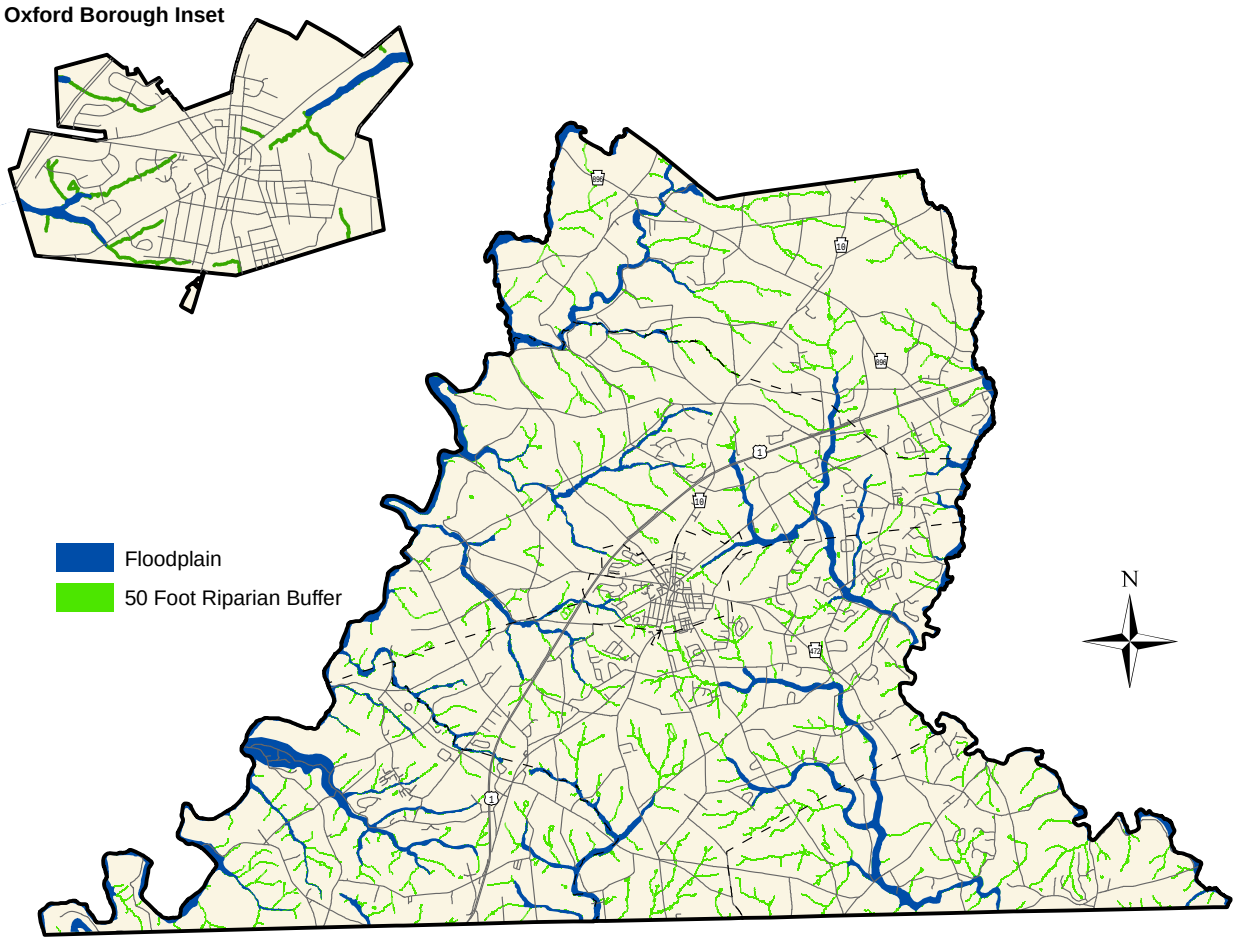


Source: CCPC, 2012

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 or subdivision and land development ordinance. Areas that may contain 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. While 50 feet (As shown on Figure 12-O) is a width commonly used by municipalities in the County, 100 feet is the

ideal width to facilitate the benefits listed below. The protection of first order streams is especially critical as headwaters often lie outside of designated floodplains where regulations for protection have already been imposed. (See Figure 12-P) The Region will need to monitor legislative action to ensure that municipal regulations are consistent with the final status of the "Buffers 100" program.

Figure 12-P: Potential Riparian Buffers



Why are Riparian Buffers important?

- ✓ Prevent erosion and sedimentation
- ✓ Filter nutrients and other chemicals before they reach the stream
- ✓ Protect water quality
- ✓ Provide temperature moderation.

☑ RECOMMENDATIONS FOR THE PROTECTION OF RIPARIAN BUFFERS

Action 12-10 Preserve a network of protected riparian buffers along perennial and intermittent streams in accordance with the minimum standards recommended by the Region.

Action 12-11 Encourage the establishment of riparian buffers along perennial and intermittent streams where, through natural causes or the establishment of the current or former use, the natural state of the stream edge has been degraded.

✓These actions address Objectives 12-B, D, F, and G

⌦ Minimum Standards: Riparian Buffers

Riparian Buffers should be protected from the edge of the streambank to 50 to 100 feet from the stream bank on both sides of the stream or watercourse.

Woodlands

There are several significantly wooded areas scattered along the western, eastern, and southern borders of the Region. (See Figure 12-R) In fact, more than 24%, or nearly 20 square miles of the Region, has been identified as wooded.

"Forests and trees inspire art, engender health, and confer therapeutic benefits on residents of local communities." ***White Clay Creek Reforestation Plan – Pennsylvania Portion.***

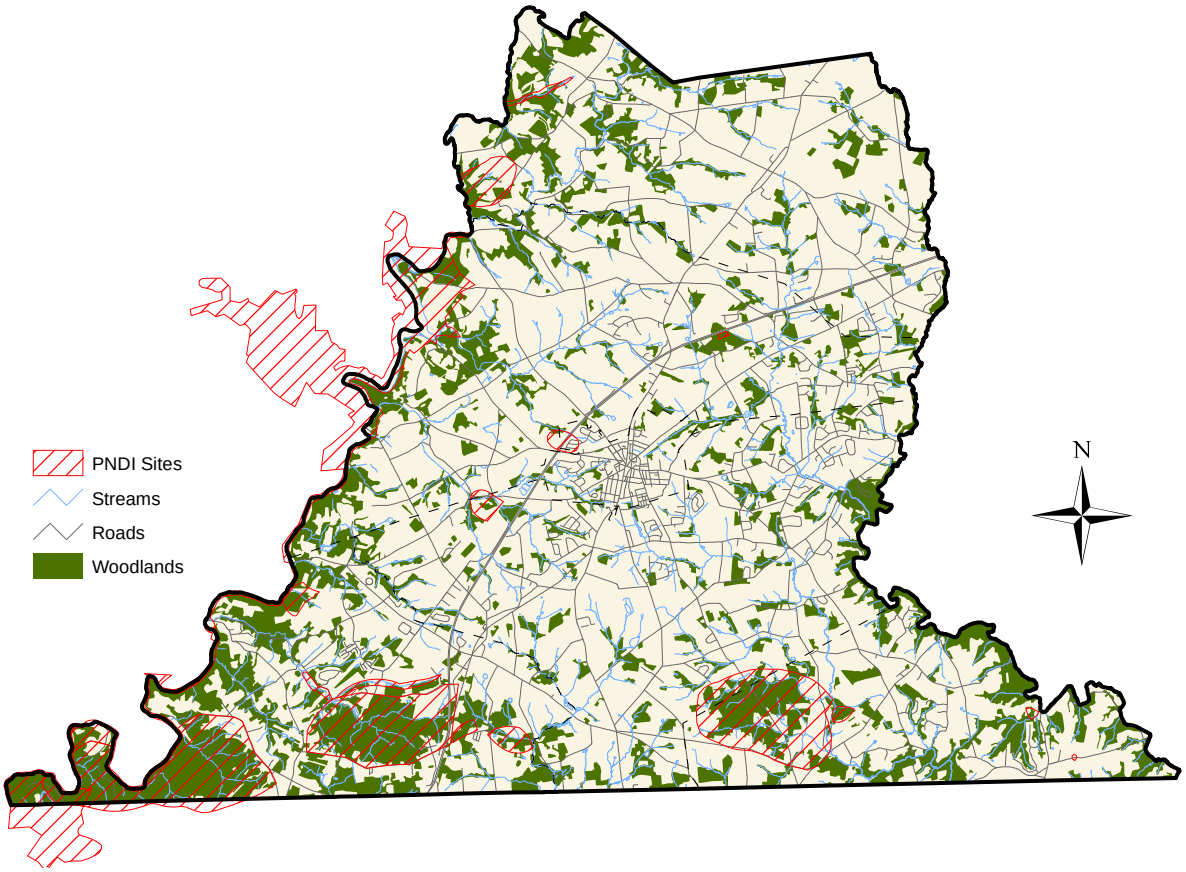
Chester County is located in the eastern deciduous forest biome, a large ecological community. Within this biome, the forests of the Region, and the wider Chester County region, are part of the oak-hickory association forest. This forest association produces large amounts of mast (nuts) and is exemplified by the species shown in the table in Figure 12-Q. Not all species included in Figure 12-Q are recommended species. (Please refer to Appendix 12-B: Recommended Plant Materials) 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.

Figure 12-Q: Inventory of Existing Trees and Shrubs in 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 Arrowood Vibernums;; 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; Cherry	Silky Dogwood; Box Elder; Common Witch Hazel; Spicebush; and Northern Arrowood Viburnum; Osage Orange; Honeysuckle; Poison Ivy
Evergreens	Douglas Fir; Hemlock; Virginia (Scrub) Pine	

Source: CPC, 2006

Figure 12-R: Woodlands and PNDI Sites



Why are Woodlands important?

- ✓ Provide temperature reduction or moderation
- ✓ Provide wildlife habitat
- ✓ Provide wind break
- ✓ Provide soil holding capacity
- ✓ Filters pollutants
- ✓ Provide scenic character


Hedgerow

Hedgerows

Hedgerows, or thickets, typically are found defining property lines (pastures and fields), lining roads, protecting small streams and drainageways in the interior of a single property. Hedgerows function as windbreaks which help to impede erosion of adjacent agricultural lands and stabilize stream banks.

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.


Red Oak

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.

Locally Significant/Important Vegetation

Locally important vegetation includes those types of resources that add character, beauty, and a sense of history to the Region. This designation includes 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.

☑ Recommendations for the Protection and Management of Vegetation in the Region

Action 12-12 Encourage the revision of municipal ordinances to include specific disturbance limitations for woodlands and other vegetation that prescribe the maximum area that can be disturbed and revise or establish, where necessary, tree replacement requirements where disturbance is unavoidable.

Action 12-13 Manage invasive and noxious plants, and restore (where possible) sustainable plant communities and woodlands on steep slopes, floodplains, and riparian buffers.

Action 12-14 Promote the use of native plant species and specify groups of plants that are appropriate or adaptable to specific planting situations in accordance with recommendations of the Region in Appendix 12-A.

Action 12-15 Recommend tree protection zone (TPZ) or similar spatial specifications to protect woodlands and other vegetation during construction. In addition, any TPZ should be identified on the conservation plan.

✓These actions address Objectives 12-B, D, E, and G

Wildlife Habitat/Wildlife 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 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. Activities that involve the modification and adaptation of the natural environment decrease natural diversity. The effective protection of the diverse communities of species and habitats native to the Region 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.


Octoraro Reservoir

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.

Pennsylvania Natural Diversity Index (PNDI) Sites

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 Chester 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. Figure 12-18 provides an approximate location of PNDI Sites in the Oxford Region.

☑ Recommendation for Wildlife Habitat and Promotion of Natural Diversity

Action 12-16 Protect, restore, and manage unique habitats, migration corridors, and plant and animal species that are designated as rare, threatened and endangered (by Federal or state agencies) and encourage efforts to plan, fund, and establish viable habitat for these species.

✓This action addresses Objective12-D and E

Current Resource Protection Standards and Recommendations

Because natural resources cross municipal boundaries, they are most effectively protected when coordinated on a regional basis. Consistency between municipal resource protection measures ensures that the Region's resources are protected at the same level. This consistency is key to establishing comprehensive resource protection. To determine the current level of protection provided by the six municipalities of the Oxford Region, a detailed inventory of each municipal zoning ordinance and subdivision and land development ordinance was undertaken as part of this planning effort. The critique was based on the minimum recommended protection standards included in this Chapter and is included in Appendix 12-A (A summary of the results is provided in Figure 12-S) These protection measures were considered the most important for the protection of resources on a regionally-consistent basis. It is recognized that some municipalities have protection measures in place that go beyond the "minimum standards" included in this Chapter and Figure 12-S. This plan supports the continuation of those extra measures.

The detailed inventory of municipal ordinances along with specific recommendations for addressing identified issues is located in Appendix 12-A and should be used in conjunction with the summary provided in Figure 12-S. Appendix 12-A includes an inventory of standards that address the protection of the following resources: floodplains, wetlands, steep slopes, agriculture soils, riparian buffers, woodlands (including timber harvesting), and specimen vegetation (PNDI Sites) each of the six municipalities. The inventory of agricultural resource protection standards can be reviewed in Chapter 11: Agricultural Resources.

While most of the municipalities in the Region have a fairly wide array of basic resource protection measures in place, there are some obvious gaps as seen in Figure 12-S. The municipalities with more red than green in their column(s) should consider expanded resource protection measures. The recommendations in Appendix 12-A should be used by each municipality to make specific improvements and additions to their resource protection measures.

The assessment of resource protection measures in Figure 12-S should be interpreted as follows:

Yes Effective resource protection standards are in place.

Limited Standards are in place for the protection of the resource but a significant issue was identified that limits their effectiveness. Issues most frequently identified in this category include lack of specific disturbance limitations, need for a more stringent standard, or a lack of internal consistency creating conflicting standards.

No No standards are in place for the protection of the resource. The minimum regulations suggested in Appendix 12-A should be implemented.

Figure 12-S: Assessment of Existing Natural Resource Protection Measures

Resources	East Nottingham	Elk	Lower Oxford	Upper Oxford	West Nottingham	Oxford Borough
Water Resources:						
Floodplains						
Wetlands and Wetlands Margins						
Land Resources:						
Steep Slopes						
Agricultural Soils						
Biotic Resources:						
Riparian Buffers						
Woodlands						
Timber Harvesting Plan Required						
Specimen Vegetation/PNDI Sites						
Hedgerows						
Tree Replacement Required						
Tree Protection during Construction						
Administrative:						
Plan Requirements for Natural Resources (SLDO)						
Protection Standards Centrally Located						

Source: Municipal Ordinances, various dates

☑ RECOMMENDATION FOR CONSISTENT MUNICIPAL RESOURCE PROTECTION STANDARDS

Action 12-17 Implement consistent protection standards in each municipality in order to provide the most effective regional strategy for resource protection in accordance with the strategies identified in Appendix 12-A and (at least) the minimum standards recommended by the Region.

✓This Action addresses all Objectives

Summary of Website References

Brandywine Valley Association's Red Streams Blue Program:
www.brandywinewatershed.org/2008/redstreamsblue/index.asp

Watersheds: http://dsf.chesco.org/water/site/default.asp

Figure (Map) Sources:

Figure 12-B: Watersheds of the Oxford Region
Data Sources: Municipal Borders, Roads, Streams - Chester County GIS; Watersheds, Subbasins - Chester County GIS, 2005

Figure 12-D: Streams and Stream Designations
Data Sources: Municipal Borders, Roads, Streams, Stream Designations (EV, HQ) - Chester County GIS; Impaired Streams – PaDEP, 2006;

Figure 12-H: Floodplains and Alluvial Soils
Data Sources: Municipal Borders, Roads, Streams - Chester County GIS; Floodplain - FEMA, 2006; Alluvial Soils Inclusions- NRCS, US Department of Agriculture.

Figure 12-I: Wetlands and Hydric Soils
Data Sources: Municipal Borders, Roads, Streams - Chester County GIS; Hydric Soils- NRCS, US Department of Agriculture; Wetlands - National Wetlands Inventory (NWI) digital files, US Fish and Wildlife Service.

Figure 12-K: Geology
Data Sources: Municipal Borders, Roads, Streams - Chester County GIS; Geology - U.S. Geological Survey, 1996.

Figure 12-M: Steep Slopes
Data Sources: Municipal Borders, Roads, Streams - Chester County GIS; Steep Slope - CCPC.

Figure 12-N: Prime Agricultural Soils
Data Sources: Municipal Borders, Roads, Streams - Chester County GIS; Prime Agricultural Soils – USDA, NRCS, 2007.

Figure 12-P: Potential Riparian Buffers
Data Sources: Municipal Borders, Roads, Streams - Chester County GIS; 100 Floodplain - FEMA; 50 Foot Riparian Buffer – CCPC, ORPC - 2012.

Figure 12-R: Woodlands and PNDI Sites
Data Sources: Municipal Borders, Roads, Streams - Chester County GIS; PNDI Sites - Nature Conservancy, 1994/2006; Woodlands - DVRPC, 1997.