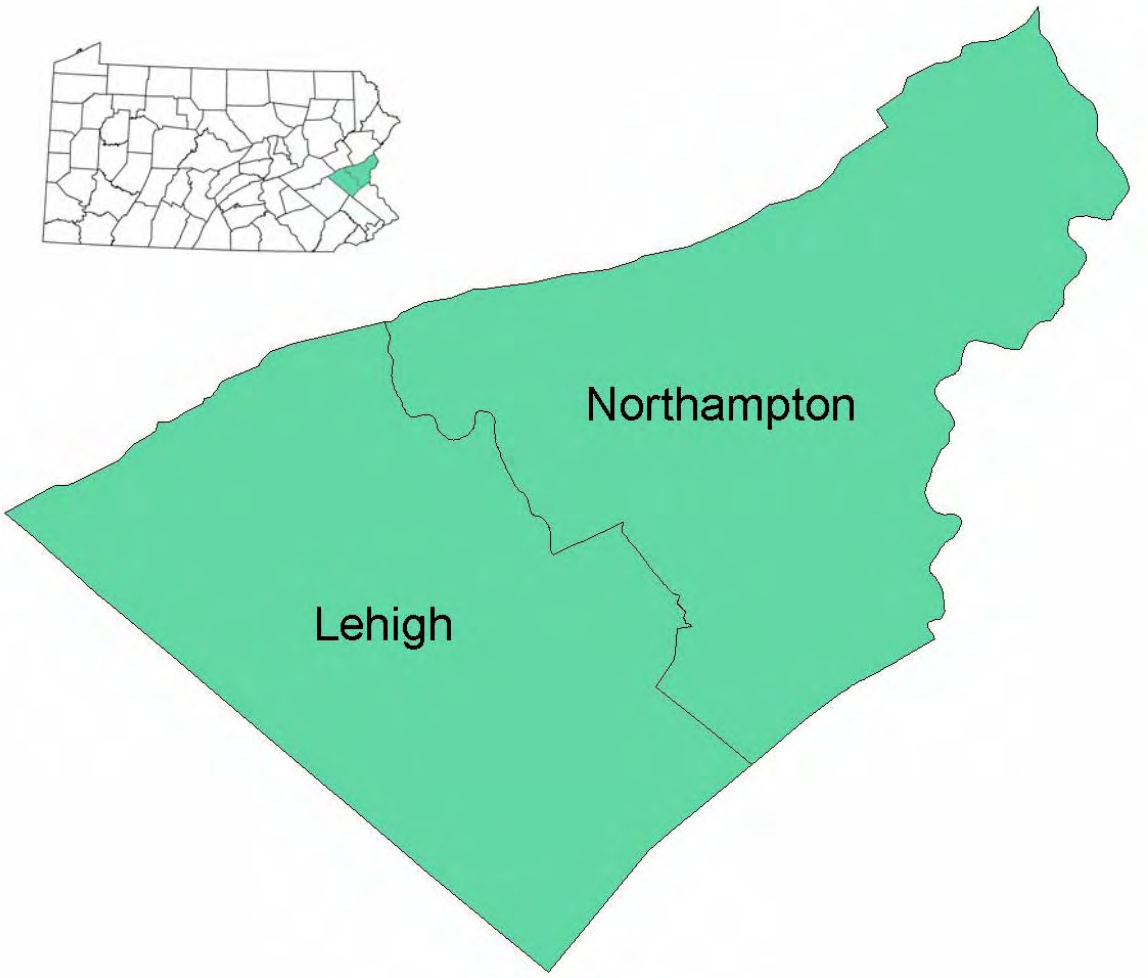
A Natural Areas Inventory of Lehigh and Northampton Counties, Pennsylvania Update 2005



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This project was financed in part by a Keystone Recreation, Park and Conservation Fund Program grant from the Pennsylvania Department of Conservation and Natural Resources, Bureau of Recreation and Conservation.

An Update to:

A NATURAL AREAS INVENTORY
OF LEHIGH AND NORTHAMPTON COUNTIES, PENNSYLVANIA
1999

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ROBERT RODALE RESERVE is one of the top sites for conservation in Lehigh County. The site includes a Northern Appalachian Circumneutral Seeps Natural Community, two plant species of special concern, and several vernal pools, such as this one, which are important breeding habitat for amphibians. Photo: PA Science Office of The Nature Conservancy.

PREFACE

The Lehigh and Northampton Counties Natural Areas Inventory is a document compiled and written by the Pennsylvania Science Office of The Nature Conservancy. It contains information on the locations of rare, threatened, and endangered species and of the highest quality natural areas in the counties; it is not an inventory of all open space. It is intended as a conservation tool and should in no way be treated or used as a field guide. Accompanying each site description are general management recommendations that would help to ensure the protection and continued existence of these rare plants, animals, and natural communities. The recommendations are based on the biological needs of these elements (species and communities). The recommendations are strictly those of The Nature Conservancy and do not necessarily reflect the policies of the state or the policies of the counties or municipalities for which the report was prepared.

Managed areas such as federal, state, county and municipal lands, private preserves, and conservation easements are also provided on the maps where that information was available to us. This information is useful in determining where gaps occur in the protection of land with rare species, natural communities, and locally significant habitats. The mapped boundaries are approximate and our list of managed areas may be incomplete, as new sites are always being added.

Implementation of the recommendations is up to the discretion of the landowners. However, cooperative efforts to protect the highest quality natural features through the development of site-specific management plans are greatly encouraged. Landowners working on management or site plans of specific areas described in this document are encouraged to contact the Pennsylvania Science Office of The Nature Conservancy for further information.

Although an attempt was made through advertising, public meetings, research, and informal communications to locate all sites important to the conservation of biodiversity within Lehigh and Northampton counties, it is possible that something was missed. Anyone with information on sites that may have been overlooked should contact the Lehigh Valley Planning Commission (see address on following page). The Lehigh and Northampton Counties Natural Areas Inventory will be updated within five years and additional sites may be included at that time.

ACKNOWLEDGMENTS

The natural areas inventory study was conducted by The Nature Conservancy, 208 Airport Drive, Middletown, PA 17057, for the counties of Lehigh and Northampton. This study was financed in part by a Keystone Recreation, Park and Conservation Fund Program grant from the Pennsylvania Department of Conservation and Natural Resources, Bureau of Recreation and Conservation. The project was sponsored by both Lehigh County and Northampton County and was conducted in cooperation with the Lehigh Valley Planning Commission.

The Pennsylvania Science Office (PSO) of The Nature Conservancy thanks the members of the agencies noted above and all the individuals who have contributed time and expertise to the study. We especially thank Frederic Brock of the Lehigh Valley Planning Commission for his time and effort. Special thanks to members of the Lehigh Valley Herpetological Society, including Rick Rosevear, Brandon Ruhe, and Dennis Buchanan, for sharing their expertise and knowledge of the counties. Special thanks also to the staff at the Jacobsburg Environmental Education Center, including Rick Wiltraut and Bill Sweeney. Thanks also to Dr. Robert Shaffer, Nancy Wisser, Polly Ivenz, Arlene Koch, Donald Heintzelman of the Wildlife Information Center in Slatington, and Richard Cary of P P& L, Inc., for providing us with information which has helped make this a more complete inventory. Finally, thanks to Arlene Koch for volunteering to proofread the draft report.

The species information utilized in the inventory came from many sources as well as our own field surveys. Biologists from institutions and agencies such as the Academy of Natural Sciences in Philadelphia, the Morris Arboretum of the University of Pennsylvania, Shippensburg University, the Department of Conservation and Natural Resources, the Pennsylvania Game Commission, and the Pennsylvania Fish and Boat Commission have contributed numerous plant and animal records over the years. In addition, many private citizens contributed valuable information that was incorporated into the study. Further, we wish to thank the many landowners who granted us permission to conduct inventories on their lands. The task of inventorying the natural heritage of the two counties would have been far more difficult without this tremendous pool of information gathered by many people over many years.

Copies of this document may be obtained from:
Lehigh Valley Planning Commission
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Hartford Fern (Lygodium palmatum), also called Climbing Fern because of its vining growth form, is a PA-Rare plant species that occurs in Lehigh County. Photo: PA Science Office of The Nature Conservancy.

GLOSSARY

anthropogenic - human caused.

ATV - all-terrain-vehicle.

barrens - areas that are naturally infertile as a consequence of nutrient-poor soils; often form on resistant rock such as quartz, sandstone or highly weathered and leached glacial material.

canopy - the layer formed by the tallest vegetation.

circumneutral - pH between 5.5 and 7.

co-dominant - where several species together comprise the dominant layer (see "dominant" below).

DCNR - Pennsylvania Department of Conservation and Natural Resources.

DEP - Pennsylvania Department of Environmental Protection.

diabase - a dark gray igneous rock. Soils derived from diabase have an unusual chemistry and may be habitat for rare plant species or communities.

dominant - the species (usually plant) exerting the greatest influence on a given community either by numerical dominance or influence on microclimate, soils and other species.

element - all-inclusive term for species of special concern and exemplary natural communities.

ericaceous - members of the heath family, including blueberries, huckleberries, rhododendrons, and azaleas; these plants are adapted to living in acidic soils.

Exceptional Value Waters (EV) - DEP designation for a stream or watershed which constitutes an outstanding national, state, regional or local resource. Examples include waters of national, state or county parks or forests, or waters which are used as a source of unfiltered potable water, or waters of wildlife refuges or State Game Lands, or other waters of substantial recreational or ecological significance. For more detailed information about EV stream designations, the reader is referred to the Special Protection Waters Implementation Handbook (Shertzer 1992).

exotic - non-native; used to describe plant or animal species that were introduced by humans; examples include Japanese honeysuckle, purple loosestrife and grass carp. Exotics present a problem because they may out-compete native species.

extant - currently in existence.

floodplain - low-lying land generally along streams or rivers that receives periodic flooding.

forb - non-grass herbaceous plant, such as goldenrod.

graminoid - grass or grass-like plant such as a sedge or a rush.

ground cover - low shrubs, herbs and mosses that are found at or close to the ground surface.

High-Quality Coldwater Fisheries (HQ-CWF) - DEP designation for a stream or watershed which has excellent quality waters and environmental or other features that require special water quality protection. For more detailed information about HQ-CWF stream designations, the reader is referred to the Special Protection Waters Implementation Handbook (Shertzer 1992).

hydrology - water system of an area including both surface water and ground water.

lepidoptera - moths and butterflies.

littoral - the area where water meets land; shoreline.

mesic - moist, not saturated.

natural area - as used in this study, a site with either an exemplary natural community or species of special concern; not to be confused with the State Forest Natural Areas which are specific management units designated by DCNR Bureau of Forestry.

non-point - refers to diffuse sources of pollution such as storm water runoff contaminated with oil or pesticides.

POSCIP - Plant of Special Concern in Pennsylvania.

Potential Natural Area - used by The Nature Conservancy to denote an area that may have desirable environmental characteristics to support rare species or exemplary natural communities, but which needs a field survey to confirm; a preliminary category given to sites prior to field survey (see METHODS section).

riparian - streamside.

ROW - right-of-way, usually referring to powerlines or pipelines.

seeps - where water flows from the ground in a diffuse pattern and saturates the soil; lush herbaceous vegetation often grows in these wet areas.

soil association - a group of soils that are geographically associated in a characteristic repeating pattern and defined and delineated as a single unit.

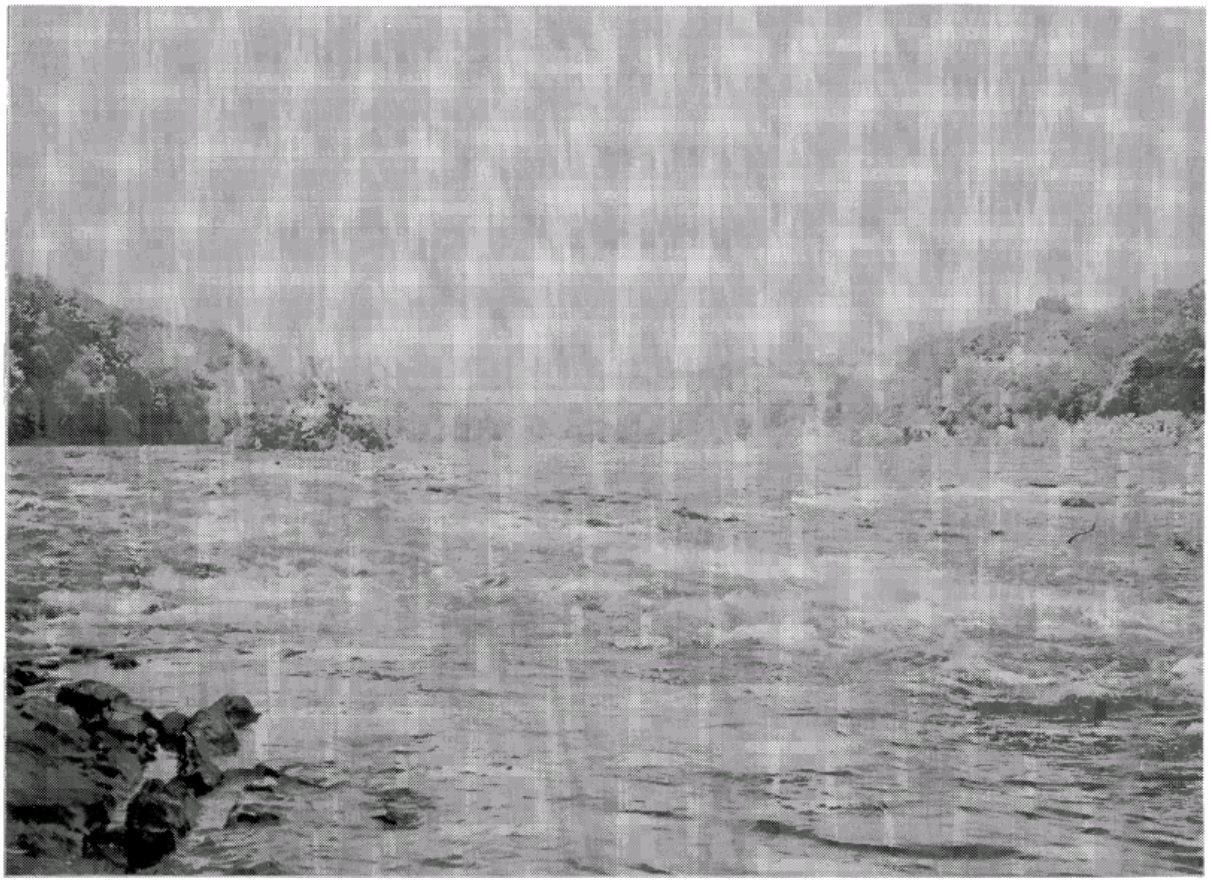
soil series - groups of soils which have vertical profiles that are almost the same, that is, with horizons (layers) that are similar in composition, thickness, and arrangement.

succession - natural process of vegetation change through time; over time, the plant species of a site will change in composition and structure as light and soil conditions change (e.g., a field that is left alone may, over time, be taken over by shrubs, then small trees and eventually a woodland).

talus - slope formed of loose rock and gravel that accumulates at the base of mountains or cliffs.

understory - layer of shrubs and small trees between the herbaceous layer and the canopy.

xeric - extremely dry or droughty.



FOUL RIFT in the Delaware River supports an animal species of concern, and the adjacent cliffs support a good quality Natural Community and a PA-Rare plant species. Photo: PA Science Office of the The Nature Conservancy.

Alphabetical Index to Lehigh County Sites (**bold** indicates new sites, or combined sites)

Site Name	Municipalities	USGS Topo. Map(s)	page #
BAKE OVEN KNOB	Heidelberg Twp.; East Penn Twp., Carbon Co.	Slatedale/Lehighton	
TRAIL			
ROCKDALE CLIFFS	North Whitehall Twp.	Cementon	
SWABIA /INDIAN/HOSENSACK WATERSHED	**Lower Milford Twp.** **Lower Macungie Twp.** **Upper Macungie Twp.**	**East Greenville** **Allentown West** **Milford Square**	
THE JUNGLE	Lower & Upper Macungie Twps.	Allentown West	
TREXLER HOLLOW	North Whitehall & Lowhill Twps.	Cementon Slatedale	
TROUT RUN WOODS	Heidelberg Twp.	Slatedale	

Alphabetical Index to Northampton County Sites (**bold** indicates new sites, or combined sites)

Site Name	Municipality	USGS Topo. Map(s)	Page #
RISMILLER WOODS	Bushkill Twp.	Wind Gap	
SCHOOL ROAD SWAMP	Upper Mount Bethel Twp.	Bangor	
SPRINGTOWN MARSH	**Springfield Twp, Bucks County)**	**Hellertown**	
STEEL CITY SLOPES	Lower Saucon Twp.	Nazareth	
TOTTS GAP	Upper Mount Bethel Twp. Smithfield & Stroud Twps., Monroe Co.	Stroudsburg	
TOTTS GAP SWAMP	Upper Mount Bethel Twp.	Stroudsburg	
WEAVERSVILLE PONDS	Allen Twp.	Catasauqua	
WHIPPOORWILL ISLAND	Williams Twp.	Easton	

Wild bleeding-heart (Dicentra eximia) is a PA-Endangered plant species. Photo: PA Science Office of the The Nature Conservancy

INTRODUCTION

Lehigh and Northampton counties are situated in the east-central part of Pennsylvania, an area rich in historical, scenic, and natural resources. The combined 728 square miles of the two counties contain a mix of forest, agriculture, industry, small towns, suburbs, and urban areas. The majority of the population lives in the heavily developed Allentown, Bethlehem, and Easton corridor, while much of the rest of the two counties has a comparatively low population density. In 1990, the valley's overall population was recorded in the census to be 538,235, which represents an 8.1 % increase over its population in 1980 (U.S. Department of Commerce, Bureau of the Census, and the Lehigh Valley Planning Commission). Growth is expected to continue at close to this rate for the next several decades. Recent growth has been influenced by the Lehigh Valley's desirability as a place to live and work as well as by its close proximity to the larger urban centers of Philadelphia and New York.

The scenic rural character which still dominates much of the Lehigh Valley is made up of a patchwork of natural and human-dominated habitats including fields, pastures, forests, rivers, streams, and ponds. The extensive forests of Blue Mountain and the many miles of rivers and streams are regularly used for a wide spectrum of recreational activities such as hunting, fishing, hiking, and bird watching. The natural systems that help create scenic beauty on the landscape and provide opportunities for recreation also function as habitat for many wild plants and animals including rare, threatened, and endangered species. The integrity of the natural environment with its benefits to both humans and wildlife can easily be lost without careful planning of growth and development. The threat of losing critical features of the natural environment is more intense in a region that is experiencing population growth and development as rapidly as the Lehigh Valley. Careful planning can maintain open space, including natural environments and the plants and animals associated with them. A balance between growth and the conservation of scenic and natural resources can be achieved by guiding development away from the most environmentally sensitive areas.

In order to plan development and ensure protection of critical natural areas, county and municipal governments, the public, and developers must know the location and importance of these sites. This knowledge can help prevent conflicts over land use and direct protection efforts and limited conservation dollars to the most vulnerable areas. The Pennsylvania Science Office of The Nature Conservancy, under contract to the Lehigh Valley Planning Commission, has undertaken this project to provide a document and maps that will aid in the identification of these critical natural areas.

The Natural Areas Inventory report presents Lehigh and Northampton counties' known outstanding natural features — floral, faunal, and geologic. The Inventory provides maps of the best natural communities (habitats) and all the known locations of animal and plant species of special concern (endangered, threatened, or rare) in the two counties. A written description and a summary table of the sites, including quality, degree of rarity, and last-observed date, accompany each map.

Potential threats and suggestions for protection of the rare plants or animals at the site are included in many of the individual site descriptions. Selected geologic features of statewide significance are also noted. In addition, the inventory describes locations of natural areas that are significant on a county-wide scale but cannot be deemed exemplary natural communities because of past disturbances. These "locally significant" sites represent good examples of habitats that are

relatively rare in the counties, support an uncommon diversity of plant species, and/or provide valuable wildlife habitat at the local level.

The information and maps presented in this report provide a useful guide for planning developments and parks, for conserving natural areas, and for setting priorities for preservation of the most vulnerable natural areas. A summary of the highest quality sites in Lehigh and Northampton counties provides suggestions for maintaining these important sites as natural areas. All of the sites in this report were evaluated for their importance in protecting biological diversity on a state and local level, but many also have scenic value, provide water quality protection, and are potential sites for low-impact passive recreation, nature observation and/or environmental education.

Municipalities with sites will get a copy of the Natural Areas Inventory of Lehigh and Northampton Counties from the Lehigh Valley Planning Commission. The inventory is one tool that will aid in the implementation of county and municipal comprehensive plans. The counties, municipalities, land trusts, and other conservation organizations can use the Natural Areas Inventory to identify potential protection projects that may be eligible for funding through state or community grant programs. Landowners will also find this inventory useful in managing and planning for the use of their land; it gives them the opportunity to explore alternatives that will provide for their needs and still protect species and habitats. In addition, land managers may wish to consult this report in an effort to avoid potential conflicts in areas with species of special concern and/or identify ways of enhancing or protecting this resource. Users of this document are encouraged to contact the Pennsylvania Science Office of The Nature Conservancy for additional information.

*Codes are used to identify these features on the maps. Rare plants and animals are subject to unauthorized collection and are not identified in the text in order to provide some measure of protection.

NATURAL HISTORY OVERVIEW OF THE COUNTY

The climate, geology, topography, and soils have been important in the development of the plant communities (forests, wetlands, etc.) as well as other natural features (e.g., streams and geologic features) in Lehigh and Northampton counties. Both natural and human disturbances have played an important role in the development and alteration of those plant communities, causing the extirpation of some species and the introduction of others. These combined factors provide the framework for locating and identifying exemplary natural communities and species of special concern within the counties. A brief overview of the physiography, geology, soils, and vegetation of the counties provides the background for the natural areas inventory methodology and the findings presented in this report.

Physiography and Geology

Physiographic Provinces are classified by the characteristic landscapes and distinctive geologic formations that comprise each province. Physiography relates in part to a region's topography and climate, two factors that significantly influence the soil development, hydrology, and land use patterns of an area. Bedrock type also influences soil formation and hydrology. Therefore, both physiography and geology are important to the patterns of plant community distribution, which is in turn important to animal distribution (see Vegetation). Certain plant communities and species might be expected to occur within some provinces but not in others due to differences in climate, soils, and moisture regime. Physiographic and geologic information used in the development of the inventory has come from a variety of sources, including Geyer and Bolles (1979 and 1987), Berg *et al*. (1981), *The Atlas of Pennsylvania* (Cuff *et al*. 1989), *The Geologic Map of Pennsylvania* (Socolow 1980), *Glacial Deposits of Pennsylvania* (Socolow 1981), and *Physiographic Provinces of Pennsylvania* (Berg *et al*. 1989).

Lehigh and Northampton counties contain parts of three Physiographic Provinces: the Ridge and Valley Province, the New England Province, and the Piedmont Province (Berg *et al*. 1989). Each of these provinces have characteristic rock formations and topography (Geyer and Bolles 1979). The Ridge and Valley Province, containing most of the land in the counties, is characterized by long ridges of sandstone and other resistant rocks, alternating with valleys of limestone or shale. Blue Mountain and Kittatinny Mountain, along the northern edge of the counties, are part of the Appalachian Mountain Section of this Province. Immediately to the south is the Great Valley Section, underlain by softer shales, siltstones, and limestones.

South of the Great Valley in both counties lies the New England Province, Reading Prong Section. The steep hills south of the Lehigh River in Northampton County are underlain by metamorphic and igneous rocks characteristic of this Section. The Piedmont Province, Gettysburg-Newark Section, occupies a narrow band along the southern margin of Lehigh County. This Section has steep-sided ridges of diabase and rolling hills underlain by conglomerates, sandstones, and shales. Diabase is a hard igneous rock, high in base minerals. Soils weathered from diabase are unusually high in cations and may support unusual plant species.

The landscape of Lehigh and Northampton counties has also been shaped by past glacial advances. The last glacial advance, the Wisconsonian, left behind thick deposits of unsorted material called till, creating a diversity of unusual habitats in the northeastern corner of Northampton County. Thinner till deposits of the earlier Illinoian glacial advance are found over most of Northampton County and much of Lehigh County Glacial meltwater deposits of sand and gravel occur on some terraces

adjacent to the Delaware River in Northampton County. Some of these gravel deposits have been quarried.

Soils

The distribution of soils in Lehigh and Northampton counties is dependent on local topography and the bedrock and glacial geology. The types of soils in a given area have led to the distinctive patterns of use that are seen on the landscape today. Much of the landscape of these two counties is now in agriculture. Most of the remaining woodlands occur along stream courses, steeper slopes, and other areas not well suited for crops.

The following brief descriptions of soil characteristics are taken from USDA soil surveys of each county, cited below, and the reader is referred to those documents for more detailed information. Soil types are important in the inventory process, as some natural communities and rare plant species are closely associated with specific soil types or characteristics.

The soils of Lehigh and Northampton counties have been surveyed separately, and different soil associations have been identified and mapped for each county. Eleven soil associations have been identified in Lehigh County (Carey and Yaworski 1963), and nine have been identified in Northampton County (Staley 1974). An association is a group of soils with a distinctive, proportional pattern of occurrence in the landscape (Carey and Yaworksi 1963). Each soil association contains one or more major soils and minor soils. The soils of both counties are described together, arranged by physiographic section.

Appalachian Mountain Section -- The **Fleetwood extremely stony land (**Lehigh Co.) and **Laidig-stony land** (Northampton Co.) soil associations are deep, stony soils of the upper slopes of Blue Mountain and Kittatinny Mountain. These lands are mostly wooded, with some boulder fields and rock outcrops. The lower slopes and footslopes of the mountains have the **Laidig-Buchanan-Andover (**Lehigh Co.) and the **Buchanan-Laidig-Andover** (Northampton Co.) soil associations. These are deep, extremely stony soils, although some have been cleared for pasture or small fields. Numerous springs and seeps are present near the base of the footslopes. The water table is high in the spring, and numerous small ponds and poorly drained areas are present.

Great Valley Section -- The **Trexler** association in Lehigh County and the **Berks-Bedington-Comly** association in Northampton County cover the most area in the counties. They are deep soils of rolling hills over acid gray shale. Most of the area is cleared and in agriculture, except along streams and steeper hillsides. The **Montevallo-Trexler** (Lehigh Co.) and the **Berks-Weikert** (Northampton Co.) associations are shallower soils on more rugged areas underlain by acid gray shale. These areas are used for crops and pasture, though soil erosion is a problem here. The southern portion of this section, in both counties, is underlain by limestone. The **Ryder-Duffield** (Lehigh Co.) and **Duffield-Clarksburg-Ryder** (Northampton Co.) associations make up thin bands of deep soils underlain by shaly limestone. The land has been used for cash crops and dairy agriculture, as well as quarrying for limestone and cement rock. Cavernous limestone underlies the **Washington-Duffield** (Lehigh Co.) and **Washington-Urban** (Northampton Co.) associations in the southern portion of the Great Valley Section. These are deep soils in thin glacial till over limestone in undulating terrain. Few natural areas exist in these lands, which have been used for urban development, intensive farming, and limestone and iron ore mines.

Reading Prong Section -- The **Chester-Brandywine-Fleetwood, Murrill,** and **Fleetwood-Chester Very Stony** soil associations are predominantly deep stony soil associations of South Mountain in Lehigh County underlain by quartzite, granite, and gneiss. They are well-drained to extremely-well-drained, and are productive croplands in areas which are not too steep or stony for agriculture. The **Conestoga-Hollinger** association on South Mountain in Northampton County also occurs on hills of metamorphic rock, with deep and stony soils suitable for small crop fields, pasture, or wood lots. There is a greater proportion of forested area in this section than in the Great Valley.

Gettysburg-Newark Section -- This section, occurring only in southwestern Lehigh County, contains the **Penn-Norton-Readington** and **Montalto** associations. The **Penn-Norton-Readington** soils are well-drained and moderately deep, and shale, conglomerate, and sandstone, and are used for agriculture where the topography is not too steep. The **Montalto** association occurs on ridges underlain by diabase, a type of rock high in cations. These soils are fertile and used for agriculture where not too steep. Steep, stony ridges underlain by diabase are mostly wooded. These areas often contain rare plant species adapted to the unusual soil chemistry.

Vegetation

The vegetation of Lehigh and Northampton counties reflects the environmental conditions (geology, topography, soils, climate) and the disturbance history, both natural and anthropogenic. The two counties are located in the original Oak-Chestnut Forest Region (Braun 1950). The American chestnut (Castanea dentata) was once a dominant feature of the Oak-Chestnut Forest, but was virtually eliminated with the introduction to North America of the chestnut blight fungus (Endothia parasitica) in 1904. Today the forest of this region is more aptly classified as Appalachian Oak Forest (Bailey 1980) or Mixed Oak Forest (Monk *et al*. 1990), dominated by white oak (Quercus alba), red oak (Q. rubra), scarlet oak (Q. coccinea), and black oak (Q. velutina), often mixed with tulip poplar (Liriodendron tulipifera), red maple (Acer rubrum), and/or American beech (Fagus grandifolia), and ericaceous shrubs. It occurs mainly on the slopes and tops of the mountain ridges that make up the northern boundaries of the two counties. Fragmented blocks of the forest are also found on some of the steeper slopes and ridges in the southern part of both counties including South Mountain, Lehigh Mountain, and various hills in Upper and Lower Milford Townships, and Lower Saucon and Williams Townships.

The lower slopes of Blue Mountain and other forested hills within the county are dominated by some mixture of oak, tulip poplar, black birch (Betula lenta), and red maple, with varying amounts of American beech, and hickory (Carya spp.). Tulip poplar was a minor component of presettlement forests but is now dominant on many sites. Tulip poplar often becomes the dominant tree after logging, seeding in on the openings and then growing more quickly than other trees. As the forest matures, however, shade-tolerant species such as red oak replace tulip poplar because it does not regenerate under a closed canopy (Tryon 1980). South Mountain is more mesic and less exposed than Blue Mountain. Much of the regrowth on South Mountain is covered by forests of tulip poplar, oaks, and hickories, with viburnums (Viburnum spp.) common in the understory. These mesic forests tend to have a good diversity of herbaceous species including wildflowers, ferns, and sedges. Invasive species such as honeysuckles (Lonicera japonica, L. morrowii, L. tatarica), Japanese barberry (Berberis thunbergii), and garlic mustard (Alliaria officinalis) are very common in these mesic in disturbed areas or in close proximity to development.

Several notable variations in the typical "Mixed Oak Forest" composition (Monk *et al*. 1990) occur with variations in soil, drainage, and topography. Drier ridge tops with shallow nutrient poor soils

are characterized by chestnut oak (Quercus montana), and black gum (Nyssa sylvatica) with red maple, sassafras (Sassafras albidum), and other oaks as associates, with an understory of ericaceous shrubs including blueberries (Vaccinium spp.), huckleberries (Gaylussacia spp.), and mountain laurel (Kalmia latifolia). These forests are most common on the highest elevations of Blue Mountain, but they are also found in the southern parts of the counties on some upper slopes and ridges. Another variant occurs along some of the stream corridors and adjacent north-facing slopes of the region and is dominated by hemlock (Tsuga canadensis) with an understory of Rhododendron (Rhododendron maximum) and witch hazel (Hamamelis virginiana). These hemlock associations have a depauperate herbaceous layer which is often limited to several species of fern and sedges. Examples of hemlock forest associations are found along Martins Creek (Bangor Quad.), Jordan Creek (Slatedale Quad.), and along the Delaware River.

Wetlands

Wetlands provide essential habitat for many plant and animal species. The type of wetland at a given location depends on soil type, disturbance, and length and duration of flooding. Lehigh and Northampton counties each have a variety of wetland community types. Forested swamp communities are found in areas where a relatively stable, high water table produces saturated soils. Bear Swamp (Stroudsburg Quad) is a good example of a forested swamp community. Common tree species in Lehigh and Northampton counties' forested swamps include red maple, black ash (Fraxinus nigra), yellow birch (Betula alleghaniensis), hemlock, and black gum (Nyssa sylvatica). Winterberry (Ilex verticillata) and highbush blueberry (Vaccinium corymbosum) are common shrubs, and the groundcover is often dominated by sphagnum mosses, sedges (Carex spp.), skunk cabbage (Symplocarpus foetidus) and ferns including cinnamon fern (Osmunda cinnamomea) and sensitive fern (Onoclea sensibilis).

Floodplain forests occur along rivers and streams in low-lying areas. These locations are periodically inundated by flood waters of spring runoff or runoff from intense storm events. In Lehigh and Northampton counties these forests are characterized by a canopy containing some combination of silver maple (Acer saccharinum), sycamore (Platanus occidentalis), river birch (Betula nigra), black willow (Salix nigra), green ash (Fraxinus pensylvanica), American elm (Ulmus americana), or box-elder (Acer negundo). Shrubs and vines common to these forests include spicebush, ninebark (Physocarpus opulifolius), silky dogwood (Cornus amomum), Virginia creeper (Parthenocissus quinquefolia), and poison ivy (Toxicodendron radicans). Floodplain forest communities, especially along the Delaware River, receive severe disturbances from flood waters including erosion and scouring by water, ice, and debris and/or deposition of massive quantities of sediments and debris. Only species with adaptations or tolerance for these kinds of conditions can survive here.

Floodplains on smaller waterways receive less intense disturbances but are still periodically flooded which limits the kinds of vegetation that can occur on them. Pin oak (Quercus palustris), swamp white oak (Quercus bicolor), silver maple, red maple, ash, sycamore, and black walnut are frequent on the wetter bottomland soils associated with smaller creeks. Understories include spicebush (Lindera benzoin), nettles (Urtica dioica), cut-leaved coneflower (Rudbeckia laciniata), wing stem (Verbesina alternifolia), jewelweed (Impatiens capensis) and many other wildflowers. In addition, floodplain forests also serve as a protective buffer against erosion and flood damage along many of the area's creeks.

Graminoid marshes are wetlands dominated by grass-like plants such as cattail (Typha latifolia), sedges, and grasses. These wetlands may be found in association with streams or in areas with ground water seepages. Large graminoid marshes are uncommon in the study area.

Seepage swamps are relatively small forested or shrub-dominated wetlands found on lower slopes where water emerges at the surface in a diffuse flow. They may be dominated by red maple with hemlock and yellow birch as associates, and an understory of rhododendron, swamp azalea (Rhododendron viscosum), spicebush, and/or highbush blueberry. Common herbs in these seepage wetlands include skunk cabbage, violets (Viola spp.), manna grass (Glyceria spp.), sedges, and ferns.

An unusual type of wetland found in northeastern Northampton County is the calcareous fen natural community. Fens are wetlands influenced by alkaline (high pH) groundwater, typically associated with limestone bedrock. Fens may be dominated by either shrubs or herbaceous vegetation, and often support rare species due to their unique chemistry (see Mt. Bethel Fens Site, p. 122).

Also found at several locations in the two counties are areas of vernal pools. Vernal pools are topographic depressions where water collects in the spring but typically dries up by mid or late summer. These can be important breeding areas for amphibians, as well as potential habitat for rare plant species.

Because wetlands are relatively uncommon in Lehigh and Northampton counties, they are important refugia for plants as well as important habitat for nesting and migrating birds. Many other animals groups such as amphibians, reptiles, odonates, and lepidopterans also depend on specific wetland habitats for all or a portion of their life cycles.

Disturbance

The nature, scale and frequency of disturbance are influential in the evolution and appearance of natural communities and associated rare species. Disturbance can be beneficial or destructive to the development and persistence of natural communities.

Some examples of natural disturbances are flooding, fire, and deer browsing. While often regarded as a detrimental impact, both fire and small-scale flooding can be beneficial to certain communities and rare species. Floodplain forests benefit from periodic scouring and deposition of sediments as streams overtop their banks. At the same time, streamside wetland communities hold excess water, thus reducing the scale of flooding downstream. In contrast, deer have been blamed for a number of negative impacts on Pennsylvania flora and fauna (Rhoads *et al*. 1992): a reduction in the amount of understory, poor regeneration of some species, decreased songbird diversity, and direct loss of rare plants.

In many cases, human disturbance has been clearly destructive to natural habitats and species associated with them. Although necessary, farming, mining and development are disturbances that have completely eradicated some natural communities and habitats. For example, old-growth forests are all but nonexistent although occasional old trees may be encountered; many wetland habitats have been filled or altered resulting in the loss of some of the native plants and animals of these sites. Although some species, including several rare species, are aided by on-site disturbance (e.g., clearing or mowing), human disturbance is detrimental to most species. With wide-ranging human disturbance, some plant and animal species may be completely eradicated from an area because they cannot compete or survive under newly created conditions.

An increasing threat to these communities and natural habitats is the introduction and spread of exotic (i.e., non-native), invasive species across the landscape. These include, among others: the chestnut blight fungus that dramatically changed the composition of our forests; the grass carp that can disrupt native aquatic life; and a long list of plants that may out-compete native species and come to dominate a site. Non-native plants such as Japanese honeysuckle, tree-of-heaven (Ailanthus altissima), Oriental bittersweet (Celastrus orbiculatus), and garlic mustard have become commonplace in disturbed

woodlands, often to the point of excluding some of the native plants. In wetlands and along streams, purple loosestrife (Lythrum salicaria), Japanese knotweed (Polygonum cuspidatum), and common reed (Phragmites australis) are aggressive, weedy species that follow in the wake of disturbance. The natural disturbances of flooding and scouring that occur along the two major river corridors have helped to facilitate the invasion and colonization of many exotic species. There are few if any plant communities along the two major river corridors that do not have significant components of exotic species. The species with the greatest impact in these communities tend to be robust herbs such as purple loosestrife and Japanese knotweed, but vines such as Japanese hops (Humulus japonicus) are also serious problems. Aquatic habitats of the rivers, streams, and lakes are also vulnerable to invasion by exotics. Curly pondweed (Potamogeton crispus), a native of Europe, has become the dominant plant species in some of the regions' waterways.

Control of these problematic, non-native species is necessary for the long-term maintenance of high quality natural systems. Discouraging the use of these and other potentially weedy exotics in and around natural areas can help to prevent further encroachment. Some nurseries now carry a selection of tree, shrub and herbaceous species that are native to Pennsylvania, and these are recommended where plantings are necessary in, or adjacent to, natural areas. *The Vascular Flora of Pennsylvania* (1993) is a helpful reference for determining whether a plant species is native to the state.

ISLAND PARK in the Lehigh River supports a PA - Endangered plant species, and its wetlands and forests also are home to a good diversity of bird species. Photo: PA Science Office of the The Nature Conservancy.

PENNSYLVANIA NATURAL DIVERSITY INVENTORY DATA SYSTEM

In order to plan the wise use of Lehigh and Northampton counties' natural features, the Pennsylvania Science Office (PSO) of The Nature Conservancy (TNC) was contracted by the Lehigh Valley Planning Commission to provide an inventory of significant flora, fauna and natural communities in Lehigh and Northampton counties. Critical to this effort is the Pennsylvania Natural Diversity Inventory (PNDI) database. PNDI was established in 1982 as a joint venture of The Pennsylvania Science Office (PSO) of the Nature Conservancy, the Pennsylvania Department of Conservation of Natural Resources (DCNR), and the Western Pennsylvania Conservancy. In its 16 years of operation, the PNDI database has become Pennsylvania's chief storehouse of information on outstanding natural habitat types (called natural communities in PNDI terminology), sensitive plant and animal species (species of special concern), and heron rookeries. Several other noteworthy natural features are also mapped, including DEP-designated Exceptional Value streams (Shertzer 1992) and outstanding geologic features (based on recommendations from Geyer and Bolles 1979). Over 10,000 detailed occurrence records, largely the result of field surveys, are stored in computer files and denoted on topographic maps. Additional data are stored in extensive manual files set up for over 150 natural community types, over 800 plant and animal species, and about 650 managed areas, and are organized based on each of Pennsylvania's 881 7½' USGS topographic quadrangle maps.

Beginning in 1982, PSO collected existing data on occurrences of elements of concern, drawing from publications, herbarium and museum specimens, and the knowledge of expert botanists, zoologists, ecologists, and naturalists. From this foundation, PSO has focused its efforts on, and conducted systematic inventories for, the best occurrences of the priority elements.

The PA Science Office has used this systematic inventory approach to identify the areas of highest natural integrity in Lehigh and Northampton counties. These areas, comprised of natural communities with their characteristic species, should represent an estimated 85-90 % of the biological diversity of an area (The Nature Conservancy, 1988); the other 10-15 % consists of sensitive plant and animal species which occur both within and outside these natural communities. A good portion of biological diversity in Lehigh and Northampton counties can be conserved by protecting sites with the best occurrences of each county’s natural communities and by protecting good populations of each county's sensitive plants and animal species. The natural community and sensitive species data are the basis for judging the biological values of sites within the counties.

NATURAL AREAS INVENTORY METHODS

Methods used in the Natural Areas Inventories followed PNDI procedures, and those developed in Illinois (White 1978) and Indiana (Anonymous 1985). The inventory proceeds in three stages: 1) information is gathered from the PNDI database files, local experts, and map and air photo interpretation; 2) ground survey and reconnaissance by aircraft is conducted; and 3) data are analyzed and mapped.

Information Gathering

A list of natural features found in Lehigh and Northampton counties was prepared from the PNDI database and supplemented with information volunteered by local individuals and organizations familiar with the counties. In the Spring of 1997 a public meeting was held in the counties and Recommended Natural Area Survey Forms (Appendix III) were distributed to facilitate public input. TNC staff solicited information about potential natural communities, plant species of special concern and important wildlife breeding areas from knowledgeable individuals and local conservation groups. A number of potential natural areas were identified.

Map and Air Photo Interpretation

PSO ecologists familiarized themselves with the air photo characteristics of high quality natural communities already documented (Appendix VI). Additional data from vegetation maps, soil-survey maps, field survey records and other sources were consulted to gain familiarity with each county's natural systems. This information along with references on physiography, geology, and soils was used to interpret photos and designate probable vegetation types and potential locations for exemplary communities and rare species. In many instances, vegetation was classified at an ecosystem level, and it was therefore critical that an ecologist or person with similar training interpret the maps and air photos.

Work progressed systematically within the area encompassed by each USGS topographic map. The natural area potential of all parcels of land was assessed using aerial photographs. Areas continuing into adjacent counties were examined in their entirety. Topographic maps for use during field surveys were marked to indicate locations and types of potential natural areas based on characteristics observed on the photos. For example, an uneven canopy with tall canopy trees could indicate an older forest; a forest opening, combined with information from geology and soils maps, could indicate a seepage swamp community with potential for rare plant species. Baseline information on sites appearing to have good quality communities or potential for rare species was compiled on Potential Natural Area Survey Forms (Appendix III) to help prioritize fieldwork.

After an initial round of photo interpretation, field surveys were conducted to determine what was actually on the ground. Locations with minimally disturbed natural communities or with species of special concern were outlined on topographic quadrangle maps. The photo signatures (characteristic patterns, texture, tone of vegetation, and other features on the photos) of these sites were then used as a guide for continued photo interpretation and future field surveys. Photo signatures, which led to poor quality sites, enabled the elimination of further fieldwork on other sites with similar signatures.

Field Work

Experienced PSO biologists and contractors conducted numerous field surveys throughout the counties during the 1997 and 1998 growing seasons. Biologists evaluated the degree of naturalness of habitats (including assessment of percent of native vs. non-native plant species, degree of human disturbance, age of trees, etc.) and searched for plant and animal species of special concern. Workers categorized the vegetation by natural community type for each potential natural area visited. An evaluation of quality was made for each natural community, care being taken to give reasons for the quality rank. Boundaries of the community types were redrawn, if needed, based on new field information. The Potential Natural Area Survey Form (Appendix III) was completed for each community with a quality-rank of "C" and above. Community information recorded included the dominant, common, and other species, as well as disturbances to the community. Field forms were completed for all occurrences of sensitive plant and animal species, and natural communities (see sample Plant Survey Form, Appendix V), the quality of each population or community was assessed, and locations were marked on USGS topographic quadrangle maps.

On April 4, 1997, a reconnaissance flight was flown over the two counties to provide a more accurate overview of the current condition and extent of known natural areas and to assess the potential of any additional areas.

Data Analysis

To organize the natural features data and set conservation priorities, each natural community or species (element) is ranked using factors of rarity and threat on a statewide (state element ranking) and range-wide (global element ranking) basis (see Appendix I). Each location of a species element (an element occurrence) is ranked according to its naturalness, its potential for future survival or recovery, its extent or population size, and any threats to it. An explanation of the five element occurrence quality ranks is given in Appendix II. The element-ranking and element occurrence-ranking systems help PSO personnel to simultaneously gauge the singular importance of each occurrence of, for example, a Pitch pine-Scrub oak barren community, rough-leaved aster, or giant swallowtail in the counties, as well as the statewide or worldwide importance of these natural features. Obviously, sites with a greater number of highly-ranked elements merit more immediate attention than sites with a smaller number of lower ranked elements.

Field data for natural communities of C-rank or better, and for all plant and animal species of concern found were combined with existing data and summarized on PNDI Element Occurrence Records for mapping and computerization. Mapped locations of natural features, including approximate watershed or subwatershed boundaries, were then digitized into a Geographic Information System.

Information on the needs of the rare species in this report has come from a variety of sources, including field guides and research publications. For reptiles and amphibians, the major source is DeGraaf and Rudis (1981) and for birds, Brauning (1992). A list of species of special concern currently known in Lehigh and Northampton counties is provided in Appendix VII.

Map Codes

All natural communities, species of special concern, and significant geologic features are coded on the maps and described in the text. The codes are PNDI map codes that are unique to each element on a given USGS topographic map. Species are identified by code to prevent unauthorized collection and possible extirpation of the species at the site. Natural communities are identified by **NC**, plants by **SP**, animals by **SA**, and geologic features by **GE**. All are followed by a three-digit code. Anyone seeking information on an individual site or species location may call or write the Pennsylvania Science Office of The Nature Conservancy; please provide the map code(s) and the corresponding topographic quadrangle map name(s) where applicable.

Priorities for Protection

Table 1 is a priority listing for Lehigh County's natural community and species locations, and is presented in the Summary and Recommendations section. Table 3 is a priority listing for Northampton County's natural community and species locations, and is also presented in the Summary and Recommendations section. These tables rank inventory sites from the most important and threatened to the least. Ranks are based on rarity, quality, and threats or management needs of the elements at the site. The table lists the site name, topographic map, and pertinent information on importance, threats, management needs, and recommendations for protection of the element. More detailed descriptions of each site are found in the text sections which follow each topographic map and associated map table. The report also includes sites which are designated as 'Locally Significant.' These are sites which lack species of special concern or high quality natural communities, but are of significant value for the preservation of biological diversity at the county level. These sites may be natural communities which are recovering from previous disturbances, or may have some unique features which support relatively high biological diversity. Locally Significant Areas are indicated on the maps and are briefly discussed in the text accompanying each map. These secondary sites are arranged in separate tables (Table 2 for Lehigh County and Table 4 for Northampton County) in the Summary and Recommendations section and ranked in approximate order of importance. They have been given qualitative ranks (high or medium) according to size, level of disturbance, proximity to other open-space lands, and potential for sustaining a diversity of plant and animal life. These secondary-site ranks must be viewed as very approximate.

SUMMARY AND RECOMMENDATIONS

Each year biologists meet to discuss and rank the most important sites for the protection of biodiversity in Pennsylvania. This meeting consists of a review and ranking of all sites within the state, in terms of the rarity and quality of the species or habitats of concern, potential threats, and protection needs. The results of these meetings provide a baseline for the Lehigh County and Northampton County Natural Areas Inventory sites of statewide significance.

The Natural Areas Inventory recognizes sites at two primary levels of significance for the protection of biological diversity: 1) sites of statewide importance; and 2) sites of local significance. Sites of statewide importance (presented in Table 1 for Lehigh County and Table 3 for Northampton County) support species of special concern or exemplary natural communities. Sites in this category that are ranked 1 or 2 may contain some of the best natural areas in the state. Locally significant sites are presented in Table 2 for Lehigh County and Table 4 for Northampton County. These areas provide locally significant habitat and may be suitable for environmental education, parks or preserves; no species of special concern or exemplary communities have been identified at the sites listed in Tables 2 and 4.

Exceptional Natural Features: Delaware River and Blue Mountain

In considering the value of specific sites for the preservation of biological diversity it is important to note that these sites are dependent on the integrity of larger scale systems such as rivers and mountain ridges.

The DELAWARE RIVER and its adjacent forested watersheds comprise one of the major corridors for the movement of biota in eastern Pennsylvania. This includes habitat for resident species, habitat required for migrating birds on a biannual basis, habitat for resident and migratory aquatic animals, habitat needed for the long-term survival of plant species, and more. Conserving the best sites as highlighted in this report must be considered as part of the effort to conserve the greater natural functional value of the river corridor. In reviewing the report it is evident that many important natural areas within the county are along the river and its major tributaries. Along with these identified sites are many areas that were beyond the scope of this project to fully investigate. The development of a comprehensive conservation plan for the portion of the county adjacent to the river and its major tributaries, conducted in conjunction with other counties in the lower Delaware River Basin, may be the best tool for conserving this important natural resource.

BLUE MOUNTAIN is the most extensive relatively contiguous area of natural habitat in the two counties. It is also one of the major corridors for the movement of biota in eastern Pennsylvania. With its extensive forests, streams, seeps, vernal pools, rock outcrops, and boulder fields, Blue Mountain is probably the wildest area remaining in southeastern Pennsylvania. It has long been recognized as one of the major east coast fall flyways for migrating raptors. The outcrops at Bake Oven Knob have been a major resource as a research station for collecting data on these migrations. The extensive relatively unfragmented forests include habitat for resident animal species including larger mammals such as bear and bobcat, as well as for numerous smaller mammals including the PA-Threatened Allegheny woodrat (Neotoma magister). Although the mountain is primarily upland forest

it includes streams, seeps, springs, and vernal pools. These features are more common on lower slopes as well as in areas at the base of the mountain where drainage is poor, such as in the glaciated portion of Northampton County. These riparian and wetland areas are important habitat for a wide diversity of plant species as well as for many groups of animals, including birds, reptiles, amphibians, odonates (dragonflies and damselflies) and other aquatic insects. Conserving sites on the mountain as highlighted in this report must be considered as part of the effort to conserve the greater natural functional value of the mountain ridge. Along with the sites identified in this report are many areas that were beyond the scope of this project to fully investigate. Preserving the ecological integrity of Blue Mountain should be considered an important component in preserving the biodiversity of the two counties.

Landscape Analysis: Connecting natural linkages in the landscape

Conservation of natural lands in Bushkill Township, an example of landscape analysis:

The science of Conservation Biology has shown that fragmented habitat is a recipe for extinction of species, as individuals cannot interconnect with each other to continue the species survival. It has been shown that protecting large cores of wildlife habitat is essential to protecting healthy ecosystems. However, protecting only large wilderness cores is not enough to facilitate the flow of life across an entire landscape. These habitat cores must be linked by natural corridors that allow natural processes such as wildfires, predator-prey relationships, and spring floods to occur. These interconnected natural corridors also need to be buffered from ecologically damaging activities by areas of more compatible usage. The result is a series of interconnected habitats that thrive ecologically, and allow unimpeded movements of wildlife and high plant diversity. These connections will allow populations of a species to interbreed, and improve overall genetic variability. These connections will be vital for species as shrinking habitats continue to degrade critical habitats (The Wildlands Project, www.twp.com).

The northern extent of Bushkill Township contains a very large contiguous forest known as Blue Mountain, which is mostly on State Game Lands 168. As a part of Kitattinny Ridge, this area contains contiguous forest and corridor providing refuge to resident and migratory species. With the ridges' extensive diversity of habitat types, it has long been recognized as providing critical habitat for resident mammals such as black bear and coyote, while also being recognized as one of the major east coast autumn flyways for migrating raptors. Although the mountain is primarily upland forest, it also includes headwater streams, seeps, springs, and vernal pools.

These riparian forests, wetlands, and waterways offer diverse critical habitat for a wide diversity of plant species as well as for birds, reptiles, amphibians, dragonflies and damselflies, and aquatic insects. Connecting ecological corridors such as large, forested tracts, and rivers and streams, are important in keeping small populations from becoming isolated. Furthermore, these corridors could become imperative for migration northward to higher elevations if the conditions in the region begin to warm climatically.

Blue Mountain and State Game Lands #168 make up an extensive ridge and forest that straddles the border of Bushkill Township. This area makes for an excellent opportunity to connect ecological corridors from the lower valley to the higher ridge. Several forested ecological corridors are present, especially along several streams that run north to south through the township. These stream-led corridors allow migration of fauna/flora from Blue Mountain to other extensive forested areas, such as Jacobsburg State Park. However, between these two large forested areas, major roads pose as physical and ecological barriers for movements of wildlife. Route 512 and several other side roads interrupt an ecological corridor between Blue Mountain and Jacobsburg State Park. For some species, a road can effectively fragment a population of a species by leaving a barrier to movement and interbreeding. The remaining small populations are vulnerable to genetic deterioration from inbreeding, environmental catastrophes, fluctuations in habitat conditions, and chance variations in age and sex ratios.

Even a major road can cause habitat fragmentation that may be ominous to a species, especially in the face of compounding environmental problems. The infrastructure of roads can cause runoff pollution, noise pollution, and air pollution. They also contribute to the spread of invasive plant species, which

could infiltrate interior forest areas and threaten the ecological integrity of these areas. This makes room for opportunistic species, like brown-headed cowbirds and other edge habitat species, which may increase near roads. This could harm interior forest species (especially birds), where nest predation and parasitism increases. Thus, roads can be a physical barrier and cause destructive ecological impacts to species. Despite the effects of roads on ecological corridors in Bushkill Township, these corridors still increase movements across the forested landscape from the lower valleys to the higher ridges. Future planning efforts should minimize the degradation of these natural corridors, and expand and improve them where possible.

Methodology

Creating NAI Forest Block Layers

1. Start from pa_nlcd_n0o layer (TNC LULC layer)
2. Get extent of area to be clipped (need x,y coordinates)
3. Clip lulc (have to use GridClip in Arc/Info)
4. Convert Grid to polygons (can use Spatial Analyst), by Grid-code
5. Clip polygons to county boundary
6. Group cover types as follows:

GRID_CODE	LULC	Group
11	Open Water	Open Water
21	Low Intensity Residential	Residential/Commercial
22	High Intensity Residential	Residential/Commercial
23	Commercial/Industrial/Transportation	Residential/Commercial
32	Quarries/Strip Mines/Gravel Pits	Quarry/Other
33	Transitional	Quarry/Other
41	Deciduous Forest	Forest
42	Evergreen Forest	Forest
43	Mixed Forest	Forest
81	Pasture/Hay	Pasture/Crops
82	Row Crops	Pasture/Crops
91	Woody Wetlands	Wetland
92	Emergent Herbaceous Wetlands	Wetland

7. In Arc/Info, dissolve on Group (have to do this in Arc/Info, because ArcView merges all dissolved shapes into a single polygon)
8. Select Group = Forest, and convert to shapefile to create a Forest Layer
9. Area units from the LULC grid are square meters. Select polygons with area >= 1,000,000 sq m (1 sq kilometer), and convert to new forest_blocks shapefile.

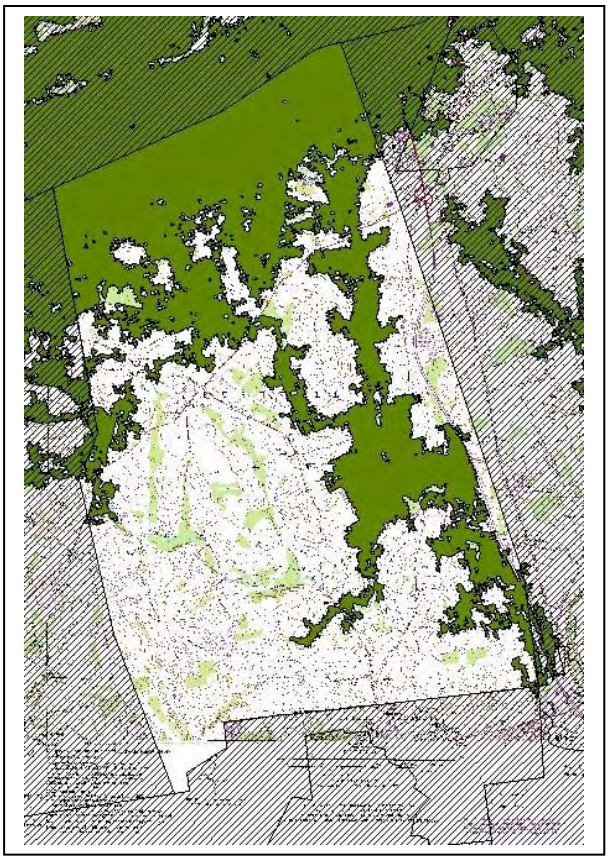
Creating fragmented forest blocks

PennDOT roads were dowloaded from PASDA –
State Roads, 2004
Local Roads, 2001

Files were in Geographic, NAD 83

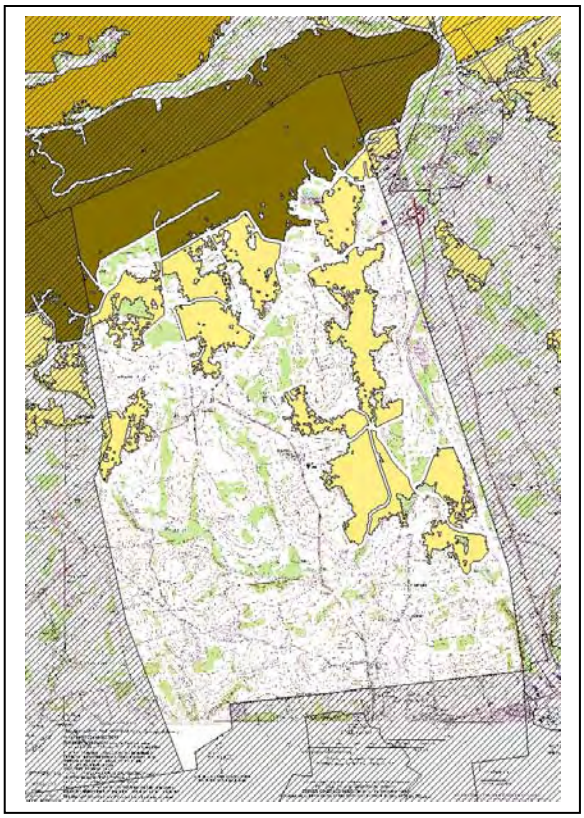
Buffer Roads as follows:
For State Roads, use PennDOT ROW distances (based on communication from PennDOT) based on road type in the Traf_rt_no field:

Forested Corridor Analysis of Bushkill Township

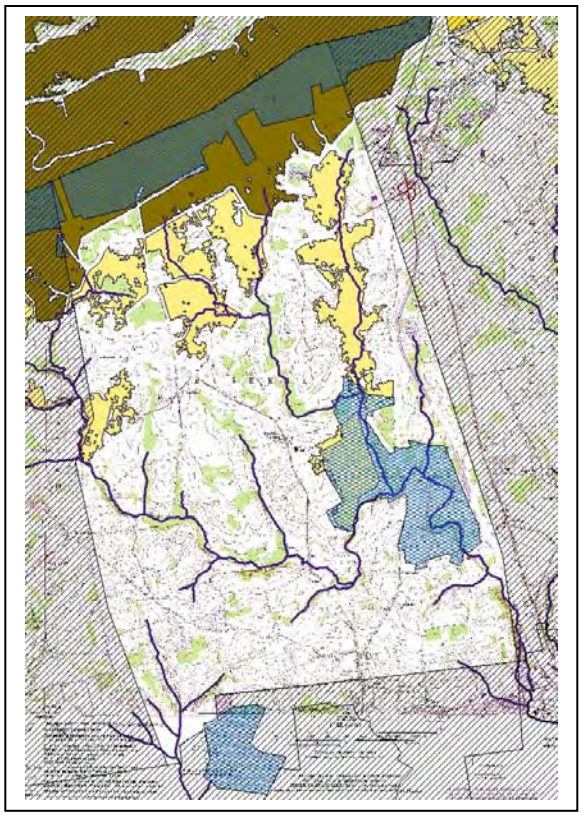


Forested blocks greater than ½ mile square determined from satellite imagery

Fragmenting features such as roads break the forested blocks into smaller units



The smaller units under 1/2 square mile are eliminated. The remaining blocks are color coded for size of interior forest habitat (darker is greater degree of forest interior)



Public lands are shaded in blue to illustrate where publicly protected forested corridors are lacking. Streams are added to show the most natural corridors. Many of these areas are in need of streamside reforestation.

I = 500 ft
PA = 150 ft
US = 150 ft
Blank (other) = 117 ft.

For local roads, I chose 100ft.

Select roads that intersect forest blocks, and buffer them using the above distances. Save to a shapefile. Create a shapefile of all Road Buffers. Add a field called Road, and attribute all of the roads buffer polys as Road = Y.

Use GeoProcessing Wizard to UNION the road segments and Forest Blocks. This creates a combined polygon theme, and retains the "Road" and "Forest Type" attributes.

Edit the unioned theme – select Road = Y and delete.

Note: deleting the roads creates multi-part polygons with 'holes' where the roads were. Need to explode the shapes to convert the multiparts into individual forest polygons. Run the ArcView sample script explode.ave. Keep the lu_type attribute.

Use TNC.Further to calculate sq mi and sq km.

Results

1) Rismiller Landscape Corridor

Unfortunately, two east to west roads fragment a north to south ecological corridor from south of Blue Mountain to Jacobsburg State Park. In addition, the village of Rismiller and associated roads present an obstacle to the present forested corridor. Further south, Route 512 cuts off the corridor along the stream. Route 512 serves as a major barrier. Other roads cut off this particular stretch of corridor south to Jacobsburg State Park (see map). In addition, the forested buffer along this stretch becomes narrow (see map), and allows for fewer movements and greater chances of predation and invasive species spread. One recommendation is for the opportunity to increase buffering of the corridor along the stream. With increased buffering of the forested corridor along the stream, forest cover will increase, habitat for species will increase, and predation will decrease among moving wildlife individuals.

Jacobsburg State Park serves as a large refuge for many species of flora/fauna species, and this park serves a large intact forest south to Bushkill Creek. Bushkill Creek also serves as a corridor for movements of wildlife. There are ample opportunities to expand the **Rismiller Landscape corridor** from **Jacobsburg State Park/Bushkill Creek** to include other areas of Bushkill Creek. The buffering of the creek could be extended south, to include areas north of the village of Aluta and near Belfast Junction, where reforestation of the creek side is most needed. This would increase an already extensive stretch of ecological corridors along the creek extending from the north at Blue Mountain to Jacobsburg State Park and Bushkill Creek. Roads seem to be the only physical barriers in much of this area. Recommendations to this area include widening narrow ecological corridors, buffering streams, and the possibility of constructing wildlife movement culvers below major roads that fragment the corridor. There are many arguments for and against construction of these wildlife culvers, and should be considered on a case-by-case basis.

2) Knechts Landscape Corridor

This forested landscape begins in the Kittatiny/Blue Mountain area and extends south through several roads that fragment the large interior forests of the northern part of the township. This corridor moves through the village of Knechts where Route 512 becomes a major interruption for the landscape corridor. The corridor continues across Route 512 and continues south along a stream towards Bushkill Center and the northern portion of Jacobsburg Environmental Center. The area is further fragmented by roads and a course filter would probably not include many of the smaller forest blocks captured by this program. The landscape corridor eventually blends into the Rismiller Landscape Corridor and Jacobsburg State Park. This corridor represents another wildlife movement corridor that extends from the north at Blue Mountain south to Jacobsburg. However, there are many barriers and interruptions that this corridor must pass through to reach the state park.

3) Bushkill Creek Landscape Corridor

Dropping south of Jacobsburg State Park is Bushkill Creek that flows south along the border of the township. This creek flows in close adjunct to Route 33, and the partially forested corridor stretches south to just north of Stockertown. This landscape corridor is by no means completely forested, and is much more fragmented than either Knechts or Rismiller Landscape Corridors. This landscape corridor is noted due to the opportunity to reforest some of the riparian areas along Bushkill Creek. If more of the creek was reforested, this corridor could link with the corridors mentioned above, creating an even larger forested corridor in the county. Roads also fragment and interrupt the Bushkill Creek Corridor. Many animal species that depend on streamside corridors for movement cannot tolerate busy roads that interrupt. This area may be a good example of building wildlife culvers to give some animal species safe harbors for crossing busy roads. Several of these wildlife culvers could be built, but funds are probably the limiting factor here. However, several areas of this creek could be examined for reforestation of the riparian zone. Replanting of these riparian zones along Bushkill Creek is important due to the possibility of improving water quality, decreasing non-point source pollution, and decrease flooding intensity along the creek.

Summary

This township contains two areas designated as natural areas by Pennsylvania Natural Heritage Program's County Inventory Program. The species of concern in these areas have specific habitat requirements that may or may not be compatible to reforestation purposes. One animal of special concern, which occurs in this township, needs a delicate balance between good water quality and open wetland habitat.

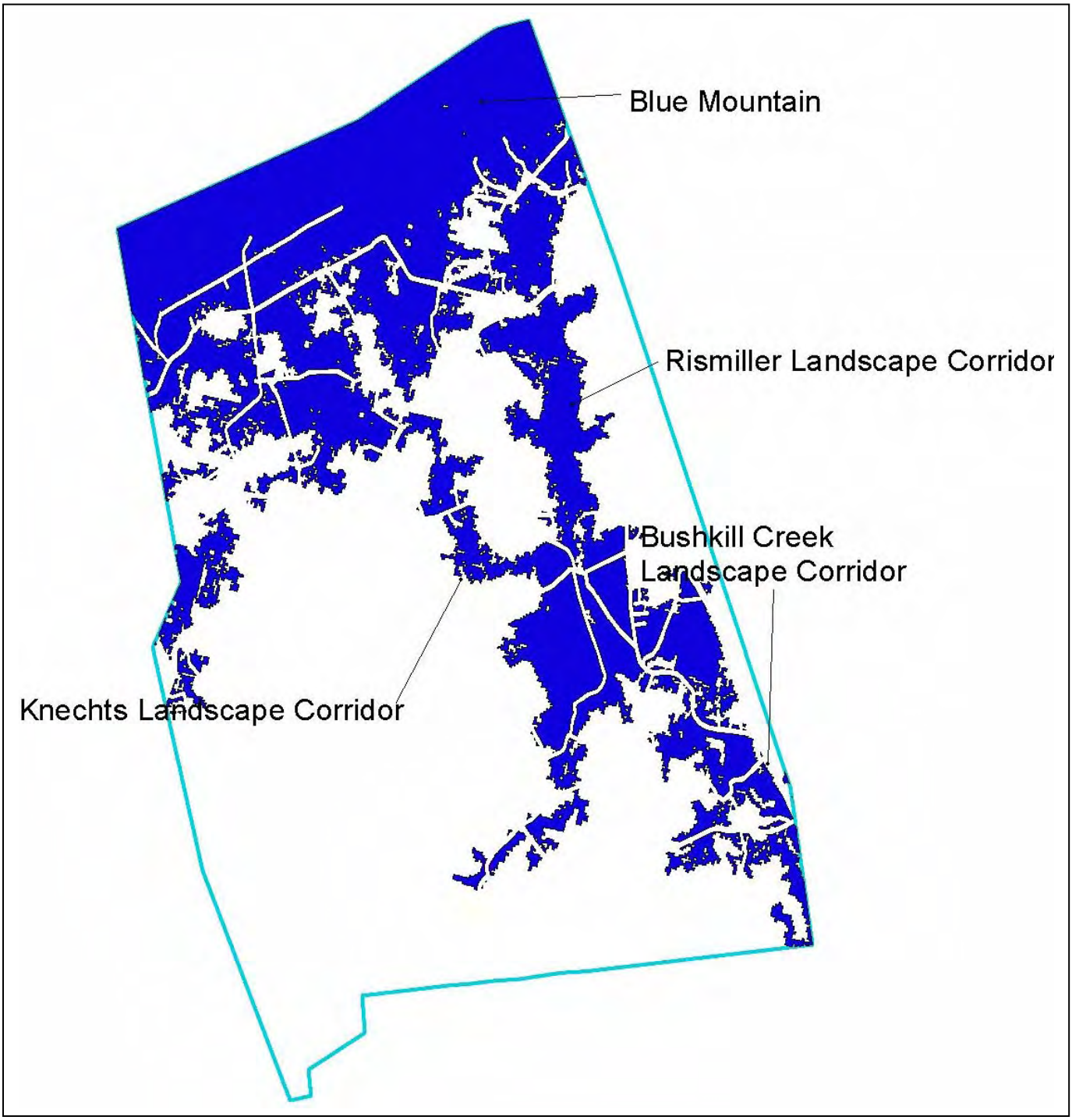
These examples represent only two landscape corridors where specifications can be made to expand the movements of wildlife species, possibly expand native plant species populations, improve stream quality, and improve environmental conditions throughout the township. There are possibly other corridors through the township that could be examined further to determine the conservation implications and restoration potential for ecological corridors.

Blue Mountain is a large uninterrupted forest block that provides complete ecological services to countless number of species. To expand the benefits of this large forested area to species further south into Bushkill Township, landscape corridors could be developed. The corridors presented above show opportunities for possible connection to Blue Mountain. Despite the amount of fragmentation that these

landscape corridors contain in them, these corridors represent opportunities for reforestation of riparian areas, wildlife culvers, and land protection in these areas. The identification of these corridors in Bushkill Township will possibly lead the way in directing conservation in the future for the township and set an example for other townships to follow.

Figure 5:

Landscape Corridors of Bushkill Township



Top Priority Natural Areas in Lehigh County

All the natural areas in the county are important to maintaining biodiversity in the region and the state. However, the following six sites from Table 1 are the most critical at present for maintaining Lehigh County's biological diversity into the future (see Figure 1 for approximate locations of these sites). Detailed descriptions of all sites are included in the Results section which follows.

ROBERT RODALE RESERVE (Salisbury Twp., Allentown, Emmaus) This site on South Mountain is a large maturing second growth forest that includes a wide variety of habitat types. It supports a fair to good quality Northern Appalachian Circumneutral Seeps Natural Community and two plant species of special concern. The seeps, along with other natural features including vernal ponds, small streams, and rock outcrops, create habitat that supports a large number of plant and animal species. The site is of particular value for both the preservation of biodiversity and for recreation because of its close proximity to the heavily developed greater Allentown area. Preventing further forest fragmentation on South Mountain will benefit all the native plants and animals that rely on this area to support some aspect of their life cycles. This site is partly owned by the City of Allentown and the Wildlands Conservancy. (**Allentown East Quad, p. 56)**

SWABIA/INDIAN/HOSENSACK WATERSHED (Lower Milford Twp.) This site includes areas of marsh and shrub swamp and is now a combined site with Hosensack Marsh, Indian Creek Floodplain, and Macungie Watershed. This site contains a new fair to good population of **White Trout Lily (*Erythonium albidum*)**, an S3 plant species of concern. The site has been disturbed by the construction of an electric power transfer station and associated powerline ROW. Some of the habitat created by these disturbances may be benefiting the rare species that occurs here. The site supports a fair to good example of an **animal species of concern**. (**East Greenville Quad, p. 78)**

LEHIGH MOUNTAIN SEEPS (Salisbury Twp.) This site is located on Lehigh Mountain adjacent to the Lehigh River. It includes a large maturing second growth forest with a wide variety of habitat types. It supports a fair to good quality Northern Appalachian Circumneutral Seeps Natural Community and one plant species of special concern. The seeps, along with other natural features including forest, small streams, rock outcrops, and the adjacent Lehigh River create habitat that supports a large number of plant and animal species. The site is of particular value for both the preservation of biodiversity and for recreation because of its close proximity to the heavily developed greater Allentown - Bethlehem area. Preventing further forest fragmentation on Lehigh Mountain will benefit all the native plants and animals that rely on this area to support some aspect of their life cycles. Minimizing disturbance will also help prevent further colonization of exotic species which are a threat to the quality of the site. Part of this site is jointly owned by Allentown, Salisbury Township, and Lehigh County. **(Allentown East Quad, p. 52)**

ROCKDALE CLIFFS (North Whitehall Twp.) The site consists of sparsely vegetated vertical cliffs of the Martinsburg formation. Groundwater seepage and a northern exposure help keep the cliffs moist for part of the growing season and the resultant microclimate creates habitat important to a PA-Endangered plant species. This site is located in the middle of a two-mile stretch of forested slope on the south side of the Lehigh River. This forest is relatively mature and includes ravines and moist north facing slopes as well as many outcrops and cliffs with drier forest associations occurring above them. It is excellent habitat for a variety of nesting and migrating birds as well as for reptile and amphibian species.

Maintaining large contiguous forested tracts such as this along the counties' waterways will be an important step in helping to minimize the loss of natural diversity from the county. (**Cementon Quad, p. 74)**

REXTOWN PONDS (Washington Twp.) The Rextown Ponds site has several small, seasonally-wet, shallow depressions or ponds in otherwise well-drained, upland forest. The depressions typically have standing water in spring and early summer and often become desiccated by late summer and fall. The vegetation includes a mixture of herbaceous and woody species, such as various grasses and sedges. A fair quality population of a Federally Threatened Plant occurs in one of the ponds. Maintaining a forest buffer around this pond will help this species persist at this site. (**Lehighton Quad, p. 96)**

BAKE OVEN KNOB (Heidelberg Twp.; East Penn Twp., Carbon Co.) This site includes a Northern Appalachian Acidic Rocky Summit Natural Community. It is characterized by prominent bedrock outcrops which are flanked by large sandstone boulders. Patches of stunted trees including red maple (Acer rubrum), sweet birch (Betula lenta), chestnut oak (Quercus prinus), and scarlet oak (Quercus coccinea) form a partially open canopy. Mountain laurel (Kalmia latifolia) and huckleberry (Gaylussacia baccata) are common shrubs. Herbs and several species of ferns grow in areas among the rocks where soil has accumulated. This site is also recognized as an important area for scientific research. It is used every year to census migrating raptors and other bird species. This site is partly on State Game Lands #217. (**Slatedale Quad, p. 136)**

Lehigh County

Table 1. The sites of statewide significance for the protection of biological diversity in Lehigh County in approximate order of priority from the most important (rank = 1) to the least (rank = 5). The presence of species of special concern and/or exemplary natural communities has been documented at these sites. More in-depth information on each site including detailed site descriptions and management recommendations where appropriate can be found on pages as listed at the end of each brief description in the table. Topographic maps showing locations of sites can be found on pages as listed in the map column. Quality ranks, legal status, and last observation dates for species of special concern and natural communities are located in the table that precedes each map page.

County Rank[1]	Site Name (municipality)	USGS Topo. Map	Natural Feature & Brief Description	Former Rank
1	**ROBERT RODALE RESERVE** (Salisbury Twp., Allentown, Emmaus)	Allentown)	The site includes a fair to good quality Northern Appalachian Circumneutral Seeps Natural Community and two plant species of special concern. This site contains a population of **Lettuceleaf Saxifrage (*Saxifragus micranthidifolia*)**, **a recently delisted plant species**. It also includes several vernal pools that are important breeding habitat for amphibians.	1
1	**SWABIA/INDIAN/ HOSENSACK WATERSHED** (Formerly Hosensack Marsh, Indian Creek Floodplain, and Macungie Watershed) (Lower Milford Twp.)	East Greenville Allentown West Milford Square	*Hosensack Marsh*-This site includes areas of marsh and shrub swamp. It supports a fair to good quality population of a **PA-Endangered animal species** and a fair to good population of **White Trout Lily (*Erythonium albidum*)**, an S3 plant species of concern. *Indian Creek Floodplain*-This site also includes areas of floodplain forest and open marsh along the floodplain of Indian Creek. Evidence of a **PA-Endangered animal species** was observed at this site in 1996. Surveys to determine the status of the species of concern at this site are highly recommended. *Macungie Watershed*-The site includes a fair to good quality **Northern Appalachian Circumneutral Seeps Natural Community**. The seeps have the potential to support several state plant species of special concern though none were observed during our surveys. This site is partly owned by Macungie Borough.	1-Hosenack 3-Indian Creek 4-Macungie
2	BAKE OVEN KNOB (Heidelberg Twp.; East Penn Twp., Carbon Co.)	Slatedale/ Lehighton	This site includes a Northern Appalachian Acidic Rocky Summit Natural Community. This site is also recognized as an important area for scientific research. It is used every year to census migrating raptors and other bird species. This site is part of State Game Lands #217.	2
2	LEHIGH MOUNTAIN SEEPS (Salisbury Twp.)	Allentown East	This site includes a fair quality **Northern Appalachian Circumneutral Seeps Natural Community** and **Lettuceleaf Saxifrage (*Saxifragus micranthidifolia*)**, **a recently delisted plant species** Competition from invasive shrubs and herbs is a threat.	2

1 Sites are ranked from 1 to 5 with 1 indicating the highest priority sites for protection based on state or national significance, and 5 indicating the lowest priority for protection. Ranks take into account potential threats, management needs and existing protection. Sites of similar rank are listed alphabetically by quadrangle.

Lehigh County

County Rank[1]	Site Name (municipality)	USGS Topo. Map	Natural Feature & Brief Description	Former Rank
2	REXTOWN PONDS (Washington Twp.)	Lehighton	This site includes several small, seasonally-wet, shallow depressions or vernal ponds in otherwise well-drained, upland forest. A fair quality population of **Northeastern Bulrush (*Scirpus ancistrochaetus*),** a **G3/PA-Threatened plant species,** occurs in one of the ponds.	2
2	ROCKDALE CLIFFS (North Whitehall Twp.)	Cementon	This site supports a good population of **Ebony Sedge (*Carex eburnea*)**, a PA-Endangered plant species. The plant grows in seepy areas of sparsely vegetated cliffs that are found along the Lehigh River. Colonization of the site by exotic species is a threat.	2
2	**SGL # 217 AND APPALACHIAN TRAIL (Lynn Twp.)**	New Tripoli	In 2002, a graminoid-dominated **Ephemeral Fluctuating pool Natural Community** was located along the ridge of Blue Mountain in SGL #217. A very good-quality population of a G3, S3 PA-endangered, and Federally-endangered plant species, the **northeastern bulrush *(Scirpus ancistrochaetus),*** was located in this pond. The Federally endangered status of this plant indicates that the species is in danger of extinction throughout all or a significant portion of its range. The northeastern bulrush is primarily found in temporary ponds and other pools with fluctuating water levels.	
3	**NEW YORK TUNNEL (Slatington Borough)**	Palmerton	Twelve individuals of **Northern Myotis (*Myotis septentrionalis*)**, an S3B, S3N animal species of concern, were found in a tunnel near a school. Associated species include Little Brown Bat (*Myotis lucifugus*). This area is surrounded by development.	
3	**SAUCON CREEK WETLANDS (formerly Mill Road Wetlands) (Upper Saucon Twp., Coopersburg)**	Allentown East	This site encompasses a series of wetlands occurring along an unnamed creek on the north side of Coopersburg. An **animal species of special concern** was observed here in 1987 and may still occur at the site. Further surveys are encouraged to determine if the species is still at the site.	3
4	FRIEDENSVILLE QUARRY (Upper Saucon Twp.)	Allentown East	This site contains a fair population of **Eared False-Foxglove (*Agalinis auriculata*), a PA-Endangered plant.** The Pennsylvania Science Office of The Nature Conservancy has conducted an annual census of this population since 1989. The landowner has agreed to exclude the site from development plans.	4

1 Sites are ranked from 1 to 5 with 1 indicating the highest priority sites for protection based on state or national significance, and 5 indicating the lowest priority for protection. Ranks take into account potential threats, management needs and existing protection. Sites of similar rank are listed alphabetically by quadrangle.

Lehigh County

County Rank[1]	Site Name (municipality)	USGS Topo. Map	Natural Feature & Brief Description	Former Rank
4	HELFRICH SPRINGS CAVE (Whitehall Twp.)	Catasauqua	This site is a cave formed in limestone and dolomite. A single individual of **Northern Myotis (*Myotis septentrionalis*)**, a G4 S2S3 animal species, was found here in 1998. The rear portion of the cave serves as a hibernaculum for several species of bats.	4
4	LOWER MILFORD MARSH (Lower Milford Twp.)	Milford Square	**The Basin Graminoid-Forb Fen Natural Community that was documented at this site functionally no longer exists and will be deleted from this final report.** This site is a fair to poor quality Basin Graminoid-Forb Fen Natural Community. It has potential for several species of concern including both plants and animals, and further surveys are recommended.	4
4	**WALNUTPORT CANAL SITE (Washington Twp.)**	Cementon	This site contains a fair population of **Virginia Rose (*Rosa virginiana*)**, an S1 Pennsylvania plant species of concern. This site consists of a canal and adjacent banks, and a strip of woods between the towpath and the river. This site also contains historical plant records in Lockport Marsh and some areas along the river. A undetermined record of **Autumn Willow (*Salix serissima*),** an S2 Pennsylvania plant species of concern, was reported but could not be confirmed..	
5	BEARS ROCKS (Lynn Twp.)	New Tripoli	During a survey of this site in 1991, evidence of **Allegheny Woodrat (*Neotoma magister*)**, a PA-Threatened animal species was discovered. However the evidence was not fresh, indicating that the species had been living in the area in the past but may not have occupied the site at the time of the survey.	5
5	**BLUE MOUNTAIN PUMPING STATION (Washington Twp.)**	**Lehighton**	During a survey of this site in 1991, evidence of **Allegheny Woodrat (*Neotoma magister*)**, a PA-Threatened animal species was discovered. However the evidence was not fresh, indicating that the species had been living in the area in the past but may not have occupied the site at the time of the survey. This site is on State Game Lands #217. This site also contains a small population of **Long's Sedge (*Carex longii*), an SU Pennsylvania plant species of concern**. This site is described as a damp area with sphagnum clumps in otherwise well-drained hardwood sapling woods with an open aspect.	5

1 Sites are ranked from 1 to 5 with 1 indicating the highest priority sites for protection based on state or national significance, and 5 indicating the lowest priority for protection. Ranks take into account potential threats, management needs and existing protection. Sites of similar rank are listed alphabetically by quadrangle.

Lehigh County

County Rank[1]	Site Name (municipality)	USGS Topo. Map	Natural Feature & Brief Description	Former Rank
5	CLEARVIEW ROAD RIVERBANK SITE (North Whitehall Twp.)	Cementon	This site supports a good population of a **Virginia Rose (*Rosa virginiana*)**, an SU shrub species and a fair population of **Baltic Rush *(Juncus arcticus var. littorali)*** a PA-Threatened graminoid species. Extensive suitable habitat for both of these species occurs along this stretch of the river.	5
5	CRACKERSPORT PONDS (South Whitehall Twp.)	Allentown West	This site supports a fair quality population of **Swamp Dog-Hobble (*Leucothoe racemosa*)**, a PA-Threatened shrub species and a fair quality population of **Winged Loosestrife** (***Lythrium alatum***) a PA-Rare herb species. The quality of this site suffers from fragmentation and disturbance. The species of concern should continue to survive at this site if it is protected from further disturbances.	5
5	EAST TEXAS-LITTLE LEHIGH CREEK (Lower Macungie Twp.)	Allentown West	A small fair to poor quality population of **Matted Spike-rush (*Eleocharis intermedia*),** a PA-Threatened plant species was observed at this site in 1993. Maintaining wooded buffers along stream corridors should benefit this species.	5
5	GAUFF HILL (Salisbury Twp.)	Allentown East	This site supports a fair quality population of **Lettuceleaf Saxifrage (*Saxifragus micranthidifolia*), a recently delisted plant species**, occurring along a small stream. Maintaining a forest corridor along this stream would be beneficial to the water quality and to the rare species.	5
5	JORDAN VALLEY MARSH (Heidelberg Twp.)	Slatedale	This site supports a fair quality population of **Brown Sedge (*Carex buxbaumii),*** a PA-Endangered sedge species. Succession is a potential threat.	5
5	LEHIGH FURNACE GAP (Washington Twp.; East Penn Twp., Carbon Co.)	Lehighton	During a survey of this site in 1991, evidence of **Allegheny Woodrat (*Neotoma magister*)**, a PA-Threatened animal species, was discovered. However the evidence was not fresh, indicating that the species had been living in the area in the past but may not have occupied the site at the time of the survey. This site is located on State Game Lands #217.	5
5	REXTOWN QUARRY SITE (Washington Twp.)	Lehighton	This site is an abandoned slate quarry. It supports a large population of **Torrey's Rush (*Juncus torreyi*),** a PA-Threatened rush. In this case, human disturbance has created a unique habitat utilized by the species of concern.	5

1 Sites are ranked from 1 to 5 with 1 indicating the highest priority sites for protection based on state or national significance, and 5 indicating the lowest priority for protection. Ranks take into account potential threats, management needs and existing protection. Sites of similar rank are listed alphabetically by quadrangle.

County Rank[1]	Site Name (municipality)	USGS Topo. Map	Natural Feature & Brief Description	Former Rank
5	TREXLER HOLLOW (Lowhill & North Whitehall Twps.)	Cementon/ Slatedale	A roadside outcrop of Martinsburg shale supports two plant species of concern, **Western Hairy Rock-Cress (*Arabis hirsuta*)**, and **Round-head Gayfeather (*Liatris scariosa*)**. Further surveys are recommended to determine if the populations of these species are more widespread in this area. Roadside herbicide spraying is a potential threat to the species of concern at this site. This site is partly on the Trexler - Lehigh County Game Preserve.	5

1 Sites are ranked from 1 to 5 with 1 indicating the highest priority sites for protection based on state or national significance, and 5 indicating the lowest priority for protection. Ranks take into account potential threats, management needs and existing protection. Sites of similar rank are listed alphabetically by quadrangle.

Table 2. Areas of local significance in Lehigh County based on size, diversity of wildlife and plant life, water quality protection, and recreation potential. (These sites do not include high quality natural communities and no species of special concern have been documented at the sites although several of the areas have potential for rare species to occur.)

County Rank[2]	Site Name (municipality)	USGS Topo. Map	Natural Feature and Importance
HIGH	Blue Mountain	New Ringgold New Tripoli Slatedale Lehighton Palmerton	This locally significant area is the most extensive relatively contiguous area of natural habitat in the two counties. It is one of the major corridors for the movement of biota in eastern Pennsylvania. It includes extensive forests with streams, seeps, springs, vernal pools, rock outcrops, and boulder fields. It has long been recognized as one of the major east coast fall flyways for migrating raptors. Conserving sites on the mountain as highlighted in this report must be considered as part of the effort to conserve the greater natural functional value of the mountain ridge. Preserving the ecological integrity of Blue Mountain should be considered an important component in preserving the biodiversity of the two counties.
HIGH	Lehigh Mountain (Salisbury Twp.)	Allentown East	This locally significant area is a large and relatively contiguous second growth forest that occurs on a north facing slope above the Lehigh River. The forest supports a large number of nesting and migratory bird species and is also good habitat for many reptile and amphibian species. This site is important because it is one of the largest tracts of relatively undisturbed forest left along the Lehigh River south of Blue Mountain. Part of this site is jointly owned by Allentown, Salisbury Township, and Lehigh County. (see also LEHIGH MOUNTAIN SEEPS SITE)
HIGH	The Jungle (Lower & Upper Macungie Twps.)	Allentown West	This very unusual locally significant area occurs on a floodplain in the vicinity of the confluence of Spring Creek and Iron Run. Along with the creeks flowing through it also receives significant input from several springs. Historic records indicate this site has supported possibly as many as six state listed plant species in the past. No species of concern were observed at the site during field surveys.
HIGH	Trout Run Woods (Heidelberg Twp.)	Slatedale	This locally significant area is a seepy woodland located along Trout Run at the base of Blue Mountain. The woods contain numerous streamlets, seeps, and several vernal ponds. This forested segment of Trout Run is good habitat for numerous plants and animals. There are historic records for species of concern at this site although none were observed during our 1997 field survey. This site is partly on State Gamelands #217.

County Rank[2]	Site Name (municipality)	USGS Topo. Map	Natural Feature and Importance
MED	**BIG BEECH WOODS (**Combined with Swabia/Indian/ Hosensack Wetland)- now a site **(Lower Milford Twp.)**	Milford Square	This site is a southeast-facing slope along Hosensack Creek with a maturing second-growth forest. Some of the trees are over two feet in diameter -- most similar, mesic sites in the county are in agriculture or younger woodland. Protecting the site would allow this natural community to mature further, as well as benefit the water quality of the Hosensack Marsh site downstream.
MED.	Jordan Creek Slopes/ State Gamelands #205 (Lowhill Twp.)	Slatedale	This locally significant area is a series of steep forested slopes occurring adjacent to Jordan Creek. These second growth forests are relatively mature and help create wildlife habitat along the Jordan Creek corridor.
MED.	Leaser Lake Woods (Lynn Twp.)	New Tripoli	This locally significant site is a relatively diverse second growth forest. Along with its plant diversity the site is significant for the many types of habitat it supports including streams, seeps, lake shore, forest, and boulder fields. The site is partly owned by Lehigh County and by the PA Fish and Boat Commission.
MED.	Mest Marsh (Upper Saucon Twp.)	Allentown East	This locally significant area includes several acres of cattail-sedge marsh and an adjacent segment of swampy floodplain along Leibert Creek. This site provides habitat for numerous bird species as well as many types of amphibians and reptiles. Open marsh habitat of this quality is uncommon in the county. This site has potential for rare species.
MED.	Mill Hill (Lower Milford Twp.)	East Greenville Milford Square	This site is a several mile long diabase ridge which is partly in both Lehigh and Montgomery Counties. It has extensive diverse second growth forest with good potential for several plant species of special concern. The majority of the Montgomery County portion of this site has been acquired by Upper Hanover Township and designated for conservation and recreation purposes.

2 Ranks are very approximate and are based primarily on the quality of the habitat. Sites with more intact natural communities (on a counties-wide scale) are given highest priority. Other sites represent areas with locally significant woodlands or wetlands or sites that support a particularly rich or unusual flora or fauna. Areas that are already protected as park land or open space may be assigned lower rank to reflect lower urgency for protection action. Sites of similar rank are listed alphabetically by quadrangle.

Top Priority Natural Areas in Northampton County:

All of the natural areas in the county are important to maintaining biodiversity in the region and the state. However, the following eight sites from Table 3 are the most critical at present for maintaining Northampton County's biological diversity into the future (see Figure 2 for approximate locations of these sites). More detailed descriptions of all sites are included in the Results section.

MT. BETHEL FENS (Upper Mt. Bethel Twp.) This site is a complex of at least ten rare wetland communities, which are comprised of small calcareous fens and seeps (open meadow-like, permanently saturated wetlands fed by high-pH groundwater), marshes and wooded swamps. Due to the combination of limestone and past glaciation, the fen habitat created here is very rare, both in PA and globally. To date, there are 15 rare plants, 2 rare animals and 2 rare mosses known to occur in the various fen communities. The Nature Conservancy (TNC) has identified the Mt. Bethel Fens as one of its highest priorities for conservation in PA. Currently, TNC is cooperating with landowners throughout the valley to ensure the survival of the fens. (**Portland & Stroudsburg Quads, p. 108 and 127, respectively)**

MOUNT JACK LIMESTONE OUTCROP (Upper Mt. Bethel Twp.) This site has exposed and eroded limestone outcrops along the Delaware River which support a good quality example of a Calcareous Riverside Outcrop Natural Community, a fair quality example of a Northern Appalachian Shale Cliff Natural Community, and three plant species of special concern. A series of sparsely vegetated rock outcrops that run along the base of several steeply sloping, sparsely vegetated shale cliffs. The low-lying riverside outcrops are scoured by ice flows in late winter and/or by flood waters in early spring. The adjacent river includes a series of riffles and turbulent rapids which is good habitat for several animal species of concern. Historic evidence of an animal species thought to be extirpated from PA was observed during 1997 field surveys, though no living individuals were found. Further surveys are encouraged to determine whether this species persists at the site. The natural communities and species of concern at this site will be best protected by leaving the site in its current condition. (**Belvidere Quad, p. 62)**

DELAWARE RIVER WATER GAP (Upper Mt. Bethel Twp.) This is one of the most striking natural features in Pennsylvania. The water gap supports a good quality example of the relatively common Northern Appalachian Acidic Cliff Natural Community. It also supports populations of a PA-Rare animal species and a PA-Endangered plant species. The cliff community also provides habitat for a variety of bird species, notably black vultures, turkey vultures, and ravens. This site is within the Delaware Water Gap National Recreation Area. (**Stroudsburg Quad, p. 127)**

BIG OFFSET BARREN (Plainfield Twp.; Hamilton Twp., Monroe Co.) This site is a broad forested plateau which straddles the Northampton/Monroe County line on the Blue Mountain. The forest is dry and includes a significant component of heath species such as lowbush blueberry and mountain laurel. Its relatively young age suggests the area has burned or been clear cut within this century. The site supports a fair to good quality population of a G3 PA-Endangered plant species. Long term survival of this species at this site may depend on the availability of forest gaps. A 1997 survey of the barren found the population doing well. (**Wind Gap & Saylorsburg Quads, p. 140 and 122)**

BEAR SWAMP (Upper Mount Bethel Twp.) This site supports an extensive fair to good quality example of a Circumneutral Broadleaf Swamp Natural Community. The swamp community occurs in two separate lobes along two separate tributaries of Martins Creek and occupies approximately 200 acres. Although there has been much historic manipulation of the landscape surrounding the swamps, the swamps are intact and support a wide range of both plant and animal species. Bear Swamp is the largest example of this kind of habitat in Northampton County. This site will be best protected by maintaining the integrity of the forest buffer and insuring a consistent hydrologic regime. Limiting or decreasing the fragmentation of the surrounding landscape will benefit this natural community. Bear Swamp is located partly within Minsi Lake -Bear Swamp County Park. (**Stroudsburg Quad, p. 127)**

MINSI LAKE VERNAL POOLS (Upper Mount Bethel Twp.) This site supports a good quality example of an Ephemeral/Fluctuating Natural Pools Natural Community. It may be the largest concentration of vernal ponds known from Pennsylvania. There are more than one hundred ponds of varying size scattered throughout several hundred acres of dry-mesic forest. Several streams and springs are also present at the site. The ponds, streams, and springs create a diversity of microhabitats which in turn support a diverse flora. The great variety of wetland microhabitats makes this area excellent breeding habitat for amphibians. This site has potential for several species of concern, though none were observed during our surveys. The area has seen disturbance in the past from logging and perhaps grazing, though much of the forest is currently recovering. Minsi Lake Vernal Ponds is located partly within Minsi Lake - Bear Swamp County Park. (**Stroudsburg Quad, p. 127)**

RISMILLER WOODS (Bushkill Twp.) This site supports a good to fair quality example of an Ephemeral/Fluctuating Natural Pools Natural Community and a good quality population of a PA-Rare shrub species. The ponds, as well as streams and springs that also occur here, create a diversity of microhabitats which support a large diversity of herbs, ferns, and graminoid species. This variety of wetland microhabitats also makes this area excellent breeding habitat for amphibians. The area has seen disturbance in the past from logging, though most of the forest is currently in good condition. These woods also provide a forest corridor connecting the sizable forests at Jacobsburg Environmental Education Center with Blue Mountain. This site will be best protected by maintaining existing forest and limiting the fragmentation of the forest on the surrounding landscape. (**Wind Gap Quad, p. 140)**

MOORESTOWN WETLAND (Bushkill Twp.) This site includes areas of marsh and shrub swamp, which are fed by ground water seepage. Red maple (Acer rubrum), cattail (Typha latifolia), skunk cabbage (Symplocarpus foetidus), and sedges (Carex spp.) are common plant species. This wetland has been impacted by silt runoff from the adjacent farm fields as well as by the roads that may be influencing the hydrology. It supports an animal species of special concern. Maintaining the hydrology is critical to the survival of this species at this site. (**Wind Gap Quad, p. 140)**

Table 3. The sites of statewide significance for the protection of biological diversity in Northampton County in approximate order of priority from the most important (rank = 1) to the least (rank = 5). The presence of species of special concern and/or exemplary natural communities has been documented at these sites. More in-depth information on each site including detailed site descriptions and management recommendations where appropriate can be found on pages as listed at the end of each brief description in the table. Topographic maps showing locations of sites can be found on pages as listed in the map column. Quality ranks, legal status, and last observation dates for species of special concern and natural communities are located in the table that precedes each map page.

County Rank[3]	Site Name (municipality)	USGS Topo. Map	Natural Feature & Brief Description	Former Rank
1	MT. BETHEL FENS (Upper Mount Bethel Twp.)	Portland, Stroudsburg	Mt. Bethel Fens is a complex of at least ten rare wetland communities, which are comprised of small calcareous fens and seeps (open meadow-like, permanently saturated wetlands fed by high pH groundwater), marshes and wooded swamps. Due to the combination of limestone and past glaciation, the fen habitat created here is very rare, both in Pennsylvania and globally. There are now 16 rare plants, rare animals and 2 rare mosses known to occur in the various fen communities. Since the report was written in 1999, a new fair to good quality population of **Shining Ladies-tresses (*Spiranthes lucida*)**, an S3 plant species of concern, was found in a small spring-fed calcareous seepage in mixed woods in the headwaters of a tributary of Jacoby Creek. The Nature Conservancy (TNC) has identified the Mt. Bethel Fens as one of its highest priorities for conservation in PA. Currently, TNC is cooperating with landowners throughout the valley to ensure the survival of the fens.	1
2	BEAR SWAMP-STROUDSBURG (Upper Mount Bethel Twp.)	Stroudsburg	This site supports a fair to good quality example of a **Circumneutral Broadleaf Swamp Natural Community**. The swamp community occurs in two separate lobes along two separate tributaries of Martins Creek and occupies approximately 200 acres. Bear Swamp is located partly within Minsi Lake - Bear Swamp County Park.	2
2	BIG OFFSET BARREN (Plainfield Twp.; Hamilton Twp., Monroe County)	Saylorsburg/ Wind Gap	This site is a broad forested plateau that straddles the Northampton and Monroe County line on the Blue Mountain. It supports a fair to good quality population of a G2G3 PA-Endangered plant species. Long-term survival of this species at this site may depend on the availability of forest gaps. This site is partly on the Appalachian National Scenic Trail Corridor.	2

County Rank[3]	Site Name (municipality)	USGS Topo. Map	Natural Feature & Brief Description	Former Rank
2	**BUSHKILL CREEK WATERSHED** (Formerly Moorestown Wetland and Knochts Pools) (Bushkill Twp.)	Wind Gap	One site within this watershed is a gently sloping forested area that includes an **Ephemeral Fluctuating Pools Natural Community.** There are at least twelve vernal pools here, possibly more. This site includes areas of marsh and shrub swamp, which are fed by ground water seepage. It has been impacted by silt runoff from the adjacent farm fields. It supports an **animal species of special concern.**	MW-2 KP-4
2	DELAWARE RIVER WATER GAP (Upper Mount Bethel Twp.; Smithfield Twp., Monroe Co.)	Portland/ Stroudsburg	The Delaware River Water Gap is one of the most striking natural features in Pennsylvania. The water gap supports a good quality example of the relatively common Northern Appalachian Acidic Cliff Natural Community. It also supports populations of a **PA-Rare animal species** and a **PA-Endangered plant species.** The cliff community also provides habitat for a variety of bird species, notably black vultures, turkey vultures, and ravens. This site is within the Delaware Water Gap National Recreation Area.	2
2	MINSI LAKE VERNAL POOLS (Upper Mount Bethel Twp.)	Stroudsburg	This site supports a good quality example of an **Ephemeral/Fluctuating Natural Pools Natural Community**. It may be the largest concentration of vernal ponds known from Pennsylvania. The great variety of wetland microhabitats makes this area excellent breeding habitat for amphibians. This site has potential for several species of concern, although none were observed during our surveys. It is located partly within Minsi Lake - Bear Swamp County Park.	2
2	MOUNT JACK LIMESTONE OUTCROP (Upper Mount Bethel Twp.)	Belvidere	This site along the Delaware River supports a good quality example of a **Calcareous Riverside Outcrop Natural Community** and a fair quality example of a **Northern Appalachian Shale Cliff Natural Community**. Two species of special concern are found at this site, including **White Heath Aster (*Aster ericoides*),** a PA-Endangered plant species, and a good to excellent quality population of **Appalachian Sand Cherry (*Prunus pumila var. depressa*)**, a Tentatively Undetermined plant species. This site is partly owned by Northampton County.	2

Northampton County

County Rank[3]	Site Name (municipality)	USGS Topo. Map	Natural Feature & Brief Description	Former Rank
2	RISMILLER WOODS (Bushkill Twp.)	Wind Gap	This site supports a good to fair quality example of an **Ephemeral/Fluctuating Natural Pools Natural Community** and a good quality population of **Swamp Dog-Hobble (*Leucothoe racemosa*)**, a **PA-Rare shrub**. The great variety of wetland microhabitats found here makes this area excellent breeding habitat for amphibians. This forested riparian corridor connects the sizable forest at Jacobsburg Environmental Education Center with Blue Mountain. Preserving these woods will provide a corridor for wildlife movement as well as habitat for the rare species.	2
3	ARROW ISLAND (Upper Mount Bethel Twp.)	Portland	This site supports two plant species of special concern, including Appalachian **Sand Cherry (*Prunus pumila var. susquehanae*)**, and **White Water-Crowfoot (*Ranunculus aquatilus var. diffusus*).** Another plant species of concern, **White Heath-Aster (*Aster ericoides*)** hasn't been seen since 1982. One occurs on the island and the other in the river. This site occurs entirely within the Delaware Water Gap National Recreation Area.	3
3	**BULL RUN (Lower Saucon Township)**	Nazareth	This site contains a good to excellent quality **"Skunk Cabbage-Golden Saxifrage Forested Seep" Natural Community**, an S4S5 Pennsylvania natural community. This community was found at the mid-slope of a forested slope. The site is described as forested slopes including headwater seeps, springs, and basin-like wetlands located at the base of the uppermost, steepest part of the slope. Current site use is low-intensity hunting and surrounding land use include low density residential housing.	
3	EAST JOHNSONVILLE SWAMP (Upper Mount Bethel Twp.)	Stroudsburg	This site supports a fair quality example of an **Acidic Broadleaf Swamp Natural Community**. The site also supports two plant species of special concern, including **Scarlet Indian-Paintbrush (*Castilleja coccinea*)**, and **Carolina Grass-of-Parnassus (*Parnassia glauca*)**, which is a PA-Endangered plant.	3
3	**FOCHT HILL VERNALS (**Lower Saucon Township**)**	Hellertown	This site contains a good quality **"Herbaceous Vernal Pond" Natural Community**, an S3 Natural Community of Pennsylvania. This area is described as a forested hillside with natural vernal ponds and a manmade pond.	

County Rank[3]	Site Name (municipality)	USGS Topo. Map	Natural Feature & Brief Description	Former Rank
3	FOUL RIFT (Lower Mount Bethel Twp.)	Belvidere	This site along the Delaware River supports a **good quality example of a Northern Appalachian Calcareous Cliff Natural Community**. The outcrops at the site support an excellent quality population of a **PA-Rare plant species.** The adjacent river supports a **G4S2S3 animal species**.	3
3	**FRYA RUN WATERSHED (Williams Twp.) (Formerly Hexenkopf Slopes, Hexenkopf Wetlands, Hexenkopf Rock (Erosional remnant), and Mariton Slopes)**	Hellertown Nazareth Easton Reigelsville)	This site includes a variety of habitat types. A **G3 animal species of concern** was discovered using a series of wetlands and seepy forest that occur along a tributary to Frya Run. The animal was observed at this site as recently as 1995. Surveys in 1998 were unsuccessful but only a small portion of the area was surveyed. During the 1998 surveys it was determined that suitable habitat still exists but it is marginal. Better habitat may occur elsewhere in the vicinity. Further surveys are recommended to determine if this species still occurs here. Avoiding disturbance to these wetlands and the adjacent forest should help keep this habitat in reasonable condition. Mariton Slopes consists of a series of forested slopes and shaded escarpments above the Delaware River. The cool heavily shaded outcrops at this site are good habitat for numerous fern species as well as spring wildflowers. The site is also valuable as migratory habitat for numerous bird species that use the river corridor. Hexenkopft Slopes consists of a broad southeast facing forested slope. The summit of the ridge includes a large linear rock outcrop formation (see GE529). Areas adjacent to the summit have large and small boulders making up the substrate. The site also includes several seeps and at least one vernal pool.	All locally s Significant Sites-new Hexenkopft Wetlands-4 4 Mariton Slopes 4
3	**GRANITE HILL** (Lower Saucon Twp., Williams Township)	Hellertown	This site contains a fair to good quality **"Herbaceous Vernal Pond" Natural Community**, an S3S4 community of special concern. This site is described as a former farm containing very disturbed woods, a conifer plantation, and lots of flowing water. This site also contains a good to excellent quality "**Birch/Black Gum Rocky Slope Woodland"** Natural Community. Granite hill is a steep, rocky forested hill rising 500 feet above the adjacent valley. The ridgetop of this site has a rocky spine running for approximately 1500 feet and the lower slope of the hill on the north side is completely forested and relatively undisturbed.	

County Rank[3]	Site Name (municipality)	USGS Topo. Map	Natural Feature & Brief Description	Former Rank
3	HELLERTOWN MARSH (Hellertown, Lower Saucon Twp.)	Hellertown	This site is a graminoid-dominated marsh located between Saucon Creek and the railroad on the west side of Hellertown. The site supports 3 plant species of special concern, including **A sedge (*Carex tetanica*)**, **Highbush Cranberry (*Viburnum trilobum*)**, and **Prairie Sedge (*Carex prairea*)**. This site also contains an unknown population of **An ant (*Lasius minutis)***, an S? animal species of concern. The site is also excellent habitat for reptile and amphibian species. Maintaining the tree/shrub buffer around the site and the current hydrologic regime are important for the survival of these species. The site is within Hellertown Borough Park.	3
3	**HELLERTOWN RESERVOIR AREA VERNALS** (Lower Saucon Twp, Bucks County)	Hellertown	This area contains a good to excellent quality **"Herbaceous Vernal Pond" Natural Community**. This site is described as a rocky upland forest grading into low wet successional forest that is part of the headwaters of an unnamed tributary of a creek. Currently the site is used for rural residental and is surrounded by low- density rural residential land use.	
3	ISLAND PARK (Easton)	Easton/ Nazareth	This isolated emergent marsh supports a wide diversity of plant and animal species including a large good-quality population of **American Lotus (*Nelumbo lutea*)**, a **PA-Endangered plant species.** The site has potential for other species of concern. Limiting new access in this area of the river to foot traffic only will greatly enhance the likelihood of its remaining one of the wildest and most diverse areas in the southern part of the county. This site is part of Hugh Moore Park.	3
3	**LEHIGH SLOPES (Bethlehem, Lower Saucon, Williams, and Palmer Townships)**	Nazareth	This site contains a fair quality population of **Bladder Fern (*Cystopteris tennesseensis*)**, an S1 Pennsylvania plant species of concern. The site is described as a west-northwest facing forested slope along the Lehigh River with scattered rock outcrops. The forest cover is mainly deciduous. The listed plant was found on mesic-limestone outcrops overlooking the Lehigh River.	

County Rank[3]	Site Name (municipality)	USGS Topo. Map	Natural Feature & Brief Description	Former Rank
3	**MORGAN HILL** (Williams Township)	Easton	This site contains a fair quality population of **Nodding Trillium (*Trillium cernuum*)**, an S3 plant species of concern. The site is described as a rocky forested hill and an extensive early successional old fields. Threats and Disturbances include development and resulting fragmentation, further spread of invasive, exotic species; in the woods are traces of stone walls, an old well woods roads, the early successional old fields were farmed until recently. This area would be best protected by decreasing fragmentation in and around the forest that can lead to the further spread of invasive plant species. Further surveys in the area are encouraged to better assess the population of the species in the area.	
3	**OUGHOUGHTON CREEK NEAR DELAWARE RIVER (Lower Mount Bethel, New Jersey)**	Bangor	This site contains an unknown quality population of **Osprey (*Pandion haliaetus*)**, **an S2B animal species of concern**. One young of this species was seen in a nest on the last survey. This species requires a large amount of habitat associated with sea coasts and large lakes and rivers.	
3	SCHOOL ROAD SWAMP (Upper Mount Bethel Twp.)	Bangor	This site is a wetland mosaic that includes large areas of both forested swamp and emergent marsh. Two animal species of concern were observed at this site in 1996. **Another animal species of concern was discovered here in 2001. More surveys should be completed to determine the status of the population at this site.** **The hydrology of the emergent marsh may be influenced by the presence a road near the site, although whether the influence plays a negative or positive role is unknown. Leaving this site in its current condition should help the species of concern that inhabit this area**.	3
3	**SPRINGTOWN MARSH** (Springfield Twp., Bucks County)	Hellertown	This area contains a fair to good quality "**Prairie Sedge-Spotted Joe-pye-weed Marsh**" Natural Community, an S1S2 community of special concern. This site is described as a hummocky, herbaceous wetland with springs and rivulets along a creek. The current land use is rural residential and a horse farm. Surrounding land use is low-density rural residential and agriculture. Also in this site are unknown quality populations of **A sedge (*Carex prairea*)**, **an S2 Pennsylvania plant species of concern**, and another unknown population of **A sedge (*Carex tetanica*), an S2 Pennsylvania plant species of concern.**	

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County Rank[3]	Site Name (municipality)	USGS Topo. Map	Natural Feature & Brief Description	Former Rank
4	EAST BANGOR WETLAND COMPLEX (Upper Mount Bethel Twp., East Bangor Borough.)	Stroudsburg	This site is the largest contiguous wetland complex in Northampton County. It includes large expanses of forested swamp, shrub swamp, wet meadows, springs, and open water. The variety of cover types is good habitat for a wide diversity of plants and animals. **Virginia Rail (*Rallus limicola*)**, an **animal species of concern** has been observed using the habitat at this site on several occasions in recent years. The site has potential for other species of concern. This site is partly managed by the PA Fish and Boat Commission.	4
4	FIVE POINTS WETLAND (Upper Mount Bethel Twp.)	Stroudsburg	A fair to good population of Yellow Sedge (*Carex flava*), a **PA-Threatened plant species,** occurs in a wetland at this site. The site has potential for several other rare plant and animal species.	4
4	**FROST HOLLOW OVERLOOK (Forks Township)**	Easton	Three adults of an **animal species of concern** were found at an overlook of the Delaware River. The type of habitat where this species was seen was rapids and pools; bottom sediments with silt, gravel, with some bedrock; bank type - gently sloping sandy silt, and large rocks.	
4	GETTERS ISLAND (Easton)	Easton	This site has evidence of **two animal species of concern**, and **one delisted former animal species of concern**. This site is a narrow much scoured island occurring in the Delaware River just north of the confluence of the Delaware River and Bushkill Creek. This stretch of the river supports **two animal species of concern**. Evidence of both animals was observed during 1997. Further surveys are encouraged to determine the size and extent of these animal populations.	4
4	GETZ SWAMP (Upper Mount Bethel Twp.)	Stroudsburg	This site supports a fair example of a Calcareous Seepage Swamp Natural Community. A recently delisted plant species, **Dotted Water-meal (*Wolffia borealis*)**, is also found at this site. This site still supports three additional plant species of concern, **A Sedge (*Carex tetanica*)**, an S2 plant species of concern, **Hemlock-Parsley (*Conioselinum chinense*)**, and S1 plant species of concern, and **Spreading Globeflower (*Trollius laxus*)**, an S1 plant species of concern, along with the natural community, two of which are PA-Endangered.	4

County Rank[3]	Site Name (municipality)	USGS Topo. Map	Natural Feature & Brief Description	Former Rank
4	**LEHIGH GAP** (Washington Twp., Lehigh Co.; Lehigh Twp., Northampton Co.; East Penn & Lower Towamensing Twps., Carbon Co.)	Palmerton	This is a water gap in Blue Mountain. Erosion by the Lehigh River has cut through the rock layers as they hav been slowly uplifted over millions of years. An impressive cross-section of rock strata is exposed on the east side of the gap. This site has potential for a variety of species of special concern, but has been severely degraded by pollution from the smelter operations on th north side of the ridge. An unknown quality population **Northern Myotis (*Myotis septentrionalis*)**, an S3B, S3 animal species of concern, was found on the Carbon County side of this site.	
4	LOHMAN WETLANDS (Upper Mount Bethel Twp.)	Stroudsburg	This site has both forested and non-forested areas, both influenced by calcareous soils. This area supports a Basin Graminoid Fen and five species of concern including **Prairie Sedge (*Carex prairea*)**, **A sedge (*Carex tetanica*)**, **Autumn Willow (*Salix serissima*), and Spreading Globeflower (*Trollius laxus*)**. Restoration of a higher water table would likely benefit some of these species.	4
4	NEFFS PONDS (Lehigh Twp.)	Palmerton	This site supports a small cluster of **vernal pools** located mostly under a forest canopy. Several of the ponds support fair to good quality populations of **Spotted Pondweed (*Potomogeton pulcher*),** a PA-Endangered plant species. These ponds are also important for amphibians' reproduction. This site is partly within State Game Lands #168.	4
4	OLD SOW ISLAND (Williams Twp.)	Easton	The scoured upper end of this island supports a good quality population of **Appalachian Sand Cherry (*Prunus pumila var. depressa*),** a **PA-Rare plant species**. This species was last observed at this site in 1986.	4
4	RAESLY WOODS (Upper Mount Bethel Twp.)	Portland	This site supports a fair quality **Calcareous Seepage Swamp Natural Community** and a small population of **Spreading Globeflower (*Trollius laxus sensu stricto*)**, a PA-Endangered plant. Disturbances include roads along the south margin, past logging, grazing, and ditch digging in some areas. Maintaining a buffer of upland forest and leaving the hydrology intact will help to improve the quality of this community over time.	4

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County Rank[3]	Site Name (municipality)	USGS Topo. Map	Natural Feature & Brief Description	Former Rank
4	RAUBS ISLAND (Williams Twp.)	Riegelsville	This site is located on an island in the Delaware River. Scour impacted habitat supports a good quality population of **Appalachian Sand Cherry *(Prunus pumila var. depressa*),** a **PA-Rare plant species**. The island is also good habitat for bird species such as osprey and herons.	4
4	WHIPPOORWILL ISLAND (Williams Twp.)	Easton	The scoured upper end of this island supports a fair to good quality population of **Appalachian Sand Cherry (*Prunus pumila var. depressa*)**, an S1 plant species of concern. The habitat is characterized as a good to excellent quality **Big Bluestem-Indian Grass River Grassland, an S3 Pennsylvania community of concern**. The island is also good habitat for bird species such as osprey and herons.	4
5	ANGLE SWAMP (Washington Twp.)	Stroudsburg	This site is a small shrub swamp with pockets of open marsh and clumps of trees. It supports a fair quality population of **Swamp Dog-Hobble (*Leucothoe racemosa*)**, a **PA-Rare shrub species.**	5
5	BERTSCH CREEK SEEP (Lehigh Twp.)	Cementon	A seep-derived tributary of the creek supports a fair quality population of **Goldenclub (*Orontium aquaticum*), a recently delisted plant species**. This species is still on the "watch-list", and this site deserves locally significant status. Leaving this site in its current condition will help the rare plant persist here.	5
5	DELAWARE SHORE NEAR KEIFER ISLAND (Lower Mount Bethel Twp.)	Bangor	A small population of **Appalachian Sand Cherry (*Prunus pumila var. depressa*),** a **PA-Rare plant species,** occurs in one of the larger openings of this scoured peninsula in the Delaware River.	5
5	EASTERN INDUSTRIES QUARRY (Lower Mount Bethel Twp.)	Bangor	A **PA-Endangered species, Osprey (*Pandion haliaetus*),** has been successfully reintroduced into the Delaware River Valley after being nearly extirpated in PA. It was observed nesting at this site in 1998.	5
5	EASTON BLUFF (Easton)	Easton	This site is a northwest facing sparsely vegetated limestone cliff. It is found in a highly developed section of the City of Easton. It supports a relatively large population of **Ebony Sedge *(Carex eburnea*),** a **PA-Endangered sedge species.** The polygon for this species has been revised.	5

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County Rank[3]	Site Name (municipality)	USGS Topo. Map	Natural Feature & Brief Description	Former Rank
5	FOX GAP POND (Upper Mount Bethel Twp.)	Stroudsburg	This site is a small, shallow pond near the base of the Blue Mountain. The pond is surrounded by forest. The pond and forest is protected as a public watershed for drinking water. Since the original report was written in 1999, a former plant species of concern, **Lesser Bladderwort (*Utricularia minor*),** an S4 plant species, has become **delisted.**	5
5	LAKE POCO (Upper Mount Bethel Twp.)	Stroudsburg	This site supports **two plant species of special concern** including **Yellow Sedge (*Carex flava*)**, and **Hemlock-Parsley (*Conioselinum chinense*),** of which is a PA-Endangered herb. There is potential for these species of concern to occur in other springs and seeps in the vicinity.	5
5	LITTLE GAP (Lehigh Twp.)	Palmerton	This area is a notch on the Blue Mountain ridge on the Carbon/Northampton county line. The area is dominated by a xeric hardwood forest community. Heaths such as mountain laurel and blueberries predominate in the ground-cover. The Appalachian Trail bisects the site. A small but expanding population of a **PR plant species** and a small but diverse acidic shrub/marsh occur on the Carbon County side of the gap.	
5	LITTLE OFFSET SWAMP (Upper Mount Bethel Twp.; Hamilton Twp., Monroe Co.)	Stroudsburg	A fair population of **Swamp Dog-Hobble (*Leucothoe racemosa*)**, a **PA-Rare shrub species,** occupies the ecotone between the swamp and the xeric oak forest surrounding it. The swamp is near the Appalachian Trail, and partly owned by the National Park Service.	5
5	LOHMAN SWAMP (Upper Mount Bethel Twp.)	Stroudsburg	This site supports a fair to good quality example of a C**alcareous Seepage Swamp Natural Community**. Although this site is relatively small and surrounded by roads, fields, and residences it is a relatively mature intact example of this natural community.	5
5	**MARITON UPLANDS-this site is now part of Frya Run Watershed** (Williams Twp.)	Riegelsville	This site includes forest of varying ages and several large meadows. It supports a fair to poor quality population of a **PA-Threatened plant species**. This site is part of the Mariton Wildlife Sanctuary and Wilderness Trust and is contiguous with the Locally Significant Area - MARITON SLOPES.	5
5	**MARTIN'S CREEK WATERSHED (Formerly Roseto Pond)** (Washington Twp.)	Stroudsburg	This site supports a small but healthy population of **Swamp Dog-Hobble (*Leucothoe racemosa*)**, an This site is located immediately adjacent to a road and therefore roadside cutting and spraying in the pond area should be avoided. An individual of a **PA-Endangered animal species** was found along a roadside at this site in 1995. A survey of the site in 1998 found no appropriate habitat for this species.	5

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County Rank[3]	Site Name (municipality)	USGS Topo. Map	Natural Feature & Brief Description	Former Rank
5	OUGHOUGHTON CREEK POWER HOUSE SITE (Lower Mount Bethel Twp.)	Belvidere	This site supports **Osprey (*Pandion haliaetus*)**, a Pennsylvania-Endangered animal species of concern, and has made a successful come- back after being nearly extirpated in PA. This species requires extensive habitat such as that associated with sea coasts, large rivers, and lakes.	5
5	POLLY ACRES SWAMP (Upper Mount Bethel Twp.)	Stroudsburg	This site is a 3-5 acre broadleaf-conifer swamp. A good quality population of **Swamp Dog-Hobble (*Leucothoe racemosa*)**, a **PA-Rare shrub species** occurs here. Keeping ATV's out of the swamp and maintaining a small-forested buffer would help preserve the integrity of the site and the rare species it contains.	5
5	PORTLAND POWERPLANT SITE (Upper Mount Bethel Twp.)	Portland	This site supports **Osprey (*Pandion haliaetus*), a PA-Endangered species** that has made a successful comeback after being nearly extirpated in PA. This species requires extensive habitat such as that associated with sea coasts, large rivers, and lakes. Since the report was written in 1999, there have been two additional nests of **Osprey (*Pandion haliaetus*), an S2B Pennsylvania-threatened animal species of concern,** found near the power plant. Three immature Ospreys were found with each of these different occurrences and one pair was observed with one of the occurrences. This area represents a classic scenario for Osprey nesting where platforms have been erected. This area hosts an optimum feeding ground for this species by providing the Delaware River and two fairly large lakes for foraging opportunities.	5
5	RAUBSVILLE LOCK 22-23 DELAWARE RIVER (Williams Twp.)	Easton	This stretch of the Delaware supports an **animal species of special concern**. Evidence of this species was observed during 1994 field surveys, though no living individuals were seen. Further surveys are needed to determine the extent and quality of this occurrence. This site is in the Delaware Canal State Park.	5
5	REDINGTON CAVE (Lower Saucon Twp.)	Nazareth	This site is a cave formed in the base of a cliff just south of the Lehigh River. A single individual of **Northern Myotis (*Myotis septentrionalis*)**, a **G4 S2/S3 animal species,** was found here in 1998. The site is partly located on property of the City of Bethlehem.	5

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County Rank[3]	Site Name (municipality)	USGS Topo. Map	Natural Feature & Brief Description	Former Rank
5	TOTTS GAP (Upper Mount Bethel Twp.; Smithfield & Stroud Twps., Monroe Co.)	Stroudsburg	This site consists of several shrub dominated rocky summit outcrop areas located on the ridge east of Totts Gap. It supports poor to fair quality populations of a PA-Threatened plant**, American Holly (*Ilex opaca*),** and a PA-Rare plant**, Sand Cherry (*Prunus pumila var. susquehanae*)**. This site occurs within the Delaware Water Gap National Recreation Area.	5
5	TOTTS GAP SWAMP (Upper Mount Bethel Twp.)	Stroudsburg	This site supports **Swamp Dog-Hobble (*Leucothoe racemosa*)**, a **PA-Rare plant species**. Leaving this site in its current condition should help the rare species to persist here.	5

3 Sites are ranked from 1 to 5 with 1 indicating the highest priority sites for protection based on state or national significance, and 5 indicating the lowest priority for protection. Ranks take into account potential threats, management needs and existing protection. Sites of similar rank are listed alphabetically by quadrangle.

Table 4. Areas of local significance in Northampton County based on size, diversity of wildlife and plant life, water quality protection, and recreation potential. (These sites do not include high quality natural communities and no species of special concern have been documented at the sites, although several of the areas have potential for rare species to occur.)

County Rank[4]	Site Name (municipality)	USGS Topo. Map	Natural Feature and Importance
HIGH	BINNEY AND SMITH WOODS (Palmer Twp.)	Easton	This locally significant area supports a relatively mature, 100 to 150 year old, undisturbed forest. It has a good diversity of trees and shrubs, and also supports a wide diversity of herbs and ferns. The site is excellent habitat for a variety of bird species which prefer riparian corridors. This woodland is probably the best quality woodland remaining in Forks Township. This tract as well as other nearby woods to the east would make an excellent addition to Hackett Park.
HIGH	MARITON SLOPES (Williams Twp.)	Riegelsville	This locally significant area is a series of forested slopes and shaded escarpments above the Delaware River. The cool heavily shaded outcrops at this site are good habitat for numerous fern species as well as spring wildflowers. The site is also valuable as migratory habitat for numerous bird species that use the river corridor.
HIGH	BLUE MOUNTAIN	Palmerton Kunkletown Wind Gap Saylorsburg Stroudsburg Portland	This locally significant area is the most extensive relatively contiguous area of natural habitat in the two counties. It includes extensive forests with streams, seeps, springs, vernal pools, rock outcrops, and boulder fields. It has long been recognized as one of the major east coast flyways for migrating raptors. Conserving sites on the mountain as listed in this report must be considered as part of the effort to conserve the greater natural functional value of the mountain ridge. Preserving the ecological integrity of Blue Mountain will be an important component in preserving the biodiversity of the two counties.
HIGH	JACOBSBURG ENVIRONMENTAL EDUCATION CENTER (Bushkill Twp.)	Wind Gap	This locally significant area consists of over 150 acres of mostly forested lands, bisected by Bushkill Creek and Sober's Run. The park has a wide diversity of habitats, from shaly rock outcrops and hemlock forests to mesic forests of red and white oaks, white ash, shagbark and bitternut hickories, and red maple. Much of the forest is fairly mature with good structure and a diverse groundcover persists despite invasion in some areas.

County Rank[4]	Site Name (municipality)	USGS Topo. Map	Natural Feature and Importance
MED.	WEAVERSVILLE PONDS (Allen Twp.)	Catasauqua	This locally significant area includes an area of isolated forest with twelve vernal ponds. Vegetation in and around the ponds varies, with some ponds having little or no vegetation (dead leaf ponds), and others having numerous species of wetland grasses and herbs, and even shrub thickets. These ponds are a significant resource for the reproduction of amphibians.
MED.	STEEL CITY SLOPES (Lower Saucon Twp.)	Nazareth	This locally significant area is a steep rocky north facing forested slope above the Lehigh River. The second growth forest supports a moderate herb diversity. Extensive rock outcrops midway up the slope are habitat for ferns and other herbs. This site is partly owned by the City of Bethlehem.
MED.	LITTLE GAP (Lehigh Twp.)	Palmerton	This locally significant area is a notch on the Blue Mountain ridge on the Carbon/Northampton county line. The area is dominated by a xeric hardwood forest community. Heaths such as mountain laurel and blueberries predominate in the ground-cover. The Appalachian Trail bisects the site. A small but expanding population of a **PR plant species** and a small but diverse acidic shrub/marsh occur on the Carbon County side of the gap.
MED.	HEXENKOPF SLOPES (Williams Twp.)	Riegelsville	This locally significant area is a broad southeast facing forested slope. The summit of the ridge includes a large linear rock outcrop formation (see GE529). Areas adjacent to the summit have large and small boulders making up the substrate. The site also includes several seeps and at least one vernal pool.
MED.	GRAND CENTRAL WOODS (Plainfield Twp.)	Wind Gap	This locally significant area is a mesic hardwood forest dissected by the headwaters of Little Bushkill Creek. The area has a good diversity of tree species and is fairly mature (80-100 yrs.). The forest shows no signs of recent disturbance, and has an uneven age structure. Several standing dead trees were observed -- these are important for cavity nesting bird and bat species. A section of the Erie-Lackawanna Railroad has been converted to a walking trail through the woods. (p.155)

4 Ranks are very approximate and are based primarily on the quality of the habitat. Sites with more intact natural communities (on a counties-wide scale) are given highest priority. Other sites represent areas with locally significant woodlands or wetlands or sites that support a particularly rich or unusual flora or fauna. Areas that are already protected as park land or open space may be assigned lower rank to reflect lower urgency for protection action. Sites of similar rank are listed alphabetically by quadrangle.

General Summary and Recommendations

Lehigh and Northampton counties have a number of groups pursuing the protection of natural areas within the counties. The following are general recommendations for protecting biological diversity within the counties.

1. **All sites that are ranked 1 or 2 (Tables 1 and 3) should be targeted immediately for protection and/or management of the site and the surrounding lands.** Privately-owned lands at these sites may be protected through a combination of conservation easements and acquisition to encourage current land use or make improvements in land use where needed.

2. **Management plans on public and private lands should address species of special concern and natural communities and assess the need for additional acres to complete protection**. Each element located within a given site will need to be addressed in new management plans for that area. Many of the already-protected sites are in need of additional land to complete protection and/or are in need of management to ensure the continued existence of the associated natural elements. Efforts are already underway to refine management plans for some of the high quality natural areas on public lands in the counties.

3. **Conservation easements or other low cost protection can be pursued on lower-ranked sites**. All sites of lower rank but with good to excellent populations of species of special concern or good natural communities on private land (Table 1) should receive protection too, but conservation easement or some type of tax incentive may be more appropriate. Conservation easements are designed to allow landowners the current use of their land while protecting the owner and the resource from outside development pressure. Management plans will be needed to ensure that these sites remain high-quality natural areas. Where easements are not possible, any proposals for significant land use changes should be scrutinized carefully by county and municipal planners.

4. **Low quality sites (e.g., with marginal or poor populations of listed species in marginal areas) should be carefully assessed before pursuing protection or management efforts.** The rare elements may be important for the maintenance of biological diversity at the local level, but costs and efforts for protecting these sites need to be weighed against other sites that will be left unprotected and which truly have the potential for long-term viability of elements. However, these sites may have other qualities such as scenic or recreation value that make them worth protecting.

5. **Locally significant sites (Tables 2 and 4) may be protected as sites from Tables 1 and 3 are completed or as new information emerges**. These are sites that do not have exemplary natural communities or known occurrences of rare species, but that could be excellent sites for county or township parks or as natural areas within existing parks (sites within existing managed areas will need to be included in management plans). Those that can serve more than one purpose – recreation, environmental education, wildlife habitat, flood and sediment control, water supply, etc. – are ideal. Species of special concern which may be found in some of these areas in future surveys can fit into counties' park or preserve plans.

6. **Protection of the reservoirs, wetlands, rivers, and creeks of Lehigh and Northampton counties is vital, especially those that protect biodiversity, supply drinking water, and are attractive recreational resources**. Many of the sites containing rare species, natural communities or locally significant habitats in **Lehigh and Northampton counties** are associated with water. Protection of these watersheds is the only way to ensure the viability of natural habitats and water quality. Cooperative efforts on land use among municipal, county, state, and federal agencies, developers, and residents can lessen the impact of development on the watersheds and plant communities of the counties. Protecting natural areas around municipal water supply watersheds provides an additional protective buffer around the water supply, habitat for wildlife, and may also provide low-impact recreation opportunities.

7. **Minimize encroachment on the parks and conservation lands throughout Lehigh and Northampton counties**. Existing parks and conservation lands provide habitat for a number of plant and animal species and may

be important not only on a county-wide level, but also on a regional scale. For example, they may serve as nesting or wintering areas for birds or as stop-over areas during migration. Where appropriate, more land should be added or agreements worked out with abutting landowners to minimize encroachments that may threaten native flora and fauna.

8. **County and municipal officials can encourage landowners whose land includes waterways to maintain vegetated buffer zones along shorelines**. Vegetated buffers (preferably of PA-native plant species) help reduce erosion and sedimentation and help to shade and cool the water. This in turn benefits aquatic animal life, including the fisheries. These buffers also provide habitat for other wildlife species and help to create a diversity of habitats along the creek or stream.

9. **Scrutinize development proposals for their impact on entire watersheds, not just the immediate impact area**. Certainly, new housing and commercial development can be given close scrutiny before it is allowed in the areas outlined in this report and careful review can be required within any watershed in the county. Municipalities can also require minimum setbacks from all water bodies to help protect water quality. Landowners within any particular watershed can act on their own to protect water by forming watershed associations to voluntarily monitor and screen proposals in their localities.

10. **Development plans should provide for creating natural buffers between the development and the core preserve area, be it a barrens community, wetland, water body, or forest**. Care should be taken to ensure that protected natural areas do not become "islands" surrounded by development. When a wetland or woodland is completely surrounded by development, even if there are no direct impacts, the site is effectively isolated and its value for wildlife is reduced. Cluster development could be used to allow the same amount of development on much less land in such areas. Yet most importantly, much of the remaining forest lands should be left intact as corridors for wildlife and native plants.

11. **Grassroots organizations are needed**. These groups can assist with the identification of landowners who wish to protect their land, provide information about easements to landowners, perhaps acquire land, and provide management and stewardship once the land is protected. Much of the work that needs to be done to protect and manage natural areas in Lehigh and Northampton counties can be done by county and municipal governments, park managers, and conservation groups such as the Wildlands Conservancy, among others. However, these organizations will need the assistance of volunteers from grassroots organizations such as the Lehigh Valley Herpetological Society, Lehigh Valley Audubon Society, and local watershed associations and land trusts.

On the USGS quadrangle maps contained in this report we have outlined the watersheds or subwatersheds where the natural communities and species of special concern occur. This area should be viewed as the ideal buffer zone for the communities and species (smaller buffer areas have been designated for locally significant sites). The core areas where the communities and species occur need to be given the most attention and fee title acquisition may be appropriate. Ideally, all of the land within the areas outlined in this report should receive some form of protection. Land uses that do not impact these important sites should be encouraged for the buffer zones.

We wish to emphasize that this Natural Areas Inventory is only a beginning. New sites with good natural communities and species of special concern wait to be discovered. Plant communities and plant and animal populations are dynamic, constantly changing with time and conditions. As this information is received and updated in the PNDI database, so too will the Lehigh County Natural Areas Inventory. If there are any questions about the impact of the proposed development or other activity, we suggest that our office, the Pennsylvania Science Office of The Nature Conservancy, be consulted. Questions regarding protection methods and tools for planning should be directed to the Lehigh Valley Planning Commission.

RESULTS

TNC ecologists conducted fieldwork for the Lehigh and Northampton Counties Inventories during the spring and summer of 1997 and the spring and summer of 1998. Contract biologists familiar with the counties also conducted field surveys for species of special concern. Sites for field evaluation were selected based primarily on historical species location information, air photo interpretation and from information supplied by local citizens. Sites searched for species of special concern were selected based on a combination of historical site location information, species' needs as listed in the literature, including *The New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada* (Gleason 1952), *The Vascular Flora of Pennsylvania* (Rhoads and Klein 1993), and others, as well as on aerial photo interpretation. Large woodlands, especially those with mature trees, unusual forest types, wetlands, rocky slopes, and woods on diabase all received priority for field inspection as potential natural communities and as habitat for rare species. Urban areas, agricultural fields and other highly disturbed lands were disregarded. Small woodlands and woodlands that consisted of young trees were considered to have low potential for species of concern and no potential for exemplary natural communities.

Sites that are mapped in this inventory are those with elements and/or potential to recover to natural community status, those that have relatively high species diversity and may yet be found to harbor rare species, and sites with examples of uncommon vegetation types for the counties. Areas mapped include not only the actual location for the elements but also a buffer, which is typically the watershed upstream or upslope of the site. For locally significant areas, the site itself is mapped with only a small buffer. These mapped areas serve two purposes: to obscure the actual location of some species that may be vulnerable to collectors, and as an indication that buffers are important for the survival of the rare elements. These buffers are meant only as a guide; smaller buffer zones may be sufficient to protect the resource, but all activities within these boundaries should be evaluated for their impacts to the resources.

Additionally, managed areas (whether owned or under easement) that are maintained in a relatively natural state are also mapped. This information provides a guide to the lands that are already protected and those areas that may still be in need of protection.

Site Summaries by USGS Topographic Maps

Portions of Lehigh and Northampton counties are found on twenty-two USGS topographic quadrangle maps (Figure 3). Natural communities, species of special concern, significant geologic features, managed open-space lands such as State Game Lands, and some areas that may be of local importance for wildlife and plant diversity have been located on these base maps. A labeling system has been used to visually indicate the relative importance of the sites on each map (see Figure 4) and in the text. Sites with bold capital type indicate the highest priority sites (statewide significance), sites with upper case plain print are of lower priority for preserving biological diversity (county-wide significance) but may have other values associated with them, and sites with bold upper and lower case type are areas that are managed for wildlife, parks or other natural resources. Below is a more detailed description of these labels in the original report. **The 2004 Northampton/Lehigh Update shows sites displayed in bold type as sites that have changed in some way. This explanation is once again shown at the bottom of each quadrangle site summary table.**

BOLD TYPE:

The most important areas for preserving biological diversity are represented on the maps in bold type; these sites all contain species of concern and/or exemplary natural communities. Site names are in bold upper case type (e.g., **RISMILLER WOODS**) followed by natural community and/or species map codes (e.g. **NC503**, **SP501**).

Note that the code numbers are specific to that quadrangle; e.g., SP506 on the Catasauqua Quadrangle may be a different species than SP506 on the Milford Square Quadrangle.

The area outlined for these sites represents the species' location and the watershed or subwatershed area where the elements (species or natural communities) are located. Development activities proposed within the encircled areas should be carefully assessed to determine the impact of the project on the species or communities before approval is granted. Consultation with the biologists of the Pennsylvania Science Office of The Nature Conservancy may be necessary to assess these impacts.

Maps which have a small portion of a buffer area from a site on an adjacent quadrangle are labeled with lowercase bold type (e.g., **nc503**, **sp501**) showing the map codes from the quadrangle where the main portion of the site occurs.

High Quality-Cold Water Fisheries (**HQ-CWF**) and Exceptional Value Waters (**EV Waters)** are also marked with bold type.

NON-BOLD UPPERCASE TYPE:

Some sites have been mapped that do not contain exemplary natural communities and that do not appear to have species of special concern. These are labeled with a site name in capitalized, non-bolded type, e.g., MEST MARSH. At these sites, the vegetation has been disturbed enough that the sites cannot be considered exemplary natural communities on a statewide or rangewide level, but they do include habitats that are important for preserving biodiversity on a county wide scale. The area outlined represents the significant habitat or feature at the site (the subwatershed area is not necessarily included). Many of these sites hold potential for parks, nature preserves within parks or passive recreation/open space areas.

Upper and Lower Case Type:

Managed areas are indicated with names in bold upper and lower case type, e.g., **Jacobsburg Environmental Education Center**. The approximate tract boundaries are also shown (--- · ---). These areas include sites that may contribute to the biological diversity of the counties but that may be managed for a variety of interests (e.g., parks, State Game Lands, private preserves, etc.). In some cases the managed areas do contain species of special concern, in which case the map codes (in bold upper case type) appear on the map as well.

Each topographic map is accompanied by a table that lists all of the exemplary natural communities and species of special concern located on the map. The communities and species are identified by a PNDI map code unique to each element on that map. Following each of these elements are its global and state ranks (Appendix I), federal and state protection status (Appendix I), the date last observed, and its quality rank (Appendix II). Sites of local significance are listed separately. Managed lands, state-designated scenic waterways, as well as natural communities and species that are located primarily on adjacent maps are listed within the "Other" category.

Key to Map Codes

NC = exemplary natural community
SP = plant of special concern
SA = animal of special concern
GE = significant geologic feature

ALLENTOWN EAST USGS QUADRANGLE MAP:

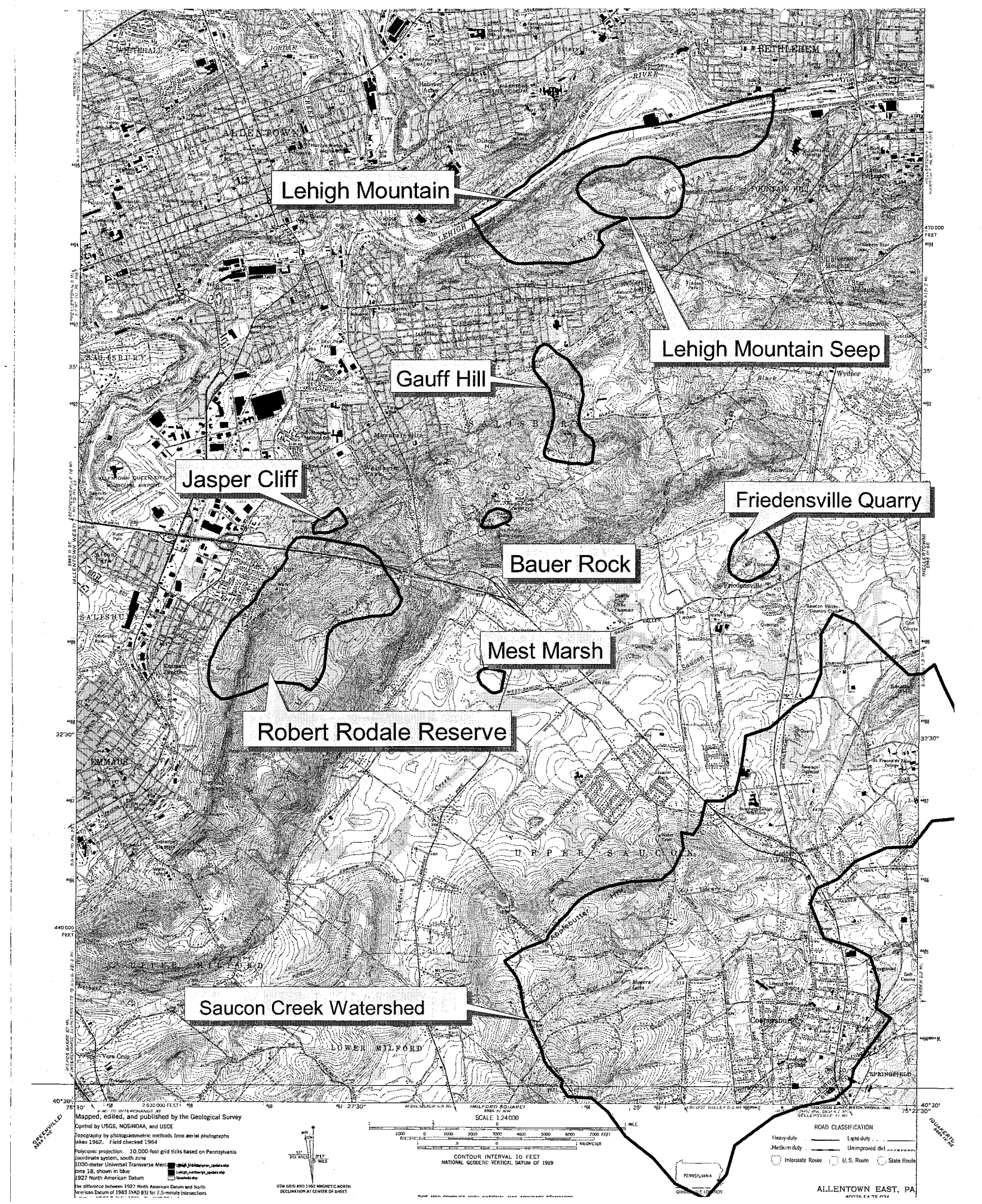
Site Name	Special Species / Community Type	PNHP Ranks*		State Status	Last Seen	Quality**	EO Number
		Global	State				
Bauer Rock	Geologic Feature	G?	S?	N	NA	E	
Freidensville Quarry Site	Eared False-Foxglove (*Agalinis auriculata*)	G3	S1	PE	**8/30/02**	**C**	SP533
Gauff Hill	Lettuce Saxifrage (Saxifragus *micranthidifolia)*	G5	S4	Delisted		**?**	SP524
Jasper Cliff	Geologic Feature	G?	S?	N	NA	E	
Lehigh Mountain Seeps	Northern Appalachian Circumneutral Seeps NC	G?	S3?	N	4/15/97	C	NC616
	Lettuceleaf Saxifrage (*Saxifragus micranthidifolia*)	G5	S4	**Delisted**	4/15/97	BC	SP522
Robert Rodale Reserve	Western Hairy Rock-Cress (*Arabis hirsuta*)	G5	S1	TU	5/16/97	C	SP546
	Northern Appalachian Circumneutral Seeps NC	G?	S3?	N	6/5/97	BC	NC617
	Lettuceleaf Saxifrage (*Saxifragus micranthidifolia*)	**G5**	**S4**	**Delisted**	**6/27/97**	**BC**	**SP523**
Saucon Creek Watershed (formerly Mill Road Wetlands)	Animal	G3	S2	**PE**	6/20/87	D?	SA539

Locally Significant: Lehigh Mountain, Mest Marsh,

Managed Lands:None

Other: Little Lehigh Creek-HQ-CWF, Monocacy Creek-HQ-CWF

* Please refer to Appendix IV for an explanation of PNHP Ranks and State Status.
**Please refer to Appendix V for an explanation of Quality Ranks.
*****Bold= indicates change in site since original report was written in 1999**.


Lehigh Mountain
Lehigh Mountain Seep
Gauff Hill
Jasper Cliff
Friedensville Quarry
Bauer Rock
Mest Marsh
Robert Rodale Reserve
Saucon Creek Watershed
ALLENTOWN
BETHLEHEM
SALISBURY
UPPER SAUCON
LOWER MILFORD
EMMAUS
Mapped, edited, and published by the Geological Survey
Control by USGS, NOS/NOAA, and USCE
Topography by photogrammetric methods from aerial photographs taken 1962. Field checked 1964
Polyconic projection. 10,000-foot grid ticks based on Pennsylvania coordinate system, south zone
1000-meter Universal Transverse Mercator grid, zone 18, shown in blue
1927 North American Datum
The difference between 1927 North American Datum and North American Datum of 1983 (NAD 83) for 7.5-minute intersections
SCALE 1:24000
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
UTM GRID AND 1992 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
ROAD CLASSIFICATION
Heavy-duty
Light-duty
Medium-duty
Unimproved dirt
Interstate Route
U.S. Route
State Route
ALLENTOWN EAST, PA

ALLENTOWN EAST QUADRANGLE MAP

BAUER ROCK (Upper Saucon Twp.) **GE560** - This is a pinnacle of banded gneiss rising approximately 40 feet above the ridgeline. The rock has fewer joints and cracks than the surrounding formations, and has eroded more slowly. From the crest of the rock there is a panoramic view of Saucon Valley to the south.

FRIEDENSVILLE QUARRY SITE (Upper Saucon Twp.) **SP533** - The Friedensville Quarry site contains a fair population of a globally-rare and state-endangered plant. The Pennsylvania Science Office of The Nature Conservancy has conducted an annual census of this population since 1989. The number of plants has ranged from 15 in 1992 to 258 in 1994. Because the plant is an annual, the numbers can vary greatly from year to year. The plants are growing in a very early successional clearing with a history of frequent disturbance. Since the species seems to require bare mineral soil, full sun, and a minimum of competition, the past land use has been favorable and the species has continued to thrive. The landowner has agreed to exclude the site from development plans, but the species is still threatened by competition from other vegetation and natural succession.

GAUFF HILL (Salisbury Twp.) **SP524-UPDATE**- The plant species, **Lettuce Saxifrage (*Saxifraga micranthidifolia*)**, that occupies this site, is now delisted. Associated plants are skunk cabbage (Symplocarpus foetidus), jewelweed (Impatiens capensis), mosses, and jack-in-the-pulpit (Arisaema triphyllum) under a partial canopy of mixed oaks (Quercus spp.) and tulip poplar (Liriodendron tulipifera). Recent development has occurred close to the edge of the stream in places, and exotic plants are present at the site. This plant species of concern can tolerate both shade and open conditions, but must have a wet substrate and limited competition to survive. Maintaining a forest corridor along this stream would be beneficial to both the water quality and the survival of the rare plant species. This site will be dropped from the county sites but may remain locally significant.

JASPER CLIFF (City of Allentown) **GE559** - This site is a massive outcrop of coarse jasper which forms low cliffs. It is notable as the only such formation in PA. Vein quartz, cracks, and cavities are characteristic features of jasper outcrops which are visible at the site.

LEHIGH MOUNTAIN (Salisbury Twp.) - This site is a large and relatively contiguous second growth forest that occurs on a north-facing slope above the Lehigh River. The forest is dominated by tulip poplar (Liriodendron tulipifera), sassafras (Sassafras albidum), red maple (Acer rubrum), sweet birch (Betula lenta), and mixed oaks (Quercus spp.). Common shrubs include spicebush (Lindera benzoin) and black-haw (Viburnum prunifolium). Herb diversity varies but is rich in some areas on lower and mid-slope positions. The forest supports a large number of nesting and migratory bird species and is also good habitat for many reptile and amphibian species. The site is bisected by a large powerline ROW which has a significant amount of invasive species growing on it. Portions of the eastern end of the site have been selectively logged in recent years and the understory forms thickets in some areas. This site is important because it is one of the largest, perhaps the largest, tract of relatively undisturbed forest left along the Lehigh River south of Blue Mountain. It is also significant because it remains good habitat for a very large number of species while being in close proximity to the highly developed cities of Allentown and Bethlehem. The quality of this site can be retained or even enhanced by maintaining as much of the currently forested area as forest and by minimizing disturbances that would fragment the site such as new roads, developments, or right-of-ways.

LEHIGH MOUNTAIN SEEPS (Salisbury Twp.) **NC616, SP522 (delisted)** – **UPDATE**-

This site includes a fair quality **Northern Appalachian Circumneutral Seeps Natural Community**. The site is a mixed second growth forest with oaks, tulip poplar (*Liriodendron tulipifera*), sassafras (*Sassafras albidum*), red maple (*Acer rubrum*) and sweet birch (*Betula lenta*) as the most common canopy trees. Large oval-shaped seepy areas dominated by skunk cabbage (*Symplocarpus foetidus*), ferns, and mosses are interspersed with upland woods across the upper slope of a northwest-facing hillside. Spicebush (*Lindera benzoin*) is abundant in the understory. This site also contains a population of **Lettuceleaf Saxifrage (*Saxifragus micranthidifolia*)**, a recently delisted species. **This delisted plant** grows in the shallow channels formed by water flowing from the seeps. The site has a past history of logging and is adjacent to a powerline ROW. Invasive shrubs, particularly multiflora rose (*Rosa multiflora*) and Japanese barberry (*Berberis thunbergii*), are common, especially in the area where **SP522** occurs. Competition from invasive shrubs and herbs is a threat to the integrity of the Natural Community as well as to the species of concern.

MEST MARSH (Upper Saucon Twp.) - This locally significant area includes several acres of cattail-sedge marsh and an adjacent segment of swampy floodplain along Leibert Creek. The marsh is dominated by cattail (Typha latifolia) with patches of sedges (Carex spp.), rushes (Scirpus spp.), and spikerushes (Eleocharis spp.). The adjacent floodplain is dominated by a mix of shrubs and ash trees with a ground cover of sedges. Braided channels, possibly coming from springs, cross the marsh and flow into Leibert Creek. This site provides habitat for numerous bird species as well as many types of amphibians and reptiles. This site would benefit from allowing a buffer to grow in between the marsh and an agricultural field which borders it on one side. Open marsh habitat of this quality is uncommon in the county. This site has potential for rare species although none were observed there during field surveys.

ROBERT RODALE RESERVE (Salisbury Twp., Allentown, Emmaus) **NC617, SP523, SP546 – UPDATE**- This site contains **Lettuceleaf Saxifrage (*Saxifragus micranthidifolia*)**, **a recently delisted plant species**. This species still contains a fair population of **Western Hairy Rockcress (*Arabis hirsuta*)**, an S1 plant species of concern. Also included here is a fair to good quality **Northern Appalachian Circumneutral Seeps Natural Community**.

This site is located on the slopes of a northwest-facing forested section of South Mountain. The site is dominated by second growth mixed hardwood forest which consists primarily of tulip poplar (Liriodendron tulipifera), but includes other species such as sweet birch (Betula lenta), red oak (Quercus rubra), chestnut oak (Quercus prinus), red maple (Acer rubrum), and hickory (Carya spp.) with varying frequency. The site includes a fair to good quality Northern Appalachian Circumneutral Seeps Natural Community. The seeps occur in sloping areas where diffuse groundwater flow intersects the soil surface. Seep-derived vegetation associations occur in many broad patches interspersed with upland forest across the slope. The sub-canopy in and around the seeps includes hornbeam (Carpinus caroliniana), American beech (Fagus grandifolia), alternate leaf dogwood (Cornus alternifolia), and hop-hornbeam (Ostrya virginiana). Common shrubs are spicebush (Lindera benzoin), witch-hazel (Hamamelis virginiana), maple-leaved viburnum (Viburnum acerifolium), and swamp azalea (Rhododendron viscosum). Dominant herbs on the species-rich seeps include skunk cabbage (Symplocarpus foetidus), false hellebore (Veratrum viride), sensitive fern (Onoclea sensibilis), and jewelweed (Impatiens capensis). Also common on the seeps are a variety of sedges (Carex spp.) and six other fern species. The seeps are excellent habitat for certain amphibian and aquatic invertebrate species. The seeps have the potential to support several state plant species of concern though none were observed there during our surveys. Other areas within the Robert Rodale Reserve site support plant species of special concern. A fair to good quality population of a PA-Rare plant species, **SP523**, occurs along forested portions of a nearby stream. And a fair quality population of an Tentatively Undetermined S1 species, **SP546**, occurs along rocky exposed portions of the powerline ROW that crosses the site. Also found at the site are several vernal pools. Vernal pools such as these may be critical habitat for amphibian reproduction. Dozens of vernal pools used to occur in a large area between Dorneyville and Kuhnsville, but agriculture, industry, and highway construction have destroyed or degraded most of these

pools. Pools that remain undisturbed are in small woodlots and are too isolated to support the kinds of species they once did. The vernal pools at the Robert Rodale Reserve site still occur in a relatively intact forest matrix which is critical to the survival of certain amphibian species. These vernal pools are thought to be one of the most active sites for salamander reproduction in the state. Although several of these pools are thought to be man-made, they have been performing the same natural functions for wildlife habitat as the natural pools nearby. Logging and increases of exotic plant species populations are threats to the quality of this site. Trails, especially those for mountain biking, should be prevented from crossing through or near the seepage areas and vernal pools. Preventing further forest fragmentation on South Mountain will benefit all the native plants and animals that rely on this area to support some aspect of their life cycles.

SAUCON CREEK WATERSHED (Upper Saucon Twp.; Hellertown and Milford Square Quads) (Formerly Mill Road Wetlands)- *SA539*- This site includes several wetlands that provide habitat for a variety of species. The wetlands are primarily marshy with strict sedge (*Carex stricta*), cattail (*Typha latifolia*), sensitive fern (*Onoclea sensibilis*), and sweet flag (*Acorus calamus*) as common species. **An animal species of special concern** was observed here in 1987 and may still occur at the site. Further surveys are encouraged to determine if the species is still found at this site and how extensive its presence is within these wetlands.

Little Lehigh Creek is a HQ-CWF throughout its basin, except for Main Stem Jordan Creek and the Mill Creek basin.

Monocacy Creek is a HQ-CWF throughout its basin.

ALLENTOWN WEST USGS QUADRANGLE MAP

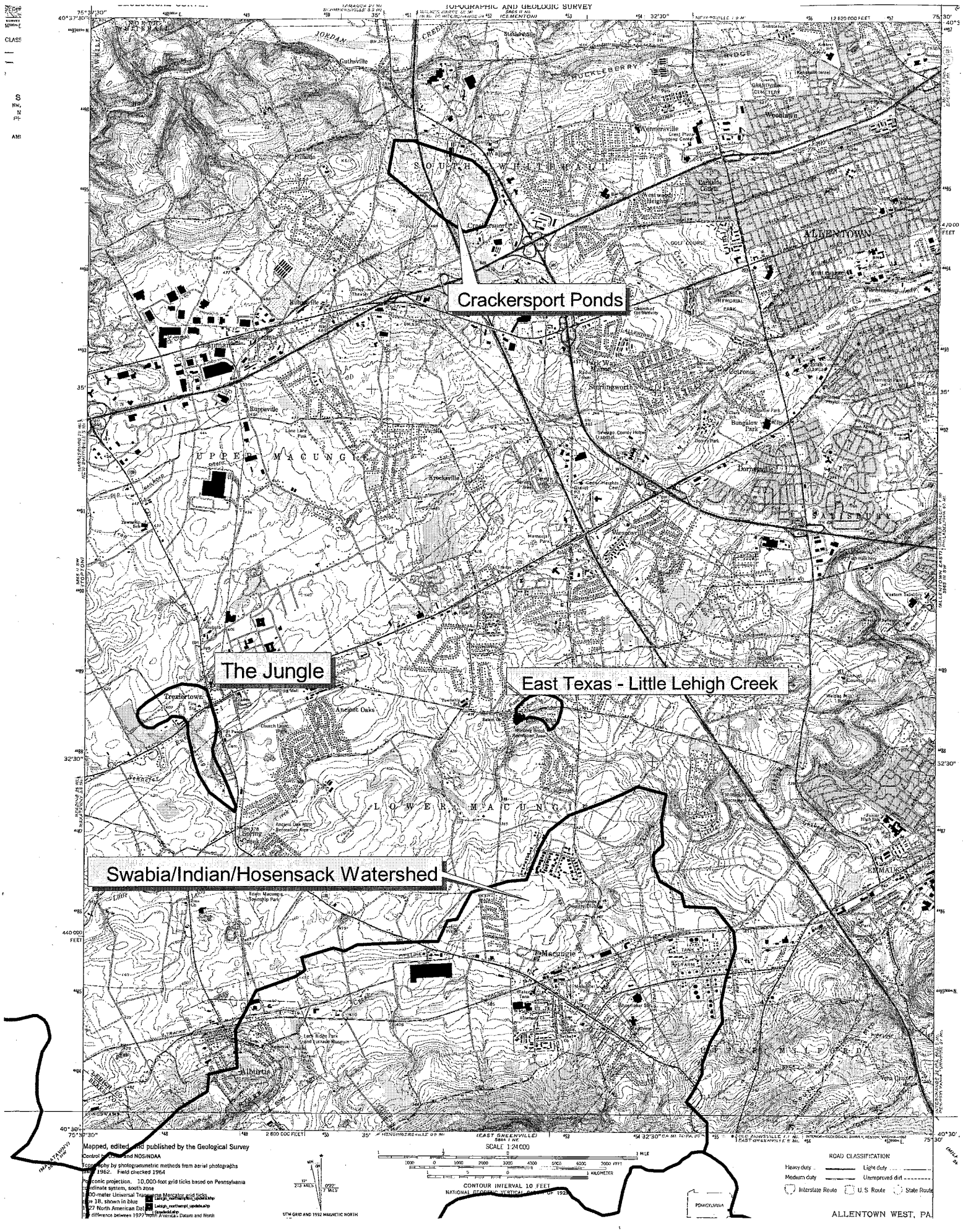
Site Name	Special Species / Community Type	PNHP Ranks*		State Status	Last Seen	Quality**	EO NUMBER
		Global	State				
Crackersport Ponds	Swamp Dog-Hobble (*Leucothoe racemosa*)	G5	S2S3	TU	6/5/97	C	SP548
	Winged-Loosestrife (*Lythrium alatum*)	G5	S1	TU	7/14/93	C	SP549
East Texas –Little Lehigh Creek	Matted Spike-rush (*Eleocharis intermedia*)	G5	S2	PT	9/29/93	CD	SP504
Swabia/Indian/Hosensack Watershed (Formerly Hosensack Marsh, Indian Creek Floodplain, and Macungie Watershed)	Animal	G3	S2	PE	6/5/97	BC	SA501
	White-Trout Lily (*Erythronium albidum*)	**G5**	**S3**	**N**	**4/20/01**	**BC**	**NEW**
	Animal	G3	S2	PE	1996	E	
	Northern Appalachian Circumneutral Seep NC	G?	S3?	N	6/26/97	C	**NC563**

Locally Significant: The Jungle
Big Beech Woods

Managed Lands:

Other: Little Lehigh Creek-HQ-CWF

* Please refer to Appendix IV for an explanation of PNHP Ranks and State Status.
**Please refer to Appendix V for an explanation of Quality Ranks.
***Bold= indicates change in site since original report was written in 1999**.


Crackersport Ponds
The Jungle
East Texas - Little Lehigh Creek
Swabia/Indian/Hosensack Watershed
ALLENTOWN WEST, PA.
Mapped, edited, and published by the Geological Survey
CONTOUR INTERVAL 10 FEET
SCALE 1:24000
ROAD CLASSIFICATION

ALLLENTOWN WEST QUADRANGLE MAP

CRACKERSPORT PONDS (South Whitehall Twp.) **SP548, SP549** - This site consists of a mosaic of forested uplands, fields, and wetlands including forested swamp, shrub swamp, and vernal pools. It supports a fair quality population of **Swamp Dog-Hobble (*Leucothoe racemosa*),** a PT shrub species. The shrub species of concern grows on raised hummocks in the pools and along the pool margins, with associated shrubs including winterberry (Ilex verticillata), highbush blueberry (Vaccinium corymbosum), and rhododendron (Rhododendron maximum). The site also supports a fair quality population of **Winged Loosestrife (*Lythrium alatum*)**, a PA-Rare herb species. This species is found growing in an open area of one of the ponds with New York ironweed (Vernonia noveboracensis), silky dogwood (Cornus amomum), sensitive fern (Onoclea sensibilis), and goldenrod (Solidago spp.). This quality of this site suffers from fragmentation. The forest has been variously encroached upon by industrial development, utility ROWs, and the PA Turnpike creating significant amounts of edge and leaving limited buffering for wetlands. Other disturbances include trash dumping and exotic species. This site has the potential to mature into a small but diverse forested wetland area. The species of concern should continue to survive at this site if it is protected from further disturbances.

EAST TEXAS-LITTLE LEHIGH CREEK (Lower Macungie Twp.) **SP504 -** A small fair to poor quality population of **Matted Spike-Rush (*Eleocharis intermedia*)**, a PA-Threatened plant species, was observed at this site in 1993. The species was found growing on the muddy alluvial margin of the Little Lehigh Creek. Associated species include jewelweed (Impatiens capensis), reed-canary grass (Phalaris arundinacea), arrow-leaved tearthumb (Polygonum sagittatum), and bur-marigold (Bidens spp.). This species has been known to occur along this stretch of the Little Lehigh since 1923. Although there have been various disturbances along the stream corridor including agriculture, residential development, and trampling from fishing, it is likely this species will continue to persist at this site. Maintaining wooded buffers along stream corridors and restricting development in floodplain areas will benefit this and other more common species that depend on riparian habitat for survival. It will also help to maintain the quality of the Little Lehigh Creek which is designated as a High Quality Clear Water Fishery. Further surveys are encouraged to determine if the species of concern at this site is located elsewhere along the creek.

THE JUNGLE (Lower Macungie & Upper Macungie Twps.) - The Jungle, as its name implies, is a site with thick vegetation. This very unique locally significant area occurs on a floodplain in the vicinity of the confluence of Spring Creek and Iron Run. Along with the creeks the site also receives significant input from several very cold large springs. A mix of shrub thicket and trees with shrubs covers most of the site although there are several streamside pools which are dominated by submerged aquatic plants. Black walnut (Juglans nigra), willow (Salix spp.), red maple (Acer rubrum), and box elder (Acer negundo) are dominant trees and spicebush (Lindera benzoin), gray dogwood (Cornus racemosa), and silky dogwood (Cornus amomum) are dominant shrubs. The waterways and pools at the site are habitat for herons and other bird species. The extremely cold, high pH water of Spring Creek supports a lush growth of aquatic plants which are good habitat and food sources for fish and aquatic insects. Numerous species of floodplain and wetland herbs occur at the site. Historic records indicate this site has supported possibly as many as six state listed plant species in the past. No species of concern were observed at the site during field surveys. The site's history of disturbance from mills and encroachment of agriculture may have destroyed these populations or they may have been overlooked. Further surveys are recommended. Streams flowing through this site are recognized as part of the Little Lehigh Creek system, which is a HQ-CWF.

SWABIA/INDIAN/HOSENSACK WATERSHED (Formerly Hosensack Marsh, Indian Creek Floodplain, Big Beech Woods and Macungie Watershed)

(Upper Milford, Lower Milford & Lower Macungie Twps.; Allentown West and Milford Square Quads)

SA501, SA531, NC563 Northern Appalachian Circumneutral Seeps Natural Community - One site within this watershed includes areas of floodplain forest and open marsh along the floodplain of Indian Creek. The forest is dominated by a mix of American elm (*Ulmus americana*), ash (*Fraxinus sp*.), Pin oak (*Quercus palustris*), tulip poplar (*Liriodendron tulipifera*), and hickory (*Carya sp*.) with dense spicebush (*Lindera benzoin*) in the understory. The marsh is dominated by cattail (*Typha latifolia*), strict sedge (*Carex stricta*), jewel weed (*Impatiens capensis*), willow herb (*Epilobium sp*.), and bulrush (*Scirpus cyperinus*). Evidence of a **PA-Endangered animal species** was observed at this site in 1996. This site was discovered late in the process of developing this report and has not been fully investigated. Surveys to determine the status of the species of concern at this site are highly recommended.

Another site within this watershed includes areas of marsh and shrub swamp part of the site has been disturbed by the construction of an electric power transfer station and associated powerline ROW. Some of the habitat created by these disturbances may be benefiting the rare species that occurs here. The site supports a fair to good example of an animal species of concern. A plant species of concern was also found in a swamp forest near this site in 2001. Associated species include red trillium (*Trillium erectum*), skunk cabbage (*Symplorocarpus foetidus*), violets (*Viola spp*.), rattlesnake root (*Prenanthes spp*.), spicebush (*Lindera benzoin*), garlic-mustard (*Allaria petiola*), musclewood (*Carpinus carolinana*), red maple (*Acer rubrum*), and black birch (*Betula lenta*). Current disturbances are minor, however it is crucial to maintain the surface hydrology of the site for this rare plant species.

A third site is located on the mid slope of a north facing forested hill due south of Macungie. The site is dominated by a second growth mixed hardwood forest, which consists primarily of a mix of tulip poplar (*Liriodendron tulipifera*), yellow birch (*Betula alleghaniensis*), red oak (*Quercus rubra*), and red maple (*Acer rubrum*). The site includes a fair to good quality Northern Appalachian Circumneutral Seeps Natural Community. The seeps occur in sloping areas where diffuse groundwater flow intersects the soil surface. Seep derived vegetation associations occur in many broad patches interspersed with upland forest across the slope. Common shrubs of the seeps include spicebush (*Lindera benzoin*), witch-hazel (*Hamamelis virginiana*), with lessor amounts of elderberry (*Sambucus sp*.) and winterberry (*Ilex verticillata*). Dominant herbaceous species in this relatively diverse natural community include cinnamon fern (*Osmunda cinnamomea*), New York fern (*Thelypteris noveboracensis*), and lady fern (*Athyrium filix-femina*), as well as skunk cabbage (*Symplocarpus foetidus*). Also common are a variety of sedges (*Carex spp*.), voilets (*Viola spp*.), and other ferns. The seeps are excellent habitat for certain amphibian and aquatic invertebrate species. Ebony jewelwing damselflies (*Calopteryx maculata*) and bullfrogs (*Rana catesbeiana*) were observed at the site during our survey. The seeps have the potential to support several state plant species of concern though none were observed during our surveys. Logging and increased amounts of exotic species are threats to the quality of this site. Trails, especially those for mountain biking should be prevented from crossing through or near the seepage areas. Although this site has experienced a variety of disturbances such as historical logging, plantings of spruce, and road construction for the reservoir, preventing further disturbances and forest fragmentation on this slope will benefit the seeps Natural Community as well as all the native plants and animals that depend on this area to support some aspect of their life cycles.

BIG BEECH WOODS-This locally significant area is a southeast-facing slope along Hosensack Creek with a maturing second-growth forest. American beech (Fagus grandifolia), tulip poplar (Liriodendron tulipifera), sugar maple (Acer saccharum), hickories (Carya spp.), white oak (Quercus alba), red oak (Q. rubra), and sweet birch (Betula lenta) are present in the overstory, with American beech (Fagus grandifolia), hemlock (Tsuga canadensis), and sugar maple (Acer saccharum) coming up in the understory. Maple-leaved viburnum (Viburnum acerifolium), spicebush (Lindera benzoin), may-apple (Podophyllum peltatum), false Solomon's Seal (Smilacina racemosa), black snakeroot (Cimicifuga racemosa), Christmas

fern (Polystichum acrostichoides), and marginal wood fern (Dryopteris marginalis) are found in the groundcover. Some of the trees are over two feet in diameter -- most similarly mesic sites in the county are in agriculture or younger woodland. Protecting the site would allow the natural community to mature further as well as benefit the water quality of the Hosensack Marsh site downstream.

Threats and Disturbances

No threats and disturbances are apparent to the **White Trout Lily** population, but maintaining the surface hydrology is essential to perpetuation of the habitat; some trees have been removed over the years.

For the **animal species of concern**, Maintenance operations and hydrology changes are disturbances and possible threats. Exotic plant species may alter the hydrology of the wetland. However, the designation of the marsh as a unique natural area may protect it from being driven over in the future.

Recommendations

It is recommended that forested buffers be used to protect the ecological integrity of the wetlands where the animal species of concern is found. More surveys are encouraged to determine the population and habitat use of the species.

For the White Trout Lily population, it is recommended that a forested buffer be placed around the wetland to protect the hydrology and ecological integrity of the plant species.

Little Lehigh Creek is a HQ-CWF throughout its basin, except for Main Stem Jordan Creek and the Mill Creek basin.

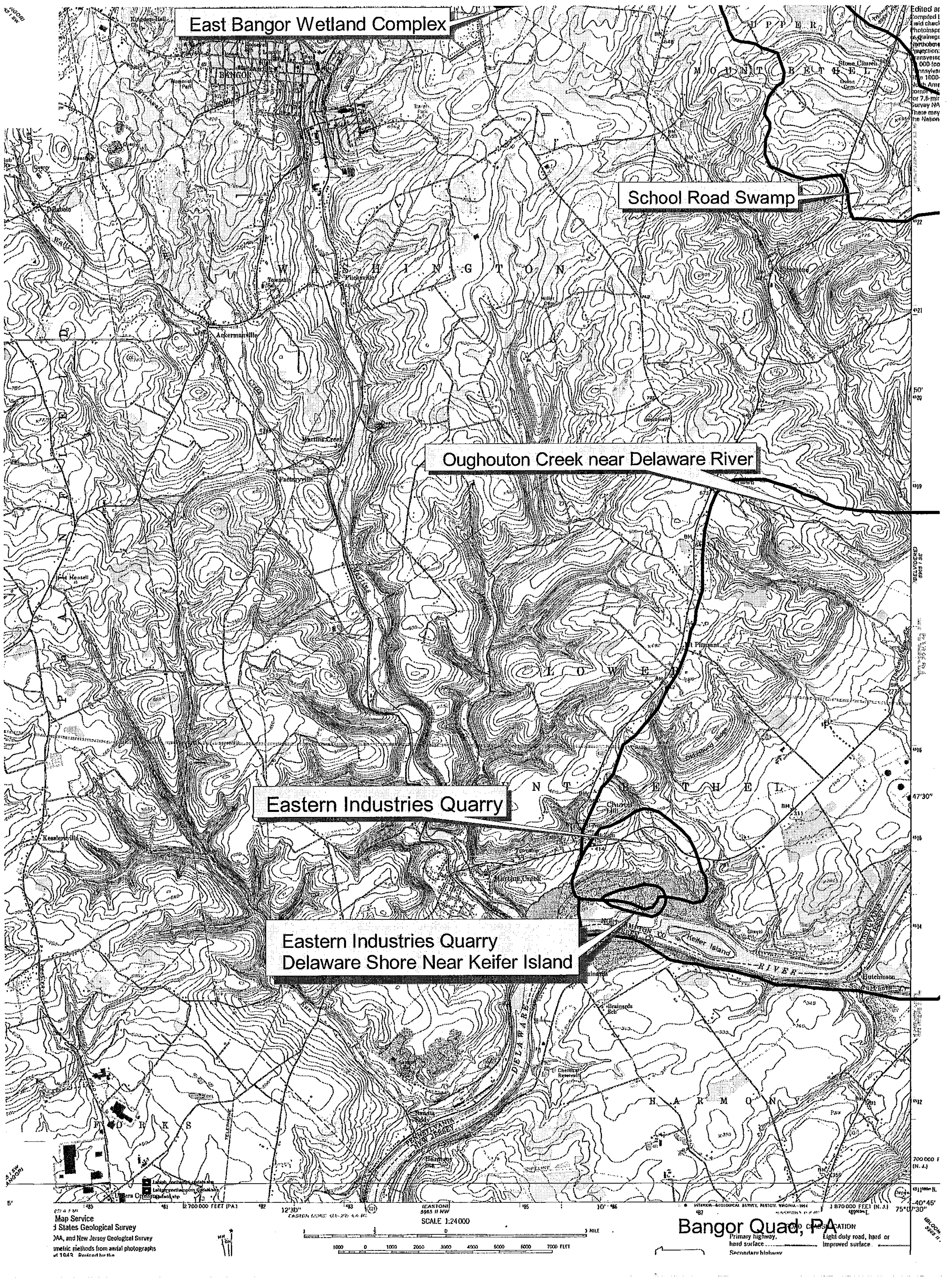
BANGOR USGS QUADRANGLE MAP

Site Name	Special Species / Community Type	PNHP Ranks*		State Status	Last Seen	Quality**	EO NUMBER
		Global	State				
Delaware Shore near Keifer Island	Appalachian Sand-Cherry (*Prunus pumila var. depressa*)	G5T5	S1	N	8/11/97	CD	SP512
East Bangor Wetland Complex	Virginia Rail (*Rallus limicola*)	G5	S3B	CA	5/15/92	E	SA618
Eastern Industries Quarry	Osprey (*Pandion haliaetus*)	G5	S2B	PT	2000	C	SA514
Oughoughton Creek near Delaware River	**Osprey (*Pandion haliaetus*)**	**G5**	**S2B**	**PT**	**2000**	**E**	**SA516-NEW**
School Road Swamp	Sora (*Porzana carolina*)	G5	S3B	CA	5/13/96	E	SA513
	Virginia Rail (*Rallus limicola*)	G5	S3B	CA	5/13/96	E	SA513
	Animal	G3	S2	PE	2001	E	SA

Locally Significant: Delaware River

Managed Lands: None

* Please refer to Appendix IV for an explanation of PNHP Ranks and State Status.
**Please refer to Appendix V for an explanation of Quality Ranks.
***Bold= indicates change in site since original report was written in 1999**.


East Bangor Wetland Complex
School Road Swamp
Oughouton Creek near Delaware River
Eastern Industries Quarry
Eastern Industries Quarry
Delaware Shore Near Keifer Island
SCALE 1:24000
Bangor Quad, PA

BANGOR USGS QUADRANGLE MAP

DELAWARE SHORE NEAR KEIFER ISLAND (Lower Mount Bethel Twp.) **SP512** - This site is a peninsula of alluvial sand and gravel deposits which extends into the Delaware River. The area is periodically scoured severely by floodwaters or ice. The upstream end of the peninsula consists of patches of stunted sycamore (Platanus occidentalis) and ash sprouts mixed with openings of mixed grasses and herbs. A small population of a PA-Rare plant species occurs in one of the larger openings. Associated species are riverbank grape, big bluestem (Andropogon gerardii), switch grass (Panicum virgatum), and wild rye (Elymus virginicus). Some exotic species such as cemetery-plant (Euphorbia cyparissias) and soapwort (Saponaria officinalis) are also present. **Appalachian Sand Cherry (*Prunus pumila var. depressa*)** is dependent upon disturbance by the river to maintain openings and prevent succession to forest. No special management is recommended.

EAST BANGOR WETLAND COMPLEX (Upper Mount Bethel Twp., East Bangor Twp.) **sa618** A small portion of the buffer for this wetland site extends onto the Bangor quadrangle. For a full description of this site, see the Stroudsburg quadrangle.

EASTERN INDUSTRIES QUARRY (Lower Mount Bethel Twp.) **SA514 – The Osprey (*Pandion haliaetus*)** has been successfully reintroduced into the Delaware River Valley after being nearly extirpated in PA. It was observed nesting at this site in 1998. This species requires extensive habitat such as that associated with sea coasts, large rivers, and lakes. Major threats include shooting and contamination of waterways by pesticides.

OUGHOUGHTON CREEK NEAR DELAWARE RIVER (Lower Mount Bethel, New Jersey)
This site contains an unknown quality population of **Osprey (*Pandion haliaetus*)**, an S2B animal species of concern. One young of this species was seen in a nest on the last survey. This species requires a large amount of habitat associated with sea coasts and large lakes and rivers.
This area represents a classic scenario for Osprey nesting where platforms have been erected. This area hosts an optimum feeding ground for this species by providing the Delaware River and two fairly large lakes for foraging opportunities.

Threats and disturbances
Major threats include shooting and contamination of aquatic ecosystems by pesticides. Disturbances include human encroachment of nests and human activities within a certain distance from the nesting platform.

Recommendations
It is recommended that only a minimal amount of disturbance should be allowed during the breeding season to increase breeding success. However, it is feasible still that surveys of this species be continued to monitor the yearly breeding success, and the number of nests found along the river.

SCHOOL ROAD SWAMP (Upper Mount Bethel Twp.; Bangor and Stroudsburg Quads) *SA513a & SA513b Porzana carolina, Rallus limicola and animal species –*
This site is a wetland mosaic that includes large areas of both forested swamp and emergent marsh. The forested swamp is dominated by red maple (*Acer rubrum*) with ash (*Fraxinus sp.*), American elm (*Ulmus americana*), and scattered swamp white oak (*Quercus bicolor*), and has a shrub layer dominated by spicebush (*Lindera benzoin*) with highbush blueberry (*Vaccinium corymbosum*), winterberry (*Ilex verticillata*), and swamp rose (*Rosa palustris*). Herbaceous species include numerous sedges and ferns,

with skunk cabbage (*Symplocarpus foetidus*) and marsh marigold (*Caltha palustris*) also being common. The emergent marsh is dominated by strict sedge (*Carex stricta*) and cattail (*Typha latifolia*) with some scattered stems of stunted red maple (*Acer rubrum*). **Two animal species of concern, Sora (*Porzana carolina*), and Virginia Rail (*Rallus limicola*),** were observed at this site in 1996. A survey in the spring of 1998 failed to relocate the species, but the habitat remains unchanged and the species may still be using the site. Another **animal species of concern** was discovered here in 2001. More surveys should be completed to determine the status of the population at this site.

Threats and Disturbances

The hydrology of the emergent marsh may be influenced by the presence a road near the site, although whether the influence plays a negative or positive role is unknown.

Recommendations

Leaving this site in its current condition should help the species of concern that inhabit this area. Additional surveys are needed to better understand how the marsh birds use this habitat and to better assess the population of the animal species of concern.

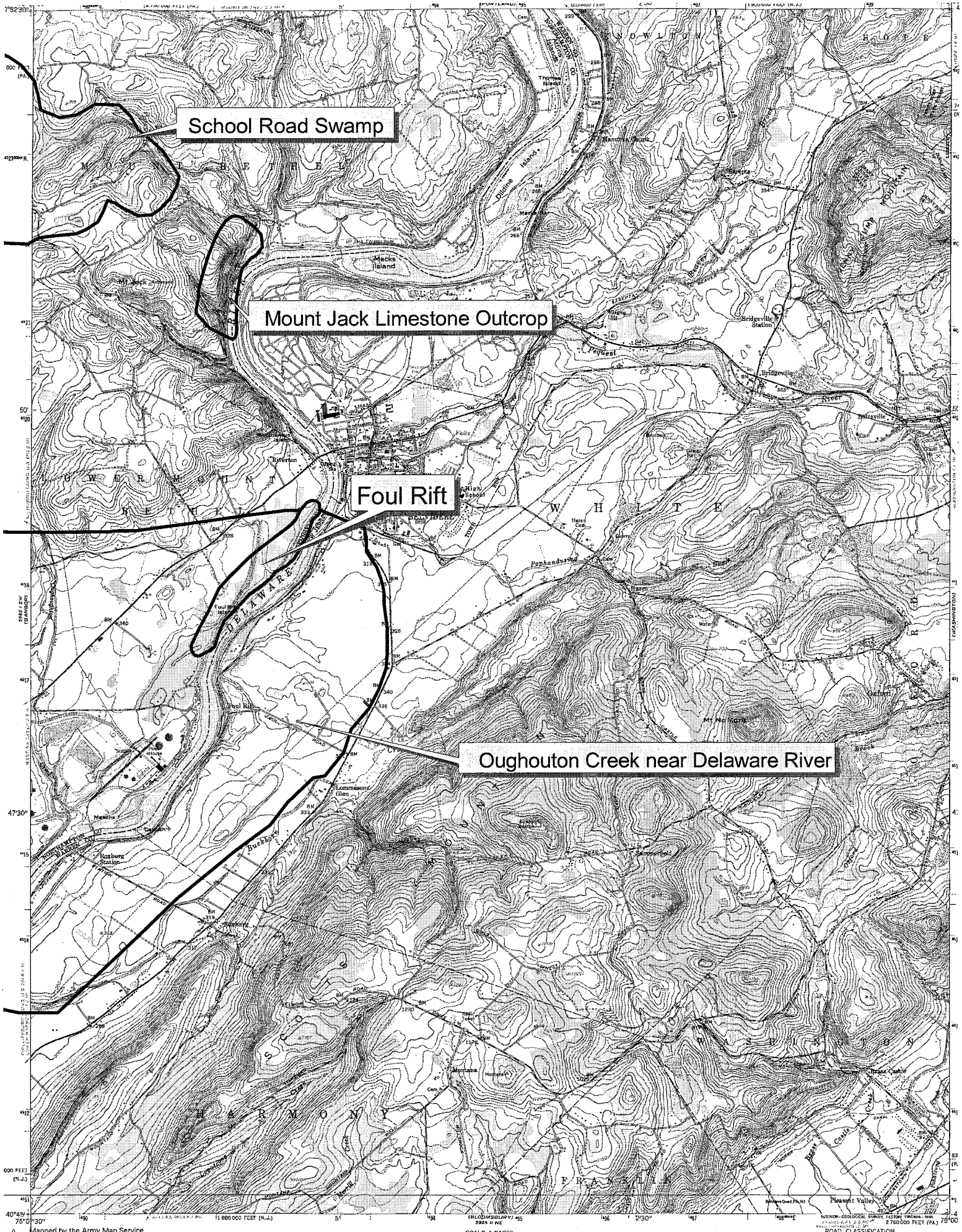
DELAWARE RIVER is an excellent recreational and scenic resource; it includes many current and historical records for species of special concern. The river and adjacent forested watersheds comprise one of the major corridors for the movement of biota in eastern Pennsylvania.

BELVIDERE USGS QUADRANGLE MAP

Site Name	Special Species / Community Type	PNHP Ranks*		State Status	Last Seen	Quality**	EO NUMBER
		Global	State				
Foul Rift	White Heath Aster (*Aster ericoides*)	G5	S3	TU	9/2/86	A	SP504
	Northern Appalachian Calcareous Cliff Natural Community	G?	S2	N	6/30/97	B	NC510
	Animal	G3G4	S3S4	CU	7/3/97	E	SA517
Mount Jack Limestone Outcrop	White Heath Aster (*Aster ericoides*)	G5	S3	TU	4/27/95	AB	SP506
	Appalachian Sand Cherry (*Prunus pumila var.depressa*)	G5T5	S1	PE	8/14/86	D	SP506
	Northern Appalachian Shale Cliff Natural Community	G?	S2	N	6/30/97	C	NC509
	Calcareous Riverside Outcrop Natural Community	G?	S1	N	6/30/97	B	NC508
	Flat-stemmed Spikerush (*Eleocharis compressa*)	G4	S1	PE	6/30/97	BC	SP508
Oughougton Creek Power House Site (now part of Oughoughton Creek near Delaware River)	**Osprey (*Pandeon haliaetus*)**	**G5**	**S2B**	**PT**	**1998**	**C**	**SA513 UPDATE**
Oughouton Creek near Delaware River	**Osprey (*Pandeon haliaetus*)**	**G5**	**S2B**	**PT**	**2000**	**E**	**SA516-NEW**
School Road Swamp	Sora (*Porzana carolina*)	G5	S3B	CA	5/13/96	E	SA513
	Virginia Rail (*Rallus limicola*)	G5	S3B	CA	5/13/96	E	SA513
	Animal	G3	S2	PE	2001	E	SA

Locally Significant: Delaware River

* Please refer to Appendix IV for an explanation of PNHP Ranks and State Status.
**Please refer to Appendix V for an explanation of Quality Ranks.
***Bold= indicates change in site since original report was written in 1999**.



Mapped by the Army Map Service
Edited and published by the U. S. Geological Survey
Compiled by photogrammetric methods from imagery dated 1942
Field checked 1943. Culture revised by the Geological Survey 1955
Photoinspected using imagery dated 1952, no major culture or drainage changes observed. Boundaries and names revised 1995

ROAD CLASSIFICATION

Primary highway, hard surface
Light duty road, hard or improved surface
Unimproved road

BELVIDERE USGS QUADRANGLE MAP

FOUL RIFT (Lower Mount Bethel Twp.) **NC510, SP504, SA517** - Exposed and eroded limestone bedrock occurring along the Delaware River at this site supports a good quality example of a **Northern Appalachian Calcareous Cliff Natural Community.** The south end of the site consists of 30-foot high vertical cliffs that rise out of the Delaware while the north end is an eroded sloping bank of limestone based bedrock. The adjacent uplands are forested and the adjacent stretch of the river includes a series of riffles and turbulent rapids. Cracks and crevices in the exposed bedrock support a unique suite of plant species which are adapted to surviving on the exposed high pH substrate. Dominant herbs and grasses on the cliff include big bluestem (Andropogon gerardii), switch grass (Panicum virgatum), Virginia creeper (Parthenocissus quinquefolia), and asters (Aster spp.). The outcrops at the site support an excellent quality population of **White Heath-Aster (*Aster ericoides*)**, a PA-Rare plant species. The adjacent river supports a G4S2S3 animal species. Evidence of the animal occurrence was observed during 1997 field surveys though no living individuals were found. Further surveys are encouraged to determine the size and extent of this animal population. This stretch of the river also has potential for several other animal species of concern which may also be targeted in future surveys. The natural community and species of concern at this site will be best protected by leaving the site in its current condition. The site does include significant populations of exotic species which have become common along the rivershore throughout much of the Delaware River corridor. The adjacent upland woods are in relatively good condition; maintaining the forested buffer along this section of the river will help maintain the integrity of this site and should help to prevent more serious colonization by exotics. The site is part of PP& L's Tekening Land Management Area.

MOUNT JACK LIMESTONE OUTCROP (Upper Mount Bethel Twp.) **NC508, NC509, SP506a, SP506b, SP508** - Exposed and eroded limestone occurring along the Delaware River at this site supports a good quality example of a Calcareous Riverside Outcrop Natural Community and a fair quality example of a Northern Appalachian Shale Cliff Natural Community. The site consists of a series of shrub and forb dominated riverside outcrops that run along the base of several steeply sloping, sparsely vegetated shale cliffs. The low lying riverside outcrops are often scoured by ice flows in late winter and/or by flood waters in early spring. By late summer the plants growing on the rocks may be exposed to extreme drought. Dominant woody species on these outcrops include false indigo (Amorpha fruticosa), willow (Salix spp.), sycamore (Platanus occidentalis), river birch (Betula nigra)and swamp rose (Rosa palustris). Dominant herbs and grasses include big bluestem (Andropogon gerardii), switch grass (Panicum virgatum), poison ivy (Toxicodendron radicans), jewelweed (Impatiens capensis), mountain-mint (Pycnanthemum spp.), and asters (Aster spp.). The Calcareous Riverside Outcrop Natural Community supports three plant species of special concern including a fair to good quality population of a PA-Endangered plant species, **Flat-stemmed Spikerush (*Eleocarhis compressa*),** and a good to excellent quality population of **White Heath Aster (*Aster ericoides*)**, a Tentatively Undetermined plant species. The shale cliff portion of the site is sparsely vegetated. It supports a unique suite of plant species which are adapted to surviving in the cracks and crevices of the exposed bedrock such as lyre-leaved rock cress (Arabis lyrata), wild columbine (Aquilegia canadensis), harebell (Campanula rotundifolia), and alum-root (Heuchera americana). Above the cliffs is a steeply sloping hillside with a forest dominated by various oak species. The adjacent stretch of the river includes a series of riffles and turbulent rapids which is excellent habitat for several animal species of concern. Historic evidence of an animal species thought to be extirpated from PA was observed during 1997 field surveys though no living individuals or recent evidence was found. Further surveys are encouraged to determine whether this or any other state listed animal species occur at the site. The natural communities and species of concern at this site will be best protected by leaving the site in its current condition. The site does include significant populations of exotic species which have become common along the river shore throughout much of the Delaware River corridor. Maintaining the forested buffer along the river throughout this stretch will help maintain the integrity of this site and should help to prevent more serious colonization by exotics.

OUGHOUGHTON CREEK NEAR DELAWARE RIVER (Lower Mount Bethel, New Jersey)
This site contains an unknown quality population of **Osprey (*Pandion haliaetus*), an S2B animal species of concern**. One young of this species was seen in a nest on the last survey. This species requires a large amount of habitat associated with sea coasts and large lakes and rivers.

This area represents a classic scenario for Osprey nesting where platforms have been erected. This area hosts an optimum feeding ground for this species by providing the Delaware River and two fairly large lakes for foraging opportunities.

Threats and disturbances
Major threats include shooting of individual birds and contamination of aquatic ecosystems by pesticides. Disturbances include human encroachment of nests and human activities within a certain distance from the nesting platform.

Recommendations
It is recommended that only a minimal amount of disturbance should be allowed during the breeding season to increase breeding success. However, it is feasible still that surveys of this species be continued to monitor the yearly breeding success, and the number of nests found along the river.

SA513 – UPDATE- The site "**Oughoughton Creek Power House**" had been merged into the site "**Oughoughton Creek Near Delaware River**". This PA-Endangered species has been successfully reintroduced into the Delaware River Valley after being nearly extirpated in PA. The site is a large area of grassland surrounding an electric generating station. It was observed nesting at this site in 1997. This species requires extensive habitat such as that associated with sea coasts, large rivers, and lakes. Major threats include shooting and contamination of waterways by pesticides.

SCHOOL ROAD SWAMP (Upper Mount Bethel Twp.; Bangor and Stroudsburg Quads) *SA513a & SA513b Porzana carolina, Rallus limicola and animal species –*
This site is a wetland mosaic that includes large areas of both forested swamp and emergent marsh. The forested swamp is dominated by red maple (*Acer rubrum*) with ash (*Fraxinus sp*.), American elm (*Ulmus americana*), and scattered swamp white oak (*Quercus bicolor*), and has a shrub layer dominated by spicebush (*Lindera benzoin*) with highbush blueberry (*Vaccinium corymbosum*), winterberry (*Ilex verticillata*), and swamp rose (*Rosa palustris*). Herbaceous species include numerous sedges and ferns, with skunk cabbage (*Symplocarpus foetidus*) and marsh marigold (*Caltha palustris*) also being common. The emergent marsh is dominated by strict sedge (*Carex stricta*) and cattail (*Typha latifolia*) with some scattered stems of stunted red maple (*Acer rubrum*). **Two animal species of concern, Sora (*Porzana carolina*), and Virginia Rail (*Rallus limicola*),** were observed at this site in 1996. A survey in the spring of 1998 failed to relocate the species, but the habitat remains unchanged and the species may still be using the site. Another **animal species of concern** was discovered here in 2001. More surveys should be completed to determine the status of the population at this site.

Threats and Disturbances
The hydrology of the emergent marsh may be influenced by the presence a road near the site, although whether the influence plays a negative or positive role is unknown.

Recommendations
Leaving this site in its current condition should help the species of concern that inhabit this area. Additional surveys are needed to better understand how the marsh birds use this habitat and to better assess the population of the animal species of concern.

DELAWARE RIVER is an excellent recreational and scenic resource; it includes many current and historical records for species of special concern. The river and adjacent forested watersheds comprise one of the major corridors for the movement of biota in eastern Pennsylvania.

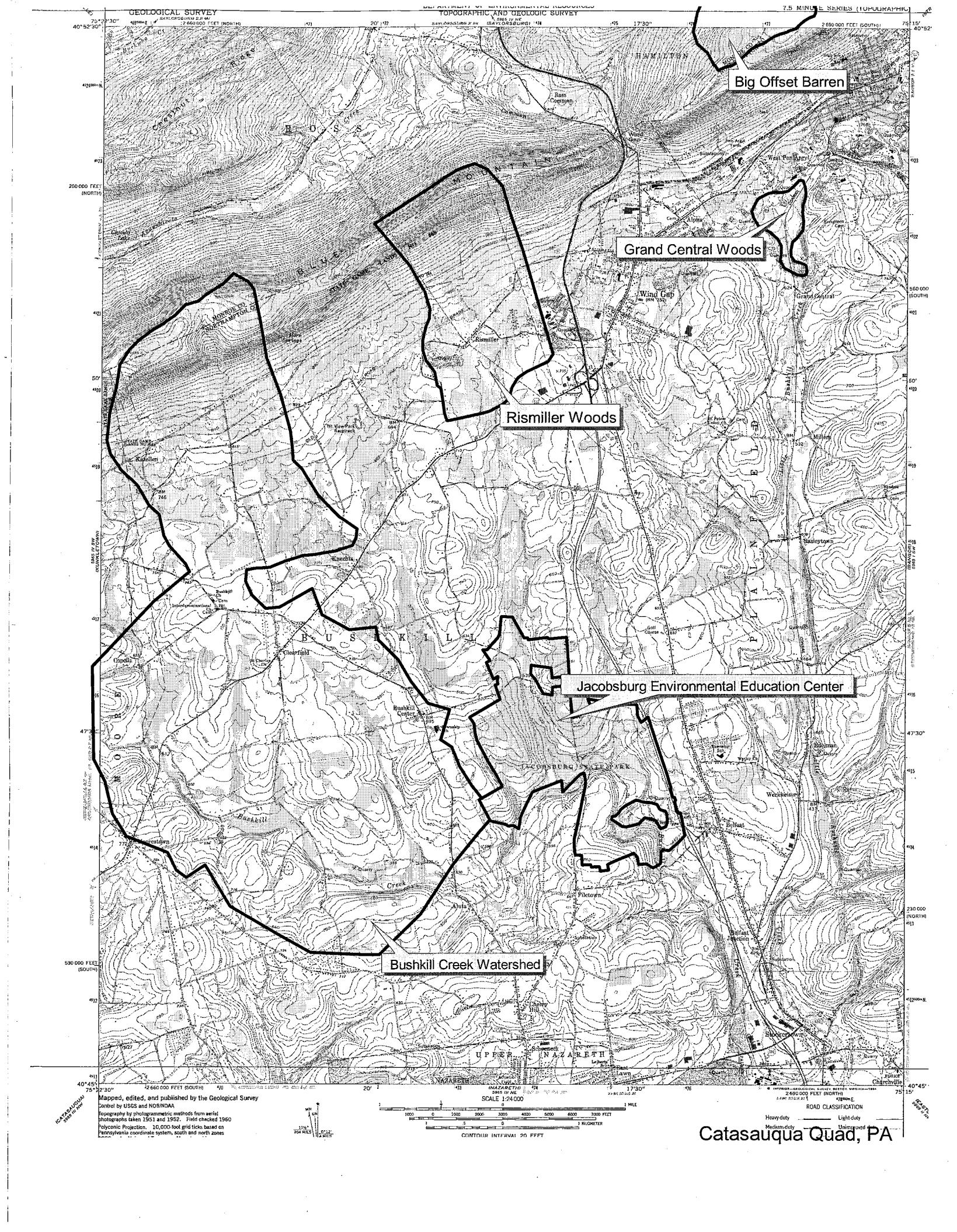
CATASAUQUA USGS QUADRANGLE MAP

Site Name	Special Species / Community Type	PNHP Ranks*		State Status	Last Seen	Quality**	EO NUMBER
		Global	State				
Helfrich Springs Cave	Northern Myotis (*Myotis septentrionalis*)	G4	S3B, S3N	CR	2/24/98	D	SA528

Locally Significant: Weaversville Ponds

Managed Areas: Jordan Creek Parkway, Lehigh River-Scenic River, Monocacy Park

* Please refer to Appendix IV for an explanation of PNHP Ranks and State Status.
**Please refer to Appendix V for an explanation of Quality Ranks.
*****Bold= indicates change in site since original report was written in 1999**.



Mapped, edited, and published by the Geological Survey

Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs taken 1951 and 1952. Field checked 1960

Polyconic Projection. 10,000-foot grid ticks based on Pennsylvania coordinate system, south and north zones

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET

ROAD CLASSIFICATION

Heavy-duty ——— Light-duty

Medium-duty ——— Unimproved

Catasauqua Quad, PA

HELFRICH SPRINGS CAVE (Whitehall Twp.) **SA528** - This site is a solutional cave formed in Epler formation limestone and dolomite. The cave is connected hydrologically with Jordan Creek. At very high water levels the Creek floods the cave, and erosion from flooding has likely also affected the cave's formation. A single individual of **Northern Myotis (*Myotis septentrionalis*)**, a G4 S2S3 species was found in the rear section of the cave, associated with eastern pipistrelles (Pipistrellus subflavus), little brown bats (Myotis lucifugus), and big brown bats (Eptesicus fuscus). There is potential for aquatic species of concern in the cave as well. The front portion of the cave was used for commercial tours in the past, and has been disturbed by the installation of catwalks and earthen walkways. The rear section of the cave is protected by a narrow, water-filled passage and has more bats. Pollution of groundwater or of the Jordan Creek are potential threats to the site. The cave is no longer operated commercially and the current owners are protecting it from human disturbance.

WEAVERSVILLE PONDS (Allen & East Allen Twps.) - This **locally significant site** includes an area of isolated forest with twelve vernal ponds which are completely surrounded by agricultural lands. The forest is dominated by a mix of second growth oaks, ash, and hickories with an understory of spicebush (Lindera benzoin) and black-haw (Viburnum prunifolium). Common herbs include jewelweed (Impatiens capensis), wild geranium (Geranium maculatum), poison ivy (Toxicodendron radicans), and enchanters nightshade (Circaea lutetiana). Vegetation in and around the ponds varies with some ponds having little or no vegetation, dead leaf ponds, and others having numerous species of wetland grasses and herbs and even thickets of shrubs. Trees on the pond margins include pin oak (Quercus palustris), swamp white oak (Quercus bicolor), black walnut (Juglans nigra), and ash (Fraxinus spp.). These ponds are a significant resource for the reproduction of amphibians in this area.

CEMENTON USGS QUADRANGLE MAP

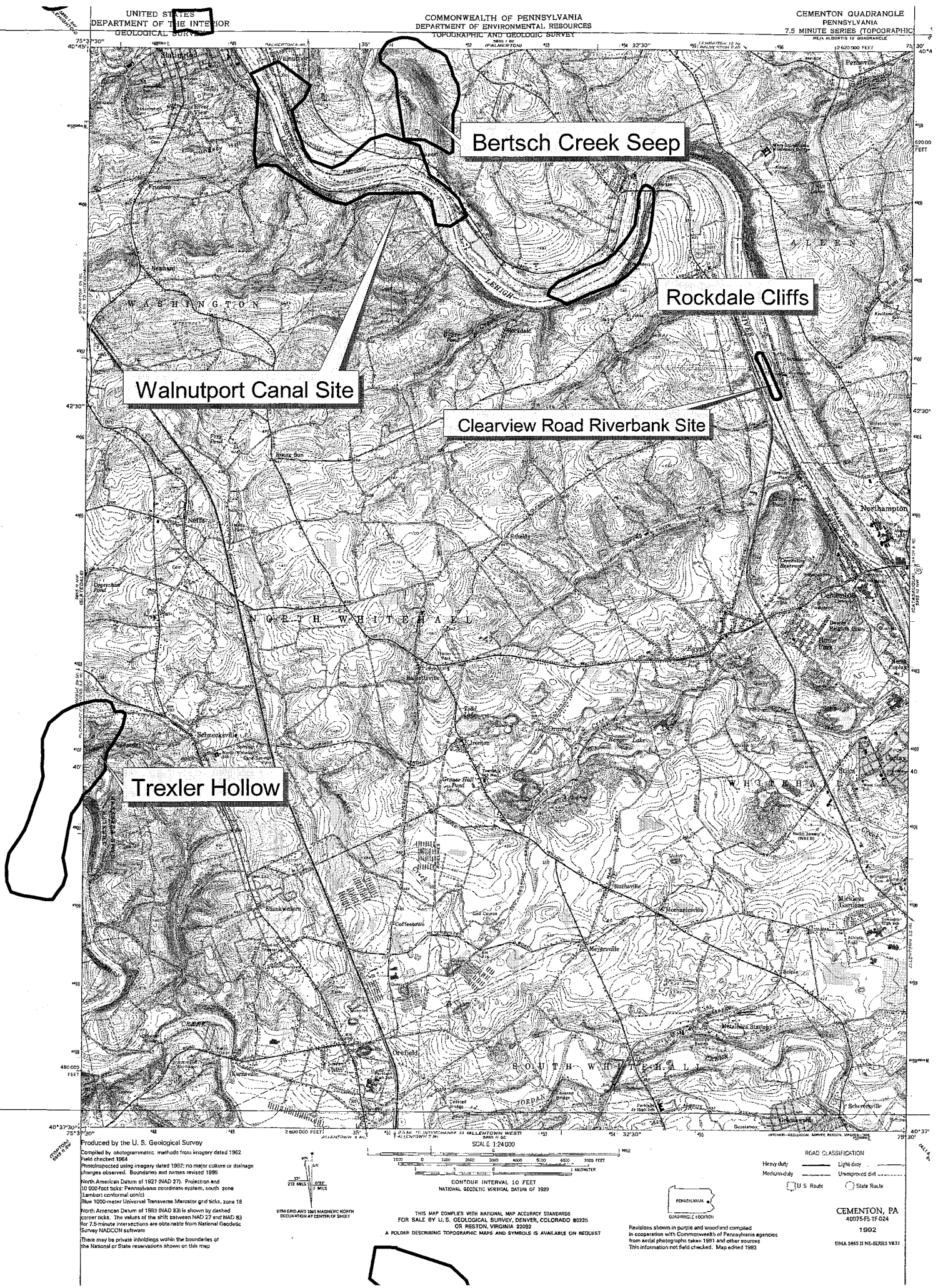
Site Name	Special Species / Community Type	PNHP Ranks*		State Status	Last Seen	Quality**	EO NUMBER
		Global	State				
Bertsch Creek Seep	**Goldenclub (*Orontium aquaticum*)**	**G5**	**S4**	**Delisted**	**5/9/91**	**C**	**SP536**
Clearview Road Riverbank Site	Baltic Rush (*Juncus arcticus var. littorali*)	G5T5	S2	PT	7/17/97	C	SP505
	Virginia Rose (*Rosa virginiana*)	G5	S1	TU	7/17/97	B	SP505
Rockdale Cliffs	Ebony Sedge (*Carex eburnea*)	G5	S1	PE	6/4/97	B	SP501
Trexler Hollow	Western Hairy Rock-Cress (*Arabis hirsuta*)	G5	S1	PE	5/16/97	C	SP518
	Round-head Gayfeather (*Liatris scariosa*)	G5?	S2	N	9/10/98	C	
Walnutport Canal Site	**Virginia Rose (*Rosa virginiana*)**	**G5**	**S1**	**TU**	**6/21/94**	**C**	**SP534**

Locally Significant: None

Managed Areas: Jordan Creek Parkway, Lehigh River-Scenic River, Trexler-Lehigh County Game Preserve

Other: sp508, see also SP508 on the Slatedale Quad

* Please refer to Appendix IV for an explanation of PNHP Ranks and State Status.
**Please refer to Appendix V for an explanation of Quality Ranks.
***Bold= indicates change in site since original report was written in 1999**.



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
TOPOGRAPHIC AND GEOLOGIC SURVEY

CEMENTON QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

Produced by the U. S. Geological Survey

Compiled by photogrammetric methods from imagery dated 1962
Field checked 1964
Photoinspected using imagery dated 1992; no major culture or drainage changes observed. Boundaries and names revised 1995

North American Datum of 1927 (NAD 27). Projection and 10 000-foot ticks: Pennsylvania coordinate system, south zone (Lambert conformal conic)
Blue 1000-meter Universal Transverse Mercator grid ticks, zone 18

North American Datum of 1983 (NAD 83) is shown by dashed corner ticks. The values of the shift between NAD 27 and NAD 83 for 7.5-minute intersections are obtainable from National Geodetic Survey NADCON software

There may be private inholdings within the boundaries of the National or State reservations shown on this map

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1985 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225
OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION
Heavy duty — Light duty
Medium-duty — Unimproved dirt
U.S. Route — State Route

PENNSYLVANIA
QUADRANGLE LOCATION

Revisions shown in purple and woodland compiled in cooperation with Commonwealth of Pennsylvania agencies from aerial photographs taken 1991 and other sources
This information not field checked. Map edited 1993

CEMENTON, PA
40075-F5-TF-024
1992

DMA 5865 II NE-SERIES V832

CEMENTON USGS QUADRANGLE

BERTSCH CREEK SEEP (Lehigh Twp.) **SP536 – UPDATE-**
This site is located in a forested stream ravine along Bertsch Creek. The lower reaches of the creek run along the bottom of a moderately steep forested slope and contain segments of rock outcrop and groves of hemlock. A seep-derived tributary of the creek supports a fair quality population of **Goldenclub (*Orontium aquaticum*), a recently delisted plant species**. Disturbances at the site are minimal. Leaving this site in its current condition will help the rare plant persist here. This area will be dropped from the county site list but will remain on the locally significant list for Northampton County.

CLEARVIEW ROAD RIVERBANK SITE (North Whitehall Twp.) **SP505a, SP505b** - This site consists of a forested strip of riverbank along the shore of the Lehigh River. This stretch of riverbank is influenced by scouring from flooding and ice and includes varying segments of rock outcrops, stunted trees and shrubs, and mixed herbs growing on alluvial sediments. The site supports populations of two plant species of special concern. One is a good population of **Virginia Rose (*Rosa virginiana*)**, a SU shrub species and the other is a fair population of **Baltic Rush (*Juncus arcticus var. littoralis*)**, a PA-Threatened graminoid species. Associated species include spiraea (Spiraea latifolia), sycamore (Platanus occidentalis), willow (Salix spp.), river birch (Betula nigra), fringed loosestrife (Lysimachia ciliata), and sensitive fern (Onoclea sensibilis). Purple loosestrife (Lythrum salicaria) is also common along the rivershore and may threaten the occurrences of the two species of concern if it becomes dominant. Extensive suitable habitat for both of these species occurs along the river, particularly upstream. Further surveys are encouraged to determine the full extent of these populations. Maintaining the forest buffer along this stretch of the river will benefit the rare plants that occur here and other more common plants and animals that depend on riparian habitat for survival.

ROCKDALE CLIFFS (North Whitehall Twp.) **SP501** - This site supports a good population of **Ebony Sedge** (***Carex eburnea***), a PA-Endangered plant species. The site consists of sparsely vegetated vertical cliffs of the Martinsburg formation. Groundwater seepage and a northern exposure help keep the cliffs moist for part of the growing season and the resultant micro-climate may help this species to survive here. Associated species include bulblet fern (Cystopteris bulbifera), zigzag goldenrod (Solidago flexicaulis), and wild columbine (Aquilegia canadensis). Trees growing on the dry cliff top include chestnut oak (Quercus prinus), sweet birch (Betula lenta), and ash (Fraxinus spp.). Trees along the bottom of the cliff, adjacent to an abandoned rail line, are primarily opportunistic species that have colonized the disturbed rail corridor. They include box-elder (Acer negundo), Norway maple (Acer platanoides), ash, and sycamore (Platanus occidentalis). This site falls in the middle of a 2 mile stretch of forested slope on the south side of the Lehigh River. This forest is relatively mature and includes ravines and moist north facing slopes as well as many outcrops and cliffs with drier forest associations occurring above them. It is excellent habitat for a variety of nesting and migrating birds as well as for reptile and amphibian species. Maintaining large contiguous forested tracts such as this along the county's waterways will be an important step in helping to minimize the loss of natural diversity from the county. Limiting further human caused disturbances along the rail corridor, on the slopes, and on the floodplain of the river at this site will help prevent more extensive colonization of the cliffs and forests by exotic plant species.

TREXLER HOLLOW (North Whitehall & Lowhill Twps.) **SP518, sp508** - A roadside outcrop of Martinsburg shale supports two plant species of concern. A fair population of **Western Hairy Rock-Cress (*Arabis hirsuta*)**, a Pennsylvania-Endangered plant species, occurs on north and northwest-facing moist cliffs along with wild columbine (Aquilegia canadensis), alum-root (Heuchera americana), early saxifrage (Saxifraga virginiensis), and fern species. A fair population of **Round-head Gayfeather (*Liatris scariosa*)**, an plant species of concern, occurs nearby on a sunnier, steep west-facing shaly slope. Associated species

include goldenrod (Solidago spp.), wild columbine, and phlox (Phlox spp.). Both species of concern occupy only a narrow band of suitable habitat; road construction and roadside or powerline spraying are potential threats. Further surveys are recommended to determine if the populations of these species are more widespread.

WALNUTPORT CANAL SITE (Walnutport Borough, North Whitehall Township, Washington Township, Lehigh Township, Lehigh and Northampton Counties)
This site contains a fair population of **Virginia Rose (*Rosa virginiana*)**, an S1 Pennsylvania plant species of concern. This site consists of a canal and adjacent banks, and a strip of woods between the towpath and the river. Associated species include Sensitive Fern (*Onoclea sensibilis*), Southern Arrow-wood (*Viburnum dentatum*), Virginia Creeper (*Parthenocissus quinquefolia*), and Wild Grape (*Vitis spp*.).

This site also contains historical plant records in Lockport Marsh and some areas along the river. An undetermined record of **Autumn Willow (*Salix serissima*),** an S2 Pennsylvania plant species of concern, was reported but could not be confirmed. Historical plant records along this area include possible specimens of Waterhemp Ragweed (*Amaranthus cannabinus*), an S3 plant species of concern, and Narrow False Oats (*Trisetum spicatum*), an S1 plant species of concern.

Threats and Disturbances
Low recreational use such as walking the path and fishing are disturbances. The mowed towpath is a threat. Exotic species are a threat to the integrity of the marsh. Woody plants could succeed over the herbaceous species in the marsh.

Recommendations
It is recommended that maintenance workers that mow the path are aware of the element occurrence and the threats associated with it.

EAST GREENVILLE USGS QUAD MAP

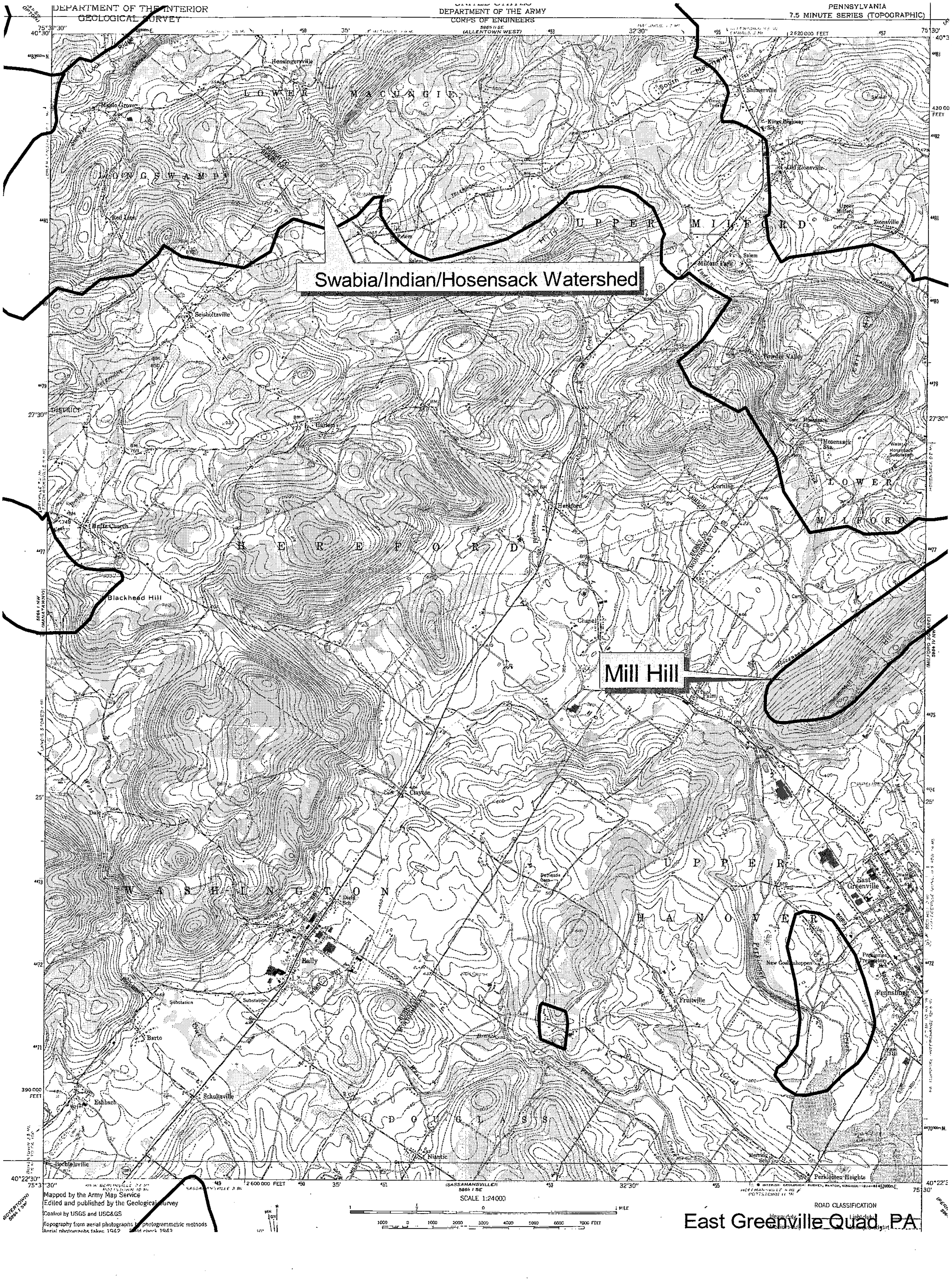
Site Name	Special Species / Community Type	PNHP Ranks*		State Status	Last Seen	Quality**	EO NUMBER
		Global	State				
Swabia/Indian/Hosensack Watershed (formerly Hosensack Marsh, Indian Creek Floodplain and Macungie Watershed)	Animal	G3	S2	PE	6/5/97	BC	SA501
	White-Trout Lily (*Erythronium albidum*)	**G5**	**S3**	**N**	**4/20/01**	**BC**	**NEW**
	Animal	G3	S2	PE	1996	E	SA531
	Northern Appalachian Circumneutral Seep NC	G?	S3?	N	6/26/97	C	NC563
	Animal	**G3**	**S2**	**PE**	**2000**	**E**	**NEW**

Locally Significant: Mill Hill

Managed Areas: Alburtis Borough Watershed, Seem Seed Tract #2-Lehigh County

Other: nc563-see Allentown West Quadrangle NC563
nc505- see Milford Square quadrangle NC505

* Please refer to Appendix IV for an explanation of PNHP Ranks and State Status.
**Please refer to Appendix V for an explanation of Quality Ranks.
***Bold= indicates change in site since original report was written in 1999**.


DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
Swabia/Indian/Hosensack Watershed
Mill Hill
LOWER MACUNGIE
LONGSWAMP
UPPER MILFORD
LOWER MILFORD
HEREFORD
WASHINGTON
UPPER HANOVER
DOUGLASS
Seisholtzville
Blackhead Hill
Hereford
Clayton
Bally
Barto
Eshbach
Schultzville
Niantic
Fruitville
East Greenville
Pennsburg
Powder Valley
Hosensack
Corning
Zionsville
Shimerville
Old Zionsville
Perkiomen Heights
Bechtelsville
Mapped by the Army Map Service
Edited and published by the Geological Survey
Control by USGS and USC&GS
SCALE 1:24000
ROAD CLASSIFICATION
East Greenville Quad, PA

EAST GREENVILLE USGS QUAD

MILL HILL (Lower Milford Twp., Upper Hanover Twp., Montgomery Co.) - This **locally significant site** is a several mile long diabase ridge which is partly in both Lehigh and Montgomery Counties. It has extensive second growth forest with good potential for several plant species of special concern. Forests on the lower slopes may include American beech (Fagus grandifolia), tulip poplar (Liriodendron tulipifera), sugar maple (Acer saccharum), basswood (Tilia americana), ash (Fraxinus spp.), hickories (Carya spp.), white oak (Quercus alba), and red oak (Q. rubra). Herb diversity in lower slope forests can be very rich with horse-balm (Collinsonia canadensis), may-apple (Podophyllum peltatum), sweet cicely (Osmorhiza claytonii), black cohosh (Cimicifuga racemosa), and numerous species of fern all being common. Upper slope areas support a less species rich forest which is dominated by chestnut oak (Quercus prinus), sweet birch (Betula lenta), tulip poplar, and red oak. The substrate at these higher elevations may include extensive areas of large diabase boulders and outcrops. Witch-hazel (Hamamelis virginiana), flowering dogwood (Cornus florida), choke cherry (Prunus virginiana), and maple-leaved viburnum (Viburnum acerifolium) are common shrubs. Herb diversity on the upper slopes is not as rich as the lower slopes but it is still significant with fern species including common polypody, walking fern, and marginal shield fern, and herb species including dolls eyes (Actaea pachypoda), climbing fumitory (Adlumia fungosa), ricegrass (Oryzopsis racemosa), and wild columbine (Aquilegia canadensis). A tributary of Hosensack Creek flows along the base of the northwestern slope of the hill. Seeps may occur on the lower slopes of the hill and run into the creek. Numerous plant and animal species depend on the variety of habitats provided by these forests and associated riparian areas. Some portions of this site have been selectively logged in the recent past. This area will be best managed by retaining its forested condition and preventing further fragmentation that may be caused by roads, right-of-ways, and development. The majority of the Montgomery County portion of this site has been acquired by Upper Hanover Township and has been designated for conservation and recreation purposes.

SWABIA/INDIAN/HOSENSACK WATERSHED (formerly Hosensack Marsh, Indian Creek Floodplain and Macungie Watershed) (Upper Milford, Lower Milford & Lower Macungie Twps.; Allentown West and Milford Square Quads)

One site within this watershed includes areas of floodplain forest and open marsh along the floodplain of Indian Creek. The forest is dominated by a mix of American elm (*Ulmus americana*), Ash (*Fraxinus sp*.), Pin Oak (*Quercus palustris*), Tulip Poplar (*Liriodendron tulipifera*), and Hickory (*Carya sp*.). There is dense Spicebush (*Lindera benzoin*) in the understory. The marsh is dominated by cattail (*Typha latifolia*), strict sedge (*Carex stricta*), jewel weed (*Impatiens capensis*), willow herb (*Epilobium sp*.), and bulrush (*Scirpus cyperinus*). Evidence of a **PA-Endangered animal species** was observed at this site in 1996. This site was discovered late in the process of developing this report and has not been fully investigated. Surveys to determine the status of the species of concern at this site are highly recommended.

Another site within this watershed includes areas of marsh and shrub swamp part of the site has been disturbed by the construction of an electric power transfer station and associated powerline ROW. Some of the habitat created by these disturbances may be benefiting the rare species that occurs here. The site supports a fair to good example of an animal species of concern. A plant species of concern was also found in a swamp forest near this site in 2001. Associated species include Red Trillium (*Trillium erectum*), Skunk Cabbage (*Symplorocarpus foetidus*), Violets (*Viola spp*.), Rattlesnake Root (*Prenanthes spp*.), spicebush (*Lindera benzoin*), Garlic-Mustard (*Allaria petiola*), Musclewood (*Carpinus carolinana*), Red Maple (*Acer rubrum*), and Black Birch (*Betula lenta*). Current disturbances are minor, however it is crucial to maintain the surface hydrology of the site for this rare plant species.

A third site is located on the mid slope of a north facing forested hill due south of Macungie. The site is dominated by a second growth mixed hardwood forest, which consists primarily of a mix of tulip poplar (*Liriodendron tulipifera*), yellow birch (*Betula alleghaniensis*), red oak (*Quercus rubra*), and red maple (*Acer rubrum*). The site includes a fair to good quality Northern Appalachian Circumneutral Seeps Natural Community. The seeps occur in sloping areas where diffuse groundwater flow intersects the soil surface. Seep derived vegetation associations occur in many broad patches interspersed with upland forest across the slope. Common shrubs of the seeps include spicebush (*Lindera benzoin*), witch-hazel (*Hamamelis virginiana*), with lessor amounts of elderberry (*Sambucus sp*.) and winterberry (*Ilex verticillata*). Dominant herbaceous species in this relatively diverse natural community include cinnamon fern (*Osmunda cinnamomea*), New York fern (*Thelypteris noveboracensis*), and lady fern (*Athyrium filix-femina*), as well as skunk cabbage (*Symplocarpus foetidus*). Also common are a variety of sedges (*Carex spp*.), voilets (*Viola spp*.), and other ferns. The seeps are excellent habitat for certain amphibian and aquatic invertebrate species. Ebony jewelwing damselflies (*Calopteryx maculata*) and bullfrogs (*Rana catesbeiana*) were observed at the site during our survey. The seeps have the potential to support several state plant species of concern though none were observed during our surveys.
Logging and increased amounts of exotic species are threats to the quality of this site. Trails, especially those for mountain biking should be prevented from crossing through or near the seepage areas.

Although this site has experienced a variety of disturbances such as historical logging, plantings of spruce, and road construction for the reservoir, preventing further disturbances and forest fragmentation on this slope will benefit the seeps Natural Community as well as all the native plants and animals that depend on this area to support some aspect of their life cycles.

Threats and Disturbances
No threats and disturbances are apparent to the **White Trout Lily** population, but maintaining the surface hydrology is essential to perpetuation of the habitat; some trees have been removed over the years.
For the **animal species of concern**, Maintenance operations and hydrology changes are disturbances and possible threats. Exotic plant species may alter the hydrology of the wetland. However, the designation of the marsh as a unique natural area may protect it from being driven over in the future.

<u>Recommendations</u>
It is recommended that forested buffers be used to protect the ecological integrity of the wetlands where the animal species of concern is found. More surveys are encouraged to determine the population and habitat use of the species.
For the White Trout Lily population, it is recommended that a forested buffer be placed around the wetland to protect the hydrology and ecological integrity of the plant species.

EASTON USGS QUADRANGLE MAP

Site Name	Special Species / Community Type	PNHP Ranks*		State Status	Last Seen	Quality**	EO NUMBER
		Global	State				
Easton Bluff	**Ebony Sedge (*Carex eburnea*)**	**G5**	**S1**	**PE**	**7/23/98**	**BC**	**SP530**
Frost Hollow Overlook	**Animal**	**G5**	**S?**	**N**	**6/18/94**	**E**	**SA576**
Frya Run Watershed (Formerly Hexenkopf Slopes, Hexenkopf Wetlands, Hexenkopf Rock (Erosional remnant), and Mariton Slopes	Animal	G3	S2	PE	1996	E	SA572
	Animal	G3	S2	PE	1998	E	
	Showy Goldenrod (*Solidago speciosa var. speciosa*)	G5T5?	SR	N	9/27/98	C	SP574
Morgan Hill	**Nodding Trillium (*Trillium cernuum*)**	**G5**	**S3**	**N**	**7/24/01**	**C**	**NEW**
Getters Island	**Animal**	**G5**	**SH?**	**N**	**8/19/97**	**H**	**SA577**
	Animal	G3G4	S3S4	N	8/19/97	E	SA577
	Animal	**G5**	**S3S4**	**Delisted**	**8/19/97**	**E**	**SA577-DL**
Island Park	American Lotus (*Nelumbo lutea*)	G4	S1	PE	7/26/97	B	SP579
Old Sow Island	Appalachian Sand Cherry (*Prunus pumila var. depressa*)	G5T5	S1	N	8/15/86	B	SP524
Raubsville Lock 22-23-Delaware River	Animal	G3G4	S2	N	6/18/94	E	SA575

Whipporwill Island	Appalachian Sand Cherry (*Prunus pumila var. depressa*)	G5T5	S1	N	8/19/97	BC	SP526
	Big Bluestem-Indian Grass River Grassland	**G?**	**S3**	**N**	**9/11/00**	**AB**	**NEW**

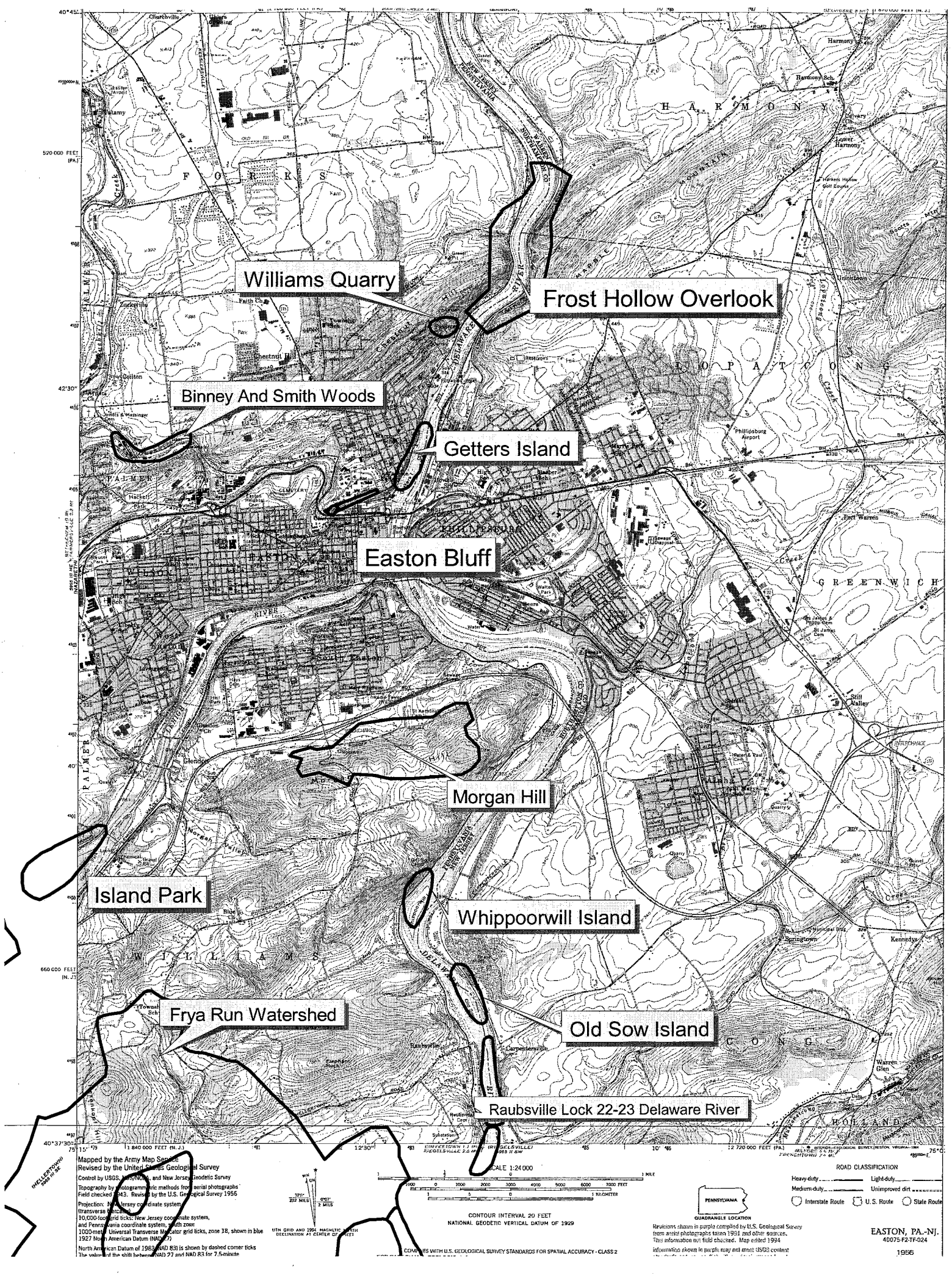
Williams Quarry	Geologic Feature	G?	S?	N	N/A		

Locally Significant: Delaware River, Binney and Smith Woods

Managed Areas: Binney-Smith Preserve, Hugh Moore Park, Lehigh River-Scenic River, Riverview Park, Wy-Hit-Tuk County Park

Other: Bushkill Creek, HQ-CWF/EV waters, Williams Quarry

* Please refer to Appendix IV for an explanation of PNHP Ranks and State Status.
**Please refer to Appendix V for an explanation of Quality Ranks.
*****Bold= indicates change in site since original report was written in 1999**.


Williams Quarry
Frost Hollow Overlook
Binney And Smith Woods
Getters Island
Easton Bluff
Morgan Hill
Island Park
Whippoorwill Island
Frya Run Watershed
Old Sow Island
Raubsville Lock 22-23 Delaware River
H A R M O N Y
F O R K S
P A L M E R
E A S T O N
W I L L I A M S
G R E E N W I C H
L O P A T C O N G
C O N G
Mapped by the Army Map Service
Revised by the United States Geological Survey
Control by USGS, NOS/NOAA, and New Jersey Geodetic Survey
Topography by photogrammetric methods from aerial photographs
Field checked 1953. Revised by the U.S. Geological Survey 1956
Projection: New Jersey coordinate system (transverse Mercator)
10,000-foot grid ticks: New Jersey coordinate system, and Pennsylvania coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 18, shown in blue
1927 North American Datum (NAD 27)
North American Datum of 1983 (NAD 83) is shown by dashed corner ticks
SCALE 1:24 000
CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
ROAD CLASSIFICATION
Heavy-duty
Light-duty
Medium-duty
Unimproved dirt
Interstate Route
U.S. Route
State Route
PENNSYLVANIA
QUADRANGLE LOCATION
EASTON, PA.-NJ.
40075-F2-TF-024
1956

EASTON USGS QUADRANGLE MAP

EASTON BLUFF (Easton Borough) **SP580 – UPDATE-Polygon revision**-
This site is a northwest facing sparsely vegetated limestone cliff. It is found in a highly developed section of the City of Easton. It supports a relatively large population of **Ebony Sedge (*Carex eburnea*)**, a PA-Endangered sedge species. This species was first identified in this area in the 1800's and has not been relocated since 1921. It was successfully relocated in July of 1998. The area immediately surrounding the site has received significant disturbances over the years and much of the vegetation currently found at the site is non-native. Common non-native species include Norway maple (Acer platanoides), tree of heaven (Ailanthus altissima), and privet (Ligustrum spp.). Despite the dominance of the non-natives, natives including woody species such as slippery elm (Ulmus rubra), hop-hornbeam (Ostrya virginiana), basswood (Tilia americana), and ninebark (Physocarpus opulifolius) and herbaceous species such as zigzag goldenrod (Solidago flexicaulis), wild columbine (Aquilegia canadensis), harebell (Campanula rotundifolia), and purple cliff-brake (Pellaea atropurpurea) all still persist at the site. Leaving this site in its current condition will probably allow the rare species to continue to survive here.

FROST HOLLOW OVERLOOK (Forks Township**)**
Three adults of an **animal species of concern** were found at an overlook of the Delaware River. The type of habitat where this species was seen was rapids and pools; bottom sediments with silt, gravel, with some bedrock; bank type - gently sloping sandy silt, and large rocks. Associated species included Black-shouldered Spinyleg (*Dromogomphus spinosus*), Rusty Snaketail (*Ophiogomphus rupinsulensis*), Rapids Clubtail (*Phanogomphus quadricolor*), Umber Shadowdragon (*Neurocordulia obsolete*), and Stygian Shadowdragon (*Neurocordulia yamaskanensis*).

Threats and Disturbances
Hydrological changes to the river could affect this species foraging and breeding habitat.

Recommendations
More surveys should be conducted in order to assess the population of this species and its foraging and breeding habitats.

FRYA RUN WATERSHED Formerly Hexenkopf Slopes, Hexenkopf Wetlands, Hexenkopf Rock (Erosional remnant), and Mariton Slopes (Williams Twp.; Hellerton, Nazareth and Easton Quads, Bucks County) *SA572, GE529, Solidago speciosa, erosional remnant*-
This site includes a variety of habitat types. A **G3 animal species of concern** was discovered using a series of wetlands and seepy forest that occur along a tributary to Frya Run. These wetlands are dominated by shrubs, sedges (*Carex spp*.), and sweetflag (*Acorus calumus*). The animal was observed at this site as recently as 1995. Surveys in 1998 were unsuccessful but only a small portion of the area was surveyed. During the 1998 surveys it was determined that suitable habitat still exists but it is marginal. Better habitat may occur elsewhere in the vicinity. Further surveys are recommended to determine if this species still occurs here. Avoiding disturbance to these wetlands and the adjacent forest should help keep this habitat in reasonable condition.
Hexenkopf hill is a broad southeast facing forested slope. The summit of the ridge is a hilltop outcrop of Pochuck gneiss, one of the oldest rocks in North America. The rock also contains the mineral magnetite (Geyer and Bolles 1979). Areas adjacent to the summit have large and small boulders making up the substrate. Common tree species include tulip poplar (*Liriodendron tulipifera*), sweet birch (*Betula lenta*), oaks (*Quercus spp*.), and hickories (*Carya spp*.). Witch-hazel (*Hamamelis virginiana*) and spicebush (*Lindera benzoin*) are common shrubs. Herb diversity is moderate with greater numbers of species being found further down slope. The site also includes several seeps and at least one vernal pool.

These wetland areas support numerous plant species and are home to many animals as well. Upland areas on the slope have long been known as nesting areas for both black vultures (*Coragyps atratus*) and turkey vultures (*Cathartes aura*). Although portions of the site have been selectively logged and it is currently bissected by a large powerline right-of-way, there are a variety of habitat types here and there is potential for several species of special concern. Retaining the forest in an unfragmented condition will benefit the numerous species that make their homes here as well as those that use this area for migration. The Mariton Slopes are a series of forested slopes and shaded escarpments above the Delaware River. The steepest portion of the slopes are dominated by red oak (*Quercus rubra*), chestnut oak (*Quercus prinus*), sweet birch (*Betula lenta*), and red maple (*Acer rubrum*) with scattered stands of hemlock (*Tsuga canadensis*). These areas consist of many vertical rock faces interspersed with narrow ravines. These cool heavily shaded outcrops are good habitat for numerous fern species as well as spring wildflowers. Rhododendron (*Rhododendron maximum*) is very common on these slopes and extends in dense thickets far upslope. The forest on the crest of the slope is less diverse with large tulip poplar (*Liriodendron tulipifera*) dominating the canopy. A predominance of tulip poplar indicates that the site has a history of logging because tulip poplar requires forest openings to germinate. It grows faster than other trees and eventually dominates a site. As the forest matures, however, shade-tolerant species (such as red oak) replace tulip poplar because it does not regenerate under a closed canopy (Tryon 1980). Wildflowers are abundant on the upper slope but exotic species such as garlic mustard (*Alliaria officinalis*), wineberry (*Rubus phoenicolasius*), and Japanese honeysuckle (*Lonicera japonica*) are also common. A plant species of concern was found here in 1998. The plant is growing in a grassy area along a path. Associated species include assorted grasses and forbs, early goldenrod (*Solidago juncea*) and poison-ivy (*Toxicodendron radicans*). Overall, this site includes numerous habitat types and is an asset to the biological diversity of the greater Delaware River corridor.

GETTERS ISLAND (Easton Borough) **SA556, SA577** – **UPDATE-**
This site has evidence of **two animal species of concern**, and **one delisted former animal species of concern**. This site is a narrow much scoured island occurring in the Delaware River just north of the confluence of the Delaware River and Bushkill Creek. The river on both sides of the island is characterized by riffles flowing over cobbles and gravel. This stretch of the river supports two animal species of concern. Evidence of both animals was observed during 1997 field surveys though no living individuals were found. Further surveys are encouraged to determine the size and extent of these animal populations. This stretch of the river also has potential for several other animal species of concern that may also be targeted in future surveys.

ISLAND PARK (Easton) **SP579 -** This site is one of several forested islands located in the stretch of the Lehigh River between Bethlehem and Easton. The forest on this island is a young to moderately aged second growth mix of sycamore (Platanus occidentalis), black walnut (Juglans nigra), river birch (Betula nigra), box elder (Acer negundo), hickory (Carya spp.), and red oak (Quercus rubra). Spicebush (Lindera benzoin), black-haw (Viburnum prunifolium), and silky dogwood (Cornus amomum) are common shrubs. The island appears to have been disturbed in the past including some excavation. The island interior includes a 5 to 10-acre slough known as "The Gut." This isolated emergent marsh wetland supports a wide diversity of plant and animal species including a large good quality population of **American Lotus (*Nelumbo lutea*),** a PA-Endangered plant species. The site has potential for other species of concern and further surveys are recommended. All of the forested islands and adjacent forested floodplains and upland slopes along this stretch of the Lehigh River, roughly from just east of Steel City to just west of West Easton, remain in a relatively isolated condition in an otherwise well-developed landscape. The size of this unbroken river corridor habitat makes it an important natural resource. Allowing these historically disturbed forests and wetlands to mature without further disturbance would benefit the preservation of diversity in the county. The area has the potential for recolonization by both osprey (Pandion haliaetus) and bald eagles (Haliaetus leucocephalus), as well as a variety of neotropical migrant bird species. This segment of the

river has been designated as the location for the crossing of the Route 33 extension. Should the Route 33 extension be constructed through this area we strongly recommend that access to the Lehigh River not be enhanced as part of the project. Limiting new access in this corridor to foot traffic will greatly enhance the likelihood of its remaining one of the wildest and most diverse areas in the southern part of the county. The endangered plant species is listed as **SP533** on the Nazareth quadrangle.

MORGAN HILL (Williams Township)
This site contains a fair quality population of **Nodding Trillium (*Trillium cernuum*)**, an S3 plant species of concern. The site is described as a rocky forested hill and an extensive early successional old fields. Associated species include Spicebush (*Lindera benzoin*), White Ash (*Fraxinus americana*), Norway Maple (*Acer platanoides*), Ash-leaved Maple (*Acer negundo*), Enchanter's Nightshade (*Circaea lutetiana*), Garlic Mustard (*Alliaria petiolata*), Sassafras (*Sassafras albidum*), Black Birch (*Betula lenta*), Bloodroot (*Sanguinaria cana*densis), Black Cohosh (*Cimicifuga racemosa*), Liverleaf (*Hepatica nobilis var. obtusa*), Wineberry (*Rubus phoenocolasius*), Life-of-man (*Aralia racemosa*), May-apple (*Podophyllum peltatum*), Stoneroot (*Collinsonia canadensis*), Lopseed (*Phryma leptostachya*), False Solomon's-seal (*Smilacina racemosa*), and Moonseed (*Menispermum canadense*). Currently the site is unused and surrounded by residential areas, a small community park, forest, and a highway.

Threats and Disturbances
Threats and Disturbances include development and resulting fragmentation, further spread of invasive, exotic species; in the woods are traces of stone walls, an old well woods roads, the early successional old fields were farmed until recently.

Recommendations
This area would be best protected by decreasing fragmentation in and around the forest that can lead to the further spread of invasive plant species. Further surveys in the area are encouraged to better assess the population of the species in the area.

OLD SOW ISLAND (Williams Twp.) **SP524** - This site is located on an island in the Delaware River adjacent to Raubsville. The island includes two primary habitat types. One is the higher elevation forested portion which is infrequently flooded and occurs on the downstream portion of the island. The other habitat type, located on the upstream half of the island, has a substrate of sand, gravel and cobble. This habitat is characterized by seasonal scouring from ice and flood waters. Vegetation consists of dense patches of shrubs and stunted trees such as sycamore (Platanus occidentalis), ash (Fraxinus spp.), and sandbar willow (Salix spp.) interspersed with small open areas dominated by robust herbs and vines such as sneezeweed (Helenium autumnale) and frost grape (Vitis riparia), as well as many exotics including purple loosestrife (Lythrum salicaria), soapwort (Saponaria officinalis), and crown-vetch (Coronilla varia). The scoured upper end of this island supports a good quality population of **Appalachian Sand Cherry (*Prunus pumila var. depressa*)**, a PA-Rare plant species. This species was last observed at this site in 1986. A survey during the 1997 field season failed to relocate the population. It is possible that the species still occurs here but was missed during the 1997 survey due to the island's dense vegetation. The island is also good habitat for bird species such as osprey and herons. Leaving this site in its current condition will best benefit the species that depend on it.

RAUBSVILLE LOCK 22-23 - DELAWARE RIVER (Williams Twp.) **SA575** - This stretch of the Delaware supports an animal species of special concern. Evidence of this species was observed during 1994 field surveys, though no living individuals were seen. Further surveys are encouraged to determine the extent and quality of this occurrence. Pollutants and excessive sedimentation are threats to this species.

WHIPPOORWILL ISLAND (Williams Twp.) **SP526** –
This site is located on an island in the Delaware River. The island includes two primary habitat types. One is the higher elevation forested portion that is infrequently flooded, has deep alluvial soil, and occurs on the downstream half of the island. The other habitat type, located primarily on the upstream half of the island, is at a slightly lower elevation with a substrate of sand, gravel and cobble. This habitat is characterized by seasonal scouring from ice and flood waters. This habitat is characterized as a good to excellent quality **Big Bluestem-Indian Grass River Grassland, an S3 Pennsylvania community of concern**. Associated species included Poison Ivy (*Toxicodendron radicans*), Switch-Grass (*Panicum virgatum*), Big Bluestem (*Andropogon gerardii*), Sandbar Willow (*Salix exigua*), Frost Grape (*Vitis riparia*), Multiflora Rose (*Rosa multiflora*), Late Eupatorium (*Eupatorium serotinum*), False-Indigo (*Amorpha fruticosa*), Bouncing-bet (*Saponaria officinalis*), and Northern Dewberry (*Rubus flagellaris*). Other vegetation consists of linear patches of shrubs and stunted trees such as sycamore (*Platanus occidentalis*), ash (*Fraxinus spp.*), interspersed with open areas dominated by herbs, vines, and grasses such as common sneezeweed (*Helenium autumnale*), and many exotics including purple loosestrife (*Lythrum salicaria*), and crown-vetch (*Coronilla varia*). The margin of the upstream portion of the island (particularly in the late season) is mostly unvegetated gravel and cobbles with a few scattered weedy species. The scoured upper end of this island supports a fair to good quality population of **Appalachian Sand Cherry (*Prunus pumila var. depressa*), an S1 Pennsylvania plant species of concern**. The island is also good habitat for bird species such as osprey (*Pandion haliaetus*) and herons.

Threats and Disturbances
The main threat to this interesting island community is the spread of non-native invasive plant species that threaten the ecological integrity of the site. Flooding is a natural disturbance that occurs periodically and restricts the vegetation that thrives in this area.

Recommendations
Leaving this site in its current condition will help the rare plant persist here.

BINNEY AND SMITH WOODS (Palmer Twp.) - This **locally significant area** supports a relatively mature undisturbed forest. This 100 to 150 year old stand of trees is located on a northeast facing slope above Bushkill Creek. It has a good diversity of trees and shrubs with red oak (Quercus rubra), sweet birch (Betula lenta), American beech (Fagus grandifolia), , and tulip poplar (Liriodendron tulipifera) being most common in the overstory and witch-hazel (Hamamelis virginiana), spicebush (Lindera benzoin), maple-leaved viburnum (Viburnum acerifolium), bladdernut (Staphylea trifolia), and gooseberry (Ribes sp.) all common in the understory. The site also supports a wide diversity of herbs and ferns such as wild ginger (Asarum canadense), black cohosh (Cimicifuga racemosa), and rattlesnake fern (Botrychium virginianum). The site is excellent habitat for a variety bird species which prefer riparian corridors. It also has boulders and rock out crops on the upper part of the slope that are good habitat for reptiles and amphibains. This woodland, which is one of few remaining woodlands along the lower reaches of Bushkill Creek, is probably the best quality woodland remaining in Forks Township. It would benefit local species diversity greatly to retain this woodland in an undisturbed condition. Maintaining this site as forest would be a good step toward restoring the lower Bushkill to a more ecologically viable system. This tract as well as other nearby woods along the Bushkill to the east would make an excellent addition to Hackett Park.

DELAWARE RIVER is an excellent recreational and scenic resource; it includes many current and historical records for species of special concern. The river and adjacent forested watersheds comprise one of the major corridors for the movement of biota in central Pennsylvania.

WILLIAMS QUARRY (Easton) **GE540** - This site is a well-known mineral collecting area. The major mineralization took place in the Precambrian period. Much of the limestone has been recrystallized into marble (Geyer and Bolles 1979).

HELLERTOWN US QUADRANGLE

Site Name	Special Species / Community Type	PNHP Ranks*		State Status	Last Seen	Quality**	EO NUMBER
		Global	State				
Focht Hill Vernals	**Herbaceous Vernal Pond Natural Community**	**G?**	**S3S4**	**N**	**8/11/00**	**B**	**NEW**
	Nodding Trilium (*Trillium cernuum*)	**G5**	**S3**	**N**	**6/30/00**	**AB**	**NEW**
Frya Run Watershed (Formerly Hexenkopf Slopes, Hexenkopf Wetlands, Hexenkopf Rock (Erosional remnant), and Mariton Slopes)	Animal	G3	S2	PE	1996	E	SA572
	Animal	G3	S2	PE	1998	E	
	Showy Goldenrod (*Solidago speciosa var. speciosa*)	G5T5?	SR	N	9/27/98	C	SP574
Granite Hill	**Herbaceous Vernal Pond Natural Community**	**G?**	**S3S4**	**N**	**4/22/00**	**BC**	**NEW**
	Birch/Black Gum Rocky Slope Woodland	**G?**	**S2**	**N**	**5/9/00**	**AB**	**NEW**
Hellertown Marsh	**An ant (*Lasius minutis)***	**G?**	**S?**	**N**	**8/26/97**	**E**	**SA527**
	A sedge (*Carex tetanica*)	G4G5	S2	PT	8/26/97	B	SP527
	Highbush Cranberry (*Viburnum trilobum*)	G5T5	S3S4	TU	6/3/91	D	SP522
	Prairie Sedge (*Carex prairea*)	G5	S2	PT	6/10/97	B	SP522
Hellertown Reservoir Area Vernals	**Herbaceous Vernal Pond Natural Community**	**G?**	**S3S4**	**N**	**8/11/00**	**AB**	**NEW**
Saucon Creek Watershed (formerly Mill Creek Wetland)	Animal	G3	S2	PE	6/20/87	D?	SA539

Springtown Marsh	**Prairie Sedge-Spotted Joe-pye-weed marsh Natural Community**	**G?**	**S1S2**	**N**	**5/16/00**	**BC**	**NEW**
	A Sedge (*Carex tetanica)*	**G4G5**	**S2**	**PT**	**5/16/00**	**BC**	**NEW**
	Prairie Sedge (*Carex prairea)*	**G5?**	**S2**	**PT**	**5/16/00**	**BC**	**NEW**

Managed Areas: Lehigh River-Scenic River, Saucon Park

* Please refer to Appendix IV for an explanation of PNHP Ranks and State Status.
**Please refer to Appendix V for an explanation of Quality Ranks.
*****Bold= indicates change in site since original report was written in 1999**.

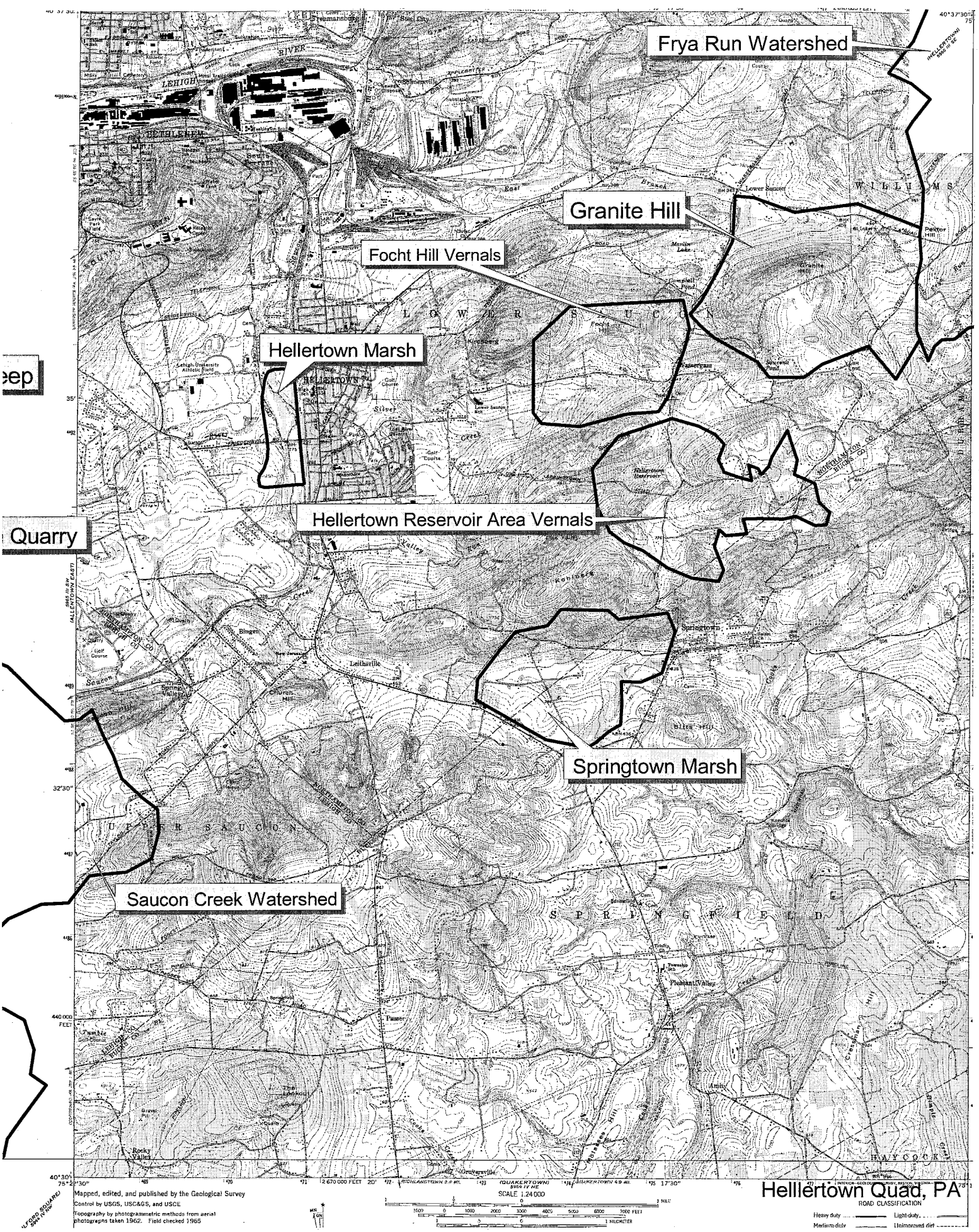
HELLERTOWN USGS QUADRANGLE

FOCHT HILL VERNALS (Lower Saucon Township)
This site contains a good quality **"Herbaceous Vernal Pond" Natural Community**, an S3 Natural Community of Pennsylvania. This area is described as a forested hillside with natural vernal ponds and a manmade pond. Associated species include False Nettle (*Boehmeria cylindrical*), Sedge (*Carex lupulina*), Sedge (*Carex intumescens*), Cardinal Flower (*Lobelia cardinalis*), and Buttonbush (*Cephalanthus occidentalis*). Currently the site is used for rural residential and the site is surrounded by low density rural residential.

This site also contains a good to excellent quality population of **Nodding Trillium (*Trillium cernuum*), an S3 plant species of concern**. This site is a forested slope on a hill extending from the ridge top to the wetlands that are the headwaters of a creek. Associated species include Silvery Spleenwort (Deparia *acrostichoides*), Interrupted Fern (*Osmunda claytonii*), False Hellebore (*Veratrum viride*), Wood-Nettle (Laportea canadensis), ZigZag Goldenrod (*Solidago flexicaulis*), Maidenhair Fern (*Adiantum pedatum*), Skunk Cabbage (*Symplocarpus foetidus*), Blue Marsh Violet (*Viola cucullata*), Sedge (*Carex scabrata*), Goldie's Wood Fern (*Dryopteris goldiana*), Northern Lady Fern (*Athyrium felix femina var. angustata*), Sensitive Fern (*Onoclea sensibilis*), Orange Jewelweed (*Impatiens capensis*), American Elderberry (*Sambucus canadensis*), and Life-of-man (*Aralia racemosa*). A large residential property is located adjacent to this land and surrounding land use includes low-density rural residential housing.

Threats and Disturbances
Threats and Disturbances to the vernal ponds include some dumping and early exploratory mining holes. Threats and Disturbances to the trillium population include some timber harvesting and earth moving in the past, but no significant disturbance presently.

Recommendations
It is recommended that a large forested buffer be placed around each of the vernal ponds to ensure protection of ecological integrity and hydrology. It is also recommended that logging be minimized throughout this entire are to ensure protection of the rare plant and natural community.


Frya Run Watershed
Granite Hill
Focht Hill Vernals
Hellertown Marsh
Hellertown Reservoir Area Vernals
Springtown Marsh
Saucon Creek Watershed
Quarry
eep
Mapped, edited, and published by the Geological Survey
Control by USGS, USC&GS, and USCE
Topography by photogrammetric methods from aerial photographs taken 1962. Field checked 1965
SCALE 1:24 000
ROAD CLASSIFICATION
Heavy duty
Light-duty
Medium-duty
Unimproved dirt
Helllertown Quad, PA

FRYA RUN WATERSHED (**Formerly Hexenkopf Slopes, Hexenkopf Wetlands, Hexenkopf Rock (Erosional remnant), and Mariton Slopes)** (Williams Twp.; Hellerton, Nazareth and Easton Quads, Bucks County) *SA572, GE529, Solidago speciosa, erosional remnant-*
This site includes a variety of habitat types. A **G3 animal species of concern** was discovered using a series of wetlands and seepy forest that occur along a tributary to Frya Run. These wetlands are dominated by shrubs, sedges (*Carex spp*.), and sweetflag (*Acorus calumus*). The animal was observed at this site as recently as 1995. Surveys in 1998 were unsuccessful but only a small portion of the area was surveyed. During the 1998 surveys it was determined that suitable habitat still exists but it is marginal. Better habitat may occur elsewhere in the vicinity. Further surveys are recommended to determine if this species still occurs here. Avoiding disturbance to these wetlands and the adjacent forest should help keep this habitat in reasonable condition.

Hexenkopf hill is a broad southeast facing forested slope. The summit of the ridge is a hilltop outcrop of Pochuck gneiss, one of the oldest rocks in North America. The rock also contains the mineral magnetite (Geyer and Bolles 1979). Areas adjacent to the summit have large and small boulders making up the substrate. Common tree species include tulip poplar (*Liriodendron tulipifera*), sweet birch (*Betula lenta*), oaks (*Quercus spp*.), and hickories (*Carya spp*.). Witch-hazel (*Hamamelis virginiana*) and spicebush (*Lindera benzoin*) are common shrubs. Herb diversity is moderate with greater numbers of species being found further down slope. The site also includes several seeps and at least one vernal pool. These wetland areas support numerous plant species and are home to many animals as well. Upland areas on the slope have long been known as nesting areas for both black vultures (*Coragyps atratus*) and turkey vultures (*Cathartes aura*). Although portions of the site have been selectively logged and it is currently bissected by a large powerline right-of-way, there are a variety of habitat types here and there is potential for several species of special concern. Retaining the forest in an unfragmented condition will benefit the numerous species that make their homes here as well as those that use this area for migration.

The Mariton Slopes are a series of forested slopes and shaded escarpments above the Delaware River. The steepest portion of the slopes are dominated by red oak (*Quercus rubra*), chestnut oak (*Quercus prinus*), sweet birch (*Betula lenta*), and red maple (*Acer rubrum*) with scattered stands of hemlock (*Tsuga canadensis*). These areas consist of many vertical rock faces interspersed with narrow ravines. These cool heavily shaded outcrops are good habitat for numerous fern species as well as spring wildflowers. Rhododendron (*Rhododendron maximum*) is very common on these slopes and extends in dense thickets far upslope. The forest on the crest of the slope is less diverse with large tulip poplar (*Liriodendron tulipifera*) dominating the canopy. A predominance of tulip poplar indicates that the site has a history of logging because tulip poplar requires forest openings to germinate. It grows faster than other trees and eventually dominates a site. As the forest matures, however, shade-tolerant species (such as red oak) replace tulip poplar because it does not regenerate under a closed canopy (Tryon 1980). Wildflowers are abundant on the upper slope but exotic species such as garlic mustard (*Alliaria officinalis*), wineberry (*Rubus phoenicolasius*), and Japanese honeysuckle (*Lonicera japonica*) are also common. A plant species of concern was found here in 1998. The plant is growing in a grassy area along a path. Associated species include assorted grasses and forbs, early goldenrod (*Solidago juncea*) and poison-ivy (*Toxicodendron radicans*). Overall, this site includes numerous habitat types and is an asset to the biological diversity of the greater Delaware River corridor

GRANITE HILL (Lower Saucon Twp., Williams Township)
This site contains a fair to good quality **"Herbaceous Vernal Pond" Natural Community**, an S3S4 community of special concern. This site is described as a former farm containing very disturbed woods, a conifer plantation, and lots of flowing water. The woods are very severly impacted by invasive non-native

species including Japanese Honeysuckle (*Lonicera japonica*), Morrow's Honeysuckle (*Lonicera morrowii*), Multiflora Rose (*Rosa multiflora*), and Garlic-Mustard (*Alliaria petiolata*). Currently the site is low density rural residential and is surrounded by low density residential.

This site also contains a good to excellent quality "**Birch/Black Gun Rocky Slope Woodland"** Natural Community. Granite hill is a steep, rocky forested hill rising 500 feet above the adjacent valley. The ridgetop of this site has a rocky spine running for approximately 1500 feet and the lower slope of the hill on the north side is completely forested and relatively undisturbed. Currently the site at the west end is surrounded by low density rural residential, but for the most part this site is in excellent condition. Associated species include Virginia Creeper (*Parthenocissus quinquefolia*), Poison-Ivy (*Toxicodendron radicans*), Allegheny-Vine (*Adlumia fungosa*), Herb-Robert (*Geranium robertianum*), Rock Polypody (*Polypodium virginianum*), Black Nightshade (*Solanum americanum),* Ricegrass (*Oryzopsis racemosa*), Serviceberry (*Amelanchier arborea*), Wineberry (*Rubus phoenicolasius),* Common Blackberry (*Rubus allegheniesis*), Tall bentgrass (*Agrostis perennans*), American Basswood (*Tilia americana*), Witch-Hazel (*Hamamelis virginiana),* Red Oak (*Quercus rubra*), White Ash (*Fraxinus americana),* Chestnut Oak (*Quercus montana*), Sugar Maple (*Acer saccharum*), Sedge (*carex communis*), Black Birch (*Betula lenta*), Choke Cherry (*Prunus virginiana*), Wild Sarsaparilla (Aralia *nudicaulis*), White Oak (*Quercus alba),* White Wood-Aster (*Aster divaricatus),* Flowering Dogwood (*Cornus florida),* Orange Jewelweed (*Impatiens capensis*), Norway Maple (*Acer platanoides*), Bedstraw (*Galium aparine),* and Black Cherry (*Prunus serotina).*

Threats and Disturbances

The Granite Hill area has a high development threat as lots are being carved out of the adjoining woods along a road. In addition, some non-native species are present, but for the most part this site is in excellent condition.

The area with the vernal ponds is threatened by off-site development that could affect hydrology. In addition, the woods are very severely impacted by invasive non-native species including Japanese Honeysuckle (*Lonicera japonica*), Morrow's Honeysuckle (*Lonicera morrowii*), Multiflora Rose (*Rosa multiflora*), and Garlic-Mustard (*Alliaria petiolata*).

Recommendations

It is recommended that a forested buffer be left around each vernal pond to ensure ecological integrity and to reduce hydrological changes. Logging should be minimized in this area to impede the further spread of invasive plant species that are already prolific in the area. Further steps to eradicate the spread of these invasive plant species are recommended.

HELLERTOWN MARSH (Hellertown, Lower Saucon Twp.)

This site contains a good population of **Prairie Sedge (*Carex prairea*)**, an S2 Pennsylvania plant species of concern. Also included in this site is a good population of **A sedge (*Carex tetanica*)**, an S2 Pennsylvania plant species of concern. A small population of **Highbush Cranberry (*Viburnum trilobum*)**, an S3S4 plant species of concern, was also found at this site. In addition, this site contains an undetermined population of **An ant (*Lasius minutis*)**, a Pennsylvania animal species of concern. This site is a graminoid dominated marsh located between Saucon Creek and the railroad on the west side of Hellertown. Associated species include A Sedge (*Carex lacustris*), Marsh Fern (*Thelypteris palustris*), American Burnet (*Sanguisorba canadensis*), Rough Bedstraw (*Galium asprellum*), Orange Jewelweed (*Impatiens capensis*), and Skunk Cabbage (*Symplocarpus foetidus*).

The ground water influence and the microtopography at this site help contribute to a moderately rich flora. The marsh is surrounded by a narrow buffer of trees and shrubs. The site supports three plant species of special concern, one of which is a PA-Threatened species. The site is excellent habitat for reptile and amphibian species. The site is included within Hellertown's Grist Mill Park.

Threats and Disturbances

The site has been influenced by the construction of the rail line adjacent to it on the east side. On the west side a large portion of the upland separating the marsh from Saucon Creek is maintained as a mowed area for passive recreational use.

Recommendations

Reducing the width of this mowed area to a path or eliminating it entirely would benefit both the creek and the marsh by providing additional buffer along the stream bank and increased continuity of the natural area as a whole. Maintaining the tree/shrub buffer around the site and maintaining the current hydrologic regime are important for the survival of these species.

HELLERTOWN RESERVOIR AREA VERNALS (Lower Saucon Twp, Bucks County)

This area contains a good to excellent quality **"Herbaceous Vernal Pond" Natural Community**. This site is described as a rocky upland forest grading into low wet successional forest that is part of the headwaters of an unnamed tributary of a creek. Currently the site is used for rural residental and is surrounded by low- density rural residential land use. Associated species include Ditch Stoncrop (*Penthorum sedioides)*, Black Tupelo (*Nyssa sylvatica)*, Southern Water-plaintain (*Alisma subcordatum)*, Spicebush (*Lindera benzoin)*, White Ash (*Fraxinus americana)*, Water-horehound (*Lycopus virginicus)*, White Grass (*Leersia virginica*), Mad-Dog Skullcap (*Scutellaria lateriflora)*, Skunk Cabbage (*Symplocarpus foetidus)*, and Fowl Mannagrass (*Glyceria striata)*.

Threats and Disturbances

Threats and Disturbances include development, altered hydrology; increasing agriculture, and non-native exotic conifer species.

Recommendations

It is recommended that a forested buffer be left around the vernal ponds to protect the integrity and the hydrology of the ponds. It is also recommended that any logging in and around the ponds be reduced to a minimum.

SAUCON CREEK WATERSHED (**formerly Mill Road Wetlands)** (Upper Saucon Twp.; Allentown East, Hellertown and Milford Square Quads) *SA539*– This site includes several wetlands that provide habitat for a variety of species. The wetlands are primarily marshy with strict sedge (*Carex stricta*), cattail (*Typha latifolia*), sensitive fern (*Onoclea sensibilis*), and sweet flag (*Acorus calamus*) as common species. An **animal species of special concern** was observed here in 1987 and may still occur at the site. Further surveys are encouraged to determine if the species is still found at this site and how extensive its presence is within these wetlands.

SPRINGTOWN MARSH (Springfield Twp., Bucks County)

This area contains a fair to good quality "**Prairie Sedge-Spotted Joe-pye-weed Marsh**" Natural Community, an S1S2 community of special concern. This site is described as a hummocky, herbaceous wetland with springs and rivulets along a creek. Also in this site are fair to good quality populations of **Prairie sedge (*Carex prairea*)**, **an S2 Pennsylvania plant species of concern**, and **A sedge (*Carex tetanica*), an S2 Pennsylvania plant species of concern.**

The current land use is rural residential and a horse farm. Surrounding land use is low-density rural residential and agriculture. Associated plant species are Strict Sedge (*Carex stricta*), Skunk Cabbage (*Symplocarpus foetidus*), American burnet (*Sanguisorba canadensis)*, **Wood's Sedge (*Carex tetanica*)**, Orange Jewelweed (*Impatiens capensis*), Tall Meadow-Rue (*Thalictrum polygamum*), Purple-stemmed Aster (*Aster puniceus*), Arrow-leaved Tearthumb (*Polygonum sagittatum*), Bog Chickweed (*Stellaria alsine*), Sensitive Fern (*Onoclea sensibilis*), Prairie Sedge (*Carex prairea*), Blue Vervain (*Verbena hastata*), Winter-Cress (*Barbarea vernalis*), Dame's-rocket (*Hesperis matronalis*), Sweet Flag (*Acorus calamus*), Common Cattail (*Typha latifolia*), Sedge (*Carex blanda*), Starflower (*Smilacina stellata*), and Silky Dogwood (*Cornus racemosa*).

Threats and Disturbances

Threats to this marsh include altered hydrology, fill and contamination of wetland. There is an indication of disturbance in the past. Fill has been placed in the edge of the wetland along the road.

Recommendations

It is recommended that this site be surveyed for possible additional species of concern. In addition, it is recommended that a forested buffer be placed around the wetland.

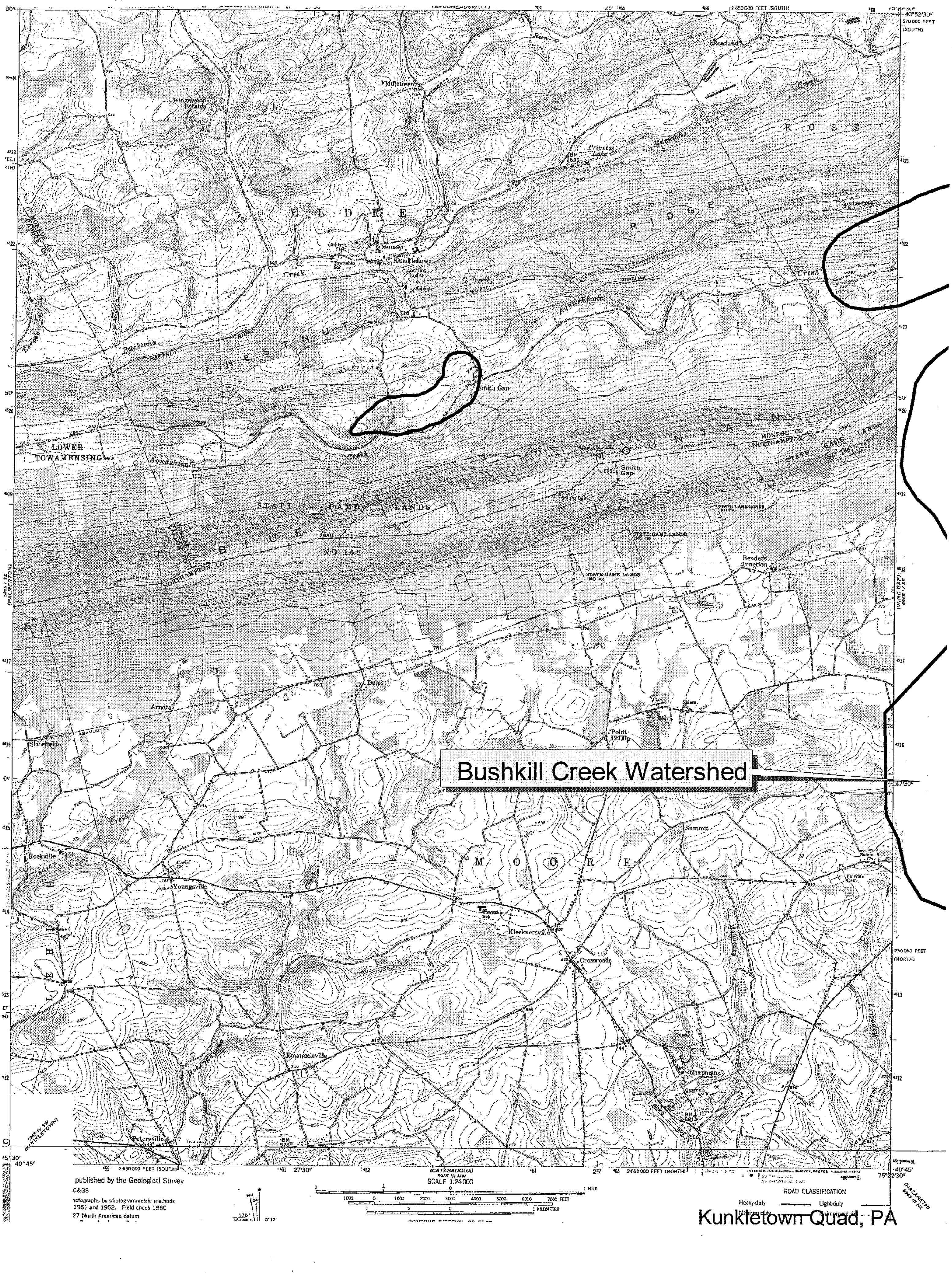
KUNKLETOWN USGS QUADRANGLE MAP

Site Name	Special Species / Community Type	PNHP Ranks*		State Status	Last Seen	Quality**	EO NUMBER
		Global	State				
Bushkill Creek Watershed (Formerly Moorestown Wetland and Knochts Pools)	**Ephemeral/Fluctuating Pool Natural Community**	**G3**	**S3**	**N**	**4/15/98**	**E**	**NC521**
	Animal	**G3**	**S2**	**PE**	**5/7/98**	**BC**	**SA506**

Locally Significant: Blue Mountain

Managed Areas: Appalachian National Scenic Trail, State Game Lands #168

Please refer to Appendix IV for an explanation of PNHP Ranks and State Status.
**Please refer to Appendix V for an explanation of Quality Ranks.
***Bold= indicates change in site since original report was written in 1999**.



Bushkill Creek Watershed
ELDRED
CHESTNUT RIDGE
BLUE MOUNTAIN
STATE GAME LANDS
MOORE
LOWER TOWAMENSING
Kunkletown
Smith Gap
Fiddletown
Princess Lake
Benders Junction
Delps
Arndts
Slatefield
Point Phillip
Summit
Rockville
Youngsville
Kleckersville
Crossroads
Emanuelsville
Chapman
Petersville
SCALE 1:24000
ROAD CLASSIFICATION
Heavy-duty
Light-duty
published by the Geological Survey
Kunkletown Quad, PA

BLUE MOUNTAIN is the most extensive relatively contiguous area of natural habitat in the two counties. It is one of the major corridors for the movement of biota in eastern Pennsylvania. It includes extensive forests with streams, seeps, springs, vernal pools, rock outcrops, and boulder fields. It has long been recognized as one of the major east coast fall flyways for migrating raptors. The extensive relatively unfragmented forests include habitat for resident animal species including larger mammals such as bear and bobcat, as well as for numerous smaller mammals including the PA-Threatened Allegheny woodrat (Neotoma magister). Wetland areas associated with streams, seeps and vernal pools are important habitat for a wide diversity of plant species as well as for many groups of animals including birds, reptiles, amphibians, odonates (dragonflies and damselflies) and others. Conserving sites on the mountain as highlighted in this report must be considered as part of the effort to conserve the greater natural functional value of the mountain ridge. Preserving the ecological integrity of Blue Mountain should be considered an important component in preserving the biodiversity of the two counties.

KUNKLETOWN USGS QUADRANGLE MAP

BUSHKILL CREEK WATERSHED (Formerly Knechts Pools and Moorestown Wetland) (Bushkill Twp.; Ross Twp., Monroe Twp.) *NC521, SA506* –
One site within this watershed is a gently sloping forested area that includes an **Ephemeral Fluctuating Pools Natural Community.** There are at least twelve vernal pools here, possibly more. The woods are variably wet with some elevated areas being drier. Dominant tree species include white oak (*Quercus alba*) and red maple (*Acer rubrum*), which occur with scattered tulip poplar (*Liriodendron tulipifera*), red oak (*Quercus rubra*), and hemlock (*Tsuga canadensis*). Spicebush (*Lindera benzoin*) is the common understory species with white pine (*Pinus strobus*) saplings and arrow-wood (*Viburnum sp*.) also occurring. The pools may have varying cover types as is typical of this community type. Cinnamon fern (*Osmunda cinnamomea*), sedges (*Carex spp*.), bulrushes (*Scirpus spp*.), and fowl manna grass (*Glyceria striata*) are common in these situations with numerous other species being possible. Vernal pools are valuable habitat for the reproduction of amphibian species and can be important in the life cycles of many other animal species. The character of this site was determined through the examination of aerial photographs and through observations made from the adjacent road. This site has the potential for several plant species of special concern and further surveys are encouraged. Disturbances at the site include a paved road that bisects the site, as well as some unpaved lanes that cross through the woods. The woods have been cut over in the past but are nearing maturity again. Maintaining the forest cover at this site and letting the pools continue in their annual cycle of water retention and loss will benefit this natural community and all the species that depend on it. If the forest in this area is harvested care should be taken not to run machinery in the pools and to leave buffering trees around them as well as nearby streams.

Another site within this watershed includes areas of marsh and shrub swamp, which are fed by ground water seepage. Red maple (*Acer rubrum*), cattail (*Typha latifolia*), skunk cabbage (*Symplocarpus foetidus*), and sedges (*Carex spp*.) are common species. It has been impacted by silt runoff from the adjacent farm fields as well as by the roads that may be influencing the hydrology. It supports an **animal species of special concern**. Maintaining the hydrology of the site is critical to the survival of this species at this site.

KUTZTOWN USGS QUADRANGLE MAP

Site Name	Special Species / Community Type	Global	State	State Status	Last Seen	Quality**
None						

Locally Significant: None

Managed Areas: None

Please refer to Appendix IV for an explanation of PNHP Ranks and State Status.
**Please refer to Appendix V for an explanation of Quality Ranks.
*****Bold= indicates change in site since original report was written in 1999**.

Only a small portion of Lehigh County appears on this quadrangle. No species of special concern, exemplary natural communities, or Locally Significant sites (i.e., sites of countywide significance) were identified in this part of the county. However, other areas that are important to natural diversity on a township level (e.g., woodlands, streams, wetlands) may occur within the portion of the county that appears on this quadrangle.

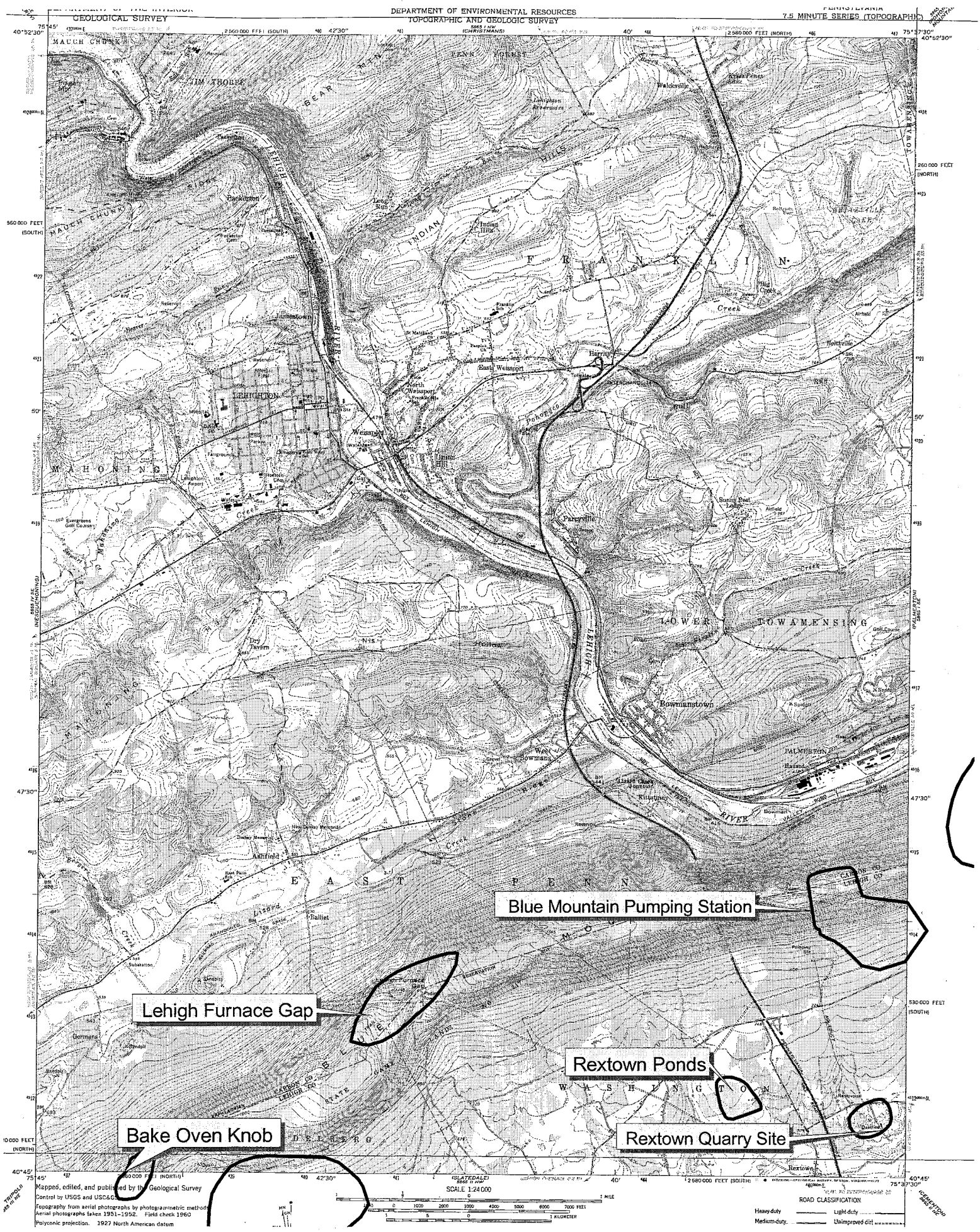
LEHIGHTON USGS QUADRANGLE

Site Name	Special Species / Community Type	PNHP Ranks*		State Status	Last Seen	Quality**	EO NUMBER
		Global	State				
Bake Oven Knob	Northern Appalachian Acidic Rocky Summit	G?	S2	N	9/10/98	C	NC502
Blue Mountain Pumping Station	Allegheny Wood Rat (*Neotoma magister*)	G3G4	S3	PT	4/17/91	H	SA535
	Long's Sedge (*Carex longii*)	**G5**	**SU**	**TU**	**6/16/99**	**D**	**SP538**
Lehigh Furnace Gap	Allegheny Wood Rat (*Neotoma magister*)	G3G4	S3	PT	5/22/91	H	SA536
Rextown Ponds	Northeastern Bulrush (*Scirpus ancistrochaetus*)	G3	S3	PT	8/11/93	C	SP528
Rextown Quarry Site	Torrey's Rush *(Juncus torreyi*)	G5	S2	PE	8/5/86	B	SP528

Locally Significant: Blue Mountain

Managed Areas: Appalachian National Scenic Trail, Lehigh River-Scenic River, State Game Lands # 217

*Please refer to Appendix IV for an explanation of PNHP Ranks and State Status.
**Please refer to Appendix V for an explanation of Quality Ranks.
***Bold= indicates change in site since original report was written in 1999.



Lehighton Quad, PA

LEHIGHTON USGS QUADRANGLE MAP

BAKE OVEN KNOB (Heidelberg Twp.; East Penn Twp., Carbon Co.) **nc502 -** A portion of the buffer area for this site overlaps onto this quadrangle; see Slatedale quadrangle **BAKE OVEN KNOB** (NC502) for a complete description.

BLUE MOUNTAIN is the most extensive relatively contiguous area of natural habitat in the two counties. It is one of the major corridors for the movement of biota in eastern Pennsylvania. It includes extensive forests with streams, seeps, springs, vernal pools, rock outcrops, and boulder fields. It has long been recognized as one of the major east coast fall flyways for migrating raptors. The extensive relatively unfragmented forests include habitat for resident animal species including larger mammals such as bear and bobcat, as well as for numerous smaller mammals including the PA-Threatened Allegheny woodrat (Neotoma magister). Wetland areas associated with streams, seeps and vernal pools are important habitat for a wide diversity of plant species as well as for many groups of animals including birds, reptiles, amphibians, odonates (dragonflies and damselflies) and others. Conserving sites on the mountain as highlighted in this report must be considered as part of the effort to conserve the greater natural functional value of the mountain ridge. Preserving the ecological integrity of Blue Mountain should be considered an important component in preserving the biodiversity of the two counties.

BLUE MOUNTAIN PUMPING STATION (Washington Twp.) **SA535, SP538** –
During a survey of this site in 1991 evidence of **Allegheny Woodrat *(Neotoma magister)***, an S3 animal species of concern, was found. However, the evidence was not fresh, indicating that the species had been living in the area in the past but was not living there at the time of the survey. The habitat requirements of this species include areas of exposed boulders or rock outcrops generally with some scattered trees or shrubs. This type of habitat is abundant along sections of the upper slopes and ridgetop of Blue Mountain. Although there have been no recent successful surveys for this species in Lehigh or Northampton counties there have been casual observations by some area residents that suggest it still persists here. It is possible that some areas where it used to occur are part of the extensive damage caused by the fallout from the historic smelter operation in Carbon County. Additionally, the species is currently thought to be declining in Pennsylvania due to problems with certain parasites. Areas of Blue Mountain that are suitable habitat for this species are very unlikely to be developed or disturbed and therefore no management action is recommended.
This site also contains a small population of **Long's Sedge (*Carex longii*), an SU Pennsylvania plant species of concern**. This site is described as a damp area with sphagnum clumps in otherwise well-drained hardwood sapling woods with an open aspect. Associated species include Rice Cutgrass (*Leersia oryzoides*), Panic-grass (*Panicum microcarpon*), Fowl mannagrass (*Glyceria striata*), Highbush Blueberry (*Vaccinium corymbosum*), Red Maple (*Acer rubrum*), and Black Gum (*Nyssa sylvatica*).

Threats and Disturbances
Threats and disturbances include previous logging, a right-of-way with exotic plant species, and an adjacent house.

Recommendations
It is recommended that logging be minimized in the area where the woodrat evidence was located. One additional recommendation is that there should be a exotic plant monitoring where the sedge habitat is located.

LEHIGH FURNACE GAP (Washington Twp.; East Penn Twp., Carbon Co.) **SA536 -** During a survey of this site in 1991 evidence of **Allegheny Woodrat (*Neotoma magister*)**, **a PA-Threatened animal species**, was discovered. However, the evidence was not fresh, indicating that the species had been living in the area in the past but was not living there at the time of the survey. The habitat requirements of this species include areas of exposed boulders or rock outcrops generally with some scattered trees or shrubs. This type of habitat is abundant along sections of the upper slopes and ridgetop of Blue Mountain. Although there have been no recent successful surveys for this species in Lehigh or Northampton counties there have been casual observations by some area residents that suggest it still persists here. It is possible that some areas where it used to occur are part of the extensive damage caused by the fallout from the historic smelter operation in Carbon County. Additionally the species is currently thought to be declining in Pennsylvania due to problems with certain parasites. Areas of Blue Mountain that are suitable habitat for this species are very unlikely to be developed or disturbed and therefore no management action is recommended.

REXTOWN PONDS (Washington Twp.) **SP528** - The Rextown Ponds site has several small, seasonally-wet, shallow depressions or ponds in an otherwise well-drained, upland forest. The depressions typically have standing water in spring and early summer and often become desiccated by late summer and fall. The vegetation includes a mixture of herbaceous and woody species, such as various grasses and sedges (Carex spp.), chain fern (Woodwardia virginica), highbush blueberry (Vaccinium corymbosum), and buttonbush (Cephalanthus occidentalis). A fair quality population of **Northeastern Bulrush (*Scirpus ancistrochaetus*)**, a PA-Threatened plant occurring in one of the ponds, appears to have somewhat better drainage than is typical of most of the sites that are inhabited by this species. As a result, the species is severely threatened by competition from other vegetation, particularly from the various woody species that are well-established in the pond.

REXTOWN QUARRY SITE (Washington Twp.) **SP515** - This site is an abandoned slate quarry. A large population of **Torrey's Rush (*Juncus torreyi*)**, a PA-threatened rush, occurs at the base of a large slag pile on muddy soil enriched by the limy slate. In this case human disturbance has created a unique habitat utilized by the species of concern. No special management recommendations are suggested for this occurrence.

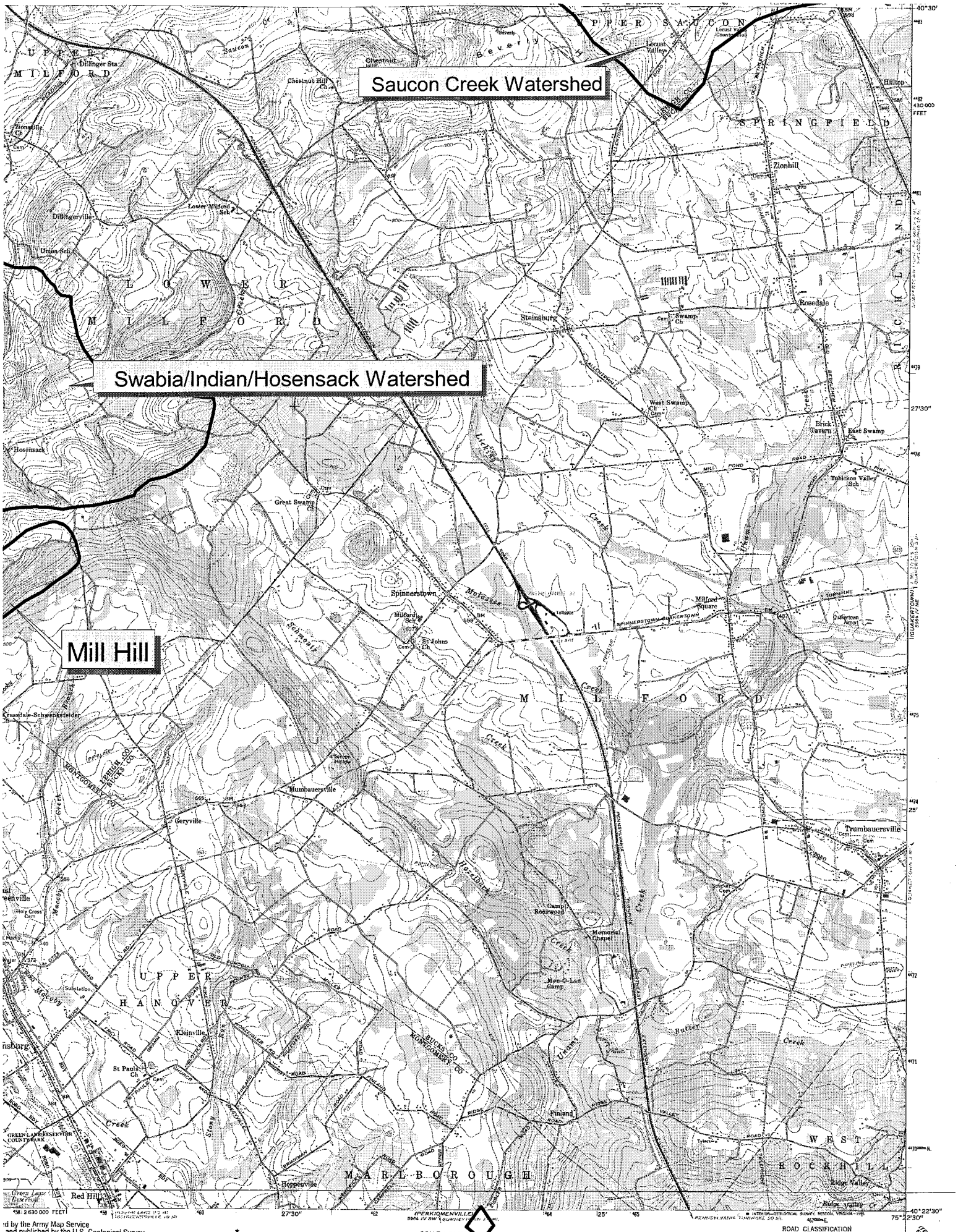
MILFORD SQUARE USGS QUADRANGLE MAP

Site Name	Special Species / Community Type	PNHP Ranks*		State Status	Last Seen	Quality**	EO NUMBER
		Global	State				
Lower Milford Marsh	**Basin Graminoid-Fen**	**G?**	**S1**	**N**	**5/26/98**	**X-Deleted**	**NC505**
Saucon Creek Watershed (formerly Mill Creek Wetland)	**Animal**	**G3**	**S2**	**PE**	**6/20/87**	**D?**	**SA539**
Swabia/Indian/Hosensack Watershed (formerly Hosensack Marsh, Indian Creek Floodplain, and Macungie Watershed	Animal	G3	S2	PE	6/5/97	BC	SA501
	White-Trout Lily (*Erythronium albidum*)	**G5**	**S3**	**N**	**4/20/01**	**BC**	**NEW**
	Northern Appalachian Circumneutral Seep Natural Community	**G?**	**S3?**	**N**	**6/26/97**	**C**	**NC563**

Locally Significant: Mill Hill, Big Beech Woods

Managed Areas:

* Please refer to Appendix IV for an explanation of PNHP Ranks and State Status.
**Please refer to Appendix V for an explanation of Quality Ranks.
***Bold= indicates change in site since original report was written in 1999**.



Milford Square Quad, PA

MILFORD SQUARE USGS QUADRANGLE

LOWER MILFORD MARSH (Lower Milford Twp.) **NC505 – UPDATE-**
The Basin Graminoid-Forb Fen Natural Community that was documented at this site functionally no longer exists and will be deleted from this update report.
This site is a fair to poor quality **Basin Graminoid-Forb Fen Natural Community** that occurs along a section of the floodplain of Hosensack Creek. The northern section has numerous springs and seeps that grade into marshes and then into swamp. The southern portion gradually becomes marshy and is densely vegetated by robust grasses and sedges (Carex spp.). Common tree species include black walnut (Juglans nigra), willow (Salix spp.), and ash (Fraxinus spp.), and common herbaceous species include sweetflag (Acorus calamus), sensitive fern (Onoclea sensibilis), reed canary-grass (Phalaris arundinacea), and skunk cabbage (Symplocarpus foetidus). This site has potential for several species of concern including both plants and animals, and further surveys are recommended. The area has received disturbance from adjacent roads and bridge crossings, and portions of the site may have been cleared for agriculture in the past. Exotic species such as multiflora rose (Rosa multiflora) and dames rocket (Hesperis matronalis) are common on some sections of the site. This site should be left in its current condition.

MILL HILL (Lower Milford Twp.; Upper Hanover Twp., Montgomery Co.) - This site is a several mile long diabase ridge which is partly in both Lehigh and Montgomery counties. It has extensive second growth forest with good potential for several plant species of special concern. Forests on the lower slopes may include American beech (Fagus grandifolia), tulip poplar (Liriodendron tulipifera), sugar maple (Acer saccharum), basswood (Tilia americana), ash (Fraxinus spp.), hickories (Carya spp.), white oak (Quercus alba), and red oak (Q. rubra). Herb diversity in lower slope forests can be very rich with horse balm (Collinsonia canadensis), may-apple (Podophyllum peltatum), sweet cicely (Osmorhiza claytonii), black cohosh (Cimicifuga racemosa), and numerous species of fern all being common. Upper slope areas support a less species rich forest which is dominated by chestnut oak (Quercus prinus), sweet birch (Betula lenta), tulip poplar, and red oak. The substrate at these higher elevations may include extensive areas of large diabase boulders and outcrops. Witch-hazel (Hamamelis virginiana), flowering dogwood (Cornus florida), choke cherry (Prunus virginiana), and maple-leaved viburnum (Viburnum acerifolium) are common shrubs. Herb diversity on the upper slopes is not as rich as the lower slopes but it is still significant with fern species including common polypody (Polypodium virginianum), walking fern (Asplenium rhizophyllus), and marginal shield fern (Dryopteris marginalis), and herb species including dolls eyes (Actaea pachypoda), climbing fumitory (Adlumia fungosa), ricegrass (Oryzopsis racemosa), and wild columbine (Aquilegia canadensis). A tributary of Hosensack Creek flows along the base of the northwestern slope of the hill. Seeps may occur on the lower slopes of the hill and run into the creek. Numerous plant and animal species depend on the variety of habitats provided by these forests and associated riparian areas. Some portions of this site have been selectively logged in the recent past. This area will be best managed by retaining its forested condition and preventing further fragmentation that may be caused by roads, right-of-ways, and development. The majority of the Montgomery County portion of this site has been acquired by Upper Hanover Township and has been designated for conservation and recreation purposes.

SAUCON CREEK WATERSHED (**formerly Mill Road Wetlands)** (Upper Saucon Twp.; Allentown East, Hellertown and Milford Square Quads) *SA539 Clemmys muhlenbergii* – This site includes several wetlands that provide habitat for a variety of species. The wetlands are primarily marshy with strict sedge (*Carex stricta*), cattail (*Typha latifolia*), sensitive fern (*Onoclea sensibilis*), and sweet flag (*Acorus calamus*) as common species. An animal species of special concern was observed here in 1987 and may still occur at the site. Further surveys are encouraged to determine if the species is still found at this site and how extensive its presence is within these wetlands.

SWABIA/INDIAN/HOSENSACK WATERSHED (formerly Hosensack Marsh, Indian Creek Floodplain, Big Beech Woods and Macungie Watershed)(Upper Milford, Lower Milford & Lower Macungie Twps.; Allentown West and Milford Square Quads)

One site within this watershed includes areas of floodplain forest and open marsh along the floodplain of Indian Creek. The forest is dominated by a mix of American Elm (*Ulmus americana*), Ash (*Fraxinus sp*.), Pin Oak (*Quercus palustris*), Tulip Poplar (*Liriodendron tulipifera*), and Hickory (*Carya sp*.) with dense Spicebush (*Lindera benzoin*) in the understory. The marsh is dominated by Cattail (*Typha latifolia*), Strict Sedge (*Carex stricta*), Jewelweed (*Impatiens capensis*), Willow Herb (*Epilobium sp*.), and Bulrush (*Scirpus cyperinus*). Evidence of a **PA-Endangered animal species** was observed at this site in 1996. This site was discovered late in the process of developing this report and has not been fully investigated. Surveys to determine the status of the species of concern at this site are highly recommended.

Another site within this watershed includes areas of marsh and shrub swamp part of the site has been disturbed by the construction of an electric power transfer station and associated powerline ROW. Some of the habitat created by these disturbances may be benefiting the rare species that occurs here. The site supports a fair to good example of an animal species of concern. A plant species of concern was also found in a swamp forest near this site in 2001. Associated species include red trillium (*Trillium erectum*), skunk cabbage (*Symplorocarpus foetidus*), violets (*Viola spp*.), rattlesnake root (*Prenanthes spp*.), spicebush (*Lindera benzoin*), garlic-mustard (*Allaria petiola*), musclewood (*Carpinus carolinana*), red maple (*Acer rubrum*), and black birch (*Betula lenta*). Current disturbances are minor, however it is crucial to maintain the surface hydrology of the site for this rare plant species.

A third site is located on the mid slope of a north facing forested hill due south of Macungie. The site is dominated by a second growth mixed hardwood forest, which consists primarily of a mix of tulip poplar (*Liriodendron tulipifera*), yellow birch (*Betula alleghaniensis*), red oak (*Quercus rubra*), and red maple (*Acer rubrum*). The site includes a fair to good quality Northern Appalachian Circumneutral Seeps Natural Community. The seeps occur in sloping areas where diffuse groundwater flow intersects the soil surface. Seep derived vegetation associations occur in many broad patches interspersed with upland forest across the slope. Common shrubs of the seeps include spicebush (*Lindera benzoin*), witch-hazel (*Hamamelis virginiana*), with lessor amounts of elderberry (*Sambucus sp*.) and winterberry (*Ilex verticillata*). Dominant herbaceous species in this relatively diverse natural community include cinnamon fern (*Osmunda cinnamomea*), New York fern (*Thelypteris noveboracensis*), and lady fern (*Athyrium filix-femina*), as well as skunk cabbage (*Symplocarpus foetidus*). Also common are a variety of sedges (*Carex spp*.), voilets (*Viola spp*.), and other ferns. The seeps are excellent habitat for certain amphibian and aquatic invertebrate species. Ebony jewelwing damselflies (*Calopteryx maculata*) and bullfrogs (*Rana catesbeiana*) were observed at the site during our survey. The seeps have the potential to support several state plant species of concern though none were observed during our surveys. Logging and increased amounts of exotic species are threats to the quality of this site. Trails, especially those for mountain biking should be prevented from crossing through or near the seepage areas. Although this site has experienced a variety of disturbances such as historical logging, plantings of spruce, and road construction for the reservoir, preventing further disturbances and forest fragmentation on this slope will benefit the seeps Natural Community as well as all the native plants and animals that depend on this area to support some aspect of their life cycles.

BIG BEECH WOODS -This locally significant area is a southeast-facing slope along Hosensack Creek with a maturing second-growth forest. American beech (Fagus grandifolia), tulip poplar (Liriodendron tulipifera), sugar maple (Acer saccharum), hickories (Carya spp.), white oak (Quercus alba), red oak (Q. rubra), and sweet birch (Betula lenta) are present in the overstory, with American beech (Fagus grandifolia), hemlock (Tsuga canadensis), and sugar maple (Acer saccharum) coming up in the understory. Maple-leaved viburnum (Viburnum acerifolium), spicebush (Lindera benzoin), may-apple (Podophyllum peltatum), false Solomon's Seal (Smilacina racemosa), black snakeroot (Cimicifuga racemosa), Christmas

fern (Polystichum acrostichoides), and marginal wood fern (Dryopteris marginalis) are found in the groundcover. Some of the trees are over two feet in diameter -- most similarly mesic sites in the county are in agriculture or younger woodland. Protecting the site would allow the natural community to mature further as well as benefit the water quality of the Hosensack Marsh site downstream.

Threats and Disturbances

No threats and disturbances are apparent to the **White Trout Lily** population, but maintaining the surface hydrology is essential to perpetuation of the habitat; some trees have been removed over the years. For the **G3 animal species of concern**, Maintenance operations and hydrology changes are disturbances and possible threats. Exotic plant species may alter the hydrology of the wetland. However, the designation of the marsh as a unique natural area may protect it from being driven over in the future.

Recommendations

It is recommended that forested buffers be used to protect the ecological integrity of the wetlands where the animal species of concern is found. More surveys are encouraged to determine the population and habitat use of the species. For the White Trout Lily population, it is recommended that a forested buffer be placed around the wetland to protect the hydrology and ecological integrity of the plant species.

NAZARETH USGS QUADRANGLE MAP

Site Name	Special Species / Community Type	PNHP Ranks*		State Status	Last Seen	Quality**	EO NUMBER
		Global	State				
Bull Run	**Skunk Cabbage-Golden Saxifrage Forest Seep**	**G?**	**S4S5**	**N**	**6/30/00**	**AB**	**NEW**
Frya Run Watershed (Formerly Hexenkopf Slopes, Hexenkopf Wetlands, Hexenkopf Rock (Erosional remnant), and Mariton Slopes)	Animal	G3	S2	PE	1996	E	SA572
	Animal	G3	S2	PE	1998	E	
	Showy Goldenrod (*Solidago speciosa var. speciosa*)	G5T5?	SR	N	9/27/98	C	SP574
	Erosional Remnant	G?	S?	N	N/A	E	GE529
Island Park	American Lotus (*Nelumbo lutea*)	G4	S1	PE	7/26/97	B	SP579
Lehigh Slopes	**Bladder Fern (*Cystopteris tennesseensis*)**	**G5**	**S1**	**TU**	**6/24/00**	**C**	**NEW**
Redington Cave	Northern Myotis (*Myotis septentrionalis*)	G4	S3B, S3N	CR	2/24/98	D	SA501

Locally Significant: Steel City Slopes

Managed Areas: Freeman's of Laubach Island, Hugh Moore Park, Lehigh River-Scenic River, Louise W. Moore County Park

Other: Bushkill Creek, HQ-CWF/EV Waters, Monocacy Creek, HQ-CWF/EV Waters

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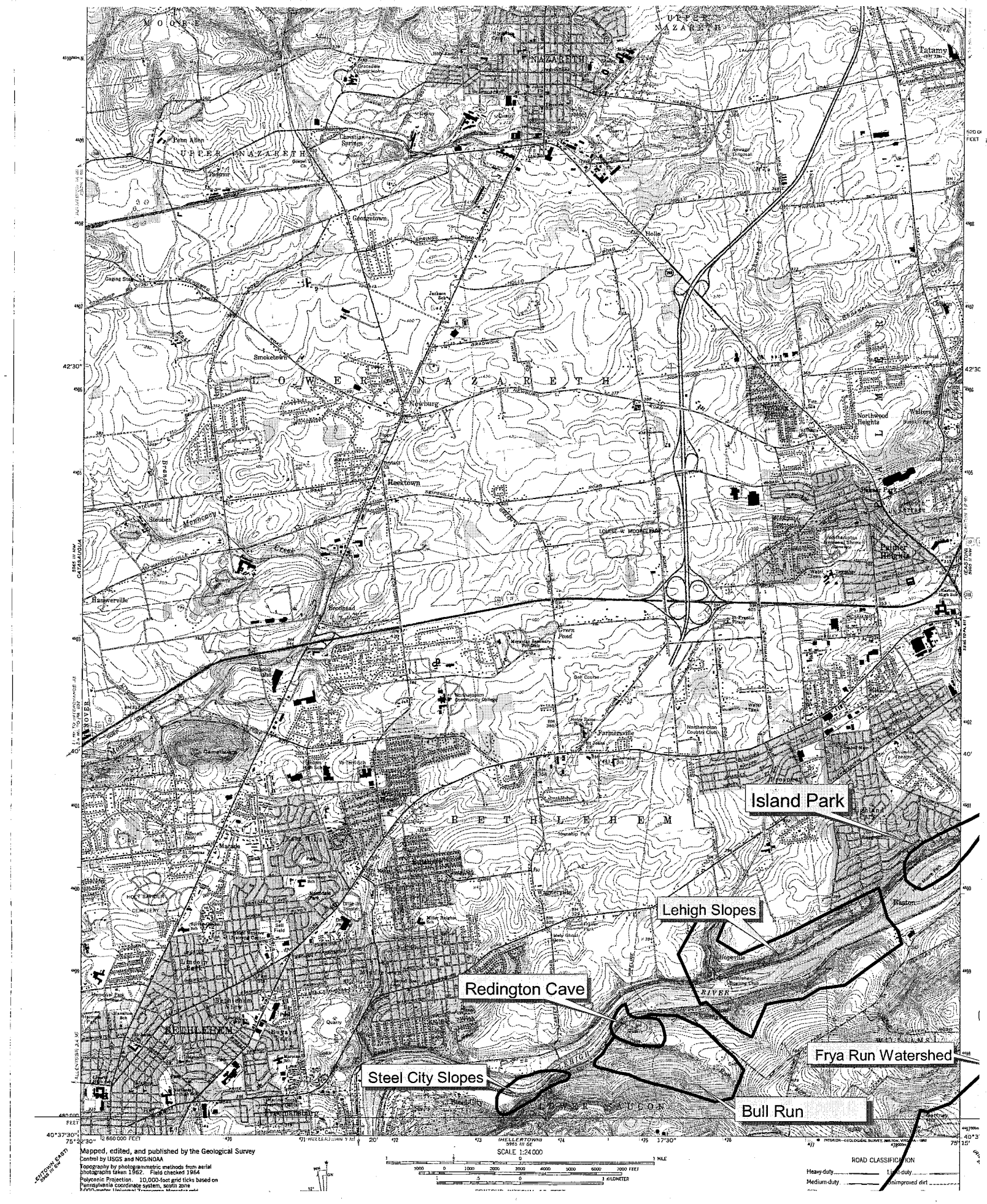


Nazareth Quadrangle, PA

NAZARETH USGS QUADRANGLE

BULL RUN (Lower Saucon Township)
This site contains a good to excellent quality **"Skunk Cabbage-Golden Saxifrage Forested Seep" Natural Community**, an S4S5 Pennsylvania natural community. This community was found at the mid-slope of a forested slope. The site is described as forested slopes including headwater seeps, springs, and basin-like wetlands located at the base of the uppermost, steepest part of the slope. Current site use is low-intensity hunting and surrounding land use include low density residential housing. Associated species include Skunk Cabbage (*Symplocarpus foetidus*), Orange Jewelweed (*Impatiens capensis*), New York Fern (*Thelypteris noveboracensis*), Broad Beech Fern (*Phegopteris hexagonoptera*), and Halberd-leaved tearthumb (*Polygonum arifolium*).

Threats and Disturbances
Threats and disturbances include development, exotic plant species, and evidence of earlier timber harvests. Exotic plant species present include Princess Tree (*Paulownia tomentosa*), Asian Bittersweet (*Celastrus orbiculatus*), and Japanese Stilt-Grass (*Microstegium vemineum*).

Recommendations
It is recommended that future surveys are conducted to assess the contiguity of the natural community, assess the invasive species present, and to possibly find additional species of concern.

FRYA RUN WATERSHED (Formerly Hexenkopf Slopes, Hexenkopf Wetlands, Hexenkopf Rock (Erosional remnant), and Mariton Slopes) (Williams Twp.; Hellerton, Nazareth and Easton Quads, Bucks County) *SA572, GE529, Solidago speciosa, erosional remnant*-
This site includes a variety of habitat types. A **G3 animal species of concern** was discovered using a series of wetlands and seepy forest that occur along a tributary to Frya Run. These wetlands are dominated by shrubs, sedges (*Carex spp*.), and sweetflag (*Acorus calumus*). The animal was observed at this site as recently as 1995. Surveys in 1998 were unsuccessful but only a small portion of the area was surveyed. During the 1998 surveys it was determined that suitable habitat still exists but it is marginal. Better habitat may occur elsewhere in the vicinity. Further surveys are recommended to determine if this species still occurs here. Avoiding disturbance to these wetlands and the adjacent forest should help keep this habitat in reasonable condition.
Hexenkopf hill is a broad southeast facing forested slope. The summit of the ridge is a hilltop outcrop of Pochuck gneiss, one of the oldest rocks in North America. The rock also contains the mineral magnetite (Geyer and Bolles 1979). Areas adjacent to the summit have large and small boulders making up the substrate. Common tree species include tulip poplar (*Liriodendron tulipifera*), sweet birch (*Betula lenta*), oaks (*Quercus spp*.), and hickories (*Carya spp*.). Witch-hazel (*Hamamelis virginiana*) and spicebush (*Lindera benzoin*) are common shrubs. Herb diversity is moderate with greater numbers of species being found further down slope. The site also includes several seeps and at least one vernal pool. These wetland areas support numerous plant species and are home to many animals as well. Upland areas on the slope have long been known as nesting areas for both black vultures (*Coragyps atratus*) and turkey vultures (*Cathartes aura*). Although portions of the site have been selectively logged and it is currently bissected by a large powerline right-of-way, there are a variety of habitat types here and there is potential for several species of special concern. Retaining the forest in an unfragmented condition will benefit the numerous species that make their homes here as well as those that use this area for migration.
The Mariton Slopes are a series of forested slopes and shaded escarpments above the Delaware River. The steepest portion of the slopes are dominated by red oak (*Quercus rubra*), chestnut oak (*Quercus prinus*), sweet birch (*Betula lenta*), and red maple (*Acer rubrum*) with scattered stands of hemlock (*Tsuga canadensis*). These areas consist of many vertical rock faces interspersed with narrow ravines. These cool heavily shaded outcrops are good habitat for numerous fern species as well as spring

wildflowers. Rhododendron (*Rhododendron maximum*) is very common on these slopes and extends in dense thickets far upslope. The forest on the crest of the slope is less diverse with large tulip poplar (*Liriodendron tulipifera*) dominating the canopy. A predominance of tulip poplar indicates that the site has a history of logging because tulip poplar requires forest openings to germinate. It grows faster than other trees and eventually dominates a site. As the forest matures, however, shade-tolerant species (such as red oak) replace tulip poplar because it does not regenerate under a closed canopy (Tryon 1980). Wildflowers are abundant on the upper slope but exotic species such as garlic mustard (*Alliaria officinalis*), wineberry (*Rubus phoenicolasius*), and Japanese honeysuckle (*Lonicera japonica*) are also common. A plant species of concern was found here in 1998. The plant is growing in a grassy area along a path. Associated species include assorted grasses and forbs, early goldenrod (*Solidago juncea*) and poison-ivy (*Toxicodendron radicans*). Overall, this site includes numerous habitat types and is an asset to the biological diversity of the greater Delaware River corridor.

ISLAND PARK (Easton) **SP579** - This site is one of several forested islands located in the stretch of the Lehigh River between Bethlehem and Easton. The forest on this island is a young to moderately aged second growth mix of sycamore (Platanus occidentalis), black walnut (Juglans nigra), river birch (Betula nigra), box elder (Acer negundo), hickory (Carya spp.), and red oak (Quercus rubra). Spicebush (Lindera benzoin), black-haw (Viburnum prunifolium), and silky dogwood (Cornus amomum) are common shrubs. The island appears to have been disturbed in the past including some excavation. The island interior includes a 5 to 10-acre slough known as "The Gut." This isolated emergent marsh wetland supports a wide diversity of plant and animal species including a large good quality population of **American Lotus (*Nelumbo lutea*)**, a PA-Endangered plant species. The site has potential for other species of concern and further surveys are recommended. All of the forested islands and adjacent forested floodplains and upland slopes along this stretch of the Lehigh River, roughly from just east of Steel City to just west of West Easton, remain in a relatively isolated condition in an otherwise well-developed landscape. The size of this unbroken river corridor habitat makes it an important natural resource. Allowing these historically disturbed forests and wetlands to mature without further disturbance would benefit the preservation of diversity in the county. The area has the potential for recolonization by both osprey (Pandion haliaetus) and bald eagles (Haliaetus leucocephalus), as well as a variety of neotropical migrant bird species. This segment of the river has been designated as the location for the crossing of the Route 33 extension. Should the Route 33 extension be constructed through this area we strongly recommend that access to the Lehigh River not be enhanced as part of the project. Limiting new access in this corridor to foot traffic will greatly enhance the likelihood of its remaining one of the wildest and most diverse areas in the southern part of the county. The endangered plant species is listed as **SP533** on the Nazareth quadrangle.

LEHIGH SLOPES (Bethlehem, Lower Saucon, Williams, and Palmer Townships)

This site contains a fair quality population of **Bladder Fern (*Cystopteris tennesseensis*)**, an S1 Pennsylvania plant species of concern. The site is described as a west-northwest facing forested slope along the Lehigh River with scattered rock outcrops. The forest cover is mainly deciduous. The listed plant was found on mesic-limestone outcrops overlooking the Lehigh River. Associated species include Marginal Shield Fern (*Dryopteris marginalis*), Christmas Fern (*Polystichum arostichoides*), Maidenhair Fern (*Adiantum pedatum*), Zigzag Goldenrod (*Solidago flexicaulis*), Black Cohosh (*Cimicifuga racemosa*), White Wood Aster (*Aster divaricatus*), American Basswood (*Tilia americana*), Red Oak (*Quercus rubra*), Stoneroot (*Collinsonia canadensis*), Sugar Maple (*Acer saccharum*), and Witch-Hazel (*Hamamelis virginiana*). This site is currently being used as a highway construction site, a railroad corridor at the base of the slope, and forest.

Threats and Disturbances

Threats and Disturbances include deer overbrowsing, highway construction in which a broad corridor has been cleared, and the construction of a bridge to link a road to I-78.

Recommendations
More surveys are recommended for this site along the slopes to better determine the size of the plant's population. Logging at this site is not recommended.

REDINGTON CAVE (Lower Saucon Twp.) **SA501 –UPDATE-REVISED POLYGON**
This site is a cave formed in the base of a cliff just south of the Lehigh River. It is a solutional cave formed in dolomite and dolomitic shale of the Leithsville Formation. The cave extends for approximately 100 feet from the base of the cliff towards the top. A single individual of **Northern Myotis (*Myotis septenrionalis*)**, a G4 S2/S3 animal species was found in the cave, associated with eastern pipistrelles (Pipistrellus subflavus). The cave is fairly small and close to the surface, and thus only marginal habitat for bats. The site is leased by the Steel City Gun Club and a firing range is at the base of the cliffs. No special management is recommended.

STEEL CITY SLOPES (Lower Saucon Twp.) - This locally significant area is a steep rocky north facing forested slope above the Lehigh River. The second growth forest of sweet birch (Betula lenta), sugar maple (Acer saccharum), basswood (Tilia americana), red oak (Quercus rubra), and chestnut oak (Quercus prinus) supports a moderate herb diversity. Extensive rock outcrops midway up the slope are habitat for ferns and other herbs. This is one of the least impacted tracts of forest along this stretch of the Lehigh River. It is contiguous with larger somewhat disturbed forested tracts to both the east and the west. Maintaining as much forest along the river as possible will benefit species that use the river corridor as well as species that migrate through this area. This site is partly owned by the City of Bethlehem.

Bushkill Creek is a HQ-CWF throughout its basin, except for Shoeneck Creek.
Monocacy Creek is a HQ-CWF throughout its basin.

NEW RINGGOLD USGS QUADRANGLE MAP

Site Name	Special Species / Community Type	PNHP Ranks*		State Status	Last Seen	Quality**	EO NUMBER
		Global	State				
None							

Locally Significant: Blue Mountain

Managed Areas:

Other: Appalachian National Scenic Trail, State Game Lands #106

* Please refer to Appendix IV for an explanation of PNHP Ranks and State Status.
**Please refer to Appendix V for an explanation of Quality Ranks.

BLUE MOUNTAIN is the most extensive relatively contiguous area of natural habitat in the two counties. It is one of the major corridors for the movement of biota in eastern Pennsylvania. It includes extensive forests with streams, seeps, springs, vernal pools, rock outcrops, and boulder fields. It has long been recognized as one of the major east coast fall flyways for migrating raptors. The extensive relatively unfragmented forests include habitat for resident animal species including larger mammals such as bear and bobcat, as well as for numerous smaller mammals including the PA-Threatened Allegheny woodrat (Neotoma magister). Wetland areas associated with streams, seeps and vernal pools are important habitat for a wide diversity of plant species as well as for many groups of animals including birds, reptiles, amphibians, odonates (dragonflies and damselflies) and others. Conserving sites on the mountain as highlighted in this report must be considered as part of the effort to conserve the greater natural functional value of the mountain ridge. Preserving the ecological integrity of Blue Mountain should be considered an important component in preserving the biodiversity of the two counties.

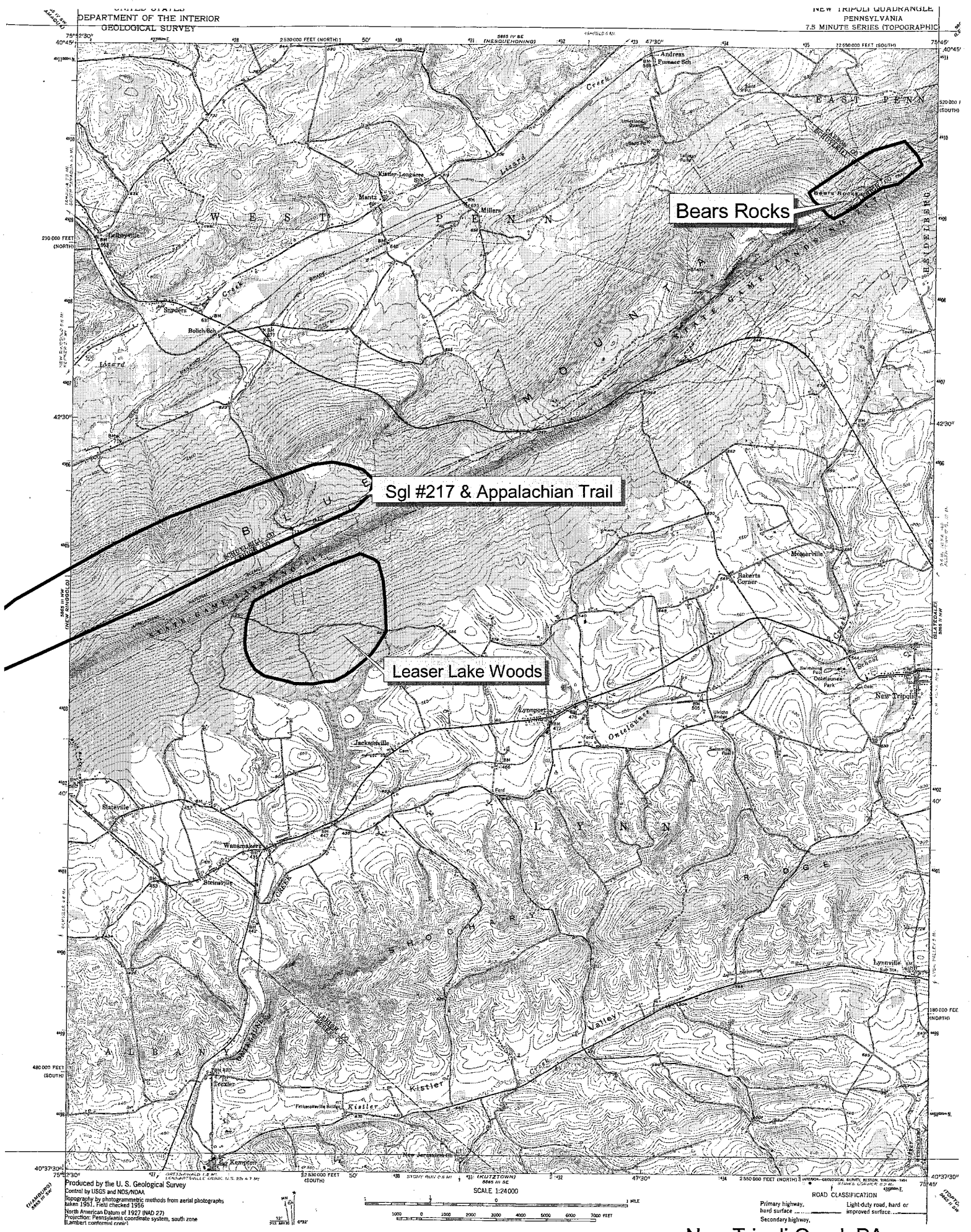
NEW TRIPOLI USGS QUADRANGLE MAP

Site Name	Special Species / Community Type	PNHP Ranks* Global	PNHP Ranks* State	State Status	Last Seen	Quality**	EO NUMBER
Bears Rocks	**Allegheny Woodrat (*Neotoma magister*)**	**G3G4**	**S3**	**PT**	**5/22/91**	**H**	**SA514**
	Erosional remnant	G?	S?	N		E	
State Game Lands # 217 and Appalachian Trail	**Northeastern Bulrush (*Scirpus ancistrochaetus*)**	**G3**	**S3**	**PT**	**7/11/02**	**AB**	**NEW**
	Ephemeral/Fluctuating Natural Pool Community	**G?**	**S3**	**N**	**4/11/02**	**E**	**NEW**

Locally Significant: Leaser Lake Woods
Blue Mountain

Managed Areas: Appalachian National Scenic Trail, Leaser Lake- PA Fish and Boat Commission, Leaser Lake- Lehigh County Property, State Game Lands #217

* Please refer to Appendix IV for an explanation of PNHP Ranks and State Status.
**Please refer to Appendix V for an explanation of Quality Ranks
***Bold= indicates change in site since original report was written in 1999**.


Bears Rocks
Sgl #217 & Appalachian Trail
Leaser Lake Woods
NEW TRIPOLI QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Produced by the U. S. Geological Survey
Control by USGS and NOS/NOAA
Topography by photogrammetric methods from aerial photographs taken 1951. Field checked 1956
North American Datum of 1927 (NAD 27)
Projection: Pennsylvania coordinate system, south zone (Lambert conformal conic)
SCALE 1:24000
ROAD CLASSIFICATION
Primary highway, hard surface
Light-duty road, hard or improved surface
Secondary highway,
New Tripoli Quad, PA

NEW TRIPOLI USGS QUADRANGLE MAP

BEARS ROCKS (Lynn Twp., Lehigh Co.; West Penn Twp., Schuylkill Co.; East Penn Twp., Carbon Co.) **SA514 –UPDATE**- This site's polygon has been revised due to the species of concern's vulnerability to logging in and around the site. During a survey of this site in 1991 evidence of **Allegheny Woodrat (*Neotoma magister*)**, a PA-Threatened animal species, was discovered. However, the evidence was not fresh, indicating that the species had been living in the area in the past but was not living there at the time of the survey. The habitat requirements of this species include areas of exposed boulders or rock outcrops generally with some scattered trees or shrubs. This type of habitat is abundant along sections of the upper slopes and ridgetop of Blue Mountain. Although there have been no recent successful surveys for this species in Lehigh or Northampton counties there have been casual observations by area residents that suggest it still persists here. The species is currently thought to be declining in Pennsylvania due to problems with certain parasites. Areas of Blue Mountain that are suitable habitat for this species are very unlikely to be developed or disturbed and therefore no management action is recommended.

GE505 - This site includes an outcrop of Tuscarora quartzite on the crest of Blue Mountain, at the corner of Carbon, Lehigh, and Schuylkill Counties. The formation consists of three large blocks standing in a row. Tuscarora quartzite is the hardest and most erosion-resistant rock found in the region, accounting for the abrupt rise of Blue Mountain at the edge of the Great Valley.

BLUE MOUNTAIN is the most extensive relatively contiguous area of natural habitat in the two counties. It is one of the major corridors for the movement of biota in eastern Pennsylvania. It includes extensive forests with streams, seeps, springs, vernal pools, rock outcrops, and boulder fields. It has long been recognized as one of the major east coast fall flyways for migrating raptors. The extensive relatively unfragmented forests include habitat for resident animal species including larger mammals such as bear and bobcat, as well as for numerous smaller mammals including the PA-Threatened Allegheny woodrat (Neotoma magister). Wetland areas associated with streams, seeps and vernal pools are important habitat for a wide diversity of plant species as well as for many groups of animals including birds, reptiles, amphibians, odonates (dragonflies and damselflies) and others. Conserving sites on the mountain as highlighted in this report must be considered as part of the effort to conserve the greater natural functional value of the mountain ridge. Preserving the ecological integrity of Blue Mountain should be considered an important component in preserving the biodiversity of the two counties.

LEASER LAKE WOODS (Lynn Twp.) - This locally significant site is a moderately aged second growth forest with a nice diversity of herbs. The forest canopy includes a good diversity of tree species with tulip poplar (Liriodendron tulipifera), sweet birch (Betula lenta), red maple (Acer rubrum), American beech (Fagus grandifolia) and hemlock (Tsuga canadensis) being dominant. Further upslope oaks such as red oak (Quercus rubra), black oak (Q. velutina), and chestnut oak (Q. prinus) are more common. Shrubs include witch-hazel (Hamamelis virginiana), spicebush (Lindera benzoin), blueberries (Vaccinium spp.), maple-leaved viburnum (Viburnum acerifolium), and black-haw (Viburnum prunifolium). Herbaceous species, of which there are many, include eight species of fern, many species of sedges and grasses, and numerous wildflowers. Along with its plant diversity the site is significant for the many types of habitat it includes, such as streams, seeps, shoreline, forest, and boulder fields. Numerous streamlets and seeps flow over the gentle forested slopes at the bottom of Blue Mountain and into Leaser Lake. They are excellent habitat for certain amphibian species such as the northern dusky salamander (Desmognathus fuscus), northern spring salamander (Gyrinophilus porphyriticus), northern two-lined salamanders (Eurycea bislineata), and others. They are also important for other species such as crayfish and odonates (dragonflies and damselflies).

Letting the forest at this site mature without further disturbance will help maintain the good quality of this locally significant area.

SGL #217 AND APPALACHIAN TRAIL (Lynn Township and Schuylkill County)

In 2002, a graminoid-dominated **Ephemeral Fluctuating Natural Pool Community** was located along the ridge of Blue Mountain in SGL #217. A very good-quality population of a G3, S3 PA-endangered, and Federally-endangered plant species, the **northeastern bulrush *(Scirpus ancistrochaetus),*** was located in this pond. The Federally endangered status of this plant indicates that the species is in danger of extinction throughout all or a significant portion of its range. The northeastern bulrush is primarily found in temporary ponds and other pools with fluctuating water levels. These ponds also typically provide important breeding habitat for forest dwelling amphibians such as the wood frog (*Rana sylvatica*), and the spotted salamander (*Ambystoma maculatum*). Associated species at this site include wool-grass (*Scirpus cyperinus*), tussock sedge *(Carex stricta*), three-way sedge (*Dulichium arundinaceum*), moss (*Sphagnum spp*.), soft rush (*Juncus effusus*), highbush blueberry (*Vaccinium corymbosum*), red maple (*Acer rubrum*) and gray birch (*Betula populifolia*). A wide undisturbed forested buffer should be maintained around this site. No disturbances were observed at this pond.

Threats and Disturbances

Nearby disturbances include the creation of clearings as food plots and logging.

Recommendations

The Game Commission should avoid the temptation to improve this wetland habitat. This site falls primarily within SGL #217, and includes a portion of the Appalachian Trail.

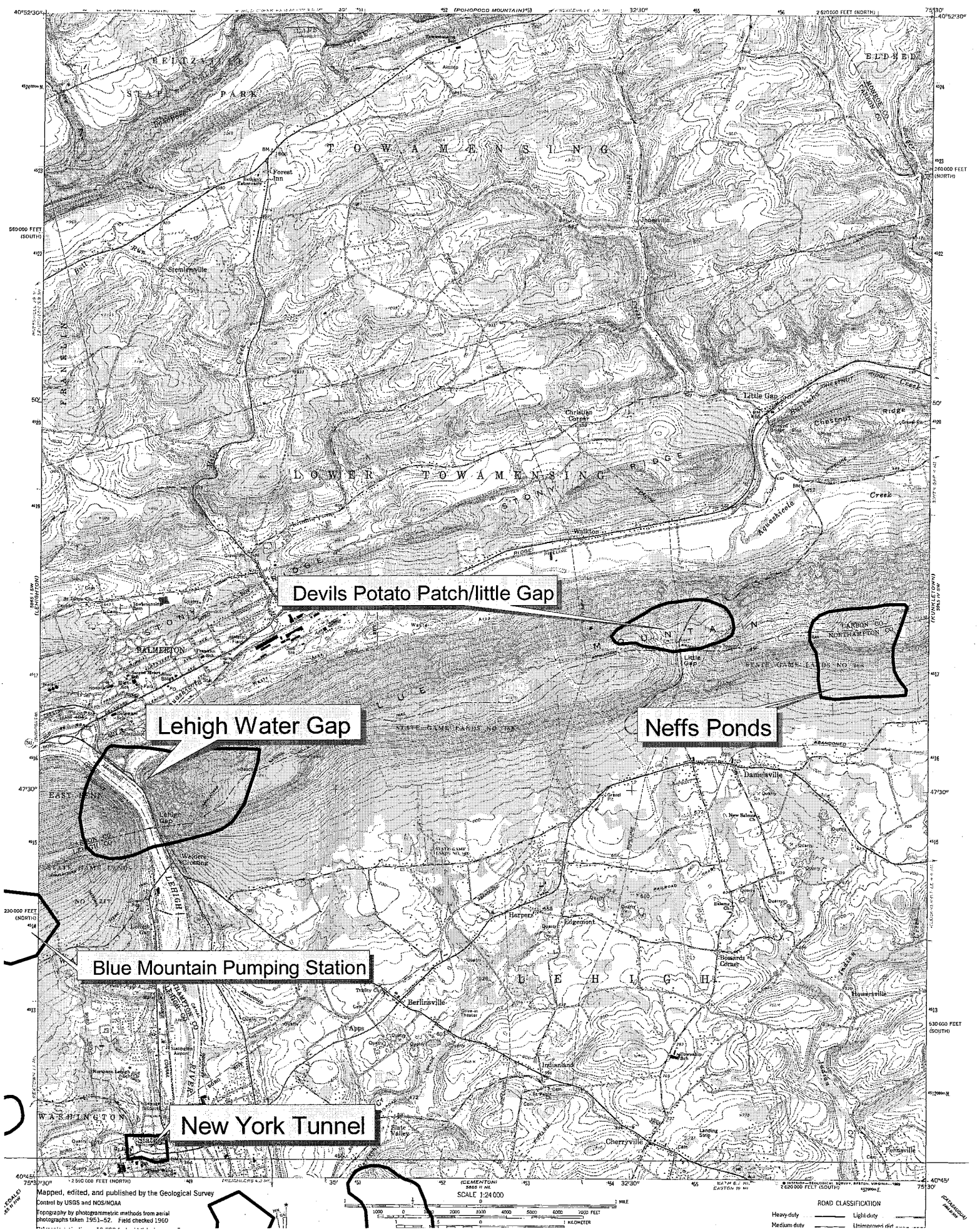
PALMERTON USGS QUADRANGLE MAP

Site Name	Special Species / Community Type	PNHP Ranks*		State Status	Last Seen	Quality**	EO NUMBER
		Global	State				
Blue Mountain Pumping Station	Allegheny Wood Rat (*Neotoma magister*)	G3G4	S3	PT	4/17/91	H	SA535
	Long's Sedge (*Carex longii*)	**G5**	**SU**	**TU**	**6/16/99**	**D**	**SP538**
Devils Potato Patch/Little Gap	Acidic Shrub Swamp	G5	S3	N	7/28/97	CD	NC537
	Boulder Belts	G?	S?	N	NA	E	GE523
	Hartford Fern (*Lygodium palmatum*)	G4	S3	N	7/28/97	D	SP536
Lehigh Gap	**Northern Myotis (*Myotis septentrionalis*)**	**G4**	**S3B, S3N**	**CR**	**3/9/95**	**D**	**SA547**
	Geologic feature	G?	S?	N	NA	E	GE526
Neffs Ponds	Spotted Pondweed (*Potomogeton pulcher*)	G5	S1	PE	7/28/97	BC	SP544
New York Tunnel	**Northern Myotis (*Myotis septentrionalis*)**	**G4**	**S3B, S3N**	**CR**	**2/24/98**	**D**	**SA547**

Locally Significant: Blue Mountain

Managed Areas: Appalachian National Scenic Trail, Kern's Mill Park, Lehigh River-Scenic River, State Game Lands #168, State Game Lands #217

* Please refer to Appendix IV for an explanation of PNHP Ranks and State Status.
**Please refer to Appendix V for an explanation of Quality Ranks
*****Bold= indicates change in site since original report was written in 1999**.



Palmerton Quad, PA

PALMERTON USGS QUADRANGLE MAP

BLUE MOUNTAIN is the most extensive relatively contiguous area of natural habitat in the two counties. It is one of the major corridors for the movement of biota in eastern Pennsylvania. It includes extensive forests with streams, seeps, springs, vernal pools, rock outcrops, and boulder fields. It has long been recognized as one of the major east coast fall flyways for migrating raptors. The extensive relatively unfragmented forests include habitat for resident animal species including larger mammals such as bear and bobcat, as well as for numerous smaller mammals including the PA-Threatened Allegheny woodrat (Neotoma magister). Wetland areas associated with streams, seeps and vernal pools are important habitat for a wide diversity of plant species as well as for many groups of animals including birds, reptiles, amphibians, odonates (dragonflies and damselflies) and others. Conserving sites on the mountain as highlighted in this report must be considered as part of the effort to conserve the greater natural functional value of the mountain ridge. Preserving the ecological integrity of Blue Mountain should be considered an important component in preserving the biodiversity of the two counties.

BLUE MOUNTAIN PUMPING STATION (Washington Twp.) **SA535, SP538** –
During a survey of this site in 1991 evidence of **Allegheny Woodrat *(Neotoma magister)***, an S3 animal species of concern, was found. However, the evidence was not fresh, indicating that the species had been living in the area in the past but was not living there at the time of the survey. The habitat requirements of this species include areas of exposed boulders or rock outcrops generally with some scattered trees or shrubs. This type of habitat is abundant along sections of the upper slopes and ridgetop of Blue Mountain. Although there have been no recent successful surveys for this species in Lehigh or Northampton counties there have been casual observations by some area residents that suggest it still persists here. It is possible that some areas where it used to occur are part of the extensive damage caused by the fallout from the historic smelter operation in Carbon County. Additionally, the species is currently thought to be declining in Pennsylvania due to problems with certain parasites. Areas of Blue Mountain that are suitable habitat for this species are very unlikely to be developed or disturbed and therefore no management action is recommended.

This site also contains a small population of **Long's Sedge (*Carex longii*), an SU Pennsylvania plant species of concern**. This site is described as a damp area with sphagnum clumps in otherwise well-drained hardwood sapling woods with an open aspect. Associated species include Rice Cutgrass (*Leersia oryzoides*), Panic-grass (*Panicum microcarpon*), Fowl mannagrass (*Glyceria striata*), Highbush Blueberry (*Vaccinium corymbosum*), Red Maple (*Acer rubrum*), and Black Gum (*Nyssa sylvatica*).

Threats and Disturbances
Threats and disturbances include previous logging, a right-of-way with exotic plant species, and an adjacent house.

Recommendations
It is recommended that logging be minimized in the area where the woodrat evidence was located. One additional recommendation is that there should be an exotic plant monitoring where the sedge habitat is located.

DEVILS POTATO PATCH /LITTLE GAP (Lehigh Twp.; Lower Towamensing Twp., Carbon Co.) - This is a notch on the Blue Mountain ridge on the Carbon/Northampton county line. The area is dominated by a xeric hardwood forest community with black-gum (Nyssa sylvatica), red maple (Acer rubrum), sassafras (Sassafras albidum), oaks (Quercus spp.), and sweet birch (Betula lenta) as the most common overstory species. Heaths such as mountain laurel and blueberries predominate in the ground-cover. The Appalachian

Trail bisects the site. A small but expanding population of **Hartford Fern (*Lygodium palmatum*)**, a PA-Rare plant species, and a small but diverse acidic shrub/marsh occur on the Carbon County side of the gap. The shrub/marsh is a several-acre perched wetland and is dominated by highbush blueberry (Vaccinium corymbosum) and hardhack (Spiraea tomentosa) with scattered red maple and black gum. Interspersed among the shrubs and trees are marshy openings dominated by strict sedge (Carex stricta) and grasses. Both the species of concern and the swamp occur in the saddle of the gap very close to the county line.
GE523 - "Devil's Potato Patch" is a boulder field occupying a wind gap in Blue Mountain. Sandstone and conglomerate rock of the Shawangunk Formation was broken off of Blue Mountain by repeated freezing and thawing during glacial times. Gravity moved the boulders to where they rest today. Similar boulder fields of "peri-glacial" origin are found along the length of Blue Mountain. Boulder fields may be used as habitat by certain reptiles, mammals, and insects.

LEHIGH GAP (Washington Twp., Lehigh Co.; Lehigh Twp., Northampton Co.; East Penn & Lower Towamensing Twps., Carbon Co.) **GE526** –
This is a water gap in Blue Mountain. Erosion by the Lehigh River has cut through the rock layers as they have been slowly uplifted over millions of years. An impressive cross-section of rock strata is exposed on the east side of the gap. This site has potential for a variety of species of special concern, but has been severely degraded by pollution from the smelter operations on the north side of the ridge. An unknown quality population of **Northern Myotis (*Myotis septentrionalis*)**, an S3B, S3N animal species of concern, was found on the Carbon County side of this site.

NEFFS PONDS (Lehigh Twp.) **SP544** - This site is located near the base of a south facing forested slope along the Blue Mountain. It supports a small cluster of vernal pools located under a canopy of chestnut oak (Quercus prinus), red maple (Acer rubrum), sassafras (Sassafras albidum), and black-gum (Nyssa sylvatica). Water levels and vegetation in the pools varied widely at the time of observation. Several pools had from 1 to 2 feet of water at their deepest points while others were merely moist. Vegetation cover was greatest in the pools with water. One pool had vegetation comparable to a shrub swamp with arrow-wood (Viburnum spp.), highbush blueberry (Vaccinium corymbosum), royal fern (Osmunda regalis), bur-reed (Sparganium spp.), and sedges (Carex spp.) being common, and another had shrubs on the margins only with herbs such as knotweed (Polygonum spp.), pondweed (Potamogeton spp.), and pale meadow-grass (Torreyochloa pallida) growing scattered over the pond. The majority of the pools lacked vegetation and were lined only with decaying leaves. Several of the ponds support fair to good quality populations of **Spotted Pondweed (*Potomogeton pulcher*)**, a PA-Endangered plant species. These ponds are also important to amphibians for reproduction. The ponds are located straddling the boundary of State Game Lands 168. Several ponds fall on or very close to private property and have been manipulated. The forest is crisscrossed with ATV trails though none are currently impacting the ponds. Limiting further disturbance around the ponds including not logging or allowing ATV's to ride through the ponds will help them and the PA-Endangered species persist at the site. Locating and posting the Game Lands boundary may prevent potential encroachment from further degrading this site.

NEW YORK TUNNEL (Borough of Slatington)-**UPDATE- NEW SITE**-
Twelve individuals of **Northern Myotis (*Myotis septentrionalis*)**, an S3B, S3N animal species of concern, were found in a tunnel near a school. Associated species include Little Brown Bat (*Myotis lucifugus*). This area is surrounded by development. No threats and disturbances were noted for this site.

PORTLAND USGS QUADRANGLE MAP

Site Name	Special Species / Community Type	PNHP Ranks*		State Status	Last Seen	Quality **	EO NUMBER
		Global	State				
Arrow Island	White Heath Aster (*Aster ericoides*)	G5	S3	TU	8/26/82	D	SP511
	Appalachian Sand Cherry (*Prunus pumila var depressa*)	G5T5	S1	PE	8/12/97	B	SP511
	White Water-Crowfoot (*Ranunculus aquatilis var diffusus*)	G5T5	S3	PR	8/12/97	E	SP552
Delaware Water Gap	Wild Bleeding Hearts (*Dicentra eximia*)	G4	S1	PE	5/5/97	A	SP513
	Allegheny Woodrat (*Neotoma magister*)	G3G4	S3	PT	7/28/97	E	SA528
	Northern Appalachian Acidic Cliff Community	G5	S5	N	5/5/97	B	NC505
Portland Power Plant Site	**Osprey (*Pandion haliaetus*)**	**G5**	**S2B**	**PT**	1998**, 1998, 2000**	**C, E**	**SA566, PA544**
	White Heath Aster (*Aster ericoides*)	G5	S3	TU	8/14/86	E	SP530
Raesly Woods	Calcareous Seepage Swamp Natural Community	G?	S1	N	4/20/91	C	NC527
	Spreading Globeflower (*Trollius laxus sensu stricto*)	G3Q	S1	PE	4/10/97	CD	SP519

	Basin Graminoid-Forb Fen	G?	S1	N	8/30/95	A	NC566
	Shining Ladies-tresses (*Spiranthes lucida*)	**G5**	**S3**	**TU**	**6/10/02**	**BC**	
	Yellow Sedge (*Carex flava*)	G5	S2	PT	9/3/97	AB	SP585
	Brook Lobelia (*Lobelia kalmii*)	G5	S1	PE	9/3/97	B	SP622
	Prairie Sedge (*Carex prairea*)	G5?	S2	PT	6/1/91	D	SP542
	Sterile Sedge (*Carex sterilis*)	G4	S1	PE	9/3/97	B	SP568
	A sedge (*Carex tetanica*)	G4G5	S2	PT	6/21/95	B	SP570
	Scarlet Indian-Paintbrush (*Castilleja coccinea*)	G5	S2	PT	5/23/97	B	SP515
	Animal	G3	S2	PE	10/5/96	A	SA507
	Hemlock-Parsley (*Conioselinum chinense*)	G5	S1	PE	9/10/96	B	SP573
	Matted Spike (*Eleocharis intermedia*)	G5	S2	PT	9/3/97	B	SP565
Mt. Bethel Fen	Thin-leaved Cotton-Grass (*Eriophorum viridicarinatum*)	G5	S2	PT	9/3/97	B	SP567
	Black Dash (*Euphyes conspicuous*)	G4	S3	N	7/6/96	B	SA570
	Baltic Rush (*Juncus articus var littoralis*)	G5T5	S2	PT	6/1/91	C	SP542
	Wiry Witchgrass (*Panicum flexile*)	G5	S2S3	TU	9/3/97	C	SP572
	Carolina Grass-of-Parnassus (*Parnassia glauca*)	G5	S2	PE	9/3/97	AB	SP523
	Mulberry Wing (*Poanes massasoit*)	G5	S3	N	7/6/96	B	SA507
	Capillary Beaked-Rush (*Rhynchospora capillacea*)	G5	S1	PE	9/3/97	AB	SP501
	Hoary Willow (*Salix candida*)	G5	S1	PE	9/27/01	D	SP507
	Autumn Willow (*Salix serissima*)	G4	S2	PT	5/31/88	D	SP545
	Whorled Nutrush (*Scleria verticillata*)	G5	S1	PE	9/3/97	AB	SP569
	Spreading Globe-flower (*Trollius laxus sensu stricto*)	G3Q	S1	C	5/4/95	C	SP515

Locally Significant: BLUE MOUNTAIN

Managed Areas: Delaware Water Gap National Recreation Area

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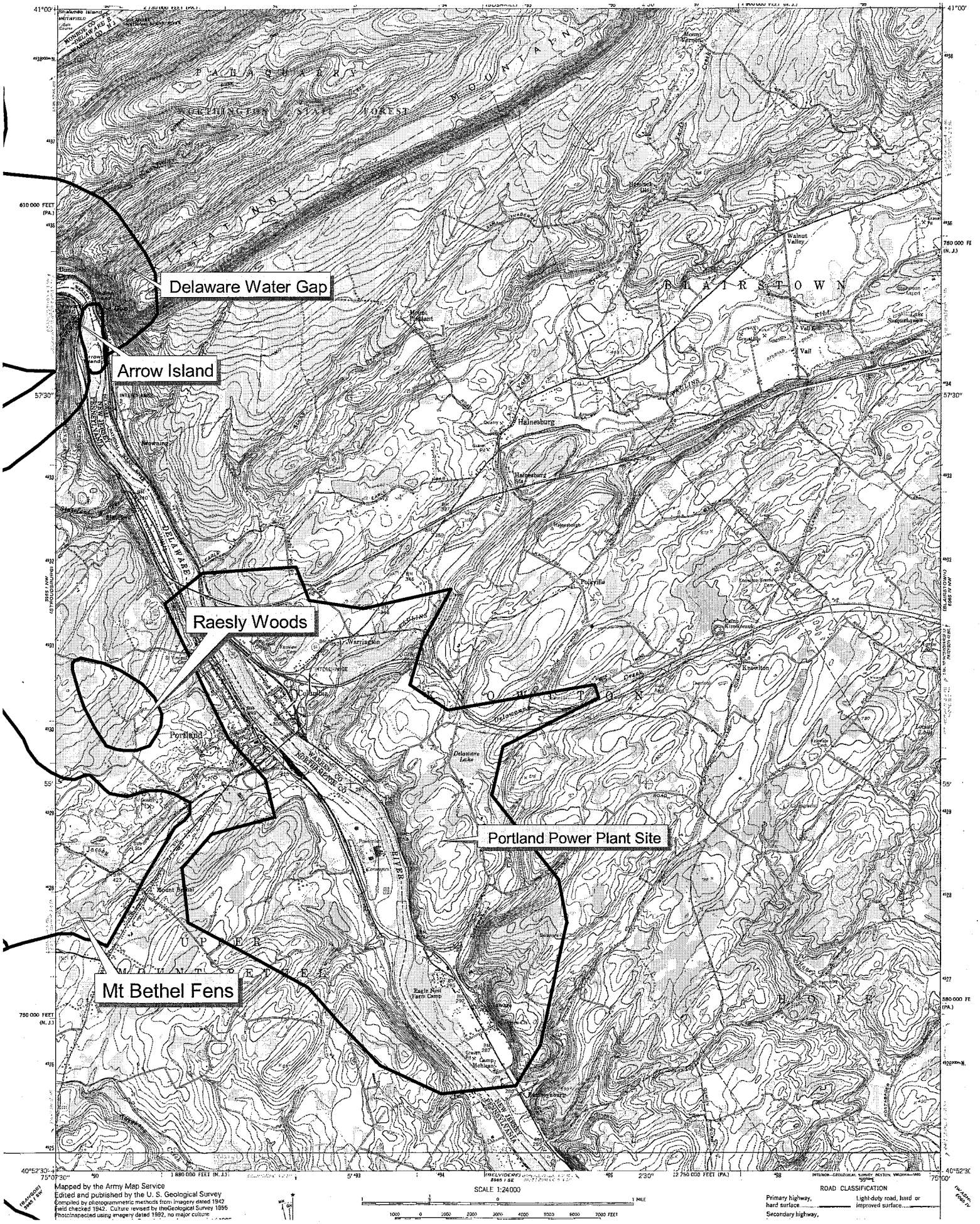


Portland Quad, PA

PORTLAND USGS QUADRANGLE MAP

ARROW ISLAND (Upper Mount Bethel Twp.) SP511, SP552 - This site is associated with a large island in the Delaware River just downstream of the Delaware Water Gap. The island is heavily scoured by ice and floodwaters. The vegetation consists of dense patches of stunted sycamore (Platanus occidentalis) and ash (Fraxinus spp.) interspersed with large openings. The open areas have prairie grasses such as big bluestem (Andropogon gerardii) and switch grass (Panicum virgatum), low shrubs such as willow (Salix spp.) and grape (Vitis spp.), and areas of bare sand and cobbles. A good population of **Appalachian Sand Cherry (*Prunus pumila var. depressa*)**, a PA-Rare shrub species, occurs scattered over a several acre area. There are no immediate threats to this population. A PA-Threatened aquatic plant species, **White Water-Crowfoot (*Ranunculus aquatilus var. diffuses*)**, also occurs at the site. It grows in the fast-flowing section of the Delaware River adjacent to the island on the east side. The full extent of this population is unknown. Other plant species growing in this section of the river include pondweeds (Potamogeton spp.) and broad waterweed (Elodea canadensis). There are no immediate threats to either of these populations and no special management is recommended. This site occurs entirely within the Delaware Water Gap National Recreation Area.

BLUE MOUNTAIN is the most extensive relatively contiguous area of natural habitat in the two counties. It is one of the major corridors for the movement of biota in eastern Pennsylvania. It includes extensive forests with streams, seeps, springs, vernal pools, rock outcrops, and boulder fields. It has long been recognized as one of the major east coast fall flyways for migrating raptors. The extensive relatively unfragmented forests include habitat for resident animal species including larger mammals such as bear and bobcat, as well as for numerous smaller mammals including the PA-Threatened Allegheny woodrat (Neotoma magister). Wetland areas associated with streams, seeps and vernal pools are important habitat for a wide diversity of plant species as well as for many groups of animals including birds, reptiles, amphibians, odonates (dragonflies and damselflies) and others. Conserving sites on the mountain as highlighted in this report must be considered as part of the effort to conserve the greater natural functional value of the mountain ridge. Preserving the ecological integrity of Blue Mountain should be considered an important component in preserving the biodiversity of the two counties.

DELAWARE RIVER is an excellent recreational and scenic resource; it includes many current and historical records for species of special concern. The river and adjacent forested watersheds comprise one of the major corridors for the movement of biota in eastern Pennsylvania

DELAWARE RIVER WATER GAP (Upper Mount Bethel Twp.; Smithfield Twp., Monroe Co.) NC505, SP513, SA528 - The Delaware River Water Gap is one of the most striking natural features in Pennsylvania. The water gap supports a good quality example of the relatively common Northern Appalachian Acidic Cliff Natural Community. On the PA side of the Delaware River the natural community extends from the lower elevations adjacent to Rt. 611 near the Northampton-Monroe County line south into Northampton County along the ridge face and then southwest for a total distance of approximately three quarters of a mile. The exposed rock escarpment of sandstone and conglomerate of the Shawangunk Formation that creates habitat for this community starts at a low elevation nearest the river and quickly increases elevation so that much of the community is adjacent to the ridgetop. The substrate is characterized by a high percentage of weathered exposed bedrock with small patches of thin soil in crevices and on ledges. Vegetation consists of widely scattered and stunted pitch pine (Pinus rigida), chestnut oak (Quercus prinus), shadbush (Amelanchier spp.), scrub oak (Quercus ilicifolia), and black cherry (Prunus serotina) with very limited amounts of lowbush blueberry (Vaccinium angustifolium) and mountain laurel (Kalmia latifolia). Herbs and grasses common at the site include poverty grass (Deschampsia flexuosa), sedges (Carex spp.), little bluestem (Schizachyrium scoparium), and common polpody (Polypodium virginianum). Other less common herb species include rock

harlequin (Corydalis sempervirens), pinweed (Lechea spp.), and rattlesnake-weed (Hieracium venosum). The highly exposed cliffs and the extensive talus piles located on the slopes below support a population of a PA-Threatened animal species, SA528. The site also supports an excellent quality population of a PA-Endangered plant species, SP513. Hundreds of individuals of this species were observed in flower during our 1997 field survey. The cliff community also provides habitat for a variety of bird species, the most notable of which are black vultures (Coragyps atratus), turkey vultures (Cathartes aura) and common ravens (Corvus brachyrhynchos). All of these species were observed at the site in 1997 and any or all of them may be nesting here. Inaccessibility of much of the cliff prevented a thorough survey for nests. The dry exposed habitat of the cliffs is also good habitat for several reptile species such as the five-lined skink (Eumeces fasciatus), fence lizard (Sceloporus undulatus), and certain snake species. This site occurs within the Delaware Water Gap National Recreation Area.

MT. BETHEL FENS (Upper Mount Bethel Twp.) (see also Mt. Bethel Fens - Stroudsburg Quad.) – **UPDATE**-Mt. Bethel Fens is a complex of at least 10 rare wetland communities located in a small valley to the west and northwest of the village of Mt. Bethel. These important wetlands are comprised of small calcareous fens and seeps (open meadow-like, permanently saturated wetlands fed by high pH groundwater), marshes and wooded swamps. They are scattered across the valley floor and walls over a 1 to 2-square mile area. The valley is unique because there are few areas in Pennsylvania that are underlain by both limestone and recently deposited glacial material. The area is underlain by limestone bedrock of Cambrian and Ordovician ages. Further, the valley was last glaciated during the Wisconsonian Glaciation. When the glacier retreated about 15,000 years ago it left an overburden above the bedrock of unsorted glacial debris (moraines or till comprised of clay, silt, sands and gravels) and kame deposits (poorly sorted material with lenses of sands, gravels and rocks) containing limestone material (for more information on bedrock and glacial geology see: Hall, 1934; Miller *et al*. 1939; Sherwood, 1964; and Epstein, 1969). The till material can be an effective block to groundwater movement while the kames may act as "pipelines" for groundwater flow. Where these pipelines intersect the surface either in depressions on the valley floor or on the lower sideslopes, seeps and springs emerge and the calcareous wetlands are formed. Due to the constant saturation by groundwater, organic matter (peat) has built up over time to a depth of about 3 feet in some places. The constantly high water table and past disturbances (fire, beaver, clearing and grazing) has resulted in these wetlands being dominated by grasses and sedges. The fens are often surrounded by a border of shrubs such as poison sumac.

Due to the combination of limestone and glaciation, the fen habitat is very rare, both in Pennsylvania and globally. It stands to reason then that many of the species that depend upon the fens are rare as well. To date, there are 15 rare plants, 3 rare animals and 2 rare mosses known to occur in the various fen communities. Another rare plant occurs in the wooded seeps adjacent to the fens. Not all of the fens include all of the species, but, taken together, the populations of most of the species are in good to excellent condition. Since the report was written in 1999, a new fair to good quality population of **Shining Ladies-tresses (*Spiranthes lucida*)**, an S3 plant species of concern, was found in a small spring-fed calcareous seepage in mixed woods in the headwaters of a tributary of Jacoby Creek.

The fens offer more than just habitat for rare species. They provide recreational opportunities such as bird watching and hunting and general open space for the enjoyment of all. They are a colorful natural garden throughout the growing season. Many uncommon, attractive species, such as fringed gentian (*Gentianopsis crinita*), asters (*Aster spp*.), and ladies tresses (*Spiranthes spp*.), occur in the open habitats in and around the fens.

To maintain the fens it is critical to look at the entire landscape in which the fens occur. This landscape provides water to the fens and the means by which species are able to colonize/move to new sites.

Maintaining the array of fens and the habitats between is critical to ensuring the fen species are able to survive. Native vegetation is needed around each fen to act as a buffer against disturbances and to help exclude weedy species. Corridors are needed for native species to relocate from one fen to another.

There are a variety of threats to the fens and the species that inhabit them. Of most immediate concern is the abundance of two very aggressive weeds - phragmites and purple loosestrife. These two plants are capable of displacing the native fen plants. Of equal concern is maintaining the hydrologic system that the fens depend upon. An abundance of clean, high pH water feeding the fens is critical to maintaining the species that occur there. Without the quantity of water, the fens will quickly change into shrub wetlands and eventually into forested wetlands. If water quality is degraded, the weedy species will be favored to the exclusion of the native flora.

The Nature Conservancy (TNC) has identified the Mt. Bethel Fens as one of its highest priorities for conservation in PA. Currently, TNC is cooperating with landowners throughout the valley to ensure the survival of the fens. TNC is working with researchers to understand groundwater flow patterns, past land use and vegetation history, beneficial disturbances and methods to control the phragmites and loosestrife. This effort by a variety of people and organizations is needed for the fens to remain indefinitely on the landscape as a refuge for rare species and as beneficial open space for the people of Upper Mt. Bethel Township and Northampton County.

PORTLAND POWERPLANT SITE (Upper Mount Bethel Twp.) **SA554 – UPDATE-**
The Osprey (*Pandion halieatus*), an S2B animal species of concern, has been successfully reintroduced into the Delaware River Valley after being nearly extirpated in PA. It was observed nesting at this site in 1997. It requires habitat associated with sea coasts or large rivers or lakes. Since the report was written in 1999, there have been two additional nests of **Osprey (*Pandion haliaetus*), an S2B Pennsylvania-threatened animal species of concern,** found near the power plant. Three immature Ospreys were found with each of these different occurrences and one pair was observed with one of the occurrences. This area represents a classic scenario for Osprey nesting where platforms have been erected. This area hosts an optimum feeding ground for this species by providing the Delaware River and two fairly large lakes for foraging opportunities.

Threats and disturbances
Major threats include shooting of individual birds and contamination of aquatic ecosystems by pesticides. Disturbances include human encroachment of nests and human activities within a certain distance from the nesting platform.

Recommendations
It is recommended that only a minimal amount of disturbance should be allowed during the breeding season to increase breeding success. However, it is feasible still that surveys of this species be continued to monitor the yearly breeding success, and the number of nests found along the river.

RAESLY WOODS (Upper Mount Bethel Twp.) **NC527, SP519** - This site supports a fair quality example of a **Calcareous Seepage Swamp Natural Community**. The swamp is fed by seeps and springs from the hill of calcareous deposits (a kame) to the northwest. Black ash (Fraxinus nigra) is the dominant overstory species, with red maple (Acer rubrum), elm (Ulmus spp.), and tulip poplar (Liriodendron tulipifera) also present. Spicebush (Lindera benzoin) is the dominant understory species. There is a diverse herb flora with skunk cabbage (Symplocarpus foetidus) and marsh marigold (Caltha palustris) being particularly abundant. Other common herbs include violets (Viola spp.), dwarf ginseng (Panax trifolius), bedstraw (Galium spp.), buttercups (Ranunculus spp.), and toothwort (Cardamine spp.). Mosses, particularly several species of sphagnum moss (Sphagnum spp.) are also common. This site is a mosaic of wet seepy areas, meandering streams, and slightly higher uplands. The upland areas have been used as pasture in the past and are more open. They provide habitat for a small population of a PA-endangered plant. The species needs the light that is provided by a thin canopy or by canopy gaps and would benefit from enhancing habitat through girdling or cutting of a few trees to maintain the openings. Disturbances include roads along the south margin, past logging, grazing, and ditch

digging in some areas. Maintaining a buffer of upland forest and leaving the hydrology intact will help to improve the quality of this community over time.

RIEGELSVILLE USGS QUADRANGLE MAP

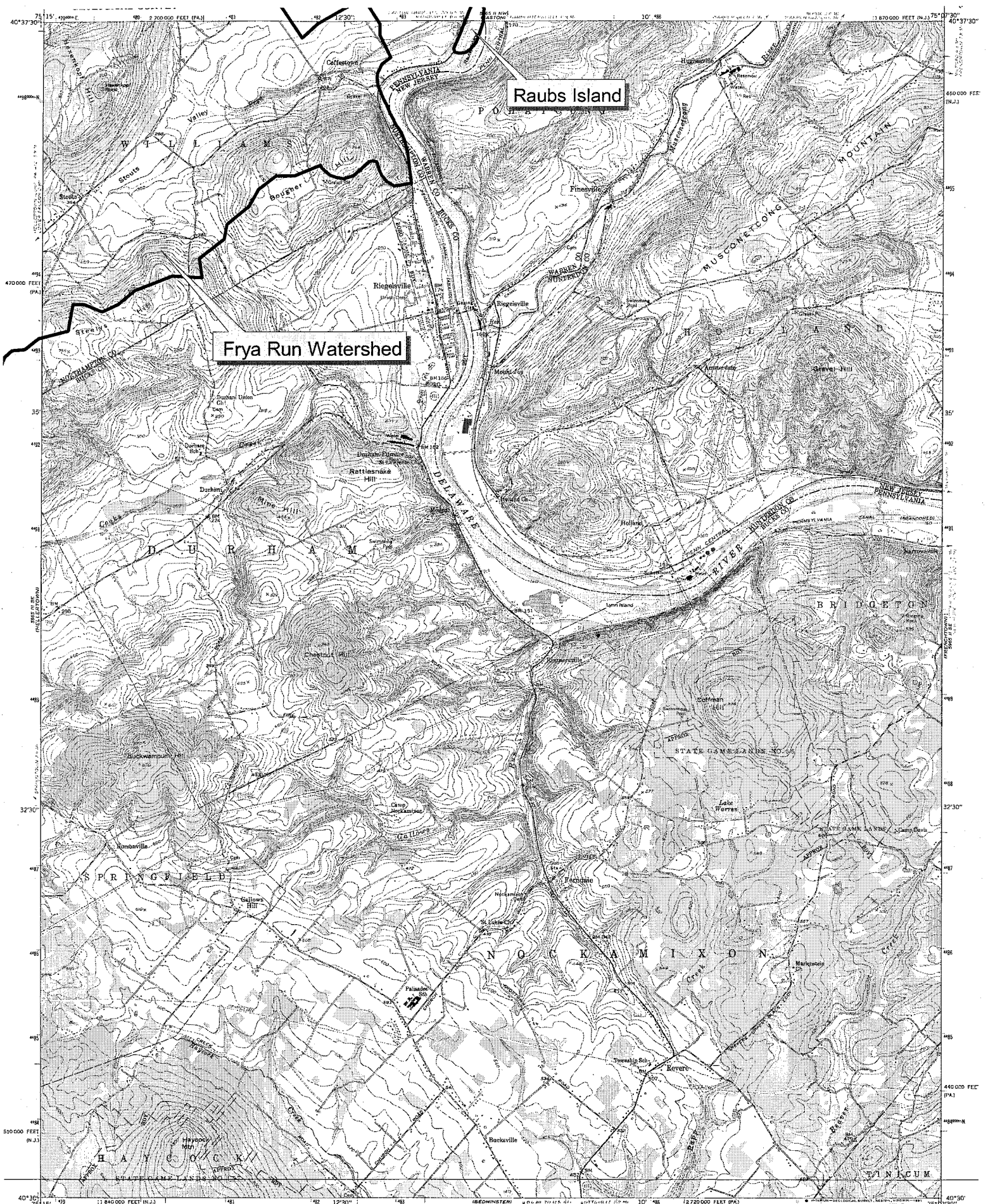
Site Name	Special Species / Community Type	PNHP Ranks*		State Status	Last Seen	Quality**	EO NUMBER
		Global	State				
Frya Run Watershed (Formerly Hexenkopf Slopes, Hexenkopf Wetlands, Hexenkopf Rock, Erosional remnant, and Mariton Slopes)	**Animal**	**G3**	**S2**	**PE**	**1998**	**E**	SA572
	Animal	**G3**	**S2**	**PE**	**1996**	**E**	
	Showy Goldenrod (*Solidago speciosa var. speciosa*)	G5T5	SR	PT	9/27/98	C	SP574
	Erosional Remnant	G?	S?	N	N/A	E	GE529
Raubs Island	Appalachian Sand Cherry *(Prunus pumila var. depressa*)	G5T5	S1	PE	8/25/00	BC	SP521

Locally Significant: Delaware River

Managed Areas: Mariton Wildlife Sanctuary and Wilderness Trust

Other: Frya Run, HQ-CWF/EV Waters

* Please refer to Appendix IV for an explanation of PNHP Ranks and State Status.
**Please refer to Appendix V for an explanation of Quality Ranks.
***Bold= indicates change in site since original report was written in 1999**.



Riegelsville Quad, PA

RIEGELSVILLE USGS QUADRANGLE MAP

DELAWARE RIVER is an excellent recreational and scenic resource; it includes many current and historical records for species of special concern. The river and adjacent forested watersheds comprise one of the major corridors for the movement of biota in eastern Pennsylvania.

FRYA RUN WATERSHED (Formerly Hexenkopf Slopes**, Hexenkopf Wetlands, Hexenkopf Rock (Erosional remnant), and Mariton Slopes)** (Williams Twp.; Hellerton, Nazareth and Easton Quads, Bucks County) *SA572, GE529, Solidago speciosa, erosional remnant-*
This site includes a variety of habitat types. A **G3 animal species of concern** was discovered using a series of wetlands and seepy forest that occur along a tributary to Frya Run. These wetlands are dominated by shrubs, sedges (*Carex spp*.), and sweetflag (*Acorus calumus*). The animal was observed at this site as recently as 1995. Surveys in 1998 were unsuccessful but only a small portion of the area was surveyed. During the 1998 surveys it was determined that suitable habitat still exists but it is marginal. Better habitat may occur elsewhere in the vicinity. Further surveys are recommended to determine if this species still occurs here. Avoiding disturbance to these wetlands and the adjacent forest should help keep this habitat in reasonable condition.

Hexenkopf Hill is a broad southeast facing forested slope. The summit of the ridge is a hilltop outcrop of Pochuck gneiss, one of the oldest rocks in North America. The rock also contains the mineral magnetite (Geyer and Bolles 1979). Areas adjacent to the summit have large and small boulders making up the substrate. Common tree species include tulip poplar (*Liriodendron tulipifera*), sweet birch (*Betula lenta*), oaks (*Quercus spp*.), and hickories (*Carya spp*.). Witch-hazel (*Hamamelis virginiana*) and spicebush (*Lindera benzoin*) are common shrubs. Herb diversity is moderate with greater numbers of species being found further down slope. The site also includes several seeps and at least one vernal pool. These wetland areas support numerous plant species and are home to many animals as well. Upland areas on the slope have long been known as nesting areas for both black vultures (*Coragyps atratus*) and turkey vultures (*Cathartes aura*). Although portions of the site have been selectively logged and it is currently bissected by a large powerline right-of-way, there are a variety of habitat types here and there is potential for several species of special concern. Retaining the forest in an unfragmented condition will benefit the numerous species that make their homes here as well as those that use this area for migration.

The Mariton Slopes are a series of forested slopes and shaded escarpments above the Delaware River. The steepest portion of the slopes are dominated by red oak (*Quercus rubra*), chestnut oak (*Quercus prinus*), sweet birch (*Betula lenta*), and red maple (*Acer rubrum*) with scattered stands of hemlock (*Tsuga canadensis*). These areas consist of many vertical rock faces interspersed with narrow ravines. These cool heavily shaded outcrops are good habitat for numerous fern species as well as spring wildflowers. Rhododendron (*Rhododendron maximum*) is very common on these slopes and extends in dense thickets far upslope. The forest on the crest of the slope is less diverse with large tulip poplar (*Liriodendron tulipifera*) dominating the canopy. A predominance of tulip poplar indicates that the site has a history of logging because tulip poplar requires forest openings to germinate. It grows faster than other trees and eventually dominates a site. As the forest matures, however, shade-tolerant species (such as red oak) replace tulip poplar because it does not regenerate under a closed canopy (Tryon 1980). Wildflowers are abundant on the upper slope but exotic species such as garlic mustard (*Alliaria officinalis*), wineberry (*Rubus phoenicolasius*), and Japanese honeysuckle (*Lonicera japonica*) are also common. **Showy Goldenrod (Solidago speciosa var. speciosa)**, a plant species of concern, was found here in 1998. The plant is growing in a grassy area along a path. Associated species include assorted grasses and forbs, early goldenrod (*Solidago juncea*) and poison-ivy (*Toxicodendron radicans*). Overall, this site includes numerous habitat types and is an asset to the biological diversity of the greater Delaware River corridor.

RAUBS ISLAND (Williams Twp.) **SP521** - This site is located on an island in the Delaware River. The island includes two primary habitat types. One is the higher elevation forested portion which is infrequently flooded, has deep alluvial soil, and occurs on the downstream half of the island. The other, which consists of shrub thicket, is located on the upstream portion of the island and is at a slightly lower elevation with a substrate of sand, gravel and cobbles. This habitat is characterized by seasonal scouring from ice and flood waters. Vegetation consists of linear patches of shrubs and stunted trees such as sycamore (Platanus occidentalis) and ash (Fraxinus spp.) interspersed with open areas dominated by herbs, vines, and grasses. This scour impacted habitat supports a good quality population of **Appalachian Sand Cherry (*Prunus pumila var. depressa*)**, a PA-Rare plant species. The rare plant grows in association with poison ivy (Toxicodendron radicans), frost grape (Vitis riparia), and many exotics including soapwort (Saponaria officinalis), Cypress-spurge (Euphorbia cyparissias), and multiflora rose (Rosa multiflora). The margin of the upstream portion of the island (particularly in the late season) is mostly unvegetated gravel and cobbles with a few scattered weedy plant species. The island is also good habitat for bird species such as osprey (Pandion haliaetus) and herons. This island has been disturbed in the past by the construction of a bridge of which only an abandoned stone pier remains. Leaving this site in its current condition will help the rare plant persist here.

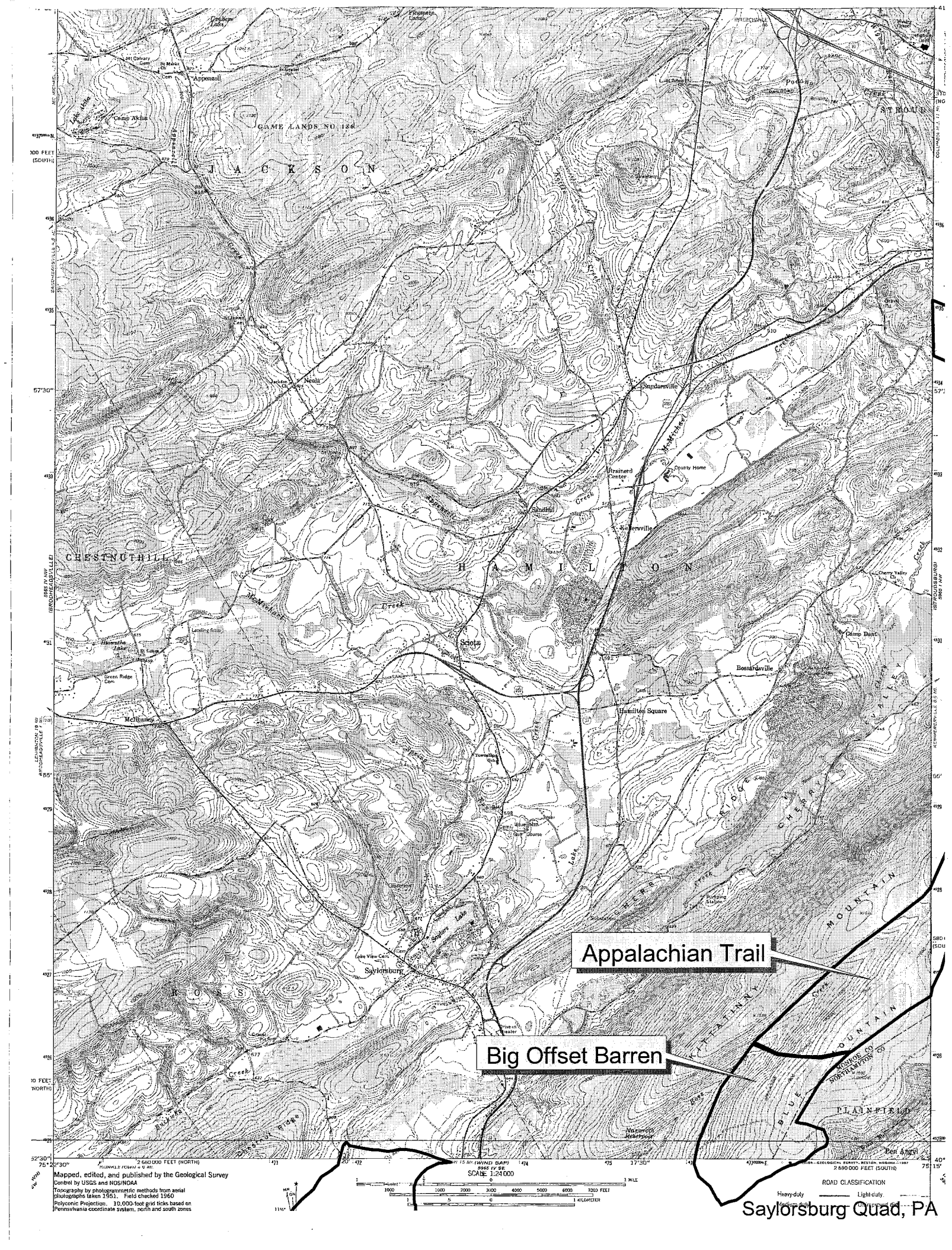
SAYLORSBURG USGS QUADRANGLE MAP

Site Name	Special Species / Community Type	PNHP Ranks*		State Status	Last Seen	Quality**	EO Number
		Global	State				
Big Offset Barren	Variable Sedge (*Carex polymorpha*)	G3	S2	PT	7/3//97	BC	SP517

Locally Significant: Blue Mountain

Managed Areas: Appalachian National Scenic Trail

* Please refer to Appendix IV for an explanation of PNHP Ranks and State Status.
**Please refer to Appendix V for an explanation of Quality Ranks.
***Bold= indicates change in site since original report was written in 1999**.


Appalachian Trail
Big Offset Barren
Saylorsburg Quad, PA
Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA
Topography by photogrammetric methods from aerial photographs taken 1951. Field checked 1960
Polyconic Projection. 10,000-foot grid ticks based on Pennsylvania coordinate system, north and south zones
SCALE 1:24 000
ROAD CLASSIFICATION
Heavy-duty
Light-duty
JACKSON
HAMILTON
CHESTNUTHILL
ROSS
PLAINFIELD
GAME LANDS NO 168
Appenzell
Neola
Snydersville
Sciota
Saylorsburg
Scotrun
Stroudsburg
Mt Calvary Ch
Camp Akiba
Lake Minsi
Brodhead Creek
Pocono Creek
Cherry Creek
Kittatinny Mountain
Blue Mountain
Monroe Co
Northampton Co

BIG OFFSET BARREN (Plainfield Twp.; Hamilton Twp., Monroe County) **SP517** - This site is a broad forested plateau which straddles the Northampton and Monroe county line on the Blue Mountain. It supports a fair to good quality population of the globally rare **Variable Sedge (*Carex polymorpha*)**, a G2G3 PE-Endangered plant species. The relatively young forest at this site is dominated by red maple (Acer rubrum) and sassafras (Sassafras albidum) with scrub-oak (Quercus ilicifolia), lowbush blueberry (Vaccinium spp.), and huckleberry (Gaylussacia baccata) occurring in the understory and in forest gaps. The forest at this site has a history of logging or fire. Long-term survival of this species at this site may depend on the availability of forest gaps. The 1997 survey of the barren found the population continuing to do well.

BLUE MOUNTAIN is the most extensive relatively contiguous area of natural habitat in the two counties. It is one of the major corridors for the movement of biota in eastern Pennsylvania. It includes extensive forests with streams, seeps, springs, vernal pools, rock outcrops, and boulder fields. It has long been recognized as one of the major east coast fall flyways for migrating raptors. The extensive relatively unfragmented forests include habitat for resident animal species including larger mammals such as bear and bobcat, as well as for numerous smaller mammals including the PA-Threatened Allegheny woodrat (Neotoma magister). Wetland areas associated with streams, seeps and vernal pools are important habitat for a wide diversity of plant species as well as for many groups of animals including birds, reptiles, amphibians, odonates (dragonflies and damselflies) and others. Conserving sites on the mountain as highlighted in this report must be considered as part of the effort to conserve the greater natural functional value of the mountain ridge. Preserving the ecological integrity of Blue Mountain should be considered an important component in preserving the biodiversity of the two counties.

SLATEDALE USGS QUADRANGLE MAP

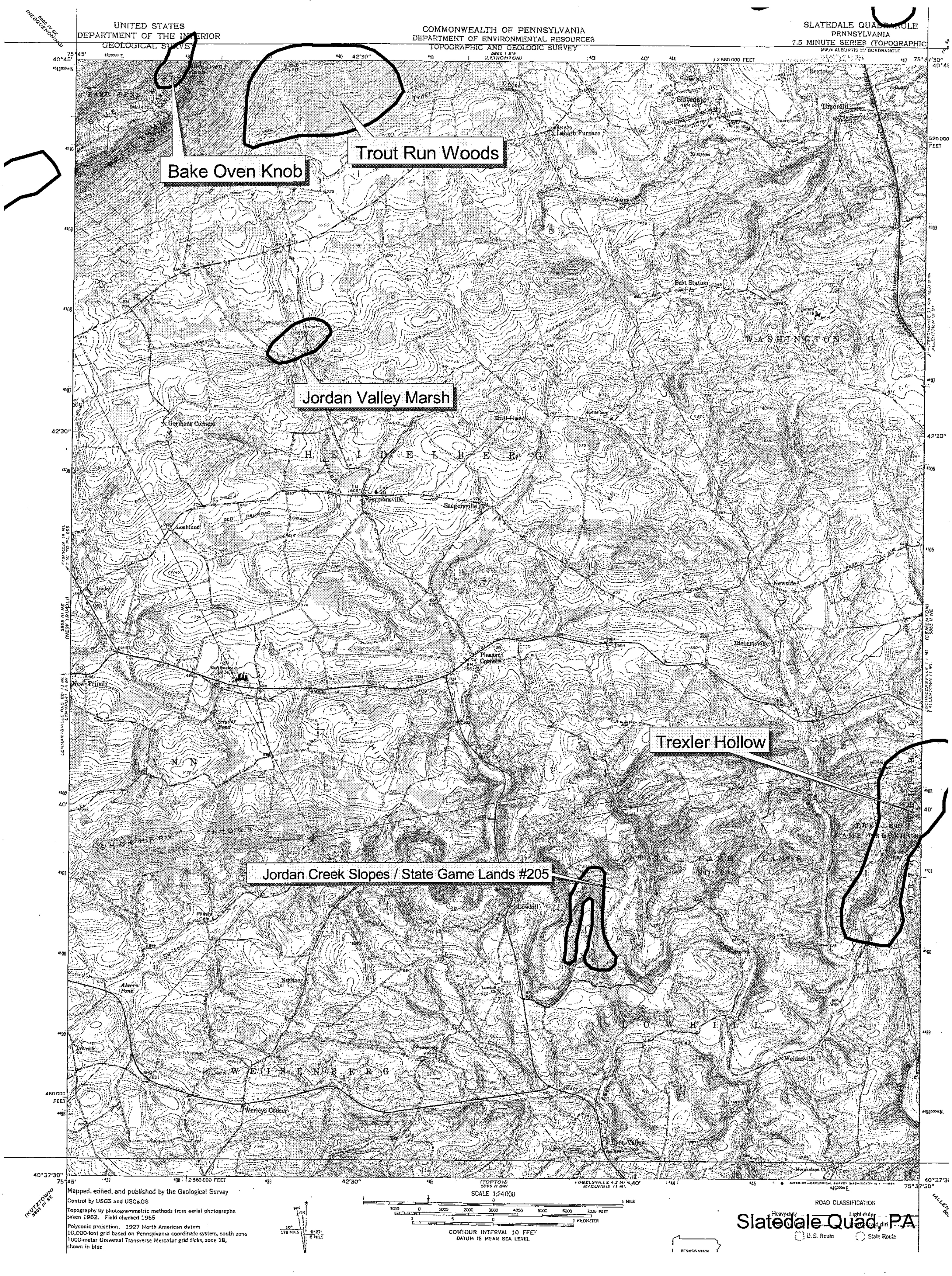
Site Name	Special Species / Community Type	PNHP Ranks*		State Status	Last Seen	Quality**	EO Number
		Global	State				
Bake Oven Knob	Northern Appalachian Acidic Rocky Summit	G?	S2	N	9/10/98	C	NC502
Jordan Valley Marsh	Brown Sedge (*Carex buxbaumii)*	G5	S3	PR	6/2/92	C	SP527
Trexler Hollow	Western Hairy Rockcress (*Arabis hirsuta*)	G5	S1	TU	5/16/97	C	SP526
	Round-head Gayfeather (*Liatris scariosa*)	G5?	S2	N	9/10/98	C	SP508

Locally Significant: Trout Run Woods, Jordan Creek Slopes/State Game Lands #205, Blue Mountain

Managed Areas: Appalachian National Scenic Trail, State Game Lands #205, State Game Lands #217, Trexler-Lehigh County Game Preserve

Other:

* Please refer to Appendix IV for an explanation of PNHP Ranks and State Status.
**Please refer to Appendix V for an explanation of Quality Ranks.
*****Bold= indicates change in site since original report was written in 1999**.


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
TOPOGRAPHIC AND GEOLOGIC SURVEY
SLATEDALE QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
Bake Oven Knob
Trout Run Woods
Jordan Valley Marsh
Trexler Hollow
Jordan Creek Slopes / State Game Lands #205
Slatedale
Germansville
New Tripoli
HEIDELBERG
WASHINGTON
LYNN
LOWHILL
WEISENBERG
Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS
Topography by photogrammetric methods from aerial photographs taken 1962. Field checked 1965
Polyconic projection. 1927 North American datum
10,000-foot grid based on Pennsylvania coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 18, shown in blue
SCALE 1:24000
CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
ROAD CLASSIFICATION
Slatedale Quad, PA

SLATEDALE USGS QUADRANGLE MAP

BAKE OVEN KNOB (Heidelberg Twp.; East Penn Twp., Carbon Co.) **NC502** - This site includes a Northern Appalachian Acidic Rocky Summit Natural Community. It is characterized by prominent bedrock outcrops which are flanked by large sandstone boulders. Patches of stunted trees including red maple (Acer rubrum), sweet birch (Betula lenta), chestnut oak (Quercus prinus), and scarlet oak (Quercus coccinea) form a partially open canopy. Mountain laurel (Kalmia latifolia) and huckleberry (Gaylussacia baccata) are common shrubs. Herbs and several species of ferns grow in areas among the rocks where soil has accumulated. The area has been disturbed in the past by the construction of a small stone building. The ruins of the building still remain at the site. Numerous non-native herb species also occur here but due to their limited area of cover they have little impact on the community as whole. This site is also recognized as an important area for scientific research. It is used in the late summer and fall of every year to census migrating raptors and other bird species. This site is part of State Game Lands #217.

BLUE MOUNTAIN is the most extensive relatively contiguous area of natural habitat in the two counties. It is one of the major corridors for the movement of biota in eastern Pennsylvania. It includes extensive forests with streams, seeps, springs, vernal pools, rock outcrops, and boulder fields. It has long been recognized as one of the major east coast fall flyways for migrating raptors. The extensive relatively unfragmented forests include habitat for resident animal species including larger mammals such as bear and bobcat, as well as for numerous smaller mammals including the PA-Threatened Allegheny woodrat (Neotoma magister). Wetland areas associated with streams, seeps and vernal pools are important habitat for a wide diversity of plant species as well as for many groups of animals including birds, reptiles, amphibians, odonates (dragonflies and damselflies) and others. Conserving sites on the mountain as highlighted in this report must be considered as part of the effort to conserve the greater natural functional value of the mountain ridge. Preserving the ecological integrity of Blue Mountain should be considered an important component in preserving the biodiversity of the two counties.

JORDAN CREEK SLOPES/STATE GAME LANDS #205 (Lowhill Twp.) - This locally significant area is a series of steep forested slopes occurring adjacent to Jordan Creek. Forest composition varies depending on the location and aspect of the different slope segments. The most common canopy species include hemlock (Tsuga canadensis), sugar maple (Acer saccharum), hickories (Carya spp.), sweet birch (Betula lenta), and red oak (Quercus rubra). Other species such as hop-hornbeam (Ostrya virginiana), American beech (Fagus grandifolia), and basswood (Tilia americana) also occur but are less common. Witch-hazel (Hamamelis virginiana) occurs in the understory and there is a low to moderate diversity of herbs. These second growth forests are relatively mature and help create important habitat along the Jordan Creek corridor. Floodplain areas along here are a mix of native and exotic species with the non-native multiflora rose (Rosa multiflora) being overly abundant. Other slopes along the creek downstream may also contribute good habitat to the Jordan Creek corridor. Visiting all the slopes along the creek was not within the scope of this project but review of aerial photography indicated there may be other relatively mature forests along this creek.

JORDAN VALLEY MARSH (Heidelberg Twp.) **SP527** - This site supports a fair quality population of **Brown Sedge (*Carex buxbaumii*)**, a PA-Endangered sedge species. The sedge occurs in a open, calcareous wet meadow adjacent to Jordan Creek. Associated species include golden ragwort (Senecio aureus), wrinkle-leaf goldenrod (Solidago rugosa), swamp dewberry (Rubus hispidus), other sedges (Carex spp.) and the exotics, sweet vernal grass (Anthoxanthum odoratum) and velvet grass (Holcus lanatus). Succession is a potential threat; the site needs to be cleared periodically by mowing or other means in order to maintain the open habitat necessary for this species survival.

TREXLER HOLLOW (Lowhill & North Whitehall Twps.) **SP508, SP526** - A roadside outcrop of Martinsburg shale supports two plant species of concern. A fair population of **Western Hairy Rock-Cress (*Arabis hirsuta*)** occurs on north and northwest-facing moist cliffs along with wild columbine (Aquilegia canadensis), alum-root (Heuchera americana), early saxifrage (Saxifraga virginiensis), and several fern species. A fair population of **Round-head Gayfeather (*Liatris scariosa*)** occurs nearby on a sunnier, steep west-facing shaly slope. Associated species include goldenrod (Solidago spp.) and wild columbine. Both species of concern occupy only a narrow band of suitable habitat; road construction and roadside or powerline herbicide spraying are potential threats. Further surveys are recommended to determine if the populations of these species are more widespread in this area.

TROUT RUN WOODS (Heidelberg Twp.) is a locally significant area that includes a seepy woodland located along Trout Run at the base of Blue Mountain. The woods are dominated by mixed oaks (Quercus spp.), sweet birch (Betula lenta), red maple (Acer rubrum), and black-gum (Nyssa sylvatica), with scattered groves of hemlock (Tsuga canadensis). They are in relatively good condition although some areas have been selectively logged in the recent past. The woods contain numerous streamlets, seeps, and several vernal ponds. Swampy or seepy areas are more prevalent adjacent to Trout Run. These areas support species typical of wet woods including skunk cabbage (Symplocarpus foetidus), cinnamon fern (Osmunda cinnamomea), sedges (Carex spp.), and sphagnum moss (Sphagnum spp.). This wooded segment of Trout Run is good habitat for many plants and animals. The creek itself with several species of native aquatic plants is excellent habitat for aquatic insects. There are historic records for species of concern occurring at this site although none were observed during a 1997 field survey. Further surveys are recommended. This site is partly on State Gamelands #217.

STROUDSBURG USGS QUADRANGLE MAP

Site Name	Special Species / Community Type	PNHP Ranks*		State Status	Last Seen	Quality**	EO Number
		Global	State				
Angle Swamp	Swamp Dog-Hobble (*Leucothoe racemosa*)	G5	S2S3	TU	5/20/98	C	SP619
Bear Swamp/Stroudsburg	Circumneutral Broadleaf Swamp Natural Community	G?	S2S3	N	4/15/97	BC	NC613
East Bangor Wetland Complex	Virginia Rail (*Rallus limicola*)	G3	S3B	N	5/15/92	E	SA618
East Johnsonville Swamp	Acidic Broadleaf Swamp Natural Community	G5	S3	N	7/3/84	CD	NC539
	Scarlet Indian-Paintbrush (*Castilleja coccinea*)	G5	S2	PT	6/12/92	D	SP583
	Carolina Grass-of-Parnassus (*Parnassia glauca*)	G5	S2	PE	1/6/93		SP588
Five Points Wetland	Yellow Sedge (*Carex flava*)	G5	S2	PT	6/8/93	BC	SP554
Fox Gap Pond	**Lesser Bladderwort (*Utricularia minor*)**	**G5**	**S4?**	**N**	**8/24/87**	**B**	**SP558 Delisted**
Getz Swamp	Calcareous Seepage Swamp Natural Community	G?	S1	N	4/19/94	C	NC501
	A sedge (*Carex tetanica)*	G4G5	S2	PT	6/8/93	D	SP529
	Hemlock-Parsley (*Conioselinum chinense*)	G5	S1	PE	8/21/91	CD	SP552
	Spreading Globeflower (*Trollius laxus*)	G3Q	S1	PE	7/1/97	C	SP501
	Dotted Water-meal (*Wolffia borealis*)	**G5**	**S?**	**TU**	**9/11/82**	**E**	**SP502 Delisted**

Lake Poco	Yellow Sedge (*Carex flava*)	G5	S2	PT	6/15/93	C	SP596
	Hemlock-Parsley (*Conioselinum chinense*)	G5	S1	PE	6/24/97	B	SP553
Little Offset Swamp	Swamp Dog-Hobble (*Leucothoe racemosa*)	G5	S2S3	PT	5/22/97	C	SP587
Lohman Swamp	Calcareous Seepage Swamp Natural Community	G?	S1	N	4/27/84	C	NC514
Lohman Wetlands	Basin Graminoid-Forb Fen	G?	S1	N	6/4/87	X	NC504 Deleted
	Prairie Sedge (*Carex prairea*)	G5?	S2	PT	6/1/93	CD	SP561
	A sedge (*Carex tetanica)*	G4G5	S2	PT	6/1/93	B	SP529
	Animal	G3	S2	PE	8/2/96	D	SA504
	Autumn Willow (*Salix serissima*)	G4	S2	PT	5/31/88	A	SP517
	Spreading Globeflower (*Trollius laxus)*	G3Q	S1	PE	6/1/95	C	SP504
Martin's Creek Watershed (formerly Roseto Pond)	Swamp Dog-Hobble (*Leucothoe racemosa*)	G5	S2S3	TU	5/22/92	C	SP589
	Animal	G3	S2	PE	8/15/95	E	SA609
Minsi Lake Vernal Pools	**Ephemeral/Fluctuating Pool Natural Community**	**G?**	**S3**	**N**	**5/6/99**	**B to A**	**NC577**

	Basin Graminoid-Forb Fen	G?	S1	N	8/30/95	A	
	Shining Ladies-tresses (*Spiranthes lucida*)	**G5**	**S3**	**TU**	**6/10/02**	**BC**	**NEW**
	Yellow Sedge (*Carex flava*)	G5	S2	PT	9/3/97	AB	SP585
	Brook Lobelia (*Lobelia kalmii*)	G5	S1	PE	9/3/97	B	SP622
	Prairie Sedge (*Carex prairea*)	G5?	S2	PT	6/1/91	D	SP542
	Sterile Sedge (*Carex sterilis*)	G4	S1	PE	9/3/97	B	SP568
	A sedge (*Carex tetanica*)	G4G5	S2	PT	6/21/95	B	SP570
	Scarlet Indian-Paintbrush (*Castilleja coccinea*)	G5	S2	PT	5/23/97	B	SP515
	Animal	G3	S2	PE	10/5/96	A	SA507
	Hemlock-Parsley (*Conioselinum chinense*)	G5	S1	PE	9/10/96	B	SP573
	Matted Spike (*Eleocharis intermedia*)	G5	S2	PT	9/3/97	B	SP565
	Thin-leaved Cotton-Grass (*Eriophorum viridicarinatum*)	G5	S2	PT	9/3/97	B	SP567
Mt. Bethel Fen	Black Dash (*Euphyes conspicuous*)	G4	S3	N	7/6/96	B	SA570
	Baltic Rush (*Juncus articus var littoralis*)	G5T5	S2	PT	6/1/91	C	SP542
	Wiry Witchgrass (*Panicum flexile*)	G5	S2S3	TU	9/3/97	C	SP572
	Carolina Grass-of-Parnassus (*Parnassia glauca*)	G5	S2	PE	9/3/97	AB	SP523
	Mulberry Wing (*Poanes massasoit*)	G5	S3	N	7/6/96	B	SA507
	Capillary Beaked-Rush (*Rhynchospora capillacea*)	G5	S1	PE	9/3/97	AB	SP501
	Hoary Willow (*Salix candida*)	G5	S1	PE	9/27/01	D	SP507
	Autumn Willow (*Salix serissima*)	G4	S2	PT	5/31/88	D	SP545
	Whorled Nutrush (*Scleria verticillata*)	G5	S1	PE	9/3/97	AB	SP569
	Spreading Globe-flower (*Trollius laxus sensu stricto*)	G3Q	S1	C	5/4/95	C	SP515

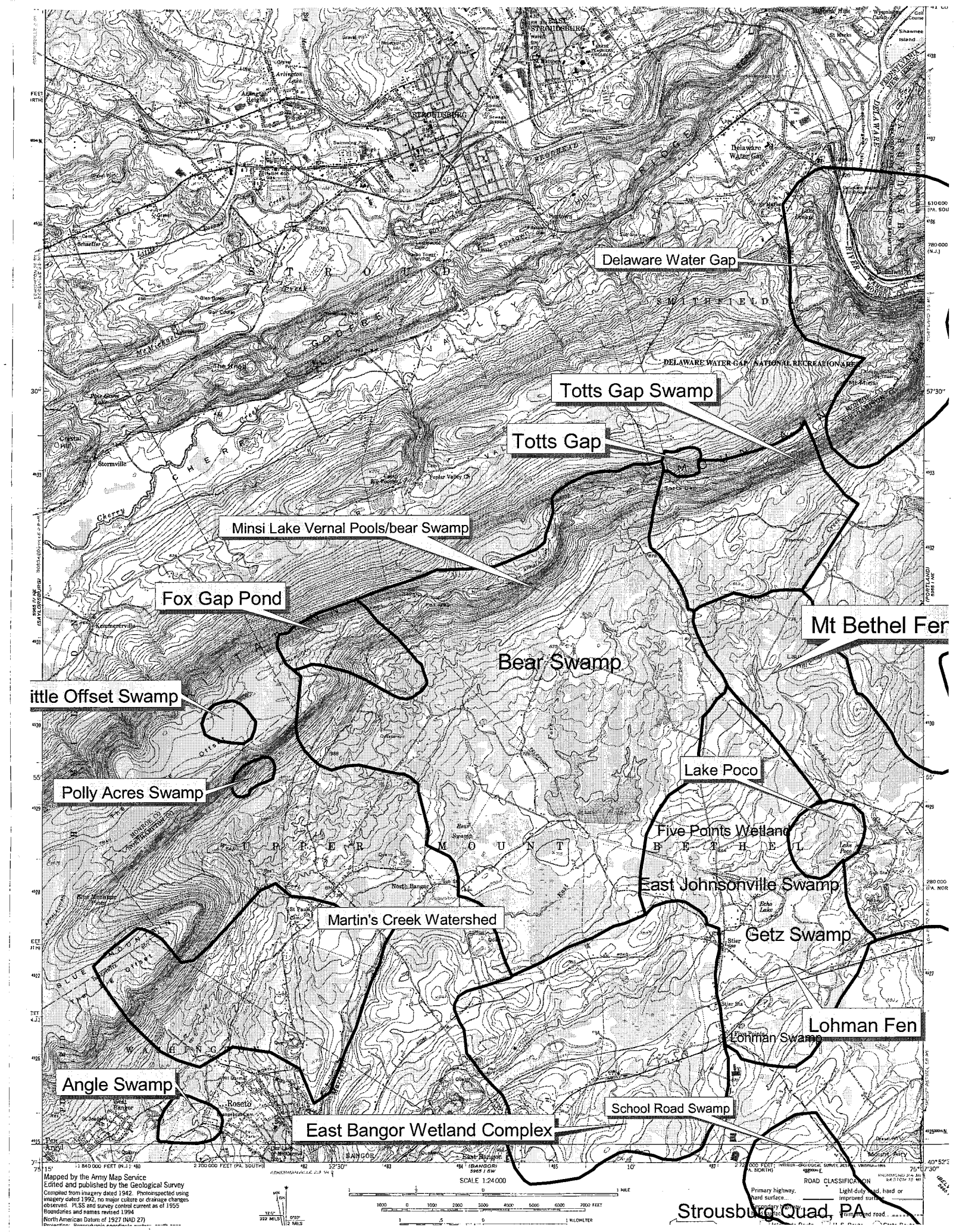
Polly Acres Swamp	Swamp Dog-Hobble (*Leucothoe racemosa*)	G5	S2S3	TU	5/22/97	BC	SP598
Raesly Woods	Calcareous Seepage Swamp Natural Community	G?	S1	N	4/20/91	C	NC527
	Spreading Globeflower (*Trollius laxus sensu stricto*)	G3Q	S1	PE	4/10/97	CD	SP519
School Road Wetland	Sora (*Porzana carolina*)	G5	S3B	CA	5/13/96	E	SA513
	Virginia Rail (*Rallus limicola*)	G5	S3B	CA	5/13/96	E	SA513
	Animal	**G3**	**S2**	**PE**	**2001**	**E**	
	Northern Appalachian Acidic Cliff Community	G5	S5	N	5/5/97	B	
Totts Gap	American Holly (*Ilex opaca*)	G5	S2	PT	7/3/89	CD	SP578
	Sand Cherry (*Prunus pumila var. susquehanae*)	G5T4	S2	PT	8/8/91	CD	SP578a
Totts Gap Swamp	Swamp Dog-Hobble (*Leucothoe racemosa*)	G5	S2S3	PT	5/23/97	C	SP614

Locally Significant: BLUE MOUNTAIN

Managed Areas: Appalachian National Scenic Trail, Delaware Water Gap National Recreation Area, Minsi Lake and Bear Swamp County Parks

Other: Slateford Creek is am exceptional value stream

* Please refer to Appendix IV for an explanation of PNHP Ranks and State Status.
**Please refer to Appendix V for an explanation of Quality Ranks.
*****Bold= indicates change in site since original report was written in 1999**.


Delaware Water Gap
Totts Gap Swamp
Totts Gap
Minsi Lake Vernal Pools/bear Swamp
Fox Gap Pond
Mt Bethel Fen
Bear Swamp
ittle Offset Swamp
Polly Acres Swamp
Lake Poco
Five Points Wetland
East Johnsonville Swamp
Martin's Creek Watershed
Getz Swamp
Lohman Fen
Lohman Swamp
Angle Swamp
School Road Swamp
East Bangor Wetland Complex
Strousburg Quad, PA
DELAWARE WATER GAP NATIONAL RECREATION AREA
STROUDSBURG
EAST STROUDSBURG
SMITHFIELD
GOOSE POND MOUNTAIN
UPPER MOUNT BETHEL
Mapped by the Army Map Service
Edited and published by the Geological Survey
SCALE 1:24000
ROAD CLASSIFICATION

STROUDSBURG USGS QUADRANGLE MAP

ANGLE SWAMP (Washington Twp.) SP619 - This site is a 1- to 2- acre shrub swamp with pockets of open marsh and clumps of trees. The majority of the site is inundated with water which ranges in depth from 6 to 24 inches. Deeper water areas are dominated by cattail (Typha latifolia) and the invasive species, common reed (Phragmites australis). Most of the site has well-defined pit and mound microtopography, with the pits containing unvegetated pools of water and the mounds supporting highbush blueberry (Vaccinium corymbosum) or red maple (Acer rubrum) with sphagnum moss (Sphagnum spp.), sedge (Carex canescens) and rushes (Juncus spp.) growing at their bases. The site has likely received some significant disturbance in the past. Logging has occurred and possibly some excavation. The invasive common reed, a very tall grass species, has degraded this site significantly. The site supports a fair quality population of **Swamp Dog-Hobble (*Leucothoe racemosa*)**, a PA-Rare shrub species and likely supports numerous amphibian and aquatic insect species. No specific management is recommended for this site.

BEAR SWAMP (Upper Mount Bethel Twp.) NC613 - This site supports a fair to good quality example of a **Circumneutral Broadleaf Swamp Natural Community**. The swamp community occurs in two separate lobes along two separate tributaries of Martins Creek and occupies approximately 200 acres. Red maple (Acer rubrum), black ash (Fraxinus nigra), and yellow birch (Betula alleghaniensis) are dominant tree species with some hemlock (Tsuga canadensis) and swamp white oak (Quercus bicolor) also present. The understory has a high percentage cover of spicebush (Lindera benzoin) with a few scattered copses of highbush blueberry (Vaccinium corymbosum) and rhododendron (Rhododendron maximum). The herb layer is lush with marsh marigold (Caltha palustris), sensitive fern (Onoclea sensibilis), false hellebore (Veratrum viride), skunk cabbage (Symplocarpus foetidus), golden saxifrage (Chrysosplenium americanum), and violets (Viola spp.) all being common in wet hollows and with cinnamon fern (Osmunda cinnamomea) and various sedges (Carex spp.) growing on raised hummocks. Although there has been much historic manipulation of the landscape surrounding the swamps, both areas are currently surrounded by forested buffers of varying widths. Other disturbances include several powerlines crossing the site, remnants of drainage channels, and the dam upstream at Minsi Lake. This site will be best protected by maintaining the integrity of the forest buffer and ensuring a consistent hydrologic regime. Limiting or decreasing the fragmentation of the landscape in this area will benefit this natural community. Current land use patterns separate the swamp from the adjacent forest around the Minsi Lake vernal ponds, as well as from the greater forest of the Delaware Water Gap Recreation Area. Species that occupy the swamp and the vernal ponds area will benefit from increasing the continuity of the forest around them so as to connect it with that of the greater forest of the Delaware Water Gap Recreation Area and Blue Mountain. Bear Swamp is located partly within Minsi Lake - Bear Swamp County Park**.**

BLUE MOUNTAIN is the most extensive relatively contiguous area of natural habitat in the two counties. It is one of the major corridors for the movement of biota in eastern Pennsylvania. It includes extensive forests with streams, seeps, springs, vernal pools, rock outcrops, and boulder fields. It has long been recognized as one of the major east coast fall flyways for migrating raptors. The extensive relatively unfragmented forests include habitat for resident animal species including larger mammals such as bear and bobcat, as well as for numerous smaller mammals including the PA-Threatened Allegheny woodrat (Neotoma magister). Wetland areas associated with streams, seeps and vernal pools are important habitat for a wide diversity of plant species as well as for many groups of animals including birds, reptiles, amphibians, odonates (dragonflies and damselflies) and others. Conserving sites on the mountain as highlighted in this report must be considered as part of the effort to conserve the greater natural functional value of the mountain ridge. Preserving the ecological integrity of Blue Mountain should be considered an important component in preserving the biodiversity of the two counties.

DELAWARE RIVER WATER GAP (Upper Mount Bethel Twp.; Smithfield Twp., Monroe Co.) NC505, sp513, sa528 - The Delaware River Water Gap is one of the most striking natural features in Pennsylvania. The water gap supports a good quality example of the relatively common Northern Appalachian Acidic Cliff Natural Community. On the PA side of the Delaware River the natural community extends from the lower elevations adjacent to Rt. 611 near the Northampton-Monroe County line south into Northampton County along the ridge face and then southwest for a total distance of approximately three quarters of a mile. The exposed rock escarpment of sandstone and conglomerate of the Shawangunk Formation that creates habitat for this community starts at a low elevation nearest the river and quickly increases elevation so that much of the community is adjacent to the ridgetop. The substrate is characterized by a high percentage of weathered exposed bedrock with small patches of thin soil in crevices and on ledges. Vegetation consists of widely scattered and stunted pitch pine (Pinus rigida), chestnut oak (Quercus prinus), shadbush (Amelanchier spp.), scrub oak (Quercus ilicifolia), and black cherry (Prunus serotina) with very limited amounts of lowbush blueberry (Vaccinium angustifolium) and mountain laurel (Kalmia latifolia). Herbs and grasses common at the site include poverty grass (Deschampsia flexuosa), sedges (Carex spp.), little bluestem (Schizachyrium scoparium), and common polpody (Polypodium virginianum). Other less common herb species include rock harlequin (Corydalis sempervirens), pinweed (Lechea spp.), and rattlesnake-weed (Hieracium venosum). The highly exposed cliffs and the extensive talus piles located on the slopes below support a population of a PA-Threatened animal species (see Portland Quadrangle sa528). The site also supports an excellent quality population of a PA-Endangered plant species (see Portland Quadrangle sp513). Hundreds of individuals of this species were observed in flower during our 1997 field survey. The cliff community also provides habitat for a variety of bird species, the most notable of which are black vultures (Coragyps atratus), turkey vultures (Cathartes aura) and ravens (Corvus brachyrhynchos). All of these species were observed at the site in 1997 and any or all of them may be nesting here. Inaccessibility of much of the cliff prevented a thorough surveys for nests. The dry exposed habitat of the cliffs is also good habitat for reptile species such as the five-lined skink (Eumeces fasciatus), fence lizard (Sceloporus undulatus), and certain snake species. This site occurs within the Delaware Water Gap National Recreation Area.

EAST BANGOR WETLAND COMPLEX (Upper Mount Bethel Twp., East Bangor Twp.) SA618 - This site represents the largest contiguous wetland complex in Northampton County. It extends from just west of Stier Station for nearly 2 miles to the dam in East Bangor. It includes large expanses of forested swamp, shrub swamp, wet meadows, springs, and open water. The variety of covertypes and the interfaces between them are good habitat for a wide diversity of animals including numerous bird, reptile, amphibian, insect, and mammal species. An animal species of concern has been observed using the habitat at this site on several occasions in recent years, but its breeding success at the site has not been documented. The site has potential for other species of concern. Numerous ducks and herons were observed during a 1997 field survey. The site has a history of disturbance which includes the dam which creates the impoundment and the rail line which bisects parts of the swamp along its southern edge. How much of the swamp is natural and how much is a result of human activities is uncertain. Despite the disturbances this wetland complex still contains an extensive amount of good habitat. An effort should be made to keep the outflow at the dam open so the upstream wetlands are not subjected to unnatural flooding. Some of the habitat has been degraded by unnatural flooding which if persistent will kill or stunt many wetland plant species. This site is partly managed by the PA Fish and Boat Commission.

EAST JOHNSONVILLE SWAMP (Upper Mount Bethel Twp.) NC539, SP583, SP588 - This site supports a fair quality example of an Acidic Broadleaf Swamp Natural Community. The canopy is dominated by red maple (Acer rubrum) growing over an understory of rhododendron (Rhododendron maximum) and highbush blueberry (Vaccinium corymbosum). Sphagnum moss (Sphagnum spp.), bur-

marigold (Bidens spp.), and canada mayflower (Maianthemum canadense) are common on the hummocky ground. The swamp is about 20 acres, and largely undisturbed. Maintaining the wooded buffer around the swamp will protect the quality of this community. A small area at the south end of the swamp has been filled and used as a Christmas tree plantation. A small population of **Scarlet Indian-Paintbrush (*Castilleja coccinea*)**, an S2 plant, occurs in the filled meadow along with goldenrod (Solidago spp.), black-eyed Susan (Rudbeckia hirta), and robin's plantain (Erigeron pulchellus). No special management is recommended for this population. At the north end of the swamp there is a 2-acre shrub fen dominated by poison sumac (Toxicodendron vernix), swamp rose (Rosa palustris), winterberry (Ilex verticillata), and other tall shrubs. A small population of **Carolina Grass-of-Parnassus (*Parnassia glauca*)**, a PA-Endangered herb occurs in an opening in the fen; more surveys are recommended to determine the extent of this population. The shrub fen may be the result of a blocked drainage caused by a road on the north end of the swamp. The blocked drainage may have caused persistent inundation killing the trees and creating the open area now filling in with shrubs. Continued thickening of the shrub layer is a threat to the endangered plant population.

FIVE POINTS WETLAND (Upper Mount Bethel Twp.) SP554 - This wetland is characterized by high pH groundwater and includes areas of marsh, shrub thicket, and forest. Woody species at the site include red maple (Acer rubrum), alder (Alnus spp.), swamp rose (Rosa palustris), silky dogwood (Cornus amomum), arrow-wood (Viburnum spp.), and poison sumac (Toxicodendron vernix). Species common in the herb layer include a wide variety of sedges and rushes as well as cattail (Typha latifolia), marsh fern (Thelypteris palustris), joe-pye-weed (Eupatorium spp.), ironweed (Vernonia noveboracensis), goldenrods (Solidago spp.), and violets (Viola spp.). A fair to good population of **Yellow Sedge (*Carex flava*)**, a PA-Threatened plant species occurs here. The site has potential for several other rare plant and animal species. This site has probably seen some disturbance in the past from grazing and is located adjacent to a road. The area closest to the road has the highest concentration of non-native species. Limiting disturbance in and adjacent to the wetland will help the species of special concern persist here.

FOX GAP POND (Upper Mount Bethel Twp.) **SP558** –
This site is a small, shallow pond near the base of the Blue Mountain. The pond is surrounded by forest. The pond and forest is protected as a public watershed for drinking water. Since the original report was written in 1999, a former plant species of concern, **Lesser Bladderwort (*Utricularia minor*),** an S4 plant species, has become delisted. Due to the delisting of the plant species, this site will be removed from the county sites but may
still be locally significant due the potential for finding additional species of concern. Succession from competing aquatic species is a potential threat. Maintaining the surrounding forest will protect the water quality as well as the species of concern.

GETZ SWAMP (Upper Mount Bethel Twp.) **NC501, SP501, SP529, SP552** - This site supports a fair example of a **Calcareous Seepage Swamp Natural Community**. This forested swamp is completely encircled by nearby roads is fed by seeps on the south side but also has several stream channels running through it. Red maple (*Acer rubrum*) is the most common tree species with black gum (*Nyssa sylvatica*) and tulip poplar (*Liriodendron tulipifera*) also being common. The understory has a high percentage cover of spicebush (*Lindera benzoin*) and highbush blueberry (*Vaccinium corymbosum*) with a few scattered copses of willow (*Salix spp.*) and viburnum. The herb layer is relatively diverse with skunk cabbage (*Symplocarpus foetidus*) and ferns being most common. A recently delisted plant species, **Dotted Water-meal (*Wolffia borealis*)**, is found at this site. This site still supports three plant species of concern, two of which are PA-Endangered. Plant species of concern **A Sedge (*Carex tetanica*),** an S2 plant species of concern, **Hemlock-Parsley (*Conioselinum chinense*)**, and **Spreading Globeflower (*Trollius laxus*)**, an S1 plant species of concern still thrive here. Although there has been much manipulation of the landscape surrounding the swamp including roads, residences, and historic pasturage, the natural community remains relatively intact. Close proximity to roads is probably the cause of the large number of exotic species which occur at the site.

Maintaining the current hydrologic regime is critical to the persistence of the community and rare species at this site. Culverts that allow water to enter and exit the site must remain clear. Obstruction of the culverts could lead to flooding that would alter the habitats in the swamp and eliminate the rare species.

LAKE POCO (Upper Mount Bethel Twp.) **SP553, SP596** - Lake Poco is a shallow lake maintained by a dam at its east end. Several seeps and small streams flow into the lake from the west. Red maple (Acer rubrum), tulip poplar (Liriodendron tulipifera), and yellow birch (Betula alleghaniensis) make up the canopy of these wet woods, with spicebush (Lindera benzoin) common in the understory. A small population of **Yellow Sedge (*Carex flava*),** an PA-Endangered herb species, was found along the edge of one seep, alongside skunk cabbage (Symplocarpus foetidus) and horsetails (Equisetum spp.). There is potential for the species of concern to occur in other springs and seeps in the vicinity. Southwest of Lake Poco is a utility line right-of-way. Another plant species of concern, **Hemlock-Parsley (*Conioselinum chinense*)**, occurs in a small (approx. 1 acre) wetland on the right-of-way. This species is indicative of high pH conditions. Associated plants in the wetland include several sedges (Carex spp.), goldenrod (Solidago spp.), sensitive fern (Onoclea sensibilis), marsh fern (Thelypteris palustris), rushes (Juncus spp.), grasses, and bulrushes (Scirpus spp.). The plant species of concern is dependent upon the artificial opening caused by clearing for the right-of-way. There is also evidence that turtles use this site and take advantage of the nearby railroad bed for nesting. The use of herbicides and changes to its hydrology are both potential threats.

LITTLE OFFSET SWAMP (Upper Mount Bethel Twp.; Hamilton Twp., Monroe Co.) **SP587** - This site is a 10-acre shrub swamp located near the top of Little Offset on the Blue Mountain. The swamp may have been formed by a small ice block left from the last glacial advance. An extremely dense shrub layer of highbush blueberry (Vaccinium corymbosum), which shades out all groundcover, rings the margin of the swamp. Other shrubs present include huckleberry (Gaylussacia baccata), swamp azalea (Rhododendron nudiflorum), and rhododendron (R. maximum). The center of the swamp is more open with occasional pitch pine (Pinus rigida), white pine (P. strobus), and pin oak (Quercus palustris) trees growing out of a mat of sedges (Carex spp.) and sphagnum moss (Sphagnum spp.). Several large pits have been blasted in the swamp, possibly to extract peat. A fair population of **Swamp Dog-Hobble (*Leucothoe racemosa*)**, a shrub species of concern, occupies the zone between the swamp and the xeric oak forest surrounding it. The open canopy is made up of bigtooth aspen (Populus grandidentata), sassafras (Sassafras albidum), red maple (Acer rubrum), black-gum (Nyssa sylvatica), and various oaks (Quercus spp.). Associated understory species include highbush blueberry (Vaccinium corymbosum), rhododendron (Rhododendron spp.), mountain laurel (Kalmia latifolia), black cherry (Prunus serotina), and red maple (Acer rubrum). The swamp is near the Appalachian Trail, and partly owned by the National Park Service. Disturbances include jeep trails, a small hunting cabin, and excavation within the swamp. Trail building, peat mining, and vehicle use could degrade the remaining habitat.

LOHMAN SWAMP (Upper Mount Bethel Twp.) **NC514** - This site supports a fair to good quality example of a Calcareous Seepage Swamp Natural Community. The overstory is dominated by red maple (Acer rubrum) with black ash (Fraxinus nigra), yellow birch (Betula alleghaniensis) and American elm (Ulmus americana) and the understory is dominated by spicebush (Lindera benzoin). The herb layer is relatively diverse, with skunk cabbage (Symplocarpus foetidus) and jewelweed (Impatiens capensis) being most common. Although this site is fairly small and isolated, it is a relatively mature intact example of this natural community.

LOHMAN WETLANDS (Upper Mount Bethel Twp.) **SP504a, SP504b, SP517, SP561, SA504** - This site has both forested an unforested portions, both influenced by calcareous soils. At one time the east end of the site likely supported a relatively **open graminoid - forb dominated calcareous fen**, but due to a lowering of the water table and possibly a change in land use that portion of the site is now a shrub dominated wetland too degraded to be designated a natural community. Shrubs including silky dogwood (Cornus amomum) and willow (Salix spp.), and stunted trees including red maple (Acer rubrum), black ash (Fraxinus nigra), and

American elm (Ulmus americana) form dense thickets over most of the site. Strict sedge (Carex stricta) is the most common herbaceous species. This area supports five species of special concern including **Prairie Sedge (*Carex prairea*), A sedge (*Carex tetanica*), Autumn Willow (*Salix serissima*), and Spreading Globeflower (*Trollius laxus*). .** Restoration of a higher water table would likely benefit the herbaceous species of concern. Disturbances at this site include roads and houses at the east and west ends, and a railroad along the southern margin. Allowing the swamp to mature without additional disturbances will improve the quality of the natural community here.

MARTIN'S CREEK WATERSHED (Washington Twp.) UPDATE- NAME CHANGE- *SP589 Leucothoe racemosa, SA609 animal species* – (Formerly Roseto Pond,
This site supports a small but healthy population of a **Swamp Dog-Hobble (*Leucothoe racemosa*), an S2S3 plant species of concern.** The plant occurs in partial light along the edge of a shallow pond. Associated species include witch-hazel (*Hamamelis virginiana*), rhododendron (*Rhododendron maximum*), and huckleberry (*Gaylussacia baccata*). This site is located adjacent to a road and therefore roadside cutting and spraying in the pond area should be avoided.
A **G3 animal species of concern** was discovered in this watershed during surveys in 1995. The wetland habitat that supports this species is a palustrine emergent/forest wetland. More surveys are needed to determine the health of the population at this site.

MINSI LAKE VERNAL POOLS (Upper Mount Bethel Twp.) **NC577** – UPDATE-
This site showed a good quality example of an **Ephemeral/Fluctuating Natural Pools Natural Community** in 1999 when the report was written. However, since the report was written, this **natural community was upgraded to element occurrence rank of A**. It may be the largest concentration of vernal ponds known from Pennsylvania. There are more than one hundred ponds of varying sizes scattered throughout several hundred acres of dry-mesic forest. The forest is dominated by a mix of tulip poplar (Liriodendron tulipifera), red maple (Acer rubrum), sweet birch (Betula lenta), red oak (Quercus rubra), white oak (Q. alba), and shagbark hickory (Carya ovata). Several streams and springs are also present at the site. The ponds, streams, and springs create a diversity of microhabitats which support a large diversity of herbs, ferns, and graminoid species. The great variety of wetland microhabitats makes this area excellent breeding habitat for amphibians. This site has potential for several species of concern though none were observed during our surveys. The area has seen disturbance in the past from logging and perhaps grazing though much of the forest is currently recovering. This site will be best protected by maintaining the integrity of the matrix forest and by limiting or decreasing the fragmentation of the forest on the surrounding landscape. Current land use patterns separate the forest containing the vernal ponds from the nearby forest of Bear Swamp. Species that occupy the vernal ponds and the swamp will benefit from increasing the connectivity of these two forested areas and by increasing or at least maintaining the connectivity of these areas with that of the greater forest of the Delaware Water Gap Recreation Area and Blue Mountain. These large forested areas of the north half of Upper Mount Bethel Township are the most extensive forests remaining within Northampton County with the exception of the forest running along the south facing slope of Blue Mountain. The proximity and connectivity of these forests to Blue Mountain and subsequently Monroe County offer great potential for retaining or even improving biodiversity. Many species, including forest interior-breeding birds such as Cerulean Warblers, require large unfragmented tracts of forest for survival. Minsi Lake Vernal Ponds is located partly within Minsi Lake - Bear Swamp County Park.

MT. BETHEL FENS (Upper Mount Bethel Twp.; Stroudsburg Quad) *NC501 (Eastern Calcareous Seepage Swamp), SP501a (Carex tetanica), SP501b (Conioselinum chinense), SP501c (Lobelia kalmii) SP501d (Panicum flexile), SP501e (Parnassia glauca), SP501f (Rhychospora capillacea), SP501g (Scleria verticillata), SP507 (Carex flava), SP515a (Carex sterilis), SP515b (Castilleja coccinea), SP515c Eriophorum viridi-carinatum), SP515d (Trollius laxus spp laxus), SP542a (Carex prairea), SP542b (Juncus*

balticus), SP545 (Salix serissima), SP565 (Eleocharis intermedia), SA501a (animal), SA501b (Euphyes conspicuus), SA566 (Poanes massasoit), (Juncus arcticus var littoralis), (Salix candida), (Spiranthes lucida).

Mt. Bethel Fens is a complex of at least 10 rare wetland communities located in a small valley to the west and northwest of the village of Mt. Bethel. These important wetlands are comprised of small calcareous fens and seeps (open meadow-like, permanently saturated wetlands fed by high pH groundwater), marshes and wooded swamps. They are scattered across the valley floor and walls over a one- to two-square mile area. The valley is unique because there are few areas in Pennsylvania that are both underlain by limestone and recently deposited glacial material. The area is underlain by limestone bedrock of Cambrian and Ordovician ages. Further, the valley was last glaciated during the Wisconsinan Glaciation. When the glacier retreated about 15,000 years ago it left an overburden above the bedrock of unsorted glacial debris (moraines or till comprised of clay, silt, sands and gravels) and kame deposits (poorly sorted material with lenses of sands, gravels and rocks) containing limestone material (for more information on bedrock and glacial geology see: Hall 1934, Miller et al. 1939, Sherwood 1964, and Epstein 1969). The till material can be an effective block to groundwater movement while the kames may act as "pipelines" for groundwater flow. Where these pipelines intersect the surface either in depressions on the valley floor or on the lower sideslopes, seeps and springs emerge and the calcareous wetlands are formed. Due to the constant saturation by groundwater, organic matter (peat) has built up over time to a depth of about 3 feet in some places. The constantly high water table and past disturbances (fire, beaver, clearing and grazing) has resulted in these wetlands being dominated by grasses and sedges. The fens are often surrounded by a border of shrubs such as poison sumac.

Due to the combination of limestone and glaciation, the fen habitat is very rare, both in Pennsylvania and globally. It stands to reason then that many of the species that depend upon the fens are rare as well. To date, there are 15 rare plants, 3 rare animals and 2 rare mosses known to occur in the various fen communities. Another rare plant occurs in the wooded seeps adjacent to the fens. Not all of the fens include all of the species, but taken together, the populations of most of the species are in good to excellent condition. Since the report was written in 1999, a new fair to good quality population of **Shining Ladies-tresses (*Spiranthes lucida*)**, an S3 plant species of concern, was found in a small spring-fed calcareous seepage in mixed woods in the headwaters of a tributary of Jacoby Creek.

The fens offer more than just habitat for rare species. They provide recreational opportunities such as birdwatching and hunting and general open space for the enjoyment of all. They are a colorful natural garden throughout the growing season. There are many uncommon, attractive species, such as fringed gentian, aster, and ladies tresses, that occur in the open habitats in and around the fens.

To maintain the fens it is critical to look at the entire landscape in which the fens occur. This landscape provides water to the fens and the means by which species are able to colonize/move to new sites. Maintaining the array of fens and the habitats between is critical to ensuring the fen species are able to survive. Native vegetation is needed around each fen to act as a buffer against disturbances and to help exclude weedy species. Corridors are needed for native species to relocate from one fen to another.

There are a variety of threats to the fens and the species that inhabit them. Of most immediate concern is the abundance of two very aggressive weeds-phragmites and purple loosestrife. These two plants are capable of displacing the native fen plants. Of equal concern is maintaining the hydrologic system that the fens depend upon. An abundance of clean, high pH water feeding the fens is critical to maintaining the species that occur there. Without the quantity of water, the fens will quickly change into shrub wetlands and eventually into forested wetlands. If water quality is degraded, the weedy species will be favored to the exclusion of the native flora.

The Nature Conservancy (TNC) has identified the Mt. Bethel Fens as one of its highest priorities for conservation in PA. Currently, TNC is cooperating with landowners throughout the valley to ensure the survival of the fens. TNC is working with researchers to understand groundwater flow patterns, past land use and vegetation history, beneficial disturbances and methods to control the phragmites and loosestrife. This effort by a variety of people and organizations is needed for the fens to remain indefinitely on the landscape as a refuge for rare species and as beneficial open space for the people of Mt. Bethel and Northampton County.

POLLY ACRES SWAMP (Upper Mount Bethel Twp.) **SP598** - This site is a 3- to 5-acre broadleaf-conifer swamp. Red maple (Acer rubrum), black-gum (Nyssa sylvatica), and yellow birch (Betula alleghaniensis) are the dominant species, with white pine (Pinus strobus) and red spruce (Picea rubens) as associates. The presence of red spruce, a northern species, is unusual for Northampton County. The understory is dominated by rhododendron (Rhododendron maximum), winterberry (Ilex verticillata), and highbush blueberry (Vaccinium corymbosum). Sphagnum moss (Sphagnum spp.) and sedges (Carex spp.) are the predominant ground-cover. Other common species in the herb layer include canada mayflower (Maianthemum canadense), goldthread (Coptis trifolia), and cinnamon fern (Osmunda cinnamomea). Very few exotic species were observed in the swamp. A good quality population of **Swamp Dog-Hobble (*Leucothoe racemosa*)**, a shrub species of concern, occurs here. The woods surrounding the swamp have been developed for residential and vacation homes. Other disturbances include a dam and pond at the east end, a small bulldozed lane into the south side, and an ATV trail in the southeast corner. Additional road building and development are potential threats. Keeping ATV's out of the swamp and maintaining a small forested buffer would help preserve the integrity of the site and the rare species it contains.

RAESLY WOODS (Upper Mount Bethel Twp.) **NC527, SP519** - This site supports a fair quality example of a Calcareous Seepage Swamp Natural Community. The swamp is fed by seeps and springs from the hill of calcareous deposits (a kame) to the northwest. Black ash (Fraxinus nigra) is the dominant overstory species, with red maple (Acer rubrum), elm (Ulmus spp.), and tulip poplar (Liriodendron tulipifera) also present. Spicebush (Lindera benzoin) is the dominant understory species. There is a diverse herb flora with skunk cabbage (Symplocarpus foetidus) and marsh marigold (Caltha palustris) being particularly abundant. Other common herbs include violets (Viola spp.), dwarf ginseng (Panax trifolius), bedstraw (Galium spp.), buttercups (Ranunculus spp.), and toothwort (Cardamine spp.). Mosses, particularly several species of sphagnum moss (Sphagnum spp.) are also common. This site is a mosaic of wet seepy areas, meandering streams, and slightly higher uplands. The upland areas have been used as pasture in the past and are more open. They provide habitat for a small population of **Spreading Globeflower (*Trollius laxus sensu stricto*),** a PA-endangered plant. The species needs the light that is provided by a thin canopy or by canopy gaps and would benefit from enhancing habitat through girdling or cutting of a few trees to maintain the openings. Disturbances include roads along the south margin, past logging, grazing, and ditch digging in some areas. Maintaining a buffer of upland forest and leaving the hydrology intact will help to improve the quality of this community over time.

SCHOOL ROAD SWAMP (Upper Mount Bethel Twp.; Bangor and Stroudsburg Quads) *SA513a & SA513b Porzana carolina, Rallus limicola and animal species*- This site is a wetland mosaic that includes large areas of both forested swamp and emergent marsh. The forested swamp is dominated by red maple (*Acer rubrum*) with ash (*Fraxinus sp.*), American elm (*Ulmus americana*), and scattered swamp white oak (*Quercus bicolor*), and has a shrub layer dominated by spicebush (*Lindera benzoin*) with highbush blueberry (*Vaccinium corymbosum*), winterberry (*Ilex verticillata*), and swamp rose (*Rosa palustris*). Herbaceous species include numerous sedges and ferns, with skunk cabbage (*Symplocarpus foetidus*) and marsh marigold (*Caltha palustris*) also being common. The emergent marsh is dominated by strict sedge (*Carex stricta*) and cattail (*Typha latifolia*) with some scattered stems of stunted red maple (*Acer rubrum*). Two animal species of concern, **Virginia Rail (*Rallus limicola*), an S3B animal species of concern, and**

Sora (*Porzana carolina*), an S3B animal species of concern, were observed at this site in 1996. A survey in the spring of 1998 failed to relocate the species, but the habitat remains unchanged and the species may still be using the site. **Another G3 animal species of concern** was discovered here in 2001. More surveys should be completed to determine the status of the population at this site.
The hydrology of the emergent marsh may be influenced by the presence a road near the site, although whether the influence plays a negative or positive role is unknown. Leaving this site in its current condition should help the species of concern that inhabit this area.

TOTTS GAP (Upper Mount Bethel Twp.; Smithfield & Stroud Twps., Monroe Co.) **SP578a, SP578b** - This site consists of several shrub dominated rocky summit outcrop areas located on the ridge east of Totts Gap. The outcrops are dominated by scrub oak (Quercus ilicifolia), blueberry (Vaccinium spp.), huckleberry (Gaylussacia baccata), and black chokeberry (Aronia melanocarpa) with a few scattered stems of pitch pine (Pinus rigida). Herbs on this xeric substrate include poverty grass (Deschampsia flexuosa), little bluestem (Schizachyrium scoparium), dewberry (Rubus spp.), and field sorrel (Rumex spp.). The site supports poor to fair quality populations of **American Holly (Ilex opaca)**, a PA-Threatened plant, and **Sand Cherry (*Prunus pumila var. susquehanae*)**, a PA-Rare plant. This site will be best protected by leaving it in its current condition.

TOTTS GAP SWAMP (Upper Mount Bethel Twp.) **SP614** - This site is an acidic broadleaf swamp dominated by a relatively open canopy of black-gum (Nyssa sylvatica), red maple (Acer rubrum), and yellow birch (Betula alleghaniensis). The dense understory is dominated by rhododendron (Rhododendron maximum), spicebush (Lindera benzoin), winterberry (Ilex verticillata), and highbush blueberry (Vaccinium corymbosum). **Swamp Dog-Hobble (*Leucothoe racemosa*),** a shrub species of concern in PA, occurs on hummocks in the swamp and also in the open oak and sassafras (Sassafras albidum) woods along the edge of the swamp. About seventy individuals were observed during a survey in the summer of 1997. A nearby disturbance is a gas pipeline ROW which runs to the east of the swamp. A thin (30 meter) band of upland forest, between the swamp and the pipeline, provides good habitat as well as a buffer for this site.

TOPTON USGS QUADRANGLE MAP

Site Name	Special Species / Community Type	Global	State	State Status	Last Seen	Quality**
None						

Locally Significant: None

Managed Areas: Fogelsville Pond, Upper Macungie Community Park

Other: Little Lehigh Creek, HQ-CWF/EV Waters

* Please refer to Appendix IV for an explanation of PNHP Ranks and State Status.
**Please refer to Appendix V for an explanation of Quality Ranks.
***Bold= indicates change in site since original report was written in 1999**.

Little Lehigh Creek is a High Quality Clear Water Fishery throughout its basin, except for Main Stem Jordan Creek and the Mill Creek basin. Maintaining wooded buffers along stream corridors and restricting development in floodplain areas will help maintain the quality of this HQ-CWF and benefit the diversity of native species that depend on it.

Only a small portion of Lehigh County appears on this quadrangle. No species of special concern, exemplary natural communities, or Locally Significant sites (i.e., sites of countywide significance) were identified in this part of the county. However, other areas that are important to natural diversity on a township level (e.g., woodlands, streams, wetlands) may occur within the portion of the county that appears on this quadrangle.

WIND GAP USGS QUADRANGLE MAP

Site Name	Special Species / Community Type	PNHP Ranks*		State Status	Last Seen	Quality **	EO Number
		Global	State				
Big Offset Barren	Variable Sedge (*Carex polymorpha*)	G3	S2	PE	7/3/97	BC	SP518
Bushkill Creek Watershed (Formerly Moorestown Wetland and Knochts Pools)	**Ephemeral/Fluctuating Pool Natural Community**	**G3**	**S3**	**N**	**4/15/98**	**E**	**NC521**
	Animal	**G3**	**S2**	**PE**	**5/7/98**	**BC**	**SA506**
Jacobsburg Environmental Education Center	**Ephemeral/Fluctuating Pool Natural Community**	**G3**	**S3**	**N**	**2004**	**E**	
Rismiller Woods	Ephemeral/Fluctuating Pool Natural Community	G?	S3	N	5/20/98	B	NC515
	Swamp Dog-Hobble (*Leucothoe racemosa*)	G5	S2S3	PT	5/20/98	B	SP515

Locally Significant: Blue Mountain, Grand Central Woods

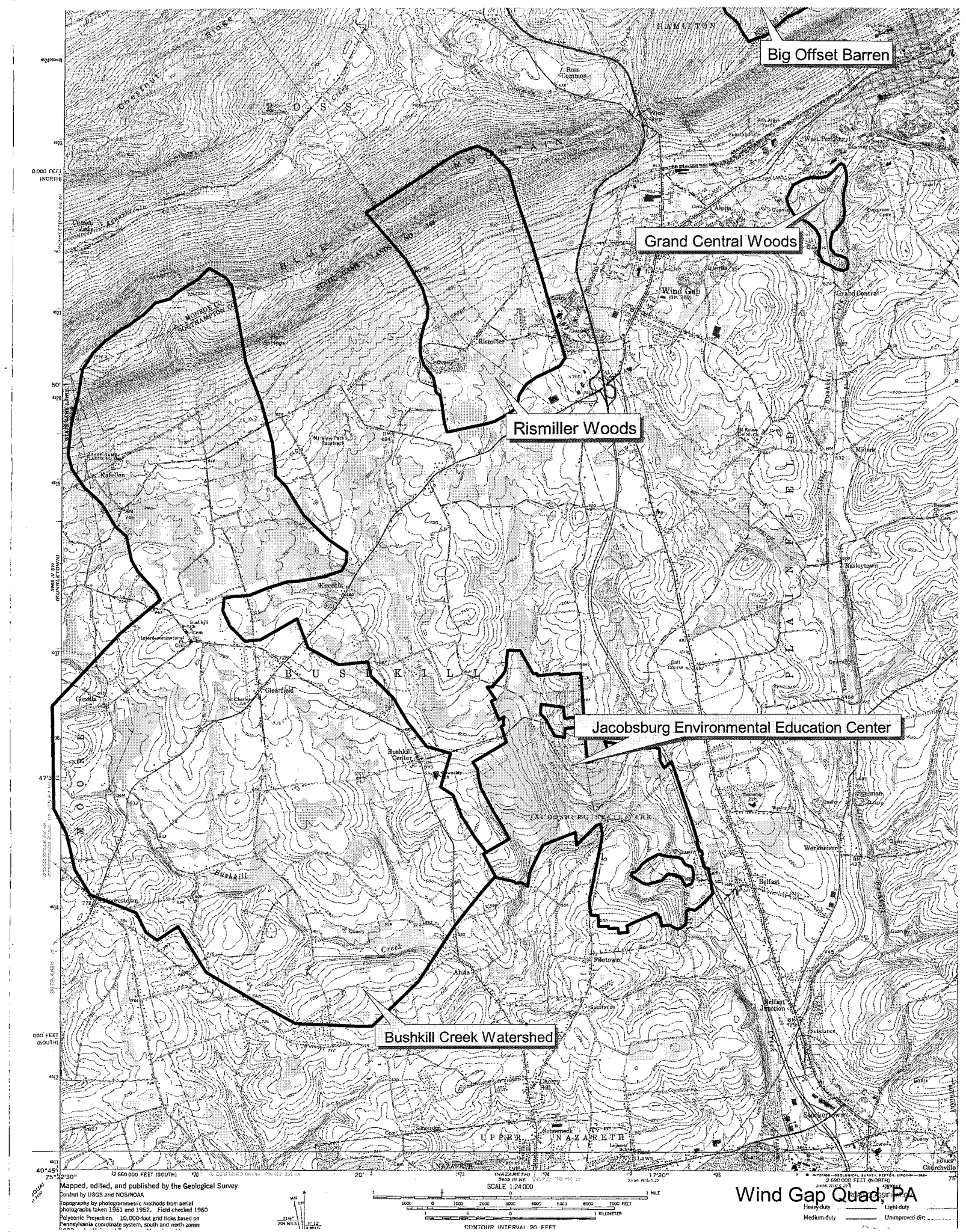
Managed Areas: Appalachian National Scenic Trail, Jacobsburg Environmental Education Center, State Game Lands #168

Other: Bushkill Creek, HQ-CWF/EV Waters

* Please refer to Appendix IV for an explanation of PNHP Ranks and State Status.
**Please refer to Appendix V for an explanation of Quality Ranks.
*****Bold= indicates change in site since original report was written in 1999.**

Conservation of natural lands in Bushkill Township, an example of landscape analysis:

The science of Conservation Biology has shown that fragmented habitat is a recipe for extinction of species, as individuals cannot interconnect with each other to continue the species survival. It has been shown that protecting large cores of wildlife habitat is essential to protecting healthy ecosystems. However, protecting only large wilderness cores is not enough to facilitate the flow of life across an entire landscape. These habitat cores must be linked by natural corridors that allow natural processes such as wildfires, predator-prey relationships, and spring floods to occur. These interconnected natural corridors also need to be buffered from ecologically damaging activities by areas of more compatible usage. The result is a series of interconnected habitats that thrive ecologically, and allow unimpeded movements of wildlife and high plant diversity. These connections will allow populations of a species to interbreed, and improve overall genetic variability. These connections will be vital for species as shrinking habitats continue to degrade critical habitats (The Wildlands Project, www.twp.com).


Big Offset Barren
Grand Central Woods
Rismiller Woods
Jacobsburg Environmental Education Center
Bushkill Creek Watershed
Wind Gap Quad, PA
SCALE 1:24 000
CONTOUR INTERVAL 20 FEET
Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA
Topography by photogrammetric methods from aerial photographs taken 1951 and 1952. Field checked 1960
Polyconic Projection. 10,000-foot grid ticks based on Pennsylvania coordinate system, south and north zones
Heavy-duty
Medium-duty
Light-duty
Unimproved dirt

The northern extent of Bushkill Township contains a very large contiguous forest known as Blue Mountain, which is mostly on State Game Lands 168. As a part of Kittatinny Ridge, this area contains contiguous forest and corridor providing refuge to resident and migratory species. With the ridges' extensive diversity of habitat types, it has long been recognized as providing critical habitat for resident mammals such as black bear and coyote, while also being recognized as one of the major east coast autumn flyways for migrating raptors. Although the mountain is primarily upland forest, it also includes headwater streams, seeps, springs, and vernal pools.

These riparian forests, wetlands, and waterways offer diverse critical habitat for a wide diversity of plant species as well as for birds, reptiles, amphibians, dragonflies and damselflies, and aquatic insects. Connecting ecological corridors such as large, forested tracts, and rivers and streams, are important in keeping small populations from becoming isolated. Furthermore, these corridors could become imperative for migration northward to higher elevations if the conditions in the region begin to warm climatically.

Blue Mountain and State Game Lands #168 make up an extensive ridge and forest that straddles the border of Bushkill Township. This area makes for an excellent opportunity to connect ecological corridors from the lower valley to the higher ridge. Several forested ecological corridors are present, especially along several streams that run north to south through the township. These stream-led corridors allow migration of fauna/flora from Blue Mountain to other extensive forested areas, such as Jacobsburg State Park. However, between these two large forested areas, major roads pose as physical and ecological barriers for movements of wildlife. Route 512 and several other side roads interrupt an ecological corridor between Blue Mountain and Jacobsburg State Park. For some species, a road can effectively fragment a population of a species by leaving a barrier to movement and interbreeding. The remaining small populations are vulnerable to genetic deterioration from inbreeding, environmental catastrophes, fluctuations in habitat conditions, and chance variations in age and sex ratios.

Even a major road can cause habitat fragmentation that may be ominous to a species, especially in the face of compounding environmental problems. The infrastructure of roads can cause runoff pollution, noise pollution, and air pollution. They also contribute to the spread of invasive plant species, which could infiltrate interior forest areas and threaten the ecological integrity of these areas. This makes room for opportunistic species, like brown-headed cowbirds and other edge habitat species, which may increase near roads. This could harm interior forest species (especially birds), where nest predation and parasitism increases. Thus, roads can be a physical barrier and cause destructive ecological impacts to species. Despite the effects of roads on ecological corridors in Bushkill Township, these corridors still increase movements across the forested landscape from the lower valleys to the higher ridges. Future planning efforts should minimize the degradation of these natural corridors, and expand and improve them where possible.

1) Rismiller Landscape Corridor

Two east to west roads fragment a north to south ecological corridor from south of Blue Mountain to Jacobsburg State Park. In addition, the village of Rismiller and associated roads present an obstacle to the present forested corridor. Further south, Route 512 serves as a major barrier, fragmenting the corridor along the stream. Other roads cut off this particular stretch of corridor south to Jacobsburg State Park (see map). In addition, the forested buffer along this stretch becomes narrow (see map), and allows for fewer movements and greater chances of predation and invasive species spread. One recommendation is to increase the forested buffer of the corridor along the stream. With increased buffering, forest cover will increase, habitat for species will increase, and predation may decrease among native wildlife.

Jacobsburg State Park serves as a large refuge for many native species of flora/fauna, and this park provides a large intact forested corridor south to Bushkill Creek. Bushkill Creek also serves as a corridor for

movements of wildlife. There are ample opportunities to expand the **Rismiller Landscape corridor** from **Jacobsburg State Park/Bushkill Creek** to include other areas of Bushkill Creek. The buffering of the creek could be extended south, to include areas north of the village of Aluta and near Belfast Junction, where reforestation of the creek side is most needed. This would increase an already extensive stretch of ecological corridors along the creek extending from the north at Blue Mountain to Jacobsburg State Park and Bushkill Creek. Roads appear to be the primary physical barriers in much of this area. Conservation recommendations include widening narrow ecological corridors, increasing forested buffers to streams, and potentially constructing wildlife movement culverts below major roads that fragment the corridor. There are arguments for and against construction of these wildlife culverts, and should be considered on a case-by-case basis.

2) Knechts Landscape Corridor

This forested landscape begins in the Kittatinny/Blue Mountain area and extends south through several roads that fragment the large interior forests of the northern part of the township. This corridor moves through the village of Knechts where Route 512 becomes a major interruption for the landscape corridor. The corridor continues across Route 512 and continues south along a stream towards Bushkill Center and the northern portion of Jacobsburg Environmental Center. The area is further fragmented by roads and a coarse filter would probably not include many of the smaller forest blocks captured by this program. The landscape corridor eventually blends into the Rismiller Landscape Corridor and Jacobsburg State Park. This corridor represents another wildlife movement corridor that extends from the north at Blue Mountain south to Jacobsburg. However, there are many barriers and interruptions that this corridor must pass through to reach the state park.

3) Bushkill Creek Landscape Corridor

Dropping south of Jacobsburg State Park is Bushkill Creek that flows south along the border of the township. This creek flows in close adjunct to Route 33, and the partially forested corridor stretches south to just north of Stockertown. This landscape corridor is by no means completely forested, and is much more fragmented than either Knechts or Rismiller Landscape Corridors. This landscape corridor is noted due to the opportunity to reforest some of the riparian areas along Bushkill Creek. If more of the creek was reforested, this corridor could link with the corridors mentioned above, creating an even larger forested corridor in the county. Roads also fragment and interrupt the Bushkill Creek Corridor. Many animal species that depend on streamside corridors for movement cannot tolerate busy roads that interrupt. This area may be a good example of building wildlife culvers to give some animal species safe harbors for crossing busy roads. Several of these wildlife culvers could be built, but funds are probably the limiting factor here. However, several areas of this creek could be examined for reforestation of the riparian zone. Replanting of these riparian zones along Bushkill Creek is important due to the possibility of improving water quality, decreasing non-point source pollution, and decrease flooding intensity along the creek.

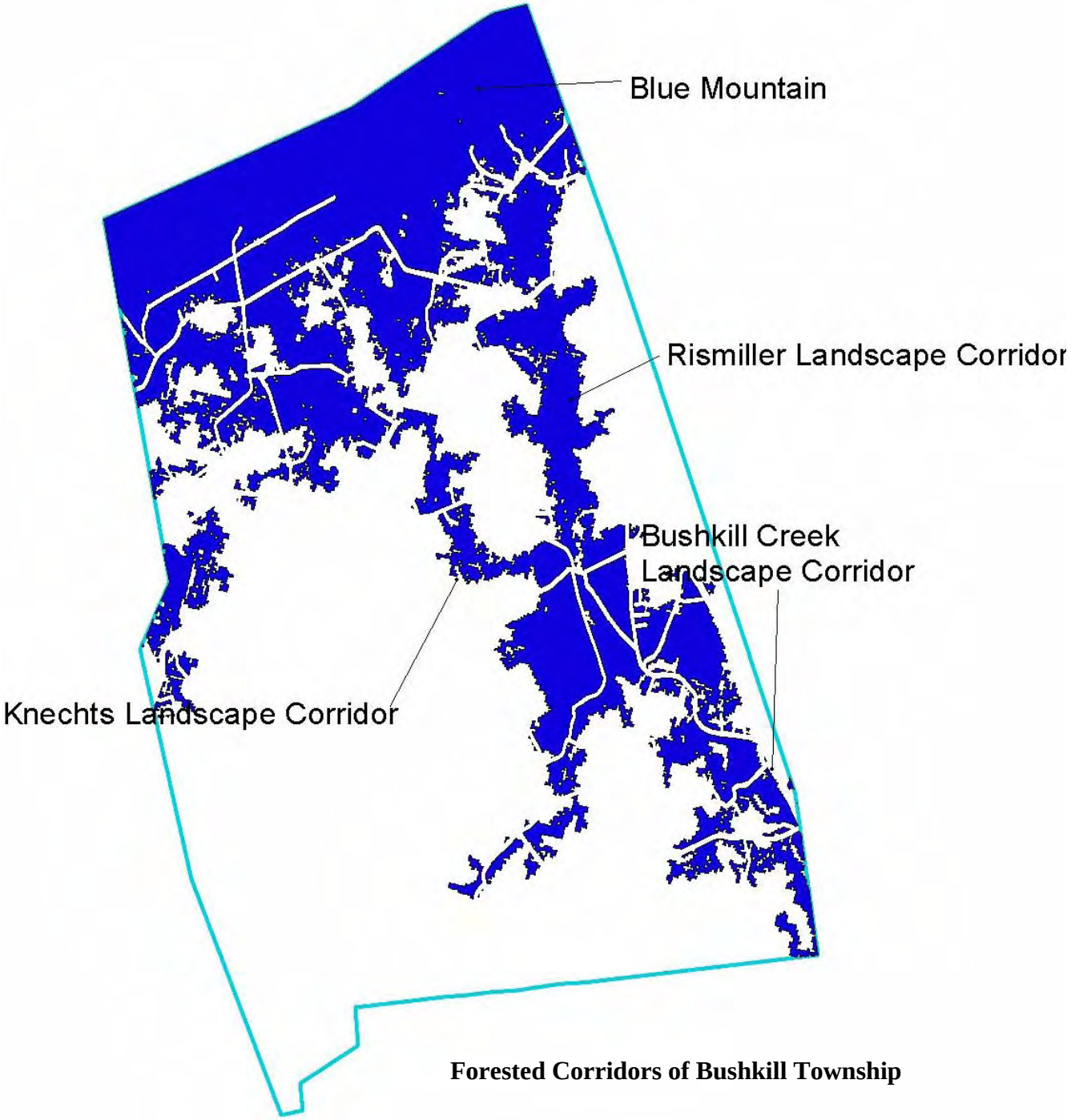
Summary

This township contains two areas designated as natural areas by Pennsylvania Natural Heritage Program's County Inventory Program. The species of concern in these areas have specific habitat requirements that may or may not be compatible to reforestation purposes. One animal of special concern, which occurs in this township, needs a delicate balance between good water quality and open wetland habitat.

These examples represent only two landscape corridors where specifications can be made to expand the movements of wildlife species, possibly expand native plant species populations, improve stream quality, and improve environmental conditions throughout the township. There are possibly other corridors through

the township that could be examined further to determine the conservation implications and restoration potential for ecological corridors.

Blue Mountain is a large uninterrupted forest block that provides complete ecological services to countless number of species. To expand the benefits of this large forested area to species further south into Bushkill Township, landscape corridors could be developed. The corridors presented above show opportunities for possible connection to Blue Mountain. Despite the amount of fragmentation that these landscape corridors contain in them, these corridors represent opportunities for reforestation of riparian areas, wildlife culvers, and land protection in these areas. The identification of these corridors in Bushkill Township will possibly lead the way in directing conservation in the future for the township and set an example for other townships to follow.



Forested Corridors of Bushkill Township

WIND GAP USGS QUADRANGLE MAP

BIG OFFSET BARREN (Plainfield Twp.; Hamilton Twp., Monroe County) **SP518** - This site is a broad forested plateau which straddles the Northampton and Monroe County line on the Blue Mountain. It supports a fair to good quality population of **Variable Sedge (*Carex polymorpha*)**, a G2G3 PE-Endangered plant species. The relatively young forest at this site is dominated by red maple (Acer rubrum) and sassafras (Sassafras albidum) with scrub-oak (Quercus ilicifolia), lowbush blueberry (Vaccinium spp.), and huckleberry (Gaylussacia baccata) occurring in the understory and in forest gaps. The forest at this site has a history of logging or fire. Long term survival of this species at this site may depend on the availability of forest gaps. The 1997 survey of the barren found the population continuing to do well. The site is located partly on Appalachian National Scenic Trail lands.

BLUE MOUNTAIN is the most extensive relatively contiguous area of natural habitat in the two counties. It is one of the major corridors for the movement of biota in eastern Pennsylvania. It includes extensive forests with streams, seeps, springs, vernal pools, rock outcrops, and boulder fields. It has long been recognized as one of the major east coast fall flyways for migrating raptors. The extensive relatively unfragmented forests include habitat for resident animal species including larger mammals such as bear and bobcat, as well as for numerous smaller mammals including the PA-Threatened Allegheny woodrat (Neotoma magister). Wetland areas associated with streams, seeps and vernal pools are important habitat for a wide diversity of plant species as well as for many groups of animals including birds, reptiles, amphibians, odonates (dragonflies and damselflies) and others. Conserving sites on the mountain as highlighted in this report must be considered as part of the effort to conserve the greater natural functional value of the mountain ridge. Preserving the ecological integrity of Blue Mountain should be considered an important component in preserving the biodiversity of the two counties.

BUSHKILL CREEK WATERSHED (Formerly Knechts Pools and Moorestown Wetland) (Bushkill Twp.; Ross Twp., Monroe Twp.) *NC521, SA506* –

One site within this watershed is a gently sloping forested area that includes an **Ephemeral Fluctuating Pools Natural Community.** There are at least twelve vernal pools here, possibly more. The woods are variably wet with some elevated areas being drier. Dominant tree species include white oak (*Quercus alba*) and red maple (*Acer rubrum*), which occur with scattered tulip poplar (*Liriodendron tulipifera*), red oak (*Quercus rubra*), and hemlock (*Tsuga canadensis*). Spicebush (*Lindera benzoin*) is the common understory species with white pine (*Pinus strobus*) saplings and arrow-wood (*Viburnum sp*.) also occurring. The pools may have varying cover types as is typical of this community type. Cinnamon fern (*Osmunda cinnamomea*), sedges (*Carex spp*.), bulrushes (*Scirpus spp*.), and fowl manna grass (*Glyceria striata*) are common in these situations with numerous other species being possible. Vernal pools are valuable habitat for the reproduction of amphibian species and can be important in the life cycles of many other animal species. The character of this site was determined through the examination of aerial photographs and through observations made from the adjacent road. This site has the potential for several plant species of special concern and further surveys are encouraged. Disturbances at the site include a paved road that bisects the site, as well as some unpaved lanes that cross through the woods. The woods have been cut over in the past but are nearing maturity again. Maintaining the forest cover at this site and letting the pools continue in their annual cycle of water retention and loss will benefit this natural community and all the species that depend on it. If the forest in this area is harvested care should be taken not to run machinery in the pools and to leave buffering trees around them as well as nearby streams.

Another site within this watershed includes areas of marsh and shrub swamp, which are fed by ground water seepage. Red maple (*Acer rubrum*), cattail (*Typha latifolia*), skunk cabbage (*Symplocarpus foetidus*), and sedges (*Carex spp*.) are common species. It has been impacted by silt runoff from the adjacent farm fields as well as by the roads that may be influencing the hydrology. It supports an **animal species of special concern**. Maintaining the hydrology of the site is critical to the survival of this species at this site.

RISMILLER WOODS (Bushkill Twp.) **NC515, SP515** - This site supports a good to fair quality example of an Ephemeral/Fluctuating Natural Pools Natural Community. The forest is dominated by a mix of tulip poplar (Liriodendron tulipifera), red maple (Acer rubrum), sweet birch (Betula lenta), red oak (Quercus rubra), white oak (Q. alba), and shagbark hickory (Carya ovata). Several streams and springs are also present at the site. The ponds, streams, and springs create a diversity of microhabitats which support a large diversity of herbs, ferns, and graminoid species. The great variety of wetland microhabitats makes this area excellent breeding habitat for amphibians. The area has seen disturbance in the past from logging though much of the forest is currently recovering. A good quality population of **Swamp Dog-Hobble (*Leucothoe racemosa*),** a PA-Rare shrub, occurs in many of the pools at this site as well as along some of the small seepy streams. Associated species include highbush blueberry (Vaccinium corymbosum), arrow-wood (Viburnum spp.), and rhododendron (Rhododendron maximum). The north end of the stream corridor is threatened by new housing developments and gravel storage. This forested riparian corridor connects the sizable forest at Jacobsburg Environmental Education Center with Blue Mountain. Preserving these woods will provide a corridor for wildlife movement as well as habitat for **Swamp Dog-Hobble.** This site will be best protected by maintaining the integrity of the matrix forest and by limiting or decreasing the fragmentation of the forest on the surrounding landscape.

GRAND CENTRAL WOODS (Plainfield Twp.) - This locally significant area is a mesic hardwood forest dissected by the headwaters of Little Bushkill Creek. The area has a good diversity of tree species and is fairly mature (80-100 yrs). White oak (Quercus alba), black oak (Quercus velutina), red oak (Quercus rubra), and white ash (Fraxinus americana) are the dominant tree species. Red maple (Acer rubrum), tulip poplar (Liriodendron tulipifera), bitternut hickory (Carya cordiformis), sassafras (Sassafras albidum), and alternate-leaved dogwood (Cornus alternifolia) are also present. Understory shrubs and trees include rhododendron (Rhododendron maximum), spicebush (Lindera benzoin), maple-leaved viburnum (Viburnum acerifolium), winterberry (Ilex verticillata), and black cherry (Prunus serotina). Although this site was visited too late in the season for many forest herbs, wild sarsparilla (Aralia nudicaulis), asters (Aster spp.), skunk cabbage (Symplocarpus foetidus), sensitive fern (Onoclea sensibilis), jack-in-the-pulpit (Arisaema triphyllum), and solomon's seal (Polygonatum spp.) were all observed. The forest shows no signs of recent disturbance, and has an uneven age structure. Several standing dead trees were observed -- these are important for cavity nesting bird and bat species. A box turtle (Terrapene carolina) was also seen on our field survey. Some exotic species such a Japanese stilt grass (Microstegium vimineum) and Japanese barberry (Berberis thunbergii), are present at the site but are not dominant. A section of the Erie-Lackawanna Railroad has been converted to a walking trail through the woods. Preserving the site will be of value for human recreation and for wildlife.

JACOBSBURG ENVIRONMENTAL ECUCATION CENTER (Bushkill Twp.)

This area consists of over 1,168 acres of mostly forested land bisected by Bushkill Creek and Sober's Run. Several small **Ephemeral Fluctuating/Natural Pool community**, a habitat of special concern, were found on the parks boundaries. The park has a wide diversity of habitats, from shaly rock outcrops and hemlock forests along the Bushkill to mesic forests of red oak (*Quercus rubra*), white oak (*Quercus alba*), white ash (*Fraxinus americana*), shagbark hickory (*Carya ovata*), bitternut hickory (*Carya cordiformis*), and red maple (*Acer rubrum*). Some common herbs include maidenhair fern (*Adiantum pedatum*), rue anemone (*Anemonella thalictroides*), bird's-foot violet (*Viola pedata*), and black snakeroot (*Cimicifuga racemosa*). Much of the forest is fairly mature with good structure and a diverse groundcover persists despite invasion of exotic species such as Japanese barberry (*Berberis thunbergii*), honeysuckle (*Lonicera japonica*), and garlic mustard (*Alliaria officinalis*) in some areas. Several small tributary streams have headwater seeps with swamp white oak (*Quercus bicolor*), skunk cabbage (*Symplocarpus foetidus*), and jack-in-the-pulpit (*Arisaema triphyllum*). The park's wide variety of habitats and ecosystems provide a good potential for rare plant species, although none were identified in our surveys. The park is also home to an environmental

education center, and has an extensive trail system used for biking, hiking and cross-country skiing. The park represents one of the largest remaining tracts of largely intact forest south of the Blue Mountain in Northampton County, and is connected to the Mountain by a riparian forest corridor. As such it is also important habitat for animals requiring large patches of forest, such as forest interior-breeding birds. This area has potential for species of concern.

Bushkill Creek is a HQ-CWF throughout its basin, except for Shoeneck Creek

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Appendix I: Federal, State Status And PNHP Ranks

FEDERAL STATUS

U.S. FISH AND WILDLIFE SERVICE CATEGORIES OF ENDANGERED AND THREATENED PLANTS AND ANIMALS

The following definitions are extracted from the September 27, 1985 U.S. Fish and Wildlife Service notice in the Federal Register:

LE - Listed Endangered - Taxa in danger of extinction throughout all or a significant portion of their ranges.

LT - Listed Threatened - Taxa that are likely to become endangered within the foreseeable future through all or a significant portion of their ranges.

PE - Proposed Endangered - Taxa proposed to be formally listed as endangered.

PT - Proposed Threatened - Taxa proposed to be formally listed as threatened.

C1 - Taxa for which the Service currently has on file substantial information on biological vulnerability and threat(s) to support the appropriateness of proposing to list them as endangered or threatened species.

C2 - Taxa for which information now in possession of the Service indicates that proposing to list them as endangered or threatened species is possibly appropriate, but for which substantial data on biological vulnerability and threat(s) are not currently known or on file to support the immediate preparation of rules.

C3 - Taxa that are no longer being considered for listing as threatened or endangered species. Such taxa are further coded to indicate three categories, depending on the reason(s) for removal from consideration.

3A--Taxa for which the Service has persuasive evidence of extinction.

3B--Names that, on the basis of current taxonomic understanding, usually as represented in published revisions and monographs, do not represent taxa meeting the Act's definition of "species".

3C--Taxa that have proven to be more abundant or widespread than was previously believed and/or those that are not subject to any identifiable threat.

N - Taxa not currently listed by the U.S. Fish and Wildlife Service

STATE STATUS-NATIVE PLANT SPECIES

Legislative Authority: Title 25, Chapter 82, Conservation of Native Wild Plants, amended June 18, 1993, Pennsylvania Department of Environmental Resources.

PE - Pennsylvania Endangered - Plant species which are in danger of extinction throughout most or all of their natural range within this Commonwealth, if critical habitat is not maintained or if the species is greatly exploited by man. This classification shall also include any populations of plant species that have been classified as Pennsylvania Extirpated, but which subsequently are found to exist in this Commonwealth.

Appendix I (Continued.)

PT - Pennsylvania Threatened - Plant species which may become endangered throughout most or all of their natural range within this Commonwealth, if critical habitat is not maintained to prevent further decline in this Commonwealth, or if the species is greatly exploited by man.

PR - Pennsylvania Rare - Plant species which are uncommon within this Commonwealth. All species of native wild plants classified as Disjunct, Endemic, Limit of Range and Restricted are included within the Pennsylvania Rare classification.

PX - Pennsylvania Extirpated - Plant species believed by the Department to be extinct within this Commonwealth. These plant species may or may not be in existence outside this Commonwealth. If plant species classified as Pennsylvania Extirpated are found to exist, the species automatically will be considered to be classified as Pennsylvania Endangered.

PV - Pennsylvania Vulnerable - Plant species which are in danger of population decline within Pennsylvania because of their beauty, economic value, use as a cultivar, or other factors which indicate that persons may seek to remove these species from their native habitats.

TU - Tentatively Undetermined - Plant species which are believed to be in danger of population decline, but which cannot presently be included within another classification due to taxonomic uncertainties, limited evidence within historical records, or insufficient data.

N - None - Plant species which are believed to be endangered, rare, or threatened, but which are being considered by the required regulatory review processes for future listing.

STATE STATUS-ANIMALS

The following state statuses are used by the Pennsylvania Game Commission for (1990, Title 34, Chapter 133 pertaining to wild birds and mammals) and by the Pennsylvania Fish and Boat Commission (1991, Title 30, Chapter 75 pertaining to fish, amphibians, reptiles and aquatic organisms):

PE - Pennsylvania Endangered

Game Commission - Species in imminent danger of extinction or extirpation throughout their range in Pennsylvania if the deleterious factors affecting them continue to operate. These are: 1) species whose numbers have already been reduced to a critically low level or whose habitat has been so drastically reduced or degraded that immediate action is required to prevent their extirpation from the Commonwealth; or 2) species whose extreme
rarity or peripherality places them in potential danger of precipitous declines or sudden extirpation throughout their range in Pennsylvania; or 3) species that have been classified as "Pennsylvania Extirpated", but which are subsequently found to exist in Pennsylvania as long as the above conditions 1 or 2 are met; or 4) species determined to be "Endangered" pursuant to the Endangered Species Act of 1973, Public law 93-205 (87 Stat. 884), as amended.

Fish and Boat Commission - Endangered Species are all species and subspecies: (1) declared by the Secretary of the United States Department of the Interior to be threatened with extinction and appear on the Endangered Species List or the Native Endangered Species list published in the Federal Register; or, (2) declared by the Executive Director (PaFC) to be threatened with extinction and appear on the Pennsylvania Endangered Species List published in the Pennsylvania Bulletin.
Appendix I (Continued.)

PT - Pennsylvania Threatened

Game Commission - Species that may become endangered within the foreseeable future throughout their range in Pennsylvania unless the causal factors affecting the organism are abated. These are: 1) species whose populations within the Commonwealth are decreasing or have been heavily depleted by adverse factors and while not actually endangered, are still in critical condition; or 2) species whose populations may be relatively abundant in the Commonwealth but are under severe threat from serious adverse factors that have been identified and documented; or 3) species whose populations are rare or peripheral and in possible danger of severe decline throughout their range in Pennsylvania; or 4) species determined to be "Threatened" pursuant to the Endangered Species Act of 1973, Public law 93-205 (87-Stat. 884), as amended, that are not listed as "Pennsylvania Endangered".

Fish and Boat Commission - Threatened Species are all species and subspecies: (1) declared by the Secretary of the United States Department of the Interior to be in such small numbers throughout their range that they may become endangered if their environment worsens and appear on a Threatened Species List published in the Federal Register; or, (2) have been declared by the Executive Director (PaFC) to be in such small numbers throughout their range that they may become endangered if their environment worsens and appear on the Pennsylvania Threatened Species List published in the Pennsylvania Bulletin.

PNHP GLOBAL ELEMENT RANKS

G1 = Critically imperiled globally because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.

G2 = Imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.

G3 = Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range or because of other factors making it vulnerable to extinction throughout its range; in terms of occurrences, in the range of 21 to 100.

G4 = Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.

G5 = Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.

GH = Of historical occurrence throughout its range, i.e., formerly part of the established biota, with the expectation that it may be rediscovered (e.g., Bachman's Warbler).

GU = Possibly in peril range wide but status uncertain; need more information.

GX = Believed to be extinct throughout its range (e.g., Passenger Pigeon) with virtually no likelihood that it will be rediscovered.

PNHP STATE ELEMENT RANKS

S1 = Critically imperiled in state because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation from the state.

S2 = Imperiled in state because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extirpation from the state.

S3 = Rare or uncommon in state (on the order of 21 to 100 occurrences).

S4 = Apparently secure in state, with many occurrences.

S5 = Demonstrably secure in state and essentially ineradicable under present conditions.

SA = Accidental in state, including species which only sporadically breed in the state.

SE = An exotic established in state; may be native elsewhere in North America (e.g., house finch).

SH = Of historical occurrence in the state with the expectation that it may be rediscovered.

SN = Regularly occurring, usually migratory and typically non-breeding species for which no significant or effective habitat conservation measures can be taken in the state.

SR = Reported from the state, but without persuasive documentation which would provide a basis for either accepting or rejecting (e.g., misidentified specimen) the report.

SRF= Reported falsely (in error) from the state but this error persisting in the literature.

SU = Possibly in peril in state but status uncertain; need more information.

SX = Apparently extirpated from the state.

Note: A "T" appearing in either the G Rank or S Rank, indicates that the intraspecific taxa is being ranked differently than the species. A "Q" in the rank indicates that there is taxonomic uncertainty about a taxa being ranked (i.e., taxa is being accepted as a full species or natural community in this list but may be treated as a variety or form by others). A "?" after a "G" or "S" indicates that the rank is uncertain at this time.

Appendix II : PNHP Element Occurrence Quality-Ranks

Quality Rank*	Explanation
A	Excellent occurrence: all A-rank occurrences of an element merit quick, strong protection. An A-rank community is nearly undisturbed by humans, or has nearly recovered from early human disturbance; further distinguished by being an extensive, well-buffered occurrence. An A-rank population of a sensitive species is large in area and number of individuals, stable, if not growing, shows good reproduction, and exists in natural habitat.
B	Good occurrence: protection of the occurrence is important to the survival of the element in Pennsylvania, especially if very few or no A-rank occurrences exist. A B-rank community is still recovering from early disturbance or recent light disturbance, or is nearly undisturbed but is less than A-rank because of significantly smaller size, poorer buffer, etc. A B-rank population of a sensitive species is at least stable, in a minimally disturbed habitat, and of moderate size and number.
C	Fair occurrence: protection of the occurrence helps conserve the diversity of a region's or counties's biota and is important to state-wide conservation if no higher-ranked occurrences exist. A C-rank community is in an early stage of recovery from disturbance, or its structure and composition have been altered such that the original vegetation of the site will never rejuvenate, yet with management and time partial restoration of the community is possible. A C-rank population of a sensitive species is in a clearly disturbed habitat, small in size and/or number, and possibly declining.
D	Poor occurrence: protection of the occurrence may be worthwhile for historical reasons or only if no higher ranked occurrences exist. A D-rank community is severely disturbed, its structure and composition been greatly altered, and recovery to original conditions, despite management and time, essentially will not take place. A D-rank population of a sensitive species is very small with a high likelihood of dying out or being destroyed, and exists in a highly disturbed and vulnerable habitat.
E	Verified as extant, but has not been given a rank; additional information needed to evaluate quality.

* Intermediate ranks may also be assigned.

Appendix III: Recommended Natural Area Survey Form

Surveyor: Address & Phone

Date of Observation_____Site Name

Quadrangle Name_____ Exact Location of
Site (please be specific & include a map or sketch)

Owner:
Owners Attitude Toward Conservation:

Site Elevation:_____ Size of Site (acres):

Source of Lead:

Current Land Use:

Type of Area: _Old Growth Forest; __Marsh; __Shrub Swamp;
_Forested Swamp; __Bog; __Natural Pond.
Written Description: Try to convey a mental image of the site features (including vegetation, significant animals & plants, aquatic features, land forms, geologic substrata, scenic qualities, etc.):

Evidence of Disturbance:

Site Condition Compared to Your Last Visit:

Please attach any additional information, species list, etc.
Please send completed report forms to Pennsylvania Science Office of The Nature Conservancy, 34 Airport Drive, Middletown, PA 17057 (717)948-3962. Additional forms may be obtained from this office. Thank you for your contribution.

Appendix IV: Potential Natural Area Survey Form

COUNTIES_____ NO.____ QUAD NAME/CODE:
Site Name:_____ PHOTO NO./DATE: _____ Location:_____ Township:

Air Survey Surveyors:_____ Date:

FOREST AGE			CUTTING			GRAZING			RECVRY POT		PRIORITY*	
yng	mat	old	lt	hvy	clr	lt	mod	hvy	gd	fr pr	hi	med lo
Wetland												
Marsh____	-	____	-	____	-	____	-					
Meadow____	-	____	-	____	-	____	-					
Shrub____	-	____	-	____	-	____	-					
Seep_____	-	____	-	____	-	____	-					
Fen_____	-	____	-	____	-	____	-					
Bog_____	-	____	-	____	-	____	-					
Pond Shore__	-	____	-	____	-	____	-					
Conifer___	-	____	-	____	-	____	-					
Hdw-Cnfr___	-	____	-	____	-	____	-					
Hardwood___	-	____	-	____	-	____	-					
Floodpln___	-	____	-	____	-	____	-					
___ ___	-	____	-	____	-	____	-					
___ ___	-	____	-	____	-	____	-					
Upland												
Ser Barr___	-	____	-	____	-	____	-					
Gras Land__	-	____	-	____	-	____	-					
Lim Barr___	-	____	-	____	-	____	-					
Rck Glade__	-	____	-	____	-	____	-					
Pine Sav___	-	____	-	____	-	____	-					
Oak Sav___	-	____	-	____	-	____	-					
Pine For___	-	____	-	____	-	____	-					
Oak For___	-	____	-	____	-	____	-					
Hdw For___	-	____	-	____	-	____	-					
Hdw-Cnfr___	-	____	-	____	-	____	-					
Cliff____	-	____	-	____	-	____	-					
_____	-	____	-	____	-	____	-					
_____	-	____	-	____	-	____	-					

Ground Survey Surveyors:_____ Date:

Community Type	Eliminate	Notable	Natural	Quality-Rank	
_____	____	___	___	_____	Comments:

Appendix IV (Concluded.)

POTENTIAL NATURAL AREAS SURVEY FORM--NATURAL COMMUNITY

NATURAL COMMUNITY (C rank or better)
Map the exact boundary around ranked portions of natural community.
EO-RANK:_____WHY?

COMMON PLANTS (or attach species list):
_____

OTHER PLANTS:

DOMINANTS OF THE PLANT COMMUNITIES (PC) IN THE NATURAL COMMUNITY:
1.
2.
3.
4.
SIGNS OF DISTURBANCE:

SPECIAL PLANT (map) FREQUENCY/HOW MANY? IN HOW MUCH AREA? PC#

ANIMALS:

Appendix V: Special Plant Survey Form

Site Name:_____ Date:_____Source Code:_____Quad Name:
Date:_____Source Code:_____Quad Code:
Date:_____Source Code:_____State:_____ Counties:
Date:_____Source Code:_____Field Quad #:
Date:_____Source Code:_____Full extent of EO known and mapped? __ yes __ no
Precise locations of individuals or groups mapped on base map? __ yes __ no

BIOLOGY

Element Name:_____Element Code:_____Occ. #:

Phenology	Approx. #	Population Area		Age Structure	Vigor
__in leaf	Ramets	Genets	__1 yd^2	__% seedlings	__very feeble	
__in bud	___ 1-10	___	__1-5 yd^2	__% immature	__feeble	
__in flower	___ 11-50	___	__5-10 yd^2	__% 1st year	__normal
__immature fruit	___ 51-100	___	__10-1000yd^2	__% mature	__vigorous
__mature fruit	___ 101-1000	___	__100yd^2-2ac	__% senescent	__exceptionally vigorous
__seed dispersing	___1001-10,000___		__2 ac+		
	___ 10K+	___	__ est. area		
	___ est. #				

Comments on above:_____ Evidence of reproduction?__yes ___no Explain:_____Type of reproduction: sexual ___asexual ___both
Evidence of symbiotic or parasitic relationships?__yes __no Explain:
Evidence of disease, predation, etc. __yes __no Explain:

Success at Each Stage of Life Cycle

	good	fair	poor	none	uncertain	Comments:
reproduction						
dispersal						
establishment						
maintenance						

HABITAT

Aspect	Slope	Light	Topographic position	Moisture
__N __NE	__Flat	__Open	__Crest	__Inundated(Hydric)
__E __NW	__0-10	__Partial	__Upper slope	__Saturated(Wet-mesic)
__S __SE	__10-35	__Filtered	__Mid-slope	__Moist(Mesic)
__W __SW	__35+	__Shade	__Lower-slope	__Dry-Mesic
	__Vertical		__Bottom	__Dry(Xeric)

Elevation:_____feet to _____feet
CROSS SECTION OF TOPOGRAPHY (HABITAT)-include scale, directions, element position:

Appendix V (Concluded.)

Associated natural community/plant community: Natural community form completed? __yes __no

Associated plant species:

Substrate/Soils: Estimated # of acres of potential habitat for element in immediate area:

IDENTIFICATION

Photograph taken? __yes __no

Specimen taken? __yes __no If yes, give coll. # & repository:

Do other members of this genus occur at this site? __yes __no If yes, complete below:

List:

Hybridization? __yes __no

Identification problems? __yes __no

CONSERVATION

Evidence of disturbance:

Threats to EO:

How large an area is needed to provide species survival here?

Explain:

Conservation/management needs:

Research needs: Data security? ___yes ___no If yes, explain:

SUMMARY

EO Quality: (i.e., how representative is this occurrence on rangewide scale? Consider the size & productivity of the population & the vitality & vigor of the individuals.)
A-Excellent B-Good C-Marginal D-Poor
Comments:

EO Condition: (i.e., is the habitat supporting the EO pristine or degraded? Is there a potential for the habitat to recover from past disturbances?)
A-Excellent B-Good C-Marginal D-Poor
Comments:

EO Viability: (i.e., what are the long-term prospects for continued existence of this occurrence at the indicated level of quality?)
A-Excellent B-Good C-Marginal D-Poor
Comments:

EO Defensibility: (i.e., can this occurrence be protected from extrinsic human factors?)
A-Excellent B-Good C-Marginal D-Poor
Comments:

EO Rank: (i.e., a summary of all the factors listed above) A B C D
Comments:_____

Appendix VI: Classification Of Natural Communities In Pennsylvania (1995 Draft)

COMMUNITY NAME	MAP CODE	GLOBAL RANK*	STATE RANK*	
ESTUARINE COMMUNITIES				
DEEPWATER SUBTIDAL COMMUNITY	EAA	G?	S1	
SHALLOW-WATER SUBTIDAL COMMUNITY	EAB	G?	S1	
FRESHWATER INTERTIDAL MUDFLAT	EBA	G3G4	S1	
FRESHWATER INTERTIDAL MARSH	ECA	G3G4	S1	
RIVERINE COMMUNITIES				
LOW-GRADIENT EPHEMERAL/INTERMITTENT CREEK		RAA	G?	S5
LOW-GRADIENT CLEARWATER CREEK		RAB	G?	S3S4
LOW-GRADIENT CLEARWATER RIVER	RAC	G?	S2S3	
LOW-GRADIENT BROWNWATER CREEK	RAD	G?	S2S3	
MEDIUM-GRADIENT EPHEMERAL/INTERMITTENT CREEK	RBA	G?	S5	
MEDIUM-GRADIENT CLEARWATER CREEK	RBB	G?	S3	
MEDIUM-GRADIENT CLEARWATER RIVER	RBC	G?	S?	
MEDIUM-GRADIENT BROWNWATER CREEK	RBD	G?	S3	
HIGH-GRADIENT EPHEMERAL/INTERMITTENT CREEK	RCA	G?	S5	
HIGH-GRADIENT CLEARWATER CREEK		RCB	G?	S3
HIGH-GRADIENT CLEARWATER RIVER	RCC	G?	S?	
HIGH-GRADIENT BROWNWATER CREEK	RCD	G?	S?	
WATERFALL AND PLUNGEPOOL	RDA	G?	S3S4	
SPRING COMMUNITY	REA	G?	S1S2	
SPRING RUN COMMUNITY		REB	G?	S1S2
LACUSTRINE				
ACIDIC GLACIAL LAKE	LAAA	G?	S2S3	
CALCAREOUS GLACIAL LAKE	LAAB	G?	S1	
NONGLACIAL LAKE	LAB	G?	S2	
ARTIFICIAL LAKE	LAC	*	*	
NATURAL POND	LBA	G?	S2S3	
ARTIFICIAL POND	LBB	*	*	
STABLE NATURAL POOL	LCA	G?	S?	
EPHEMERAL/FLUCTUATING NATURAL POOL	LCB	G?	S2	
ARTIFICIAL POOL	LCC	*	*	
EPHEMERAL/FLUCTUATING LIMESTONE SINKHOLE	LCD	G?	S1	

Appendix VI (Continued.)

COMMUNITY NAME	MAP CODE	GLOBAL RANK*	STATE RANK*	
PALUSTRINE COMMUNITIES				
ACIDIC BROADLEAF SWAMP	PAA	G5	S2S3	
CIRCUMNEUTRAL BROADLEAF SWAMP	PAB	G?	S2S3	
BOREAL CONIFER SWAMP	PAC	G?	S3	
NORTHERN CONIFER SWAMP	PAD	G?	S3S4	
BROADLEAF-CONIFER SWAMP	PAE	G?	S3S4	
FLOODPLAIN SWAMP	PAF	G?	S1	
EASTERN CALCAREOUS SEEPAGE SWAMP	PAG	G?	S1	
ACIDIC SHRUB SWAMP	PAH	G5	S3	
CIRCUMNEUTRAL SHRUB SWAMP	PAJ	G?	S3	
GRAMINOID MARSH	PBA	G?	S3	
ROBUST EMERGENT MARSH	PBB	G?	S2	
MIXED GRAMINOID-ROBUST EMERGENT MARSH	PBC	G?	S2S3	
CALCAREOUS MARSH	PBD	G?	S1	
OLIGOTROPHIC GLACIAL KETTLEHOLE BOG	PCAA	G?	S3	
WEAKLY MINEROTROPHIC LAKESIDE BOG	PCAB	G?	S2	
NONGLACIAL BOG	PCB	G?	S3	
RECONSTITUTED BOG	PCC	*	*	
POOR (GRAMINOID) FEN	PCD	G?	S1	
SHRUB (CALCAREOUS) FEN		PDA	G2G3	S1
BASIN GRAMINOID-FORB (CALCAREOUS) FEN	PDB	G?	S1	
HILLSIDE GRAMINOID-FORB (CALCAREOUS) FEN	PDC	G?	S1	
NORTHERN APPALACHIAN CIRCUMNEUTRAL SEEP	PEA	G?	S3?	
NORTHERN APPALACHIAN CALCAREOUS SEEP	PEB	G?	S1	
NORTHERN APPALACHIAN ACIDIC SEEP	PEC	G?	S3?	
RIVERSIDE SEEP	PED	G?	S2?	
TERRESTRIAL COMMUNITIES				
NORTHERN CONIFER FOREST	TBA	G5	S3S4	
NORTHERN HARDWOOD (DECIDUOUS) FOREST		TBB	G?	S3S4
NORTHERN HARDWOOD-CONIFER FOREST	TBC	G?	S3	
XERIC CENTRAL HARDWOOD (DECIDUOUS) FOREST	TCA	G?	S5	
XERIC CENTRAL CONIFER FOREST	TCB	G?	S3S4	
XERIC CENTRAL HARDWOOD-CONIFER FOREST	TCC	G?	S3	
RIDGETOP DWARF-TREE FOREST	TCD	G4	S2S3	
DRY-MESIC ACIDIC CENTRAL FOREST	TCE	G?	S5	
DRY-MESIC CALCAREOUS CENTRAL FOREST	TCF	G?	S2S3	
MESIC CENTRAL FOREST	TCG	G?	S2	
TALUS SLOPE FOREST	TCH	G?	S2?	
COASTAL PLAIN FOREST	TEA	G?	S1	
FLOODPLAIN FOREST	TFA	G?	S2	
RIVER GRAVEL COMMUNITY	TGA	G?	S4S5	
MESIC SCRUB OAK-HEATH-PITCH PINE BARRENS	TCDA	G1	S1	
EASTERN SERPENTINE BARRENS	THA	G2	S1	

Appendix VI (Continued.)

COMMUNITY NAME	MAP CODE	GLOBAL RANK*	STATE RANK*
CENTRAL APPALACHIAN SHALE BARREN	THBA	G?	S1
NORTHERN APPALACHIAN SHALE BARREN	THBB	G?	S2

NORTHERN APPALACHIAN SAND BARREN	THC	G?	S?	
NORTHERN APPALACHIAN BOULDER FIELD	THD	G?	S5	
NORTHERN APPALACHIAN CALCAREOUS CLIFF	THE	G?	S2	
NORTHERN APPALACHIAN ACIDIC CLIFF	THF	G?	S5	
NORTHERN APPALACHIAN SHALE CLIFF	THG	G?	S2	
RIVERSIDE OUTCROP/CLIFF	THJ	G?	S1S2	
NORTHERN APPALACHIAN TALUS WOODLAND		TCHA	G?	S?
NORTHERN APPALACHIAN ACIDIC ROCKY SUMMIT	THK	G?	S2	
NORTHERN APPALACHIAN CALCAREOUS ROCKY SUMMIT	THM	G?	S1	
CALCAREOUS ROCKY SLOPE	TFG	G?	S?	
CALCAREOUS RIVERSIDE OUTCROP	THH	G?	S1	
LAKE SEDIMENT SLUMP	TGB	G?	S1	
EASTERN GREAT LAKES BEACH COMMUNITY	TJA	G?	S?	
EASTERN GREAT LAKES DUNE COMMUNITY	TJB	G?	S?	
EASTERN GREAT LAKES SAND PLAINS COMMUNITY	TJC	G?	S?	
EASTERN GREAT LAKES BLUFF/CLIFF COMMUNITY	TJD	G?	S?	

SUBTERRANEAN COMMUNITIES

SOLUTION CAVE TERRESTRIAL COMMUNITY	SAA	G?	S3	
SOLUTION CAVE AQUATIC COMMUNITY	SAB	G?	S3	
TECTONIC CAVE COMMUNITY	SAC	G?	S3S4	
TALUS CAVE COMMUNITY	SAD	G?	S2S4	

DISTURBED COMMUNITIES

BARE SOIL	DAA	--	--	
MEADOW/PASTURELAND	DAB	--	--	
CULTIVATED LAND	DAC	--	--	
SUCCESSIONAL FIELD	DAD	--	--	
YOUNG MISCELLANEOUS FOREST	DAE	--	--	
CONIFER PLANTATION	DAF	--	--	

* Not all natural communities have been assigned a global or state rank; disturbed or artificial communities are not assigned ranks.

PLANTS

SCIENTIFIC NAME	COMMON NAME
Arabis hirsuta	western hairy rock-cress
Aster ericoides	white heath aster
Carex buxbaumii	brown sedge
Carex eburnea	ebony sedge
Carex flava	yellow sedge
Carex polymorpha	variable sedge
Carex prairea	prairie sedge
Carex sterilis	sterile sedge
Carex tetanica	a sedge
Castilleja coccinea	scarlet Indian-paintbrush
Conioselinum chinense	hemlock-parsley
Dicentra eximia	wild bleeding hearts
Eleocharis compressa	flat-stemmed spike-rush
Eleocharis intermedia	matted spike-rush
Eriophorum viridicarnatum	thin-leaved cotton-grass
Ilex opaca	American holly
Juncus balticus	baltic rush
Juncus torreyi	Torrey's rush
Liatris scariosa var nieuwlandii	a gay feather
Leucothoe racemosa	swamp dog-hobble
Lobelia kalmii	brook lobelia
Lythrum alatum	winged-loosestrife
Nelumbo lutea	American lotus
Orontium aquaticum	golden club
Panicum flexile	wiry witchgrass
Parnassia glauca	Carolina grass-of-parnassus
Potamogeton pulcher	spotted pondweed
Prunus pumila	sand cherry
Ranunculus longirostris	eastern white water-crowfoot
Rhyncospora capillacea	capillary beaked-rush
Rosa virginiana	Virginia rose
Salix serissima	autumn willow
Saxifraga micranthidifolia	lettuce saxifrage
Scirpus ancistrochaetus	northeastern bullrush
Scleria verticillata	whorled nutrush
Solidago speciosa	slender goldenrod
Tomanthera auriculata	eared false-foxglove
Trollius laxus ssp laxus	spreading globe flower
Utricularia minor	lesser bladderwort
Viburnum trilobum	highbush cranberry
Wolffia borealis	dotted water-meal

ANIMALS

Only a few animal species of special concern are currently known in Lehigh and Northampton Counties. In an effort to assure maximum protection of those species, a list of the animals is not provided. Any landowners of sites that contain animal species of concern as identified in this report may obtain additional information by contacting the PA Science Office of The Nature Conservancy at 208 Airport Drive, Middletown PA 17057.