ERIE COUNTY

NATURAL HERITAGE INVENTORY

Prepared For the Erie County Department of Planning

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Any errors or omissions from the text or the maps are solely the responsibility of the author.

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INTRODUCTION

Erie County possesses natural resources rich in biological diversity and of biological significance. These natural resources include flora, fauna, and their habitats, as well as a variety of terrestrial and aquatic ecosystems. Of Pennsylvania's counties, Erie County is among the highest in biological diversity. Erie County contains biological diversity of any county in Pennsylvania. Erie County contains biological communities and species that are both rare and biologically significant on a global scale and within Pennsylvania. Among these ecological communities are the lake shoreline habitats, including lake bluffs, lake sediment slumps, sandspits, beaches, and beach dunes, which are unique to Erie County, Pennsylvania, and rare in the region. These lake shoreline communities provide habitats for a number of species of special concern that are rare or uncommon in Pennsylvania, and rare in the region. These lake shoreline communities provide habitats for a number of species of special concern that are rare or uncommon in Pennsylvania, as their habitats are limited. From a global standpoint, the biological communities within the French Creek drainage basin are of world-wide significance. Within Erie County, French Creek and associated aquatic biological communities, such as Lake Pleasant, LeBoeuf Creek, and LeBoeuf Creek stream valley are of exceptional biological significance. In addition to the biological communities of state and global importance, the County also possesses natural resources that are biologically significant (i.e., rare or uncommon) at the county level. These natural resources contribute to the quality of life of Erie County residents. And, if properly protected and managed, these natural resources can be a significant long-term resource for Erie County via the provision of resource and recreational opportunities that are planned and managed in accordance with the recreational carrying capacity of the natural resource.

Current census figures indicate that the County's population remains essentially the same as in 1980 and that a "limited growth" population is projected for 2000 A.D. Nonetheless, there are pockets of population growth within the County as the population continues to shift from the City of Erie to adjacent suburbs and other areas of the County (Erie County Department of Planning). Between 1980 and 1990, twenty of Erie County's thirty-nine municipalities did experience population growth. Five municipalities had population increases of ten percent or more; Edinboro Borough, Girard Borough, McKean Township, Washington Township, and Waterford Township (Penn State Data Center, 1991). Per information review during the inventory, the natural features that make this County so inviting to residents and tourists are being lost because of localized unguided growth and disturbances to the landscape caused by such land use activities as development, agriculture, mineral extraction, and timber harvesting.

Maintenance of the County's outstanding natural resources requires a balance of landscape development activities, land use practices, and natural resource protection policies. To assist in this effort, the Erie County Natural Heritage Inventory identifies significant biotic (living) resources located in Erie County and provides recommendations to aid in the protection and management of these resources. The result of this study can be used to:

(1) Assist County and local governments in comprehensive planning, land use reviews, and decision making in sites where natural areas are located;

(2) Provide public and private interests with information which can lead to the ultimate protection and preservation of natural areas (examples: PA Department of Environmental Resources, State parks, local parks and recreation departments, and private conservation organizations);

(3) Provide valuable information to the academic community;

(4) Alert land developers and property owners to natural area locations so that development can be channeled around environmentally sensitive areas to avoid costly delays in development activities.

According to Section 301.2 of the Pennsylvania Municipalities Planning Code, Act 247 of 1968, as amended, the County "...planning agency shall make careful surveys, studies and analyses of...natural features affecting development; natural, historic and cultural resources; and the prospects for future growth...". The Natural Heritage Inventory is the first major step undertaken by the County in the development of the Erie County Comprehensive Plan in accordance with State Act 247.

ABSTRACT

The natural heritage sites that have qualified for inclusion in this report are ranked according to their significance as areas of importance to the biological diversity and ecological integrity of the county. Also included in this evaluation is the level of state and/or global significance ("S" or "G" rank). The three county significance ranks are **Exceptional**, **High**, and **Notable** significance. The three county significance ranks have been used to prioritize the significance of all identified sites and suggest the relative attention that sites should receive for the amount, degree and rate of protection. The sites are in alphabetical order for each level. Designation as to type of natural heritage site (NA=Natural Area, BDA=Biological Diversity Area, DA=Dedicated Area, LCA=Landscape Conservation Area, OHA=Other Heritage Area) is included as part of the site name. Refer to the "Introduction" section on page X for explanations of these site categories. Definitions of the three county significance ranks are given in Appendix II.

NATURAL HERITAGE AREAS SUMMARY

Table 1: Summary of Natural Heritage Areas in order of relative county significance.

SITE	QUADRANGLE	DESCRIPTION
EXCEPTIONAL		
Ashtabula Creek BDA	Conneaut East Springfield	Exceptional quality floodplain swamp of state and county significance.
Bentley Run/Alder BDA	Union City	Highly diverse area that contains natural communities of global or state significance. Communities provide habitats for several special plant species of state significance.
Devils Backbone NA/BDA	Albion Edinboro North	Stream valleys contain a forest community rare in the state and uncommon in the county, rare habitats, special plant species, and a high quality stream community.

SITE	QUADRANGLE	DESCRIPTION
EXCEPTIONAL		
French Creek Basin LCA	Cambridge Springs NE Corry Edinboro North Hammett Millers Station Waterford Wattsburg Union City	Encompasses that part of the French Creek BDA that is of exceptional county significance, and adjacent biological resources that retain their natural character. Provides protection to the aquatic resources in the mainstem of French Creek and in LeBouef Creek by including these streams' watersheds.
French Creek BDA	Cambridge Springs NE Corry Edinboro North Hammett Millers Station Waterford Wattsburg Union City	Contains 49 natural communities of global and/or state significance significance, plus numerous special animal species of global and/or state significance.
Hubbell Run BDA	Corry Union City	Upper reaches of Hubbell Run contain natural communities and species of special concern that are of global and/or state significance. Three natural communities are natural areas.
Lake Plain Shoreline BDA	Fairview Fairview SW	A forest community of state and county significance contains uncommon shoreline habitats that harbor special plant species.
Lake Shoreline LCA	Fairview North East	Contains the exceptional portions of the Lake Plain Shoreline BDA, North East Lake Bluff BDA, and a variety of coastal shoreline habitats that retain their natural character.

SITE	QUADRANGLE	DESCRIPTION
EXCEPTIONAL		
Love Marsh BDA	Swanville	Habitat for plant species of state and regional significance.
McLane Fens BDA	Edinboro North	Contains natural communities of global and state significance that provide habitats for plant species of state significance.
North East Lake Bluff BDA	North East	Lake bluff habitat of unusual quality, containing a rare habitat that harbors plant species of state significance.
Presque Isle BDA/OHA	Erie North Erie South Swanville	Inter-related natural communities (lake littoral zone, embayment, and shoreline habitats) that are of national and state significance. Natural communities provide habitat for 63 species of special concern, as well as other significant plant and animal species. Nature study/instruction is provided for the general public and the site is utilized for scientific research and natural science studies.
Six Mile Creek BDA	Hammett Harborcreek	High quality stream community, forest community critically imperiled in the state, and an uncommon cliff community contained in site. Two natural communities contain special species habitats.
Sixteen Mile Creek Gorge NA	North East	Recovering natural area that includes a high gradient stream and a northern hardwood forest with mature and old growth stands.

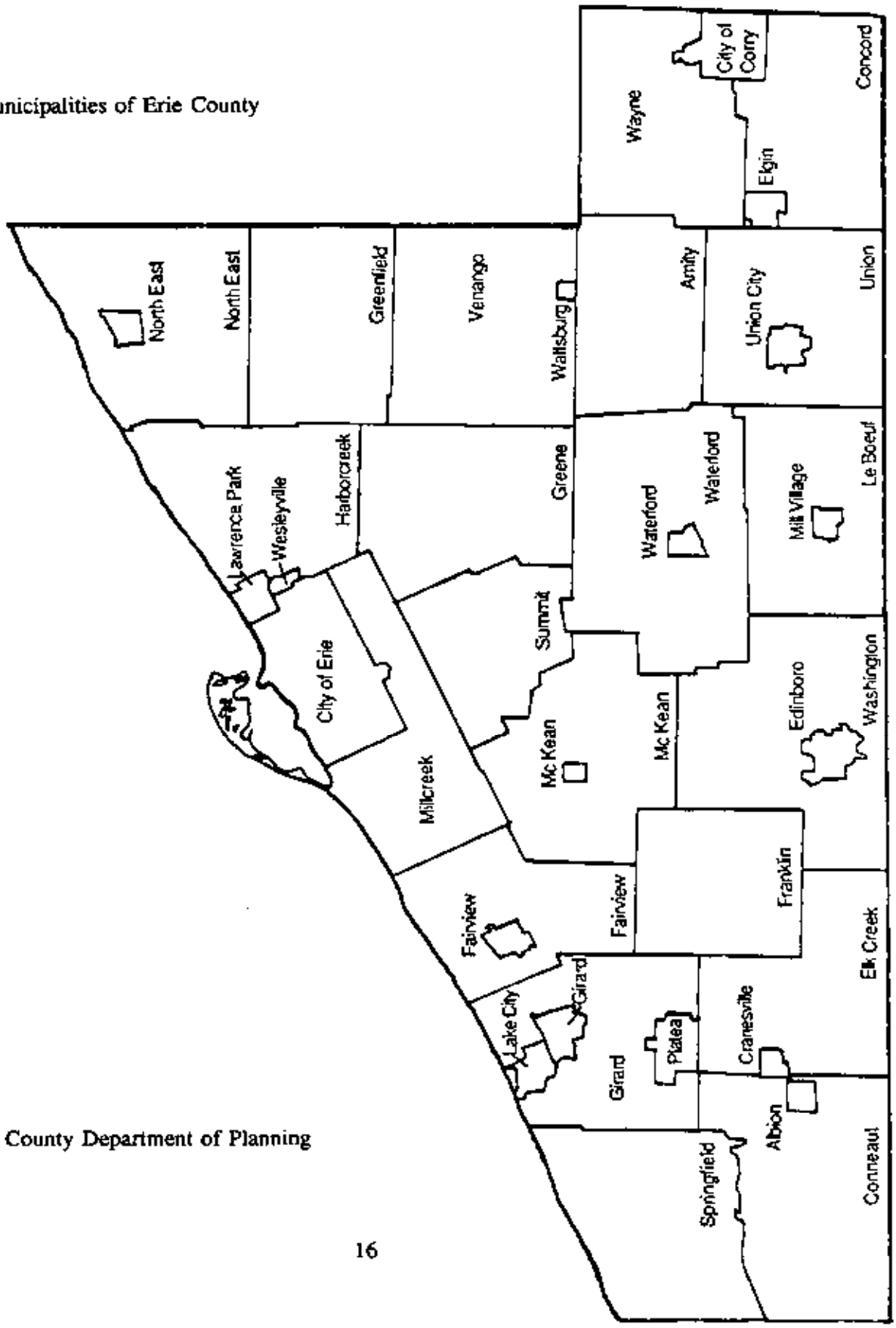
SITE	QUADRANGLE	DESCRIPTION
EXCEPTIONAL		
Titus Bog Natural Area DA	Union City	Contains a natural area, consisting of glacial bog and basin graminoid-forb fen communities.
Twenty Mile Creek BDA	North East	A calcareous seep community that provides habitat for plant species of state significance.
Walnut Creek Valley BDA	Swanville	Contains a forest community and calcareous seep communities that provide special species habitats. Natural communities and special plant species are of state and/or county significance.
Wattsburg Fen Natural Area DA	Union City	Contains a recovering natural area, harboring a shrub fen community, with one of the richest orchid floras in the state.
Wintergreen Gorge BDA	Hammett	Partially mature forest community, of county and state significance, in which there are two rare habitats that harbor plant species of state significance.
HIGH		
Eight Mile Creek BDA	Harborcreek	A forest community, of county and state significance, bordered by a rare shoreline habitat that harbors plant species of special concern.
French Creek Basin LCA	Corry Erie South North East	Encompasses the portion of the French Creek BDA that is of high county significance, as well as adjacent biological resources that both retain natural riparian characteristics and provide quality wildlife habitat.

SITE	QUADRANGLE	DESCRIPTION
HIGH		
French Creek Basin LCA (cont'd.)		Provides protection to the aquatic resources in LeBouef Creek by including this stream's watershed.
French Creek BDA	Erie South North East	Contains a medium gradient clearwater stream bordered by a highly diverse complex of riparian, terrestrial and wetland biotic resources. Stream is of state significance. Biological resources are of county significance.
Lake Plain BDA	Conneaut East Springfield	Special species habitat for plants of state significance.
Lake Plain Forested Wetland BDA	Harborcreek North East	Forested wetland community of state significance, which contains habitats for plant species of global and state significance.
Lake Plain Shoreline BDA	Albion East Springfield	Critical breeding habitat for a fish species of state significance.
Lake Plain Wetland BDA	East Springfield	Habitat for a special plant species.
Lake Shoreline LCA	Conneaut East Springfield Erie North	Contains the Eight Mile Creek BDA, part of the Lake Plain Shoreline BDA, the Lake Plain BDA,FairviewLake Plain Wetland BDA, and Harborcreeka variety of shoreline habitats that Swanvilleretain their natural characteristics.

SITE	QUADRANGLE	DESCRIPTION
NOTABLE		
Asbury Woods Nature Center OHA	Swanville	Educational area containing a diversity of natural and managed vegetation communities.
Battles Museum OHA	Albion	Educational area containing a variety of vegetation communities.
French Creek Basin LCA	Cambridge Springs Edinboro South	Encompasses that portion of the French Creek basin of notable county significance.
French Creek BDA	Cambridge Springs Edinboro South	Contains two high quality streams. Protection of these streams is necessary to maintain integrity of globally significant aquatic resources located in the downstream portions of the French Creek watershed.
Harborcreek BDA	Harborcreek	Habitat for special plant species.
Lake Shoreline LCA	Albion Erie South Hammett	Contains the portion of the Lake Plain Shoreline BDA that is of notable county significance. Encompasses parts of the Presque Isle Bay watershed and the Crooked Creek watershed in order to protect aquatic resources within the Presque Isle BDA/OHA and Lake Plain Shoreline BDA.
LeBoeuf Township BDA	Millers Station	Habitat for special animal species.
Lee Road Woods BDA	Erie South	Habitat for special animal species.
Union Township BDA	Union City	Habitat for special plant species.

SITE	QUADRANGLE	DESCRIPTION
NOTABLE		
Upper Conneaut Creek BDA	East Springfield	Habitat for special plant species.
West Branch Conneaut Creek BDA	Beaver Center	Habitat for special animal species.

Figure 1: Municipalities of Erie County



Source: Erie County Department of Planning

MUNICIPALITIES SUMMARY

Table 2: Municipality Summary

Municipality	Site Names & *Managed Lands*	U.S.G.S. Quadrangle	see page
Townships			
Amity	Bentley Run/Alder BDA	Union City	235
	French Creek Basin LCA	Union City	231
		Waterford	218
	French Creek BDA	Union City	239
		Waterford	218
	Hubbell Run BDA	Union City	231
	Titus Bog Natural Area DA	Union City	231
	Wattsburg Fen Natural Area DA	Union City	232
	State Game Lands #102	Union City	239
	State Game Lands #162	Union City	238
	State Game Lands #167	Union City	239
	State Game Lands #190	Waterford	225
Concord	French Creek Basin LCA	Corry	245
		Union City	231
	French Creek BDA	Corry	245
		Spartansburg	256
		Union City	239
	State Game Lands #144	Spartansburg	256
	State Game Lands #291	Columbus	250
		Spring Creek	253
Conneaut	Ashtabula Creek Swamp BDA	Conneaut	187
		East Springfield	193
	Lake Shoreline LCA	Albion	197
	Lake Plain Shoreline BDA	Albion	197
	Upper Conneaut Creek BDA	East Springfield	194
	West Branch Conneaut Creek BDA	Beaver Center	275
	State Game Lands #101	Beaver Center	275
Elk Creek	Lake Shoreline LCA	Albion	197

Municipality	**Sites Names & *Managed Lands***	**U.S.G.S. Quadrangle**	**see page**
Townships (cont.)			
Fairview	Devils Backbone NA/BDA	Albion	197
		Edinboro North	207
	Lake Shoreline LCA	Fairview	167
		Swanville	156
	Walnut Creek Valley BDA	Swanville	162
Franklin	Devils Backbone NA/BDA	Albion	197
		Edinboro North	207
Girard	Battles Museum OHA	Albion	199
	Devils Backbone NA/BDA	Albion	197
	Lake Plain Shoreline BDA	Albion	197
		East Springfield	191
		Fairview	167
		Fairview SW	174
	Lake Shoreline LCA	Albion	197
		East Springfield	191
		Fairview	167
		Fairview SW	174
Greene	French Creek Basin LCA	Erie South	151
		Hammett	141
		Waterford	218
	French Creek BDA	Erie South	151
		Hammett	141
		Waterford	218
	Lake Shoreline LCA	Erie South	151
		Hammett	133
	Six Mile Creek Gorge BDA	Hammett	133
	Wintergreen Gorge	Hammett	138
	State Game Lands #109	Erie South	153
		Hammett	147
	State Game Lands #161	Hammett	148
		Waterford	226
	State Game Lands #218	Hammett	147

Municipality	**Site Names & *Managed Lands***	**U.S.G.S. Quadrangle**	**see page**
Townships (cont.)			
Greenfield	French Creek Basin LCA	North East	112
		Wattsburg	120
	French Creek BDA	North East	112
		Wattsburg	120
	Six Mile Creek Gorge BDA	Hammett	133
	State Game Lands #163	North East	116
	State Game Lands #191	Wattsburg	128
Harborcreek	Eight Mile Creek BDA	Harborcreek	102
	Harborcreek BDA	Haborcreek	108
	Lake Shoreline LCA	Erie North	75
		Erie South	151
		Harborcreek	100
		Hammett	133
	Six Mile Creek Gorge BDA	Hammett	133
		Harborcreek	104
	Wintergreen Gorge BDA	Hammett	138
	Shades Beach Park	Harborcreek	104
	Six Mile Creek Park	Hammett	133
		Harborcreek	107
	Lawrence Park Lake Shoreline LCA	Erie North	75
	Presque Isle BDA/OHA	Erie North	82
LeBoeuf	French Creek Basin LCA	Cambridge Springs	266
		Cambridge Springs NE	210
		Millers Station	262
		Waterford	218
	French Creek BDA	Cambridge Springs	266
		Cambridge Springs NE	210
		Millers Station	262
		Waterford	218
	LeBoeuf Township BDA	Millers Station	262
McKean	French Creek Basin LCA	Cambridge Springs NE	210

Municipality	**Site Names &** *Managed Lands*	**U.S.G.S. Quadrangle**	**see page**
Townships (cont.)			
Millcreek	Asbury Woods Nature Center OHA	Swanville	164
	Lake Shoreline LCA	Erie North	75
		Erie South	151
		Swanville	156
	Love Marsh BDA	Swanville	161
	Presque Isle BDA/OHA	Swanville	156
North East	Lake Plain Forested Wetland BDA	Harborcreek	107
		North East	115
	Lake Shoreline LCA	Harborcreek	100
		North East	111
	North East Lake Bluff BDA	North East	111
	Sixteen Mile Creek Gorge NA	North East	114
	Twenty Mile Creek BDA	North East	115
Springfield	Lake Plain BDA	Conneaut	187
		East Springfield	191
	Lake Plain Shoreline BDA	East Springfield	191
		Fairview SW	174
	Lake Plain Wetland BDA	East Springfield	191
	Lake Shoreline LCA	Conneaut	186
		East Springfield	191
		Fairview SW	174
	State Game Lands #314	Conneaut	186
		East Springfield	191
Summit	French Creek Basin LCA	Erie South	151
		Hammett	141
	French Creek BDA	Erie South	151
	Lake Shoreline	Erie South	151
	Lee Road Woods BDA	Erie South	152
	State Game Lands #109	Erie South	153
Union	Bentley Run/Alder Run BDA	Union City	235
	French Creek Basin LCA	Millers Station	262
		Union City	231
		Waterford	218

Municipality	**Site Names &** *Managed Lands*	**U.S.G.S. Quadrangle**	**see page**
Townships (cont.)			
	French Creek BDA	Union City	231
		Waterford	218
	Union Township BDA	Union City	241
	State Game Lands #102	Union City	239
Venango	French Creek Basin LCA	Hammett	141
		Union City	231
		Waterford	218
		Wattsburg	120
	French Creek BDA	Hammett	141
		Union City	239
		Waterford	218
		Wattsburg	120
	Six Mile Creek Gorge BDA	Hammett	133
	State Game Lands #155	Hammett	147
		Union City	238
		Wattsburg	127
	State Game Lands #163	Wattsburg	128
	State Game Lands #167	Wattsburg	127
		Union City	238
	State Game Lands #191	Wattsburg	128
Washington	French Creek Basin LCA	Cambridge Springs	266
		Cambridge Springs NE	210
		Edinboro North	204
		Edinboro South	269
	French Creek BDA	Cambridge Springs	266
		Cambridge Springs NE	210
		Edinboro North	204
		Edinboro South	269
	McLane Fens BDA	Edinboro North	206
Waterford	French Creek Basin LCA	Cambridge Springs NE	210
		Erie South	151
		Waterford	218
	French Creek BDA	Cambridge Springs NE	210
		Erie South	151
		Waterford	218
	State Game Lands #109	Waterford	218
	State Game Lands #161	Waterford	226
Municipality	**Site Names &** ***Managed Lands***	**U.S.G.S.**	**see**

		Quadrangle	page
Townships (cont.)			
Wayne	French Creek Basin LCA	Corry	245
		Union City	231
	French Creek BDA	Corry	245
	Hubbell Run BDA	Corry	245
		Union City	231
	State Game Lands #154	Corry	246
	State Game Lands #263	Columbus	250
Boroughs			
Albion	none		
Cranesville	none		
Edinboro	French Creek Basin LCA	Cambridge Springs	266
		Cambridge Springs NE	210
		Edinboro North	204
		Edinboro South	269
	French Creek BDA	Cambridge Springs	266
		Cambridge Springs NE	210
		Edinboro North	204
		Edinboro South	269
Elgin	French Creek Basin LCA	Corry	245
		Union City	231
	French Creek BDA	Corry	245
Fairview	none		
Girard	Battles Museum OHA	Albion	199
Lake City	Lake Plain Shoreline BDA	Fairview	167
	Lake Shoreline LCA	Fairview	167
McKean	none		

Municipality	**Site Names & *Managed Lands***	**U.S.G.S. Quadrangle**	**see page**
Boroughs			
Mill Village	French Creek Basin LCA	Millers Station	262
		Waterford	218
North East	none		
Platea	Lake Plain Shoreline BDA	Albion	197
	Lake Shoreline LCA	Albion	197
Union City	French Creek Basin LCA	Union City	231
	French Creek BDA	Union City	231
Waterford	French Creek Basin LCA	Waterford	218
	French Creek BDA	Waterford	218
Wattsburg	French Creek Basin LCA	Wattsburg	120
		Union City	231
Wesleyville	none		
Cities			
City of Corry	French Creek BDA	Corry	245
City of Erie	Lake Shoreline LCA	Erie North	75
		Erie South	151
		Swanville	156
	Presque Isle BDA/OHA	Erie North	82
		Erie South	151
		Swanville	156
Unorganized Territory			
Presque Isle State Park	Presque Isle BDA/OHA	Erie North	82
		Swanville	156

DEDICATED AREAS

Table 3: Important managed lands protecting biotic resources in Erie County.

The objective of the Erie County Natural Heritage Inventory is to provide information that can be utilized in planning for the protection of the biological diversity and ecological integrity of the county. Ultimately, the preservation of such resources will depend in part upon the establishment of management plans and dedicated areas to protect these resources.

Presently, there are two locations in Erie County that are managed largely to protect natural ecological systems and biological diversity. For this reason, the dedicated areas listed below are regarded as among the most important public and private Natural Heritage Areas. Those responsible for the management of these sites and surrounding lands should continue with their programs of protection and management and strongly consider increased protection for these areas. In many cases, these dedicated areas do not follow the real ecological boundaries that define the habitats, communities and ecosystems recognized in the report. Often, therefore, the dedicated area boundaries for a site will fall within the "BDA" boundaries, indicating that the dedicated area needs to be expanded to fully buffer and protect the site. Planning within government and private sectors should recognize the role of these important areas and work toward their expansion. Still, with the degree of protection conferred, dedicated areas represent an important core for expanding biodiversity conservation in Erie County.

Managed Lands Name/Owner	Comments and Recommendations
Titus Bog Natural Area DA/ Botanical Society of Western Pennsylvania & Presque Isle Audubon Society	Located above the headwaters of Hubbell Run, the DA contains a natural area, consisting of glacial bog and basin graminoid-forb fen natural communities, bordered by a narrow vegetative buffer. Recomendations for preservation of these natural communities includes (1) protection of ground and surface water quality and quantity entering the bog and fen; and (2) expansion of the natural vegetation buffer, in order to maintain the ecological integrity of the bog and fen.
Wattsburg Fen Natural Area DA/ Western Pennsylvania Conservancy	Located within the headwaters of Hubbell Run, the DA contains a recovering natural area, harboring a shrub fen natural community with the one of the richest orchids floras in the state. Recomendations for preservation of the biotic resources within the DA includes (1) protection of ground and surface water quality and quantity entering the property; and (2) expansion of the natural vegetation buffer, in order to maintain the ecological integrity of the fen and associated biotic resources.

NATURAL HERITAGE AREAS CLASSIFICATION

The Natural Heritage Areas identified in this report have been recognized according to the classification below. Sites chosen are those which are believed to be of sufficient size and quality (i.e., the natural systems are relatively intact) to continue as viable communities into the foreseeable future. The inventory includes sites that are unique or uncommon in the county, but not necessarily of state or global significance, although sites with state or global significance are included. For example, a mature oak dominated forest is common in many places in Pennsylvania, however, a forest community of this type is uncommon in Erie County and would likely be included in the inventory.

The following classification provides definitions and examples of the five types of Natural Heritage Areas included in this report. Following the definitions of Natural Heritage Areas are explanations of Managed Lands, Geological Features and Fossil Localities in the county. The types of Natural Heritage Areas found in the report are:

- NATURAL AREAS (NA)
  - I. Pristine Natural Areas
  - II. Recovering Natural Areas
- BIOLOGICAL DIVERSITY AREAS (BDA)
  - I. Special Species Habitat
  - II. High Diversity Area
  - III. Community/Ecosystem Conservation Area
- DEDICATED AREAS (DA)
- LANDSCAPE CONSERVATION AREAS (LCA)
- OTHER HERITAGE AREAS (OHA)

Definitions and examples of each Natural Heritage Area follows:

NATURAL AREAS (NA)

I. Pristine Natural Area

A site that has essentially the same ecological conditions that are believed to have existed prior to European settlement, and is large enough, and buffered enough, to support and permanently protect the natural community.

Example: A tract of virgin forest ten or more acres in size, the surrounding landscape is only moderately disturbed and the forest community has long term viability.

II. Recovering Natural Area

An area that is relatively undisturbed, or past disturbances are essentially minor, and the landscape has largely recovered to a pristine condition.

Example: A tract of forest that, although harvested a century ago, has regenerated so that it now supports a recovered old growth forest community and its associated qualities.

BIOLOGICAL DIVERSITY AREAS (BDA)

I. Special Species Habitat

An area that includes natural or human influenced habitat that harbors one or more occurrences of plants or animals recognized as state or national species of special concern.

Examples: A natural forested stream valley that supports a threatened plant population.
A stream that provides habitat for a rare animal.

II. High Diversity Area

An area found to possess a high diversity of species of plants and animals native to the county.

Example: A relatively large tract of land that provides a variety of habitats.

III. Community/Ecosystem Conservation Area

An area that supports a rare or exemplary natural community (assemblage of plants and animals), including the highest quality and least disturbed examples of relatively common community types.

Example: A marshland that supports a wetland community found in no or few other sites in the county.

DEDICATED AREAS (DA)

A property, possibly disturbed in the past, where the owner's stated objectives are to protect and maintain the ecological integrity and biological diversity of the property largely through a hands-off management approach, with intervention only when there are demonstrable threats to the ecology of the area.

Example: A forested tract that was previously harvested, but is now under the ownership of a conservation organization that has dedicated its management to the protection of the forest community.

LANDSCAPE CONSERVATION AREAS (LCA)

A large contiguous area that is important because of its size, open space, habitats, and although including a variety of land uses, has not been heavily disturbed and thus retains much of its natural character. (Note: Areas with heavy disturbance may be included within a LCA boundary when watershed protection is the intent of all or part of the LCA.)

Example: An entire watershed that includes several thousand acres of forest that is interspersed with agricultural lands, limited residential and commercial development, and park land.

OTHER HERITAGE AREAS (OHA)

I. Scientific Area

An area that is consistently utilized for scientific monitoring of the environment, or for other natural science studies.

Example: A successional field that is regularly studied to monitor environmental changes.

II. Educational Area

Land used regularly by educational institutions, local environmental organizations, or general public for nature study or instruction.

Example: A site that is regularly visited by school classes to study the species of plants and animals native to the county.

MANAGED LANDS

"Managed Lands" as defined in this county natural heritage inventory are owned or leased properties that are included in the report because of their importance, or potential importance, to the overall maintenance and protection of ecological resources of the county. Managed Lands are of two types:

- Public properties established and managed to a large extent for natural resources, and/or those that have the potential to manage such resources in order to maintain or enhance important ecological assets in the county, and by this evaluation are deemed by the inventory to be among the most ecologically "valuable" of public properties. Examples include: state game lands, state parks, national historic sites, county or municipal park lands.

- Private properties that are held by private organizations concerned with the management and protection of natural resources, and which upon evaluation have been deemed by this inventory to be among the most ecologically "valuable" of such properties. Examples include: private nature preserves, private environmental education centers.

Managed Lands are properties that do not necessarily include, or are included within, identified natural heritage areas, e.g. Natural Areas, Biological Diversity Areas. However, these properties are often large in size (e.g., essentially all state game lands) and, for this and potentially for other reasons, are ecologically important in a general sense. The ecological importance and value of some Managed Lands is due to their association with an area identified for natural heritage significance, e.g., a Managed Land within the boundaries of a Natural Area, or Biological Diversity Area. However, Managed Lands are legally bounded properties, and are not to be confused with areas of natural heritage importance, which are identified by their ecological significance. An important consideration is that many Managed Lands have the potential to become even more ecologically valuable if their management becomes more sensitive to biological diversity issues and protection.

There are already some Managed Lands that are dedicated to the protection of natural ecological systems and biological diversity. Referred to as **Dedicated Areas**, these properties are distinct from other Managed Lands because of the ecological emphasis of the owner's management practices and goals. Dedicated Areas are among the most important natural heritage areas since plans to protect the ecological resources therein already exist. An evaluation of Dedicated Areas in the inventory was based upon the stated management criteria and existing practices of the owner/manager. A definition for "Dedicated Areas" is given earlier in this section of the report, and a summary of the Dedicated Areas identified in Erie County is supplied in Table 3.

In Erie County Managed Lands were identified during the data collection phase of the inventory and assessed based upon a combination of more than one of the following factors: existing information, aerial imagery interpretation, aerial reconnaissance, and/or field surveys. The Managed Lands addressed in the inventory include: (1) public or private properties tracked by the PNDI Natural Heritage Program because they contain natural communities and/or species of special concern and because they are managed, at least in part, for their ecological value; and (2) public or private properties identified via the aforementioned methods which retain ecological values which contribute to the county's overall biological diversity and/or ecological integrity, but did not qualify in whole or in part as natural heritage areas.

GEOLOGIC FEATURES AND FOSSIL LOCALITIES

Geologic features include those areas that illustrate regional geologic processes, landforms, or scenery and are those recognized as outstanding in Pennsylvania by Geyer and Bolles (1979, 1987). Fossil localities are those recognized by Hoskins et. al. (1983). These places are not of importance to biological diversity and are therefore not considered Natural Heritage Areas. However, they are included as natural history references in the county.

This document is presented in several sections. The County Overview summarizes county geology, soils, climate, and past and present vegetation; information on the Pennsylvania Natural Diversity Inventory; and the methodology used to conduct the inventory. General recommendations for sites identified in this report are located in the section referred to as General Recommendations for the Protection of Natural Heritage Areas. This section is followed by an explanation of the threats that are posed on sites in the county in the section entitled Land-Uses and Potential Threats to Natural Heritage Areas. The Results section is organized by USGS topographic maps with a table, summary, and recommendations presented for each map of the county. Each of the tables in this section present summary information for heritage sites, managed areas, and geologic and fossil sites, as identified by Geyer and Bolles (1979 and 1987) and Hoskins et al. (1983). Finally, appendices present additional background information on natural communities, classification, and definitions.

The inventory is a joint effort of the Pennsylvania Department of Community Affairs, the Erie County Department of Planning, and the Western Pennsylvania Conservancy, a private non-profit natural resources conservation organization. The purpose of the inventory is to provide the county and state with a useful tool for planning development and for setting protection priorities for significant natural heritage resources in Erie County. It is, however, only a preliminary report of the important areas in Erie County. Further investigation is needed and, therefore, this inventory should not be viewed as the final word on the subject of natural heritage sites in the county.

NOTE: The inventory does not address all the attributes of the county's natural resources. Natural resource areas that do not exhibit characteristics that qualify as natural heritage areas in this study may have other important attributes, such as flood water control, water quality protection, or green space. Thus, exclusion of a natural resource area from the inventory does not mean the area is without environmental value based on other types of criteria. Criteria which are outside the scope of the inventory.

Any questions concerning sites or updates should be addressed to the Western Pennsylvania Conservancy, 316 Fourth Avenue, Pittsburgh, Pennsylvania, 15222; Phone: (412) 288-2777.

COUNTY OVERVIEW

Erie County is situated in northwestern Pennsylvania bordering Lake Erie. The county has an area of 802 square miles and, in 1990, the county population was 275,572. The population is largely concentrated in the City of Erie and immediately adjacent suburbs. Considerably smaller population concentrations are located in the City of Corry and the 15 boroughs within the county (Bureau of the Census, 1991). Per aerial reconnaissance conducted for the inventory, the remainder of the county has a more rural character containing scattered development. Per a 1985 inventory by the U.S.D.A. Soil Conservation Service, approximately 13 percent of the county is urban and surface waters (i.e., streams and lakes), 41 percent is woodlands, 42 percent is farmland, and five percent is classified as miscellaneous land (L. Steckler, Soil Cons. Serv., pers. commun.).

Although Erie County contains a significant amount of woodlands, these woodlands differ in species composition and age from the primary growth forests that once covered most of the county. (Refer to pages 41 to 46 for additional information on the county's native vegetation.) Essentially all of the forested land in the county has been previously cut, leaving second growth woodlands. Most of the woodlands were timbered as recently as about 70 years ago (T. Erdman, DER Bur. of Forestry, pers. commun.). In addition to timber harvesting, mineral extraction (oil, gas, and gravel mining) is common. Gravel mines and oil/gas wells are scattered throughout the landscape.

Although not a major employer, agriculture is considered to be a major contributor to the local economy (Pennsylvania Department of Labor and Industry, 1991). While the amount of county land used as farmland has decreased since the mid-1950s, agriculture in Erie County continues to produce orchard fruits, grapes, field crops, vegetables, nursery products, livestock and livestock products. In the lake plain, where the moderating effect of Lake Erie waters extends the growing season, orchards fruits, grapes, and early maturing vegetables are the primary crops; field crops, vegetables, and fruits are major agricultural products in the remainder of the county (Taylor, 1960).

Despite the amount of land in the county utilized for agriculture, manufacturing industries and service industries are Erie County's two primary employers. These manufacturing and service industries are primarily located within the City of Erie and immediate suburbs. Like the rest of the nation, information trends indicate that the county will continue to shift from "low tech" manufacturing to a service-oriented economy (Pennsylvania Department of Labor and Industry, 1991). In recognition of the changes occurring

in the county's economic structure, a recent study of the county's economic "assets" has addressed the most obvious natural attribute -- Presque Isle peninsula and adjacent waters as a focal point for increased tourism (The Brandow Company, 1992). Tourism is another service-oriented industry that contributes to the county's economy. Of the state's 67 counties, Erie County ranked 16th in tourist expenditures (i.e., $122 million) in 1990 and 1,950 jobs were generated by these tourist expenditures (Department of Commerce, 1992). Tourism is primarily focused upon Erie County's coastal shoreline.

The northern border of the county consists of 67 miles of Lake Erie shoreline. Presque Isle, a sandspit peninsula, extends into the lake northwest of the City of Erie. Presque Isle is largely a state park that has been reported to receive as many as five million visitors annually (Sullivan, 1991). Recreation is the primary use of Presque Isle peninsula and of the county's coastal waters. Recreational activities include hiking, swimming, bird-watching, pleasure driving, year-round sport fishing, picnicking, and boating. Marinas for recreational boats are located along the shoreline of Presque Isle Bay and within Presque Isle State Park. Marinas and boat launching facilities are also scattered along the county's Lake Erie shoreline, primarily at the mouth of lake tributaries. Presque Isle peninsula almost completely encircles a bay that is Pennsylvania's only Great Lakes harbor and port. Erie harbor contains shipping and docking facilities (U.S. Department of Commerce, 1980).

Indeed, the county's lake shoreline natural resources are exceptional and provide recreational opportunities for both county residents and tourists. In addition to these shoreline resources, Erie County contains several natural heritage areas of comparable size to Presque Isle peninsula and which also possess exceptional biotic resources and aesthetic qualities. These resources have the potential to provide recreational opportunities for county residents and tourists. However, recreational use must be compatible with the protection of these significant biotic resources (i.e., lake shoreline and inland ecological resources) in order to preserve these exceptional natural resources and retain the natural qualities that benefit county residents and that could both attract and retain tourism.

Ecosystem management in sync with recreational carrying capacity enables the long-term protection of the natural resources that attract recreational use and retains that attraction by maintaining, or even when applicable enhancing, the quality of these natural resources for county residents, as well as tourists.

PHYSIOGRAPHY

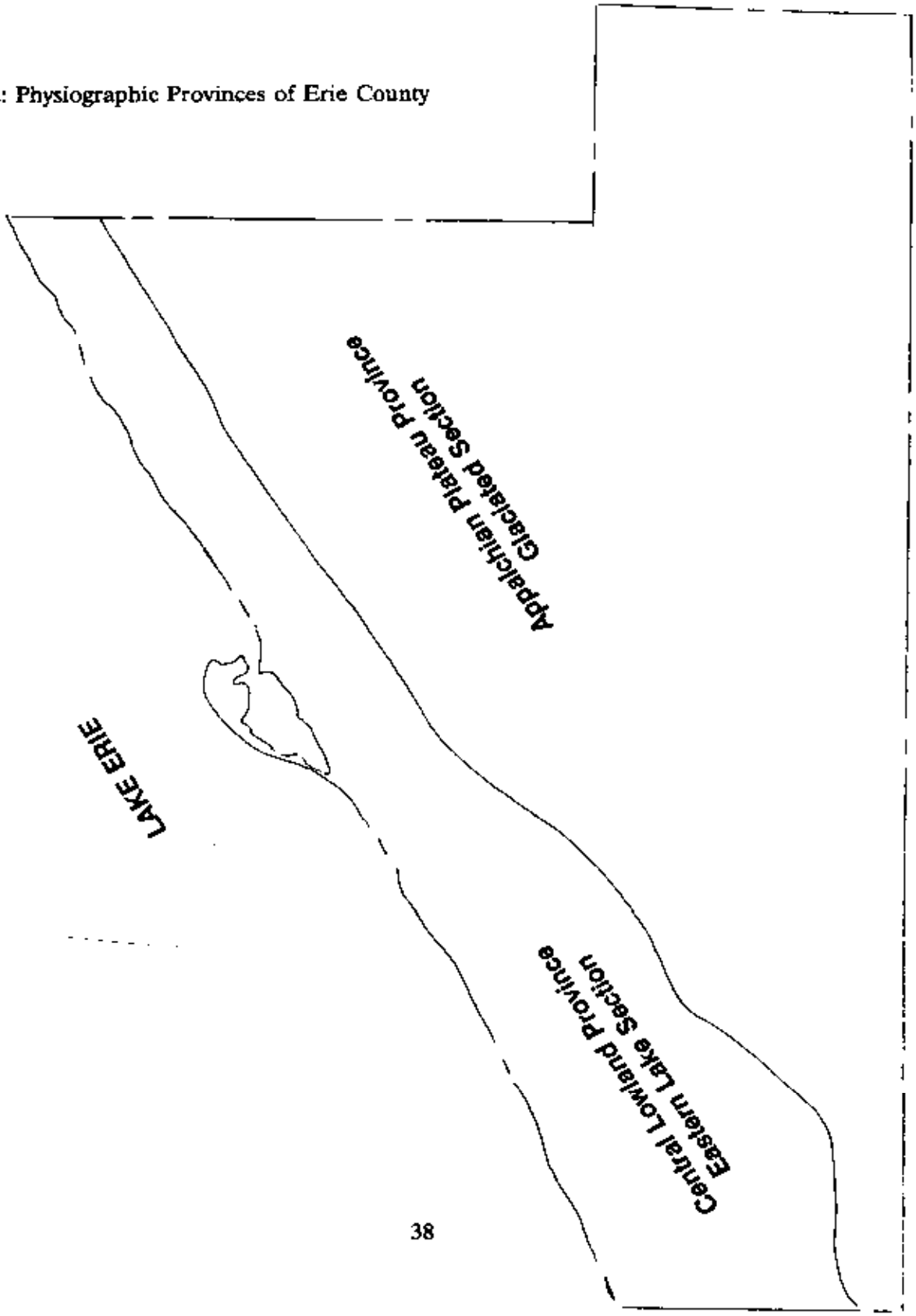
Erie County is located in two physiographic provinces. Most of the county is within the Glaciated Section of the Appalachian Plateaus Province. The area of the county that borders Lake Erie is located in the Eastern Lake Section of the Central Lowlands Province.

Erie County has been completely covered by at least three glaciers. The last glacier occurred during the Wisconsin stage of the Pleistocene epoch. The Wisconsin glacier advanced into the county and receded five times. The last glacial advance receded about 10,000 years ago. Glacial scour, deposition, and meltwater from this glacier created the topography and surfacial geology from which most of the county's soils formed (Taylor, 1960). Most of the materials were deposited directly from the ice. These deposits mantled the county with glacial till and formed ground and end moraines that extend southwest and northeast across the county. Meltwater deposited the remaining glacial materials creating topographic features such as eskers, kames, and drumlins (Shepps et al. 1959). Other glacial features include kettle lakes, kettle hole bogs, and swamps within some glacially formed valleys (Geyer and Bolles, 1979). Glacial deposits filled deep, pre-glacial valleys. The general aspect of this portion of the county is a series of deep broad valleys separated by gently undulating broad ridge tops. Ridge top elevations are generally from 1,200 to 2,000 feet. Valley elevations are mostly less than 1,000 feet (Lull, 1968). Local relief is minimal and seldom exceeds 100 feet (Geyer and Bolles, 1987; Shepps et al., 1959). Stream valley drainage patterns vary from well developed with streams that provide good surface drainage, to poorly defined drainage patterns with restricted surface drainage (Taylor, 1960).

The Eastern Lake Section of the Central Lowland Province is a band of Lake Erie shoreline that extends inland about two miles in the eastern portion of the county and about five miles inland in the western part (Geyer and Bolles, 1979). This area is commonly referred to as the lake plain. Lake levels fluctuated as the last glacier receded (Taylor, 1960). High lake levels reworked glacial deposits and redeposited them. Sand and gravelly sand formed blanket deposits and beach ridges (Shepps et al., 1959). The beach ridges indicate the location of past lake shorelines. They parallel the present Lake Erie shoreline and extend across the county. Lakes and lagoons formed in the low-lying areas between the beach ridges. Sheltered from Lake Erie currents these slack waters deposited silt and clay. The lake plain that developed contains stratified silt and sand (Taylor, 1960). The lake plain is characterized by low elevations and relief. Elevation start slightly above lake levels and extend to about 800 feet above sea level. The lake plain is

primarily flat, except where beach ridges mark former lake levels. Short-course streams flow across the lake plain into Lake Erie. These streams have cut through glacial or lake deposits and into the underlying bedrock, forming steeply sloped valleys (Geyer and Bolles, 1979). As described on pages 75 to 79, fluctuating lake levels and other geophysical processes still influence the natural character and biological communities of the lake plain shoreline (Great Lakes Research Institute, 1984).

Figure 2: Physiographic Provinces of Erie County



BEDROCK AND SOILS

The sedimentary bedrock that underlies Erie County can be described in relation to the physiographic provinces. The bedrock underlaying the lake plain within the Central Lowland Province -- Eastern Lake section are Upper Devonian period rocks. From youngest to oldest these rocks are Chadakoin Formation, Girard Shale, and Northeast Shale. Closest to the surface, the Chadakoin Formation consists of alternating shales and sandstones. Girard Shale consists of an uniform textured ashen-gray shale. Beneath the Girard Shale is the Northeast Shale, containing gray shale and sandstone. The bedrock of the lake plain is covered by unconsolidated sand and gravel glacial deposits of the Quaternary Period. These deposits range in depth from ten to over 100 feet. The bedrock is exposed at the base of portions of the lake bluff and within some deep stream valleys (Geyer and Bolles, 1979), such as those associated with Six Mile and Eight Mile Creeks.

The bedrock in the Appalachian Plateaus Province -- Glaciated Section of the county differs somewhat from that in the lake plain. Most of southern Erie County is underlain by Devonian shales, sandstones, and redbeds (Shepps at al., 1959). From youngest to oldest the Upper Devonian rocks are the Riceville and Oswayo Formations, Venango Formation, Chadakoin Formation, and Girard Shale. The Riceville and Osawayo Formations contain shale and siltstone. The Venango Formation consists of red, gray, and brown shale and sandstone. The Chadakoin Formation and Girard Shale rocks are described above. Covering the Riceville and Osawayo Formations are Quaternary Period glacial deposits. These glacial deposits consist of gravel with varying amounts of clay and sand (Geyer and Bolles, 1987).

There are ten general soil areas in Erie County per Taylor (1960). Taylor describes these general soil areas as follows:

Silty and clayey soils, chiefly on the lake plain -- This general area consists of low-lying parts of the lake plain and former lakebeds in the upland. The soils formed in deep lacustrine sediments that settled out of slack lagoon waters. The soils are separated from the lake by beach ridges and escarpments. Escarpments have been cut into the area as a result of stream and lake shoreline erosion;

Sandy soils of the lake plain -- This general area lies along the shoreline of Lake Erie. The soils have formed in deep, sandy lake sediments. Relief is level to steep. The slopes are uniform and are as much as 500 feet long. Escarpments have been cut into the areas as the result of stream and lake shoreline erosion. The lake sediment overlie slowly permeable gray, calcareous silty material, locally known as quicksand;

Gravelly and sandy soils of the beach ridges -- This general area occupies beach ridges along the lake plain from the Ohio border to New York border. The beach ridges consist of thick deposits of gravel and sand that formed the shoreline when the lake was at higher levels. Near the lake the ridges have short, steep slopes. Long, gentle slopes extend inland from the ridge crests. In a few places the gentle slopes contain a series of crests and swales;

Gravelly soils of the outwash terraces -- This general area is on gravelly outwash terraces that were deposited in the larger valleys formed before the area was covered by the last glacier. As glacial ice melted, gravelly and sandy debris was released. The coarser textured gravelly and sandy materials were deposited where the progress of the ice was blocked by the sides of the valleys. In these places the slope pattern is complex. Small, steep, round hills or kames, are separated by depressions or potholes. The finer textured gravelly and sandy materials were carried by the glacial streams and deposited on an outwash terrace that has a few potholes. The rest of this general area consists of soils on stream terraces and flood plains;

Deep, medium-textured soils in moderately limy till of the glaciated upland -- This general area is on an upland that has a mantle of gravelly till. It occurs as hills of medium-textured soils that are surrounded by gravelly material of the outwash terraces. The slopes are long and uniform. Many slopes, one-half mile long, extend from the tops of ridges to the outwash terraces;

Deep, medium-textured soils in slightly limy till of the glaciated upland -- This general area consists of upland that is mantled with gravelly till. The slopes are uniform and long and often as much as one-half mile long. The soils contain fragipans, at depths of six to 30 inches, that are slowly permeable to water and air;

Deep, silty and clayey soils of the glaciated upland flats -- This general area is in the southwestern part of the county. It is on upland that is mantled with glacial till containing almost no gravel. The soils are mainly level to gently sloping. Most of the slopes are short, but some are as much as one-half mile long. At depths of one to two feet, the soils have compact subsoils that are slowly permeable to air and water. After rains, water remains ponded on level places. The soils are calcareous at depths of two to five feet;

Deep, silty and clayey soils of the gently or moderately sloping glaciated upland -- This general area is on upland that is mantled with glacial till. The individual areas are in the western part of the county between areas of lacustrine deposits and areas of coarse-textured glacial till. Relief is mainly gently sloping to

moderately sloping, and the slopes are long and uniform. The soils have compact subsoils, which are slowly permeable to air and water at depths of one to two feet. After rains, water remains ponded on level areas;

Shallow, medium-textured soils of the glaciated upland and the lake plain -- This general area comprises gently sloping parts of the lake plain and moderately sloping to steep parts of the upland. In most places the soil is shallow over the bedrock and acid shale, which is at depths of 12 to 24 inches. The subsoil consists of dense, acid silts and clays; and

Silty and clayey soils of glacial lakebeds -- This general area occupies the sites of former glacial lakes. When the glacial ice melted, slack-water lakes formed in the valleys. The soils formed in deep deposits of silts and clays that were deposited by the slack water. The soils are mainly level to nearly level and have uniform slopes. Escarpments have been cut into the area by the streams that drained the lakes. The dense silty and clayey materials making up these soils are slowly permeable to air and water. After rains, water remains ponded in level areas.

CLIMATE

In addition to geology, climate is a significant factor in the development of vegetation. The climate of Erie County is greatly influenced by the waters of Lake Erie. This influence is most pronounced to five or six miles inland of the Lake Erie shoreline, covering the entire lake plain. The lake warms air temperatures in the fall and early winter; cools air temperatures in the spring and summer. As a result, the lake plain climate is very different from the inland glaciated section of the county. The lake plain has approximately 80 more days in the growing season, about six inches less rain, and the average annual temperature is about two degrees warmer (Taylor, 1960).

VEGETATION

Erie County is a part of Pennsylvania that contains a high diversity of vegetation. This diversity is due, in part, to a variety of conditions. As referenced heretofore, physiography, bedrock, soils, climate, and hydrology are the primary natural influences that determine the vegetation in the county. Human-induced influences such as land use patterns and introduced (i.e., non-native) species also significantly influence vegetation. The potential threats posed by common land use activities and introduced species to the

protection of natural heritage areas are addressed in general on pages 52 to 54 and specifically described for individual natural heritage sites.

The review of Erie County vegetation describes forests, wetlands, natural lakes, and coastal habitats.

The Eastern Deciduous Forest covers all of Pennsylvania, however, variation in topography, climate, soils, drainage, geologic history, and human-induced disturbance has resulted in several primary and secondary communities in the biome (Erdman and Wiegman, 1974). These variations and how they relate to the forest communities of Erie County forests can be placed in perspective by reviewing the potential, past, and present characteristics of these forests. Taylor (1960) describes the county's original forests. Braun (1967) describes both mature original forests and the types of forests that could grow again given time and suitable conditions. Kuchler (1964a; 1964b) and Bailey (1980) predict potential forest types (i.e., climax forests that could grow again given natural succession and lack of disturbance). Jennings (1927) classifies forests observed during the first quarter of this century. Lull (1968), Erdman and Wiegman (1974), and Eyre (1980) primarily describe existing forest characteristics. Although, Eyre also alludes to future forest development.

Bailey (1980) and Kuchler (1964a; 1964b) describe the potential forest vegetation type to be a predominantly beech-maple (Fagus grandifolia-Acer) forest south of the lake shoreline and northern hardwood forest in the rest of the county. Kuchler describes the northern hardwood forest as being dominated by sugar maple (Acer saccharum), yellow birch (Betula lutea), beech, and hemlock (Tsuga canadensis) with these associated species: red maple (Acer rubrum), striped maple (A. pensylvanicum), mountain maple (A. spicatum), white ash (Fraxinus americana), white pine (Pinus strobus), black cherry (Prunus serotina), hemlock, and American basswood (Tilia americana). The beech-maple forest is dominated by sugar maple and beech. Other components would be: white ash, shagbark hickory (Carya ovata), black walnut (Juglans nigra), tulip poplar (Liriodendron tulipifera), black cherry, northern red oak (Quercus rubra), American basswood, American elm (Ulmus americana), and slippery elm (U. rubra) (Kuchler, 1964a; 1964b). Jennings (1927) and Braun (1968) consider the beech-sugar maple forest to be the climax forest.

The original vegetation in Erie County was primarily forest (Taylor, 1960). The beech-maple forest region described by Braun (1967) extended to the southern boundary of the Wisconsin glaciation and, thus, covered the entire county. Dominated by a beech and sugar maple association, this forest region contained

both climax communities and seral forest communities due to the youth of the post-glacial land surface. Taylor (1960) indicates that the original forests were comprised mostly of hardwoods with some pines (Pinus spp.) and hemlock. Beech-sugar maple and beech-red maple forests predominated. Sub-dominant forest types of the native vegetation were white elm-white or black ash-red maple (Ulmus americana-Fraxinus americana/F. nigra-Acer rubrum); American chestnut-oak (Castanea dentata-Quercus spp.); Northeast conifers; and oak-hickory (Quercus spp.-Carya spp.). Chestnut blight (Endothia parasitica), an introduced parasitic fungus, is responsible for the demise of the American chestnut, which grew mainly in the county's lake plain.

Since settlement, essentially all the forests in Erie County have been logged at least once. Most of the county's forests were timbered again about 70 years ago (T. Erdman, DER Bur. of Forestry, pers. commun.). About this same time, E.O. Jennings classified the plant communities of central and western Pennsylvania. Jennings (1927) indicates that climax forests existed in portions of Erie County where glacial soils, topography and drainage permitted "quick" establishment of the sugar maple-beech dominated forest. In poorly drained wide valleys and glacial depressions various successional stages occurred, ranging from a black ash-red maple association through the white elm lowland association to the climax beech-maple association. Along the southern shore of Lake Erie the climate moderating effects of the lake resulted in a sugar maple-beech-birch-white pine-hemlock dominated forest. Secondary species of this forest were black birch (Betula lenta), paper birch (B. papyrifera), red maple, quaking aspen (Populus tremuloides), pin cherry (Prunus pensylvanica), chestnut, white ash, cucumber tree (Magnolia acuminata), tulip poplar, black cherry, and big-tooth aspen (Populus grandidentata).

Eyre (1980) considers the county to now be almost entirely covered by a type of northern hardwood forest -- a sugar maple-beech-yellow birch predominated forest. Associated species are red maple, hemlock, white ash, black cherry, basswood, sweet birch, northern red oak, white pine, American elm, and eastern hop-hornbeam (Ostrya virginiana). In the northwestern corner of Erie County, Eyre reports an minor intrusion of black ash-American elm-red maple forest from Ohio. Within this latter forest type the proportions of the three dominant species vary; often red maple and American elm are more plentiful. White ash can replace black ash in better drained sites. Forest associates are silver maple (Acer saccharinum), swamp white oak (Quercus bicolor), sycamore (Platanus occidentalis), pin oak (Q. palustris), black tupelo, (Nyssa sylvatica), and common cottonwood (Populus deltoides). Lull (1968) describes two

forest regions presently existing in the county - a beech-birch-maple, or northern hardwood forest, and a oak-tulip poplar region. The northern hardwood forest region is essentially the same as the forest region described by Eyre (1980). The species that dominate the oak-tulip poplar forest region vary with elevation, soils, and latitude. Lull describes a lower elevation oak-tulip poplar region south of the Lake Erie in the lake plain. Within this region, tulip poplar-white oak (Quercus alba)-northern red oak forest types dominate, however, hemlock is common in ravines, and northern hardwoods may dominate north facing slopes.

Erdman and Wiegman (1974) concur with Braun that a beech-maple dominated forest was located in glaciated northwestern Pennsylvania, but indicate the forest has been significantly altered by heavy settlement, logging, and agriculture. As a result, they note that existing second growth forests which resemble the original beech-maple forest are uncommon. Secondary forests may be predominantly beech-maple, but usually other species such as aspen (Populus spp.), red maple, black cherry, and white ash are common. Old growth stands are rare. Older communities occur in ravines where the presence of hemlock results in a forest that more closely resembles a hemlock-northern hardwood forest.

At present, forests have been essentially removed from the City of Erie and immediate suburbs, however, forests are scattered throughout the rest of the county. Woodlands presently comprise less than half of the county's land area (L. Steckler, Soil Cons. Serv., pers. commun.). Erie County forests are currently experiencing another round of timber harvesting. Many trees are sufficiently mature to be timbered. Cherry and oak timber is in particular demand. Ash and white pine are also frequently harvested. Currently, a usual forest stand in the county can be characterized as follows: The most common species is maple -- red maple or sugar maple. Then present in about equal amounts are cherry, ash, yellow poplar, and sometimes northern red oak. The least common species are beech, hemlock, cucumber, butternut (Juglans cinerea), basswood, yellow birch, and sometimes northern red oak (T. Erdman, DER Bur. of Forestry, pers. commun.). Bissell (Cleveland Museum of Natural History, pers. commun.) has noted that oak dominated forests, beech-maple dominated forests, and rich mesophytic forests are uncommon forest communities in Erie County. Field surveys and aerial reconnaissance conducted for the inventory support the appraisals of Erdman and Bissell regarding the county's forests (i.e., mature and old growth forests are uncommon and beech-sugar maple dominated forests were rarely observed). Nonetheless, pockets of these forests remain in the county and other significant forest types exist in the county, such as mesic central forests.

Erie County contains a wide variety of wetland types, as well as three of the five glacial lakes in western Pennsylvania -- Lake Pleasant, Lake LeBoeuf, and Edinboro Lake. Wetlands are scattered throughout the entire county. The largest wetlands are on glacial deposits that filled deep valleys, while many smaller wetlands formed in the irregular, hummocky topography of the end and ground moraines. After the last glacier retreated from Erie County the warmer climate permitted the northward migration of vegetation of a more southern character. In certain parts of the county conditions still exist that support somewhat isolated areas harboring boreal vegetation. These peatmoss-tamarack (Sphagnum spp.-Larix laracina) bog relict communities are associated with the undrained or poorly drained kettle holes and other depressions. Further north the peatmoss-tamarack bog would likely develop into a balsam fir-spruce (Abies balsamea-Picea spp.) climax forest. The present Erie County climate, however, provides conditions for the relict bogs to succeed to more southern mesophytic vegetation stages tending toward a beech-sugar maple climax forest (Jennings 1927). Jennings observes that timber harvesting and draining have resulted in the loss of some peatmoss-tamarack bogs by enabling the southern vegetation to occupy these areas sooner than it otherwise would. Per the inventory, a wide variety of significant wetland communities occur in the county, such as shrub fens, robust emergent marshes, floodplain swamps, and glacial and alkaline bogs. Glaciation in northwest Pennsylvania has produced wetlands and glacial lakes which support plant species and communities that are uncommon in the state (Keener, 1986; Genoways and Brenner, 1985).

As the only county in the Pennsylvania to border the Great Lakes, Erie County contains coastal habitats along the Lake Erie shoreline that are unique to the county and rare in the state. Examples of some of these habitats are sandspits, lake bluffs, and the embayment known as Presque Isle Bay. Plant species associated with the lake shoreline appear to be influenced by climate and hydrologic factors, as well as available habitat (Keener and Park, 1986). For example: The habitat of variegated horsetail (Equisetum variegatum) includes damp often calcareous sands and shores (Fernald, 1989). In the case of the Presque Isle sandspit peninsula, the habitats that occur on the sandspit are uncommon along the south shore of Lake Erie and on the North American continent. Communities representing seral succession from palustrine pond to terrestrial forest are found on the sandspit peninsula. The Presque Isle peninsula sandspit contains six natural community types, including unique ecosystems, that provide habitats for thousands of plant and animal species. Several of these species are Pennsylvania species of special concern and some are species

of global significance. Presque Isle Bay provides habitat for emergent, floating, and submerged aquatic vegetation, including species rare in the state.

PENNSYLVANIA NATURAL DIVERSITY INVENTORY

The Pennsylvania Natural Diversity Inventory (PNDI) was established in 1982 as a joint effort of the Western Pennsylvania Conservancy, the Pennsylvania Department of Environmental Resources (DER)-Bureau of Forestry, and the Pennsylvania Science Office of The Nature Conservancy. The Nature Conservancy developed and continues to refine the methodology that PNDI uses as part of a network of "Natural Heritage Programs" around the country. Heritage Programs are now established in each of the 50 United States, as well as in Canada and Latin America.

PNDI uses a computer indexed data base that contains location and baseline ecological information about rare plants, rare animals, unique plant communities, significant habitats and geologic features in Pennsylvania. Presently, PNDI is Pennsylvania's chief storehouse of such information with approximately 9,000 detailed occurrence records stored on computer and cross referenced to location on 881 7.5-minute United States Geologic Survey (USGS) topographic maps that cover Pennsylvania. Extensive manual files store additional information covering over 150 natural community types, over 800 plant and animal species, and about 1,100 managed areas.

PNDI uses a system of "global ranks" and "state ranks" to describe the relative degree of rarity for species and natural communities. This system puts the status of these biotic resources into perspective, especially those resources that do not have official state status, such as invertebrate animals and natural communities of organisms. Appendix I provides a summary of global and state ranks. Appendix II provides a separate county ranking system.

The value of PNDI lies largely in its ability to supply technically sound information about natural ecological resources, including those that are rare and possibly regulated (e.g. endangered species). Knowing about such resources as early as possible can greatly streamline decision making concerning land-use in the county. Information on the occurrences of elements (species and natural communities) of special concern has been gathered from museums, universities, colleges, and recent field work by professionals throughout the state. County inventories, including this one, employ the same approach in identifying the areas of highest natural integrity and significance.

For more information regarding PNDI contact the Department of Environmental Resources at (717) 783-0388.

NATURAL HERITAGE INVENTORY METHODS

County Natural Heritage Inventories have been completed (April 1993) in five Pennsylvania counties, and are in process for another 13 counties. In western Pennsylvania, these include Butler, Centre, Beaver, Clinton, Allegheny and Washington counties. Methods used in this inventory are based on both the Butler and Centre County reports, as well as those used by the Indiana Department of Natural Resources (Anonymous, 1985); Reese et al. (1988); and Davis et al. (1990) to conduct similar projects. The Erie County Natural Heritage Inventory proceeded in the following stages:

- gathering existing information
- aerial photo and map interpretation
- aerial reconnaissance
- ground survey
- data analysis.

Gathering existing information

The PNDI database supplied a list of the known special concern species and important natural community sites for Erie County. When appropriate the PNDI date which identified the precise location of a species of special concern or natural community site was incorporated into the inventory. The Western Pennsylvania Conservancy and the Erie County Department of Planning held a meeting with the Erie County Natural Heritage Inventory Study Committee and the public to introduce the inventory and to solicit recommendations on natural areas with potential natural heritage area qualities. Natural Heritage Site Recommendation Forms (Appendix IV) were available to those who wished to recommend sites. Local individuals, as well as local and regional agencies and organizations were contacted to provide information concerning sites and habitats for species of special concern in the county. Thus, some of the information used to identify the areas in the inventory came from over 24 interviews and responses to recommendation forms mailed to 404 individuals, agencies, and organizations.

Additional information used to choose potential sites in the county included: soil maps (Taylor, 1960), previous field surveys, planning documents (U.S. Department of Commerce, 1980; Erie County Metropolitan Planning Commission, 1977; Erie County Metropolitan Planning Department, 1976;

Department of Environmental Resources, 1976), National Wetland Inventory maps, current and historical U.S. Geological Survey topographic maps, various published material referencing Erie County, which included: Bissell and Danielson (1992; 1991), Bissell, Balczon and Masteller (1989), Geyer and Bolles (1987; 1979), Department of Environmental Resources (1987), Hoskins et al. (1983), Erdman and Wiegman (1974), Enviro-Engineers, Inc. (Undated), and Masteller et al. (1976). Aerial photo interpretation and aerial reconnaissance (described below) were also primary sources of information. Based upon information collected via existing information, map interpretation, and aerial reconnaissance, a total of 228 potential sites were targeted for consideration.

Aerial photo and map interpretation

An effective method for determining potential sites in the county and establishing site boundaries was through the use of aerial photographs, as these photos enabled a detailed study of the county's landscape. The Erie County office of the USDA Agricultural Stabilization and Conservation Service (ASCS) made available aerial photos of the county from 1981 and historical photos from 1959. These photos were used to identify potential sites. Since the 1981 photographs were relatively recent they were assumed to be fairly accurate representations of the present conditions of the landscape in the county. The photographs were used to compare the physical signature (characteristic appearance) of known high quality areas to those of yet unvisited areas. Sites that had similar signatures to high quality areas and sites that had unique signatures could be identified as potentially significant sites, while sites that appeared to be disturbed or very common could be dismissed. U.S.G.S. topographic maps were referenced as part of the aerial photo interpretation process. Potential sites located on the photos were transcribed onto the topography maps. Later in the inventory process, the 1991 aerial imagery owned by the Erie County Department of Planning was available. The 1991 aerial imagery was used in the final stages of the inventory for determining site boundaries, as well as identifying potential threats and disturbances that were not always obvious during ground surveys.

Aerial Reconnaissance

Flying over the landscape aids in the interpretation of features identified on aerial photos, by providing color and tonal differences and a three-dimensional perspective of areas and objects that appear as two-dimensional on photographs. Some sites can be eliminated after such direct inspection. Also, information concerning extent, quality and context can be gathered easily from the air. Any sites that can be eliminated via aerial inspection can save many hours of ground inspection, particularly when dealing with remote areas. Extensive, but not inclusive, aerial surveys were made of Erie County. The information gathered via the aerial surveys proved valuable and facilitated a number of decisions as to whether to include or exclude specific sites. Aerial surveys of 128 sites were conducted for the Erie County inventory.

The use of aerial reconnaissance flights, as well as aerial photos, was particularly important in cases where a site was too large to completely examine on the ground. Important information on unvisited portions of the site could be gathered more efficiently than conducting a field survey of the entire site. Aerial reconnaissance and photographs were also useful in evaluating sites that were inaccessible or for which permission to field survey was not granted. In effect, this method of site evaluation aided significantly in collecting the needed site information that the allotted time for the project would not otherwise permit.

Ground Survey

The natural heritage ecologist did not enter a property unless the owner had granted permission. Permission for property access was obtained via written and verbal contact with property owners. Over 477 letters were mailed to property owners, requesting permission to conduct field surveys for the inventory. Telephone calls were made to follow-up on property access requests and to respond to questions about the inventory. Of the over 477 letters mailed 202 responses were received. Of the total responses to verbal and written requests for property access, 67 positive responses were received, allowing field surveys to be conducted at 78 sites. No response was considered to be a negative response, unless subsequential telephone conversations provided permission to conduct a field survey.

Provided access was authorized by the property owner, areas that were identified using the methods mentioned were ground surveyed to evaluate the natural condition and quality of the habitat, as well as to evaluate the significance of the natural resources present. Site Survey Forms (Appendix III) were completed for each site and an evaluation of the quality of the site was made. The flora, fauna, level of disturbance,

approximate age of community, and local threats were among the most important data recorded for each site. Sites for species of special concern were often visited to evaluate the condition of the species and the associated habitat.

Boundaries for each area were drawn on the U.S.G.S. topographic maps using field survey data and aerial imagery (Erie County Department of Planning, 1991) as references. In addition, a few aerial reconnaissance flights were performed after having visited the sites so that questions concerning boundaries, threats, and impacts to the site could be addressed. Site boundaries were drawn to include both the key features of the site and additional "buffer areas" critical to the protection of the site.

Data Analysis

A file was prepared for each site which included a description of its overall significance and characteristics such as its quality, size, condition, recoverability and rarity. The quality of the site was determined by examining how well it fulfilled the definition as one of the natural heritage area types described in the introduction. Each natural community and species of special concern is ranked by PNDI using factors of rarity and threat on a state-wide (state rank) and range-wide (global rank) basis (Appendix I and V). In addition, each site was ranked by inventory methods according to its relative significance in the county (Table 1, Appendix II). Sites that were the most biologically significant per natural heritage criteria were selected for inclusion in the inventory, following data analysis and a comparison of similar types of sites.

Field data for the significant natural communities and for sites harboring plant and animal species of special concern in the county were combined with information generated during the data collection phase of the inventory, summarized, and the locations were transcribed on to a clear polyester sheet which served as an overlay for each of the 7 1/2 minute U.S.G.S. quadrangle maps (Fig. 3). Unless site size was available via existing information, natural heritage area sizes were determined using a planogrid with a 95 percent degree of accuracy.

GENERAL RECOMMENDATIONS FOR THE PROTECTION OF NATURAL HERITAGE AREAS

The inventory identifies natural heritage areas in order to promote their protection. Specific site recommendations for the maintenance of these important biotic and ecological resources are made based upon (1) the type of natural heritage site that the site is classified as; (2) the ecological characteristics of each site; (3) evidence of past or present disturbance within the site; and (4) the potential effects of the land-use activities that surround the site. Thus, these recommendations and site mapping recognize the interaction between the site's biotic resources and the natural ecosystems and/or land-use activities in proximity to the site. The general recommendations furnished below are meant to further clarify the differences between the various natural heritage areas and to provide a general framework for specific management recommendations.

Natural Areas

Natural Areas are recognized as areas whose communities have flourished with little or no human disturbance, particularly recent disturbances. Their continuance as the best examples of natural communities in the county depends upon the maintenance of the undisturbed qualities. Therefore, the protection of Natural Areas requires that the disturbances associated with all land-uses including those described below be eliminated from the site and its buffer. In some cases, specific and non-invasive management may be required to maintain the qualities of the NA (e.g. removal of exotic plant species that are threatening the integrity of the natural community may be an acceptable practice, whereas, spraying for gypsy moth probably would not be considering the broad scale effects of the pesticide).

Biological Diversity Areas

Biological Diversity Areas include those sites that are recognized as supporting special species (Special Species Habitat), relatively large numbers and kinds of species (High Diversity Areas), or entire communities or ecosystems (Community/Ecosystem Conservation Areas). Occasionally, Special Species Habitats and High Diversity Areas require an amount of human manipulation of the site in order to maintain suitable conditions for the species or a group of species. This is particularly true in places where natural habitats have been displaced and where species are now surviving in human influenced/created areas that mimic certain natural habitats. Beyond such specific cases, however, these BDA's should remain as free from other disturbances as possible. Actions/projects impacting BDA's should take into consideration the

ecological requirements of the species/community which is the feature of the area. Activities which may impact that ecological feature within these areas should be brought to the attention of the responsible agency, when such an agency exists, or seek out ecological consultation from private groups such as conservancies, land trusts, and watershed associations, for specific protection recommendations based on those ecological requirements.

Dedicated Areas

Dedicated Areas are recognized because of the owner's specific intention to protect their present and potential future ecological resources. Under such protection, those sites that are not presently examples of special habitat or exemplary communities will be permitted to mature and attain qualities recognized for Natural Areas or Biological Diversity Areas. Sites that are already significant as NA's or BDA's will be allowed to continue, undisturbed, as the best examples of natural communities in the county. The management of DA's may therefore follow the recommendations furnished for NA's and BDA's and may involve some level of carefully planned intervention to maintain their significant ecological resources. Usually, management involves simply leaving the area alone to mature and recover from previous disturbance. Generally, many land-uses, including those discussed in the following section, are not compatible with DA's and should be avoided.

Landscape Conservation Areas

Landscape Conservation Areas recognize large pieces of the landscape that are relatively undisturbed, but may include a variety of land-uses. Also, LCA's may contain NA's, BDA's, OHA's or managed land - all which serve to increase the significance and complement the integrity of the LCA. Management requirements for LCA's are less stringent than those for either NA's, BDA's, or DA's because they are sometimes not specifically delineated to protect specific species or communities, although some LCA's are designed with aquatic resources in mind in which case a watershed boundary may be used to identify the LCA. Whereas with NA's, BDA's, and DA's, disturbances should be evaluated in terms of direct impacts to areas, with LCA's disturbances should be considered on a broad scale in terms of fragmentation and general habitat integrity. Construction of new roads and utility corridors, non-conservation timber harvesting, clearing or disruption of large pieces of land, and other activities that divide and alter the character of the landscape should be avoided. People and human created features are often part of LCA's but should not dominate the landscape. By limiting the amount of land in intensive use (agricultural zones,

residential zones, etc.) and by compressing development into already disturbed areas (villages, roads, existing ROW's, etc.), large pieces of the landscape can be maintained intact. In addition, land that is presently in use needs to have management that is sensitive to the protection of the natural feature being recognized by the LCA.

Other Heritage Areas

Areas containing ecological resources that involve public education or scientific study fall into this category of Natural Heritage Area's. These activities lend importance to places that might not otherwise be considered as unique or significant relative to other areas in the county. OHA's require that resources emphasized for study be protected from disturbances that are not within the context of the study (e.g. a stream may be studied as an aquatic habitat affected by a land-use within its watershed and will therefore, require different protection approaches). This protection should include the environment and processes necessary for its sustenance. For example, if aquatic resources are the focus of the OHA, an entire watershed may require protection. If the focus is a small patch of forest, a much more compact area of protection may be appropriate. Also, the study of the resource may require management or sampling, and may alter the natural character of the site. Such management would not be appropriate within an NA, BDA, or DA, but is acceptable in an OHA.

LAND-USES AND POTENTIAL IMPACTS TO NATURAL HERITAGE AREAS

The activities that take place on lands that are within or around a natural heritage site may cause physical, chemical, and biological modifications that significantly effect the site's ecological resources. In western Pennsylvania the land-uses that most often impact natural heritage sites are mineral extraction, development, agriculture, utility right-of-ways. To a lesser degree, timber harvesting and gypsy moth control also have impacts, especially if done without utilizing best conservation management practices designed for the site involved. Additionally, fragmentation of habitats caused by these and other land-uses is both pervasive and cumulative. While land-use activities can impact the areas identified in the inventory, there is a range of options for dealing with the threats, depending upon site characteristics and the particular land-uses in proximity to the site. All natural heritage areas identified in this report include buffer zones (see pages 66-67) that provide an area necessary for the protection of ecological resources of concern.

Mineral Extraction

Mineral extraction is a term used to describe the removal of natural resources via mining or well drilling operations. Mining operations are used to access coal, rock, sand and gravel deposits. Drilling operations extract petroleum, natural gas, sulfur, mineral brine, and water from wells drilled into formations containing the minerals. Generally, mineral extraction changes the topographic, physical, and/or chemical characteristics of terrestrial or aquatic resources (Darnell, 1976). These changes have the potential to affect biological resources on and off the site of the mineral extraction operation.

All mining operations change topography and can destroy natural habitat(s) via the removal of natural vegetation, soil, bedrock overburden, mineral deposits, and the creation of spoil and mineral storage areas. Sand and gravel mining in streams or lakes can significantly reduce or eliminate aquatic habitats/communities by modifying substrate composition and stream hydrology. Topographic and physical changes caused by mining activities can lower water tables, lake levels and spring flow, and can significantly modify stream flow rates. Erosion, mineral washing, and aggregate sorting can change neighboring surface waters and wetlands via the input of sediment and fine particulates. Sediment and fines can alter bottom topography, increase turbidity, reduce light penetration, increase water temperature, reduce dissolved oxygen, modify natural water chemistry, and reduce habitat diversity for plants and animals (Darnell, 1976).

Mine drainage and wastewaters have the potential to adversely effect the water quality of surface waters, ground water, and aquifers, particularly when good science and careful conservation practices are not used in the design and operation of mines and mining activity. Wastewaters and stormwater runoff from mining operations can contain suspended sediment, acids, toxins, and total dissolved solids (Darnell, 1976). While coal extraction does not occur in Erie County, other minerals are extracted, such as sand and gravel, gas, and water. Wastewaters and stormwater runoff from sand and gravel mining operations have the potential to adversely effect the water quality and aquatic habitats of surface waters that receive these discharges. In areas of western Pennsylvania where coal mining occurs, waters associated with coal mine drainage and washing facilities have a low pH; high concentrations of metals, such as iron and manganese; and high concentrations of suspended solids. These pollutants, as well as leachates from coal piles and slurries reduce water quality and inhibit plant and animal life (Michaud and Richardson, 1989).

Well drilling operations generally involve a limited amount of land area and therefore, tend to result in less habitat loss than mining operations. Nevertheless, these operations should also follow the guidelines

and regulations provided by the appropriate regulatory agency to decrease the risk of the operation impacting adjacent areas. Gas or oil drilling operations that follow accepted guidelines and include casings which extend beyond ground water production zones can minimize or eliminate leakage of water into the well. Water drilling operations can lower local water tables and result in groundwater loss. When properly operated, well drilling activities do not discharge liquids or foreign materials outside the drill area. However, petroleum spills can contaminate soil, surface waters and groundwater. Brine is a by-product of oil and gas wells and contains high concentration of salts. When discharged, brine can pollute surface waters or shallow groundwater tables (Darnell, 1976). It is recommended that the best management practices be employed during mineral extraction activities and that prior to permit issuance, impacts to surrounding ecological communities be strongly considered.

Further information regarding regulations can be obtained by contacting the Department of Environmental Resources-Bureau of Mining and Reclamation at (412) 442-4000 or the Department of Environmental Resources-Bureau of Oil and Gas Management at (412) 442-4000.

Development

The effects of development activities on the environment can be categorized as (1) during construction impacts, (2) effects that occur immediately after construction, and (3) the long-term effects related to the permanent physical changes brought about by development and/or by subsequent human use and management. The overall effect of any development activity varies with environmental features, including physical characteristics (soils, slope, and vegetative cover), timing, type of construction, and the care taken during the active construction periods. Long-term effects related to subsequent human use depend upon environmental features, intensity of use, and management practices (Darnell, 1976). Development activities generally result in the permanent loss or modification of terrestrial and/or aquatic biological ecosystems. The extent of the loss or modification is related to the size and type of development.

Development activities can have effects that extend beyond the areas directly involved in the development. Therefore, consideration of the impacts associated with development must address more than the biota whose habitat will be altered on-site (Ghiselin, 1980). Impacts of particular concern are habitat fragmentation (discussed in a later section), nonpoint-source pollution, erosion, stream channel alteration, and wastewater discharges.

"Nonpoint-source pollution" is pollution generated by stormwater runoff from land-based activities. The types of pollutants contained in stormwater runoff are related to the land-based activity. Generally speaking, the pollutants in stormwater runoff originating from urban and infrastructure development include nutrients, suspended solids, septic effluent, pathogens, organic compounds, petroleum hydrocarbons, heavy metals, pesticides and industrial chemicals, road deicing salts, toxic chemicals, fertilizers, and eroded soil (Guldin, 1989; Newton, 1989). Nonpoint-source pollution can have significant adverse effects on water quality by entering surface waters, wetlands, or infiltrating groundwater. It is also the most difficult pollution source to track and remediate.

Erosion occurs when wind or water wear away soil or rock. Erosion is a continual, natural process that results in substantial changes that take place over many years or, in the case of rapid changes caused by flooding, wind throw or rock slides, that take place in a limited area predisposed to those kinds of changes. Many natural communities and individual species have adapted to and depend upon cycles of habitat change brought about by erosional forces. However, human activities often precipitate erosion in ecosystems not adapted to rapid or extensive change and hence, can damage or destroy natural communities. Human-induced erosion can result in land loss (e.g., stream bank recession) and degradation of water quality, through sedimentation and mineral release, thereby adversely effecting aquatic life and habitats. Development can increase erosion by removing vegetation, roots, leaves, and litter that retard erosion. On a larger scale, development may require the grading of hillsides and the complete removal of topsoil, leaving large areas of land bare and vulnerable to erosion (Erie County Metropolitan Planning Commission, 1977).

Wastewater discharges are liquid effluents discharged from a relatively self-contained (point) source that generally carry pollutants (Kunz, 1970). Pollutants in these discharges are most often total suspended solids, compounds that increase biochemical oxygen demand, nitrogen, phosphorus, and heavy metals (Council on Environmental Quality, 1981). While by law wastewater discharges have effluent limits which restrict the quantities, rates and concentrations of pollutants that enter the receiving waters (Department of Environmental Resources, 1979), an effluent may still contain one or more pollutants that can adversely effect a habitat, species, or ecosystem. Examples: Depending on the level of treatment, municipal wastewater treatment plant effluent can contain nutrient levels that would significantly accelerate the eutrophication of a lake, adversely effecting the water quality and biota of the lake. Additionally, chlorine

used to sterilize sewage treatment plant effluent discharges is itself a toxic compound and a precursor to other compounds that are toxic to aquatic life.

To minimize the impact of development on the natural landscape, proper planning is essential. The planning phase for any project involving development should take into consideration the ecological resources that may potentially be jeopardized by the project.

Two agencies that serve as regulators of most construction activity are the Erie County Conservation District (phone: 814-796-4203) and the Department of Environmental Resources (phone: 814-332-6945). Both agencies can be contacted if further information is needed.

Agriculture

The removal of natural vegetation to create crop land can result in the loss of terrestrial and aquatic biological resources. Conversion to agricultural land-use is also one of the three primary reasons for the continued decline of wetlands in the United States (Guldin, 1989). In addition to the direct loss of natural communities by conversion to crop land, crop and animal production activities can produce nonpoint-sources of pollution that effect water quality by entering surface waters or ground water via runoff, seepage, or percolation. Water quality problems related to agricultural nonpoint-source pollution generally result from eroded sediments, nutrients, and animal wastes (Terrell and Perfetti, 1989).

Sediment is a primary pollutant contributed by agriculture to receiving waters. Sediment destroys spawning areas, food sources, and the habitat of fish, crustaceans and other aquatic life. Sediment loss varies significantly with the kind and extent of management practices. The use of conservation cropping systems (i.e., cover crops and conservation tillage) reduces the amount of sediment entering receiving waters (Guldin, 1989; Terrell and Perfetti, 1989).

Agricultural activities, including use of cattle feedlots and the intensive application of fertilizers, add nutrients and chemicals to surface waters and groundwater (Erie County Metropolitan Planning Commission, 1977). Eutrophication rates are increased by agricultural inputs of nutrients, especially nitrogen and phosphorous. Nutrient inputs usually originate from either fertilizer runoff or erosion from fields or pastures (Terrell and Perfetti, 1989), far exceeding the rate brought about by natural processes.

Pesticides are commonly applied to agricultural lands. Most agricultural pesticides are either insecticides or herbicides. The longer the pesticide persists in the soil, the more likely it will be transported from the crop area to surface or ground waters where it may adversely effect non-target organisms, such as

animals, humans, and noncrop plants. The effects of pesticides on aquatic organisms vary with the toxicity of the pesticide, how long it remains active in the environment, and its tendency to accumulate in the food chain. Pesticides can be directly toxic to fish and other organisms in the food chain (Guldin, 1989; Terrell and Perfetti, 1989), or may be toxic in combination with other chemicals. It is recommended that pesticides should be used only to the extent necessary and applied at the levels recommended by the manufacture and/or the appropriate regulatory agency . Less persistent pesticides are being more widely used in the county, although the use of pesticides that persist for extended periods of time (e.g., into the next growing season) still continues (L. Steckler, USDA Soil Cons. Serv., pers. commun.).

The Erie County Conservation District (phone: 814-796-4203), U.S.D.A. Soil Conservation Service (phone: 814-796-6784), or the Penn State Cooperative Extension Service (phone: 814-825-0900) can be contacted for further information regarding agricultural practices in Erie County.

Utility Right-of-Ways

Utility Right-of-Ways (ROW's) are typically unforested ribbons of leased land that are cleared of vegetation to accommodate the construction and maintenance of overhead lines or pipelines. Varying in width from 40 or 50 feet to hundreds of feet, these utility ROW's stretch across the landscape, through both densely populated and sparsely populated areas. After construction, vegetation on these ROW's is controlled through mechanical and chemical methods, and in some instances designed to discourage growth of woody plants, especially trees.

To keep costs as low as possible and reduce the amount of potential maintenance on ROW's, utility companies attempt to stretch their lines over as short a distance as possible. Often that means running perpendicular to steep slopes, crossing wetlands, crossing streams, or cutting through blocks of formerly unbroken forest. At a broad scale, utility ROW's fragment the landscape by breaking formerly contiguous habitats and communities into smaller sections (see the Fragmentation section that follows). In some cases, utility ROW's have more direct effects on natural communities.

If lacking sufficient vegetation, particularly woody vegetation, to intercept, store and transpire water, ROW's that traverse steep slopes have the potential to promote erosion. Following practices promoted by county conservation and soil & water conservation districts, the problems associated with ROW's on steep slopes can be minimized. Unfortunately, even the best planned erosion control measures can be nullified by unauthorized and uncontrolled use of All Terrain Vehicles (A.T.V.'s). In those cases, siltation of streams,

severe run-off events, and even changes in local hydrology can result from ROW's channeling water rapidly down slopes and into streams.

Unforested corridors, like ROW's, that link remote interior areas of forest to more disturbed, open habitats - including the ROW's themselves - invite invasion of exotic plants [e.g. multiflora rose (Rosa multiflora), garlic mustard (Alliaria officinalis), non-native grasses)]; aggressive native plant species like hay-scented fern (Dennstaedtia punctilobula); opportunistic animal predators like raccoon, fox, and even domestic dogs and cats; aggressive parasitic birds species [e.g. brown-headed cowbird (Molothrus ater)], and possibly many insect pests.

The maintenance of ROW's can create another set of problems. Mechanical clearing and cutting, often done with heavy equipment, compacts the soil, decreasing the ability of the soil to absorb water and making the ROW more susceptible to erosion. Also, where ROW's cross streams or wetlands, use of heavy equipment can damage natural drainage and disrupt slow to recover aquatic habitats. Further disruption occurs when pipelines or underground telephone lines need to be replaced. In addition, adjacent natural communities are continually threatened by the potential rupture of underground or aboveground pipes, in which case irreversible damage could occur.

To avoid further fragmentation of the landscape and multiplying the impacts mentioned above, new transmission lines should be routed along existing ROW's outside of natural heritage sites. This should be made a general practice by all utility companies and, when possible, ROWs should be linked with roads. ROW maintenance should be planned and carried out under the supervision of the local Soil and Water Conservation District to minimize damage.

Application of herbicides which avoids the problems of mechanical clearing have their own impact since they can damage adjacent vegetation if there is over-spray or excessive treatment, particularly when applied from the air. (The reason for maintaining a permanent grass cover on gas and oil piplines is to allow for the rapid identification of leaks in these lines thorough the use of aircraft; thus the application of herbicides is considered to be less damaging than a spill which goes undetected for a long period of time). Loss or damage of adjacent vegetation compounds the problem associated with erosion and siltation. When applicable, such as in the case of overhead power lines, maintenance of a shrub layer throughout the ROW is recommended by the Pennsylvania Bureau of Forestry.

Little research has been undertaken regarding the effects of herbicide (broad-leaf, broad spectrum, or otherwise) over spray and runoff on nearby aquatic systems. Alternative management strategies should be strongly considered in the decision to use herbicides on ROW's. Currently, examples of cooperative management between conservation groups, land owners, and utility companies show a trend toward more limited and specific application of herbicides, as well as toward development of strategies for decreasing maintenance needs of ROW's (e.g., planting of shrubs and periodic sapling cutting) (M. Droege, MD Chapt. of The Nature Conservancy, pers. commun.; K. Langdon, U.S. Park Serv., pers. commun.). It is important to note, that planting of exotic shrubs or ground cover vegetation would introduce species that could out compete natural vegetation, even in areas beyond the ROW, and cause negative changes in the composition of communities bordering the ROW. Even plantings of native vegetation may introduce new genes into existing local populations, possibly affecting the vigor and ability of existing communities and individual species to survive local conditions. Therefore, planting and encouraging the growth of native local species is the best solution.

Road ROWs impact the landscape and natural resources in much the same way utility ROWs and, for the most part, result in more destructive and permanent disturbance than utility ROWs. Fragmentation is certainly the most notable impact that roads have on the landscape. Road density and thus, fragmentation increases as the landscape becomes more urbanized. A description of how fragmentation caused by road ROWs impacts the land can be found in the Fragmentation section that follows). Roads are most often constructed with impervious surfaces. Such surfaces cause an increase in water runoff which may result in erosion problems, flooding, etc. Other problems associated with road ROWs include pollution of streams, soil, and air resulting from the use of deicing chemicals in the winter, accidental gasoline spills (gasoline contains heavy metals), asbestos (a component of brake linings which is released as brake linings wear down), and automobile emissions. Road ROWs, in addition, pose a physical barrier to animal movements.

Forestry Practices

In the past 150 years, most areas in Pennsylvania have been cut at least once, some two or three times. Once the economic staple for many regions in Pennsylvania, timber harvesting is still important in rural areas near large blocks of private, state and national forest. Although not a driving economic force in most areas, timber harvesting stands as one of the most widespread resource uses in the state. In general, there are two approaches to timber management: even-aged and uneven aged management. Even-aged

management refers to the removal of most or all the trees in a section of forest to encourage regeneration of a stand where all trees are of the same age. "Clearcutting", "shelterwood" cutting, or "seed tree" cutting are types of even-aged techniques. Large openings created by extensive cuts allow pioneer tree species like aspen (Populus spp.) and cherry (Prunus spp.) to invade and out-compete slower growing, lower seed producing trees characteristic of more mature forests. Loss of original forest seed trees compounds the effect, slowing succession and recovery to an even greater degree. Below the canopy, dramatic increases in light level and decreases in humidity and soil moisture, resulting from overstory removal, lead to loss of many species of flora and fauna not able to tolerate the new environmental conditions or unable to compete with more opportunistic species. However, depending on the site, the species composition prior to cutting, and other factors, even aged management can lead to greater diversity of forest species (Personal Communications, James Nelson, Pa Bureau of Forestry).

Uneven-aged, or selective cutting, usually requires that only certain trees are removed from a stand. Stand improvement cuts may remove decadent, diseased or oddly growing trees to allow the remaining trees better access to light, water and nutrients. These trees are valuable to wildlife (Noss, 1992) and will diversify the habitat and supply food to the invertebrates and microorganisms living on the forest floor when they succumb and fall. "High-grading" is a term used to describe a selective cut that only removes the highest quality trees.

Timber harvests result in the compaction of soil from use of heavy machinery and vehicles as well as loss of soil to erosion, particularly if they are poorly planned, do not follow accepted soil and water conservation guidelines, and are done without monitoring the condition of the erosion control apparatus throughout the project. The degree of soil loss and alteration is dependent upon the type and location of the cut and the amount of care taken during the operation. Steep slopes, areas with fine soils, and areas recovering from fire damage are places that are obviously very susceptible to erosion. Large cuts, especially even-age cuts, increase the risk of high volume runoff events. Roads required to access the site and later remove timber, impact communities outside the harvest area by increasing fragmentation and the potential for erosion. An increase in road density is known to be harmful to sensitive wildlife and may have other deleterious effects (Noss, 1992). Another impact of selective cutting is the damage done to remaining trees by heavy machinery during the extraction of timber or by falling trees as they are being cut.

Current timber management practices have addressed some of these concerns, particularly those related to erosion and the impact of siltation on streams and other waters. Practices used within the Pennsylvania State Forests are exemplary and designed to reduce adjacent impacts as much as possible. However, the effect of timbering removal, however carefully controlled, is the disruption of natural forest communities and thus will alter the qualities of natural heritage areas. Forested wetland communities are especially disturbed by timber harvesting because of their hydric and highly compactable soils and their sensitivity to changes in moisture levels associated with loss of vegetation during timber removal. The ability of these natural communities to recover after harvesting, is not known. Uneven-aged management and longer rotation cuts are thought to be ecologically preferable to clear cutting and other even-aged management methods, but more study of timber harvesting methods and specific forest types is necessary for a complete understanding. Future research should include the study of ecological health of the whole forest community and not simply the trees within the community. Keeping the number of roads to an absolute minimum and reducing the size of cuts can help to minimize fragmentation. Avoiding highly erodible areas and areas with fine, compactable soils is a basic management consideration.

Gypsy Moth Control

The gypsy moth (Lymantria dispar) poses a threat to the forest communities of Pennsylvania and the eastern United States. Since accidental introduction into Massachusetts in the late 1860's, the gypsy moth has worked it's way south and west across the northeast, increasing in population size and area, and rapidly defoliating trees during the larval stage of its life cycle. Oak (Quercus) dominated forests receive the most impact from the insect, although it defoliates many tree species during its feeding. Extensive outbreaks of the insect occur in forests where oaks comprise at least 15-25% of the community (Nichols, 1980). Unfortunately, a large portion of Pennsylvania forests consist of a high percentage of oak. The results of these extensive outbreaks include mortality of individual trees, and groups of trees, reduction of food available for other forest insects, and possible long term changes in the understory of the forest as a result of increased light reaching the forest floor (Schweitzer, 1988). Increased light levels can also encourage invasion of exotic or weedy species.

The extent to which the gypsy moth threatens Erie County forests is as yet undetermined. Available information is not sufficient to determine the extent of infestation or to make accurate predictions on an annual basis regarding gypsy moth outbreaks. County woodlands do contain species (i.e., aspen (Populus),

willow (Salix), and apple (Pyrus) on which the insect larva will feed. However, overall oaks do not occur in Erie County woodlands to the extent preferred by the insect, although oak dominated pockets do occur (T. Erdman, DER Bur. of Forestry, pers. commun.). While the gypsy moth does not yet appear to be as much of a threat to Erie County forests as the insect poses to other counties in Pennsylvania, the issues regarding gypsy moth control addressed below are included in the inventory should the threat posed increase and because the general information on the application of insecticides to forests is worthy of consideration.

In an attempt to control the gypsy moth, a number of measures have been taken such as spraying insecticides and introducing parasites. Dimilin, Sevin, Orthene, Dylox, and Bt (Bacillus thuringiensis, a biological control), are five currently used insecticides; all impact more than just the gypsy moth. The toxicity of these insecticides extends to many species, potentially thousands depending on the pesticide, and some remain active in the environment (terrestrial and aquatic systems) for at least several weeks following application (Schweitzer, 1988).

In general, insecticides negatively impact invertebrate populations and can indirectly affect other species that depend on various invertebrates for food or other interactions. Introducing parasites to control the gypsy moth is a questionable control method since, in most cases, little is known about the long term effects of such releases on the environment. One concern is that these organisms may have an impact on native insect populations when the gypsy moth populations decrease and the parasites are forced to find an alternative food source, although presently there is no data to support this concern. Based on this information, it is recommended that Natural Areas, Biological Diversity Areas, Dedicated Areas, and Landscape Conservation Areas be eliminated from, or not considered for any type of gypsy moth control program. If spraying is needed in other parts of the county, to protect forested residential or commercial property, then Bt should be the method of control used. Bt is a bacterium which serves as a more benign, biological control that disrupts the digestive system of the larva when ingested. The spraying of Bt eliminates the use of more harmful chemicals in the environment. However, it is considered a broad spectrum insecticide and, as such, can have the same effects on many native insects.

Fragmentation

The land uses and activities discussed heretofore can each affect natural communities and natural heritage sites in very specific ways. Beyond the direct impacts associated with these activities are the general, but very real and cumulative problems of habitat and landscape fragmentation. In this context,

fragmentation refers to the breaking apart of natural features (e.g., forests, streams, ridge lines) and the natural transitions between features (e.g., dry forest to mesic forest to swamp forest) on the landscape by human activities and development.

Both natural and human features can serve to divide habitats, for example: streams and roads. Occasionally, human features provide habitats that are analogous to natural habitats (e.g. road cuts vs. eroding slopes), however, more often they are not comparable to natural habitats in form, function, or position on the landscape. Roads, railroads, pipeline ROW's, farm fields, villages and housing developments not only occupy a substantial portion of the landscape, but break it into a large number of various size patches that function differently from natural patches of habitat.

Landscapes can be considered as a network of interacting patches that are sustained through the exchange of materials including genes, species, energy and biomass. If these exchanges are impeded, islands of habitat can be created and the processes of species movement, migration, colonization and extinction that function to maintain biological diversity, can no longer operate effectively. Cut off from larger populations, the species and communities within these areas face the problems of limited genetic diversity and low (species) recruitment rates. Ultimately, the number of existing species declines and fewer are available to take their place. It is precisely this decline in the ability of pieces of the landscape to support many species with different requirements that leads to a decline in biodiversity.

The effect of fragmentation on a specific species or ecological community depends upon the type and size of the community patch and upon the nature of the fragmentation. A grass-covered powerline, for example, could serve as a breeding habitat and as a dispersal corridor for grassland species but exist as a barrier to dispersal of interior forest species (Noss and Harris, 1986). Unfortunately, even though many of the most common and abundant species of plants and animals can take advantage of edges and manipulated habitats, many of the rarer ones can not. Fragmentation is of particular concern to "interior" dependent species - species which require the stable, low competition habitats found within contiguous forest ecosystems. The spotted owl is a well known example of an interior dependent species. It should be noted however, that interior species are functioning as part of a system and, although it is the individual species that is usually the focus of the protection and management, it is the entire ecosystem that the species depends upon that should be protected.

In evaluating the fragmentation of landscapes, it is important to consider the biological resources that are being protected or impacted within specific patches. These are complex considerations and require input from natural resource professionals who have a working understanding of landscape ecology as well as individual species biology. Management efforts directed toward providing linkages between habitats to facilitate the movement of species, gene and energy flow, etc. will be required if significant ecological areas are to maintain their natural diversity. Riparian corridors, under-road culverts, abandoned rail ROW's, and ridge lines can all be utilized to provide linkage between sites and habitats. Generally, it is preferable to concentrate land-use activities rather than spread them out. Clustering development, improving existing roadways rather than building new ones, and using existing ROW's to expand transmission capabilities are some approaches that limit fragmentation.

BUFFERS

Buffers or buffer zones are the areas surrounding the core areas of a site and provide insulation between significant ecological qualities and the existing, or potential, negative disturbances nearby. The size of the buffer depends upon physical factors (slope, topography, and hydrology) and ecological factors (species present, disturbance regime, etc.) as well as characteristics of the buffer itself, such as uniformity, species composition, and age. Although similar sites may have similar kinds of buffers, no two buffers will be exactly alike in size or extent. Two wetlands, for instance, of exactly the same size, and in the same region, may require very different buffers, if one receives mostly ground water and the other mostly surface water, or if one supports migratory waterfowl and the other does not.

Also, the buffer and the area being "buffered" constantly interact and affect one another. As an example, protecting a section of old growth forest surrounded by second growth forest would involve creating a buffer that would allow plant species to spread outward from the old growth section and at the same time, discourage inward colonization by weedy opportunistic species. The buffer would also protect the site from heavy winds and storms. Buffers must always be considered in the context of what they are protecting and how these zones will evolve when functioning as buffers. In the case of the old growth forest, a hiking trail through the buffer would probably not significantly change the buffer or impact the old growth forest. However, the expansion of camping facilities into the buffer could slow or prevent the build-

up of humus and the reproduction of trees, introduce invasive species and pollutants, and eventually alter the character of the buffer and ultimately decrease its effectiveness in protecting the old growth site.

Each site (Natural Heritage Areas) recognized in this report is mapped to include a buffer area. The decision as to how large a buffer should be for an individual site took into account the requirements of the natural community or species habitat that were the focus of the site. Buffers were not regarded as fixed distance areas around sites and the often irregular site boundaries demonstrate that point. A fixed buffer may serve to reduce direct impacts on a site, but may not account for the connections a site has with other parts of the landscape. By either failing to protect the natural system of which the site is a part (e.g., ground water recharge zone for a spring) or by allowing other land-uses nearby (e.g., ore extraction within a rock formation supporting a bat cave), a buffer can fail to provide adequate protection to a site. In addition to considering the above referenced factors when determining buffers for Natural Heritage Area boundaries, consideration was also given to recommendations by Brown and Schaefer et al. (1987) and recommendations by the DER Bureau of Topographic and Geologic Survey to the Western Pennsylvania Conservancy on the use of buffers to protect water quality and quantity, as well as to maintain the ecological integrity of the natural community(ies) that comprise a natural heritage area.

RESULTS

Erie County is covered by 27 7.5-minute U.S.G.S. quadrangle maps (Fig. 3). These maps are arranged beginning with Erie North in the northwest corner and ending with Pierpont in the southwest. The Natural Heritage Areas, managed lands, geologic and fossil localities in Erie County have been labelled on these topographic maps. A summary table of sites precedes each map and lists the identified Natural Heritage Areas. Under each site are the associated natural communities or species of special concern (endangered, threatened, etc.). Managed lands, geologic features, and fossil localities are listed after the Natural Heritage Areas. Included as part of each site name is the abbreviated Natural Heritage Area designation (NA = Natural Area, BDA = Biological Diversity Area, DA = Dedicated Area, LCA = Landscape Conservation Area, OHA = Other Heritage Area). Following each site name is the site's relative county significance. Table I summarizes Erie County natural heritage sites by significance rank. Appendix II defines the three county significance ranks. A written summary follows each table, which identifies the natural communities and provides descriptions, potential threats, and recommendations for protection.

The summary tables do not specify the names of the elements (natural communities or species of special concern) to avoid the possible consequences that heavy visitation, collection or intentional disturbance might have to the plant or animal populations. Also, the report is not burdened with detailed information required to manage these species and communities of special concern. This report does encourage communication between ecological professionals at the Conservancy and within state natural resource agencies with officials and organizations in the county. For many county planning purposes, officials need only to know that significant elements are present at a certain location. Additionally, out of respect for landowners, visitation to private property should be by permission only.

A map labeling and site mapping system has been utilized to indicate the significant heritage sites on each topographic map. The labels are:

BOLD PRINT UPPER CASE LETTERS

- Natural Areas. These include all categories of natural areas (pristine and recovering). Site names are followed by "NA". e.g., **SIXTEEN MILE CREEK GORGE NA**.

-- Biological Diversity Areas. These include special species habitats, high diversity areas and

-- Dedicated Areas. These important managed areas will be designated with a DA following each name. e.g., **WATTSBURG FEN NATURAL AREA DA**.

-- Landscape Conservation Areas. These names are followed by an "LCA" designation. e.g.,

-- Other Heritage Areas. These include Scientific and Educational Areas. Site names are follo

Bold Print Upper and Lower Case Letters

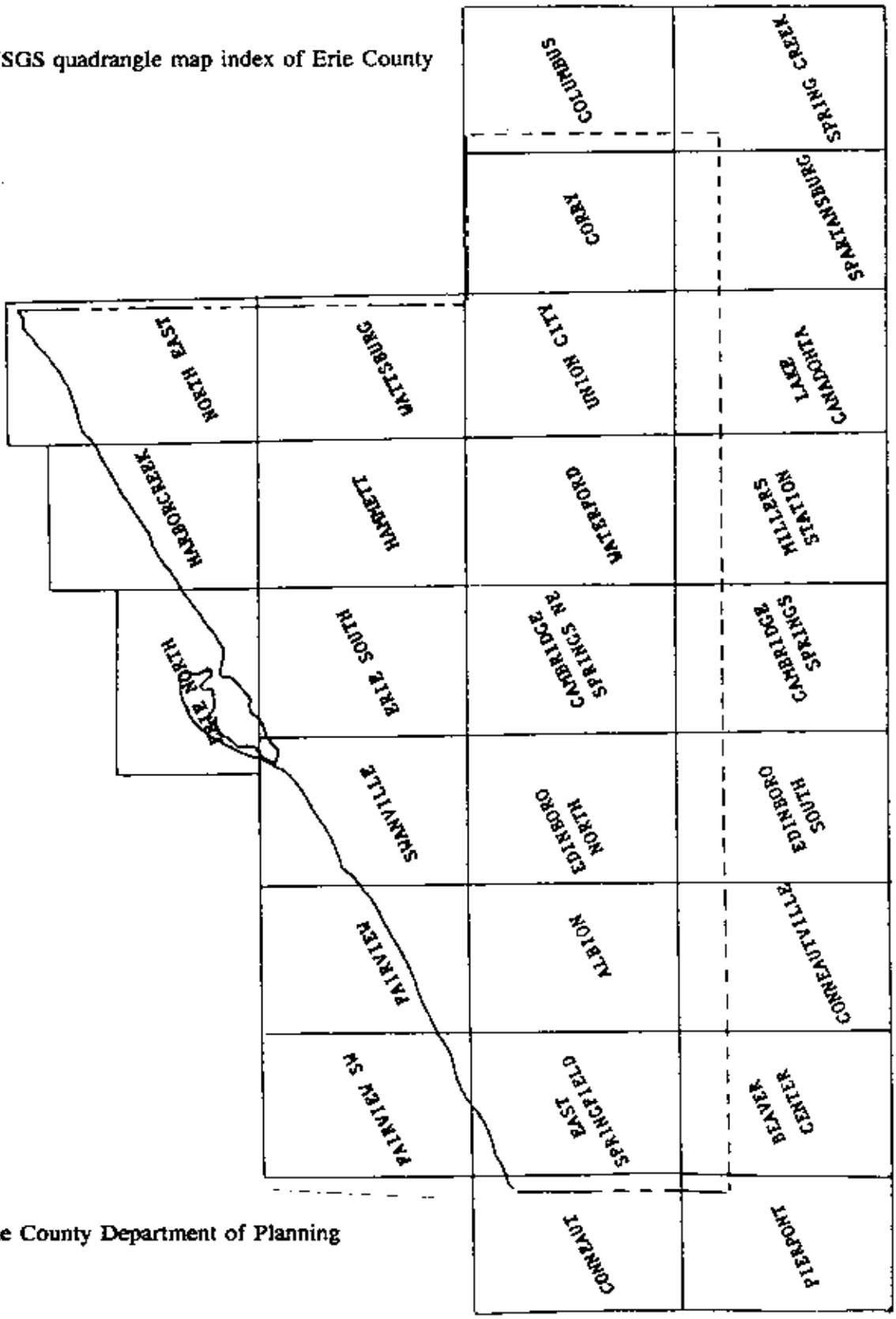
-- Managed Lands such as Pennsylvania state game lands, and state and local parks, e.g., **State Game Lands #109**, **Presque Isle State Park**.

-- Geologic Features and Fossil Localities, e.g., **Drumlins**.

Mapping uses the following conventions:

- Natural Areas, Biological Diversity Areas, and Other Heritage Areas are mapped using **solid lines** (————), which include both the site core (natural community or species of special concern habitat) and critical buffer lands surrounding the core.
- Landscape Conservation Areas are mapped using **dotted lines** (• • • • •)
- Dedicated Areas and other Managed Lands are mapped using the standard convention of **dash-dot lines** (—— · ——).
- Geologic/Fossil Areas are indicated by a **large darkened circle**.

Figure 3: USGS quadrangle map index of Erie County



Source: Erie County Department of Planning

ERIE NORTH QUADRANGLE

	PNDI Rank		Legal Status		Last
	Global	State	Fed.	State	Seen
LAKE SHORELINE LCA *High Significance*					
PRESQUE ISLE BDA/OHA *Exceptional Significance*					
NATURAL COMMUNITY: NC001	G?	S?	N	N	1987
SPECIAL ANIMAL: SA001	G3	S1	C2	PE	19??
NATURAL COMMUNITY: NC002	G?	S?	N	N	1987
SPECIAL ANIMAL: SA002	G3	S1	C2	PE	19??
SPECIAL ANIMAL: SA003	G5	S1	N	PC	1982
SPECIAL ANIMAL: SA004	G5	S1	N	PC	1987
SPECIAL ANIMAL: SA005	G5	S1	N	N	1988
SPECIAL ANIMAL: SA006	G5T5	S3S4	N	N	1988
SPECIAL ANIMAL: SA007	G5	S1	N	N	1988
SPECIAL PLANT: SP001	G4G5	S1	N	PE	>1985
SPECIAL PLANT: SP002	G5	S1	N	N	>1985
SPECIAL PLANT: SP003	G5	S2S3	PE	N	>1985
SPECIAL PLANT: SP004	G5	S2	N	PT	>1985
SPECIAL PLANT: SP005	G5	S2	N	TU	>1985
SPECIAL PLANT: SP006	G5	S2S3	N	TU	>1985
NATURAL COMMUNITY: NC003	G?	S1	N	N	1987/1992
SPECIAL PLANT: SP007	G5	S1	N	TU	>1985
SPECIAL PLANT: SP008	G5	S1	N	PE	>1985
SPECIAL PLANT: SP009	G3?	S1	N	PE	>1985
SPECIAL PLANT: SP010	G5?	S1	N	PE	>1985
SPECIAL PLANT: SP011	G5	S2	N	PT	>1985
SPECIAL PLANT: SP012	G4Q	S3	N	PE	>1985
SPECIAL PLANT: SP013	G5	S1	N	PE	>1985

SPECIAL PLANT: SP014	G5QT?Q	S1	N	PE	>1985
SPECIAL PLANT: SP015	G5	S1	N	PE	>1985
SPECIAL PLANT: SP016	G4	S1	N	PE	>1985
SPECIAL PLANT: SP017	G5	S2	N	PT	>1985
SPECIAL PLANT: SP018	G5	S2	N	PT	>1985
SPECIAL PLANT: SP019	G5	S2	N	PR	>1985
SPECIAL PLANT: SP020	G5	S3	N	PR	>1985
SPECIAL PLANT: SP021	G5	S2	N	PT	>1985
SPECIAL PLANT: SP022	G5	S3	N	TU	>1985
SPECIAL PLANT: SP023	G5	S1	N	PE	>1985
SPECIAL PLANT: SP024	G5	S2	N	PT	>1985
SPECIAL PLANT: SP025	G5	S1	N	PE	>1985
NATURAL COMMUNITY: NC004	G?	S2S3	N	N	1987
SPECIAL ANIMAL: SA008	G5	S1	N	PE	1987
SPECIAL ANIMAL: SA009	G5	S1	N	PT	1976
SPECIAL ANIMAL: SA010	G4	S1	N	N	1976
SPECIAL PLANT: SP026	G5	S1	N	N	>1985
SPECIAL PLANT: SP027	G5T5	S2	N	PR	>1985
SPECIAL PLANT: SP028	G5	S2	N	PT	>1985
SPECIAL PLANT: SP029	G5	S1	N	PE	>1985
SPECIAL PLANT: SP030	G5	S2	N	PT	>1985
SPECIAL PLANT: SP031	G4	S1	N	PE	>1985
SPECIAL PLANT: SP032	G5	S1	N	PE	>1985
SPECIAL PLANT: SP033	G5	S2	N	PR	>1985
SPECIAL PLANT: SP034	G5	S3	N	PR	>1985
NATURAL COMMUNITY: NC005	G?	S3	N	N	1987
SPECIAL ANIMAL: SA011	G5	S2	N	N	1985
NATURAL COMMUNITY: NC006	G?	S1	N	N	1987
SPECIAL PLANT: SP035	G5	S2	N	PT	>1985
SPECIAL PLANT: SP036	G5T4	S1	N	PE	>1985
SPECIAL PLANT: SP037	G5	S2	N	PR	>1985
SPECIAL PLANT: SP038	G5?	S2	N	PT	>1985
SPECIAL PLANT: SP039	G5	S3	N	PR	>1985
SPECIAL PLANT: SP040	G5	S2	N	PT	>1985
SPECIAL PLANT: SP041	G5	S3	N	PR	>1985
SPECIAL PLANT: SP042	G5	S2	N	PR	>1985
SPECIAL PLANT: SP043	G5G4	S3	N	PE	>1985

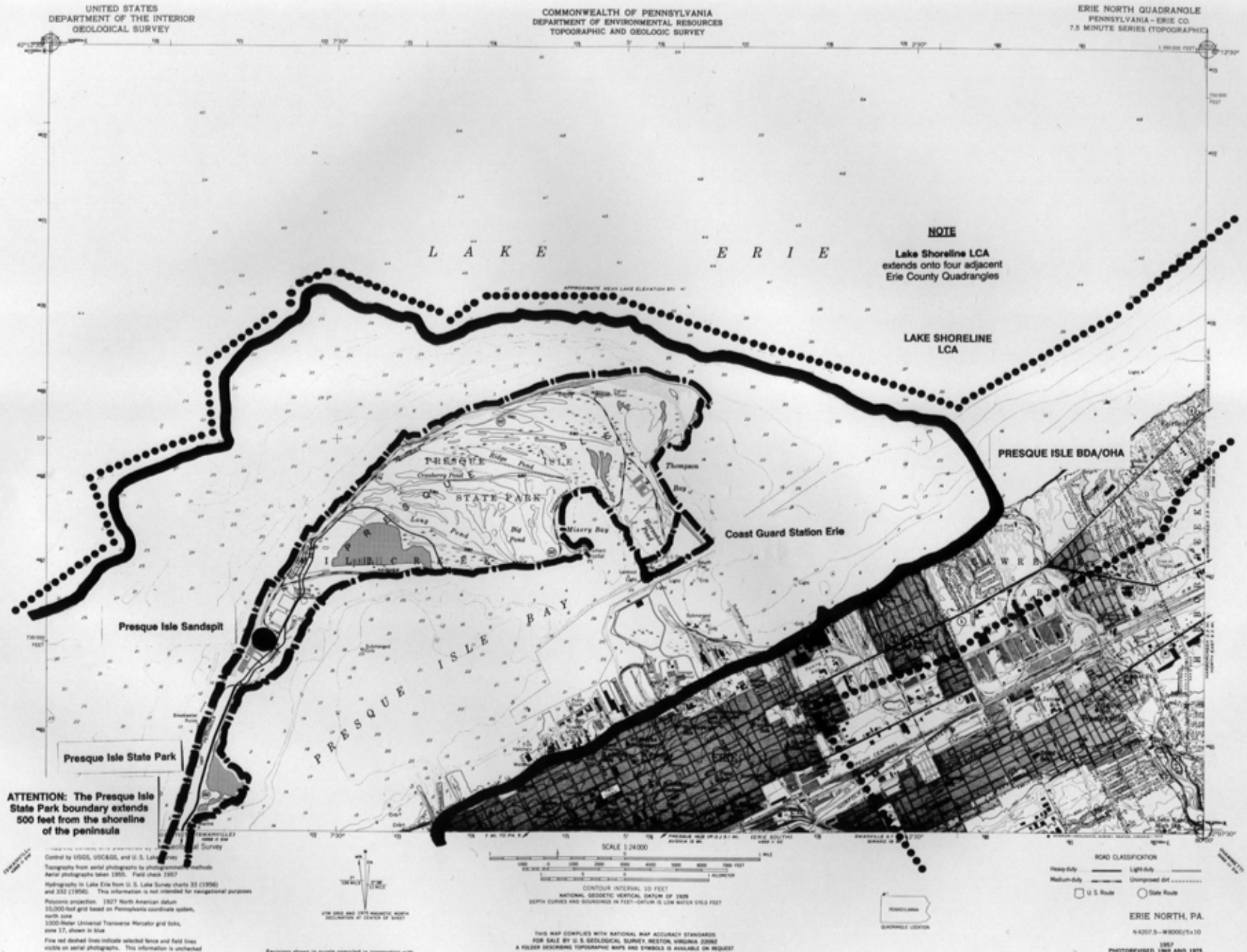
NATURAL COMMUNITY: NC007	G?	S1	N	N	1987
SPECIAL PLANT: SP044	G5T?	S2	N	TU	>1985
SPECIAL PLANT: SP045	G5T?	S3S4	N	PR	>1985
SPECIAL PLANT: SP046	G5	S1S2	N	TU	>1985
SPECIAL PLANT: SP047	G4G5	S1	N	PE	>1985
SPECIAL PLANT: SP048	G5	S2S3	N	PR	>1985
NATURAL COMMUNITY: NC008	G?	S1	N	N	1987
SPECIAL ANIMAL: SA012	G5	S1	N	PC	1987
SPECIAL ANIMAL: SA013	G5	S1	N	N	1989
SPECIAL ANIMAL: SA014	G5T5	S3S4	N	N	1989
SPECIAL ANIMAL: SA015	G5	S1	N	N	1989
SPECIAL ANIMAL: SA016	G3	S1	C2	PE	19??
SPECIAL PLANT: SP049	G5	S2S3	N	PT	1988

MANAGED LANDS:

Coast Guard Station Erie
Presque Isle State Park

GEOLOGIC FEATURES/FOSSIL LOCALITIES

Presque Isle Sandspit


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
TOPOGRAPHIC AND GEOLOGIC SURVEY
ERIE NORTH QUADRANGLE
PENNSYLVANIA-ERIE CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
L A K E E R I E
NOTE
Lake Shoreline LCA
extends onto four adjacent
Erie County Quadrangles
LAKE SHORELINE
LCA
PRESQUE ISLE BDA/OHA
Coast Guard Station Erie
PRESQUE ISLE STATE PARK
Presque Isle Sandspit
PRESQUE ISLE BAY
Presque Isle State Park
ATTENTION: The Presque Isle
State Park boundary extends
500 feet from the shoreline
of the peninsula
SCALE 1:24000
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
ROAD CLASSIFICATION
ERIE NORTH, PA.
1957
PHOTOREVISED 1969 AND 1975

ERIE NORTH QUADRANGLE

The **Lake Shoreline LCA** consists of the various habitats that comprise the 67 mile long Lake Erie shoreline in Erie County. Some of the exceptional habitat types that characterize the shoreline include lake bluff, lake bluff slumps, sandspits, beaches, dunes, sand plains, and select Lake Erie tributary stream valleys. Within Pennsylvania, the Lake Erie shoreline habitats and associated vegetation communities are unique to Erie County and, hence, among the rarest habitat types in the state. County, State, and federal agencies have recognized the natural resource value of Erie County's lake bluff system (U.S. Department of Commerce, 1980; Erie County Metropolitan Planning Commission, 1977; Department of Environmental Resources, 1976). From a more regional perspective, the shoreline environments of the Great Lakes have been the focus of recent preservation and conservation efforts, as awareness has increased regarding the significance of this natural resource. The **Lake Shoreline LCA** boundaries are indicated on the Erie North, Harborcreek, North East, Hammett, Erie South, Swanville, Fairview, Fairview SW, Conneaut, East Springfield, and Albion Quadrangles. (Refer to Figure 4 for the general location of the **LCA**. The actual boundaries of the **LCA** are depicted on the aforementioned U.S.G.S. quadrangle maps.)

Per U.S. Geological Survey topographic maps, lake bluff habitat exists along nearly the entire Lake Erie and Presque Isle Bay shorelines and consists of escarpments from ten to 170 feet high. The lake bluff formed as Lake Erie gradually receded to its present elevation. Lake bluff geology consists of Devonian shale bedrock overlaid by glacial till covered by deep, sandy lacustrine sediments. The lake bluff extends along the entire shoreline from the Ohio to New York state borders, except where interrupted by stream valleys associated with lake tributaries. From the New York border to the City of Erie, the lake bluff consists of lacustrine deposits overlaying Devonian shale exposed at the base of the bluff. Wave action has eroded the shale to create a shale-based bluff. The exposed shale provides structural stability for the bluff by inhibiting shoreline erosion and bluff recession. From the City of Erie to the Ohio border, the lacustrine deposits are thicker and extend from the top of the bluff (i.e., bluff crest) to lake level with little shale bedrock exposure. Hence, this portion of the lake bluff does not have the same protection from shoreline erosion and bluff recession provided by the Devonian shale exposed at the base of the lake bluff east of the City of Erie (The Great Lakes Research Institute, 1975; Taylor, 1960).

Figure 4: Lake Shoreline Landscape Conservation Area

Natural shoreline erosion and bluff recession processes make the lake bluff habitat a dynamic landform. The presence or absence of vegetation on the lake bluff and the type of vegetation present is directly related to landform dynamics. Bluff erosion both creates habitat for vegetation and results in loss of habitat. Erosion, such as undercutting and slides, can result in the loss of vegetated areas and/or produce slopes too steep for vegetation to occupy. As a result, portions of the lake bluff are completely unvegetated. Yet, in areas where erosion reduces bluff slope, herbaceous and woody vegetation can grow. The presence of vegetation on the lake bluff can provide protection from minor erosional forces and is an indicator of relative stability (The Great Lake Research Institute, 1975; Taylor, 1960).

Due to landform dynamics, vegetation on the lake bluff represents a continuum of ecological succession seral stages, ranging from unvegetated substrate to mature forest. Bluff slope and stability are two factors that determine the seral stages present on the lake bluff. Another factor determining the type of vegetation on the lake bluff is hydrology. Lake bluff hydrology regimes provide habitat for a range of terrestrial and palustrine vegetation associations. Groundwater seepage and watercourses create saturated conditions in numerous places on the lake bluff. At the other extreme, xeric conditions exist due to porous lake bluff substrate. Mesic conditions are also present.

Lake sediment slumps are another type of habitat that is unique to the Erie County shoreline. Lake sediment slumps are formed when lacustrine sediments, composed primarily of clay or sand, become saturated, causing the saturated material to move down the bluff slope (Erie County Metropolitan Planning Commission, 1977). Some of these slumps provide habitat for plant species of special concern in Pennsylvania.

Narrow beaches, ranging in width from ten to 50 feet, border the lake bluff along nearly the entire shoreline. The narrow beaches at the base of the lake bluff are formed by the west to east littoral transport of lacustrine materials (i.e., sand, gravel, and cobble) along the shoreline. The active zone of littoral transport of lacustrine materials extends from the Lake Erie shoreline to a depth of about 30 feet (Sullivan, 1991). When present, the beaches protect to varying degrees the lake bluffs they border from wave action erosion (The Great Lakes Research Institute, 1975). Protected from Lake Erie wave action by Presque Isle peninsula, the lake bluff area that borders the Presque Isle Bay shoreline does not receive longshore transported materials (The Great Lake Research Institute, 1975; Taylor, 1960). At Presque Isle peninsula, some of the lacustrine materials accumulate to form beaches, as well as dunes and sandplains. (Refer to pages 82 to 95 for additional information on the geology, habitats, and natural communities of Presque Isle peninsula.)

In Pennsylvania, beaches, dunes, and sandplains are only found along the Erie County lake shore and are especially well developed at Presque Isle. Beaches contain lower beach, drift beach, and upper beach

habitats. The lower beach extends from the normal shoreline to the highest average point reached by the waves of summer storms. The lower beach is generally devoid of macrophytic vegetation. Conditions range from hydrophytic to xerophytic, depending upon whether or not the lower beach is being washed by waves. The drift beach extends from the upper limits of the lower beach to the upper limit of the point reached by winter storm waves. The upper beach is characterized by accumulation of driftwood, loose clean sand, and colonies of succulent annuals. Waves from heavy storms pile sand on the upper beach, forming dunes. Dunes rise from about three to nine feet above the upper beach and form long narrow ridges parallel to the shoreline. Dunes are eventually colonized by perennial plants. Sandplains are habitat composed of flat level sand that extend landward of the upper beach. Sandplains are formed initially by winter storm wave action. Additional sand is deposited by the wind, elevating the sandplain above the upper beach out of the reach of storm waves. Both annual and perennial plants occupy sandplains.

Lake Erie tributaries dissect the shoreline and lake bluff via the processes of valley formation and headward erosion. The stream valleys and associated natural communities contribute significantly to the natural character and biological diversity of the **Lake Shoreline LCA**. Based upon field work conducted for the inventory, the stream valleys associated with a few of the Lake Erie tributaries contain natural communities that are rare or uncommon in the county. In addition to valley formation, these streams contribute materials to littoral sediment transport for beach formation and the mouths of these streams are associated with shoreline habitats, such as beaches and sandspits.

Shoreline erosion and bluff recession are processes which significantly influence the lake bluff, as well as other habitats contained within this natural heritage site. Shoreline erosion and recession result from both natural and human-induced processes. The natural processes that contribute most to lake bluff erosion and recession include stream dissection, lake water levels, storm conditions and frequencies, geological structure of the bluff and beach area, wind direction and strength, material available in the littoral sediment transport system, groundwater seepage, sheet water runoff on bluff face, runoff from behind bluff crest, frost action and raindrop impact, ice conditions on lake, vegetation on crest and slope, sediment loading by streams, bluff base beach deposits, and gravity. Human-induced processes that increase shoreline erosion and recession include artificial drainage onto the bluff slope, shoreline control systems, land cover modification and land use practices, and off shore dredging (The Great Lakes Research Institute, 1975).

The Pennsylvania Coastal Zone Management program (U.S. Department of Commerce, 1980) acknowledges the complexity involved in understanding shoreline erosion and bluff recession processes. The scope of the Erie County Natural Heritage Inventory does not permit a review of the numerous issues that pertain to human-influenced processes that promote shoreline erosion and bluff recession. Refer to Commonwealth of Pennsylvania Coastal Zone Management Program and Final Environmental Impact

Statement (U.S. Department of Commerce, 1980) for additional reference materials that address shoreline erosion and bluff recession. However, a limited explanation of the human-induced processes that contribute to erosion and recession follows in order to promote an understanding of the ramifications of these processes to the protection of the **Lake Shoreline LCA**:

-- Artificial drainage of surface water from behind the bluff crest onto the bluff slope can accelerate bluff erosion and recession. The artificial drainage of subsurface water, ground water, or sewage disposal effluent can contribute to bluff instability by concentrating and/or accelerating groundwater seepage on the bluff slope, promoting landslides and slumping of the artificially saturated substrate (The Great Lakes Research Institute, 1975);

-- Efforts to control shoreline dynamics via shoreline protection systems must take into account the basic physics of beach dynamics. Otherwise, problems created by these systems can require additional construction and/or continual maintenance when shoreline control objectives are not achieved. Artificial beach nourishment and shoreline control structures are examples of two shoreline control systems that can result in habitat loss or degradation and/or promote erosion of downstream habitat. Shoreline control structures that project perpendicular to the shoreline interrupt the longshore current and littoral transport of beach sand. Sand is accumulated on the up-drift side and beach erosion occurs on the immediately adjacent down-drift side. Artificial beach nourishment requires continual maintenance, as erosion removes the sand used to create beach area. The continual maintenance associated with artificial beach nourishment causes repeated habitat destruction, as artificial beach nourishment can eliminate or modify habitat where the sand used for nourishment is removed and where the sand is placed (Darnell, 1976). (Issues related to beach erosion and stabilization efforts at Presque Isle are addressed on pages 86, 87, and 91. While bluff recession is caused by various processes, the interruption of littoral sediment transport by natural or human-induced processes (i.e., shoreline control structures) has been observed to have detrimental effects on down-drift areas even though these same processes may protect another area of the lake bluff (U.S. Department of Commerce, 1980);

-- The general effects of development on natural heritage sites is described on pages 56 to 58. Land use activities can promote shoreline erosion and bluff recession. Land use activities in proximity to the bluff crest can cause vegetation changes on the lake bluff. Change in vegetation cover is directly associated with lake bluff erosion and recession. Vegetation provides protection from minor erosional forces to the bluff slope and crest and, thereby, provides a degree of bluff stability. The degree of protection relates to the type of vegetation present on the bluff slope, crest, and behind the crest. Dense vegetation reduces the ability of surface and subsurface runoff to erode the lake bluff. The root structure of woody vegetation provides more stability than that provided by sod formed by herbaceous species (The Great Lakes Research Institute,

1975). A direct relationship between development and bluff recession has been recognized. Accelerated bluff erosion is directly related to the presence of development (U.S. Department of Commerce, 1980). In response to the aforementioned relationship between development and bluff recession, the State has enacted the Bluff Recession and Setback Act (Department of Environmental Resources, 1980). Development within or in proximity to the **LCA** could cause or promote shoreline erosion bluff recession (i.e., permanent habitat loss or habitat degradation); and

-- By increasing the off shore slope, off shore dredging can promote beach and lake bluff erosion, as erosion serves to replace the material displaced by dredging activities (The Great Lakes Research Institute, 1975).

While natural processes have formed and perpetuated the dynamic habitats that comprise the Erie County shoreline, human-induced processes can produce conditions that jeopardize the **Lake Shoreline LCA** by causing or accelerating the natural processes of shoreline erosion and bluff recession. To preserve the natural character of the **Lake Shoreline LCA** and the unique habitats located within this significant site, the general recommendations for Landscape Conservation Areas on page 53 need to be applied, as well as the following specific recommendations for the protection of the **Lake Shoreline LCA** (Note: Areas with heavy disturbance may be included within a LCA boundary when watershed protection is the intent of all or part of the LCA.):

(1) State, County and municipal governments should develop land use plans and related ordinances that encourage shoreline and/or lake bluff development within the natural heritage area's boundaries that preserves or enhances the natural character of the **LCA**, and encourages development that accomplishes this goal;

(2) When governments plan or review development projects proposed within the **LCA,** consideration should be given to both the direct and secondary effects of the project on the natural heritage area. Only development compatible with protection of the **LCA** should be sanctioned;

(3) Public lands located within the **LCA** should be managed to protect and/or restore the natural character of the natural heritage site;

(4) Owners of privately owned parks within the **Lake Shoreline LCA** should consider managing these parks in a manner that protects and/or restores shoreline habitats and associated natural communities;

(5) Projects that include off shore dredging within site boundaries should be evaluated to determine whether the dredging activities would adversely effect the natural heritage area. If so, the dredging activities should be modified or eliminated from the project to prevent the adverse effect(s);

(6) Shoreline control systems within site boundaries should be planned and implemented only if these systems do not adversely modify or significantly contribute to the adverse modification of the natural heritage site;

(7) To promote bluff stability, owners of property within the site boundaries are encouraged to allow the establishment of vegetation cover on the bluff and behind the bluff crest;
(8) Artificial drainage of surface waters, groundwaters, or effluents within site boundaries that could contribute to bluff instability or adversely modify the quality and/or quantity of site hydrology should be avoided; and
(9) Federal, state, and local governments should encourage and, as appropriate, undertake the preservation and restoration of shoreline and lake bluff habitats on public lands.

Within the Erie North Quadrangle, the **Lake Shoreline LCA** contains about 5.2 miles of Lake Erie shoreline, as well a natural heritage area of exceptional significance -- the **Presque Isle BDA/OHA**. (This natural heritage is described on pages 82 to 96.) Along this section of the **LCA,** shoreline habitats are bordered by or directly disturbed by urban and waterfront development. Urban development has occurred near the bluff crest, and, occasionally, on the bluff crest or slope. Urban development has also modified lake bluff habitat by changing landform configuration, inducing fragmentation, or altering/removing natural vegetation cover. Urban development within the City of Erie has resulted in the total loss of bluff habitat in some areas. However, to the extent that the lake bluff habitat and hydrology remain intact, the restoration of natural vegetation communities is possible. Other shoreline habitats have been disturbed or lost as a result of waterfront development. Despite this extensive disturbance, portions of the shoreline could be restored and remediation should be pursued. **On the Erie North Quadrangle, the boundaries of the LCA encompass the Presque Isle BDA/OHA, as well as the City of Erie and portions of adjacent municipalities. The urbanized area is contained within the LCA as both existing and future land use activities within these municipalities can significantly influence the ecological integrity of the bay's limnology (Potomac-Hudson Engineering, Inc., 1991), as well as the contiguous shoreline.** Refer to the **Presque Isle BDA/OHA** description on pages 82 to 96 for additional information on the **BDA/OHA** and recommendations regarding protection and management.

For the section of the **LCA** on the Erie North Quadrangle, the following recommendations for the protection of natural heritage areas should be applied: (1) the general recommendations regarding Landscape Conservation Area site protection on page 53; (2) the specific recommendations for the protection of the **Lake Shoreline LCA** on page 81; and (3) the recommendations specific to the **Presque Isle BDA/OHA** on pages 86, 92, and 97 to 97.

Presque Isle BDA/OHA is a high diversity area that results from an intricate interdependency between geological processes and natural communities. The primary components of this ecosystem are the numerous natural communities that occur on the sandspit peninsula (i.e., Presque Isle); the natural embayment formed by the sandspit peninsula (i.e., Presque Isle Bay); and the open waters of Lake Erie

contiguous with the peninsula shoreline to a depth of about 30 feet (Sullivan, 1991). The **Presque Isle BDA/OHA** is represented on the Erie North, Erie South, and Swanville Quadrangles.

The **Presque Isle BDA/OHA** contains an ecological resource that is unique within the state. This ecological resource is also rare within the Great Lakes Basin and uncommon on the North American continent. A considerable amount of information documents natural systems and biodiversity within the **Presque Isle BDA/OHA**. Presentation of the information available on Presque Isle peninsula in the format used throughout the remainder of the inventory would unnecessarily encumber the report. Therefore, rather that listing the individual occurrences of natural communities and numerous occurrence of the 120 species of special concern populations on the peninsula, the different types of natural communities present are described. And for those natural community types that provide special species habitat only the species associated with that habitat are listed, rather than each special species population occurrence within the community. The primary resources (Campbell, In press; Sullivan, 1991; Bissell and Bier, 1987) utilized to prepare the description of the peninsula's biotic resources should be reviewed if more detailed information is sought by the reader.

The **Presque Isle BDA/OHA** is comprised of lacustrine, palustrine, and terrestrial natural communities. The lacustrine natural communities are the Eastern Great Lakes littoral zone (**NC001**) and the Eastern Great Lakes bay (**NC008**). Palustrine natural communities contained within the sandspit are: sandspit pond and bay community (**NC002**), Great Lakes palustrine sandplain (**NC003**), robust/graminoid emergent marsh (**NC004**), and circumneutral shrub swamp (**NC005**). The Eastern Great Lakes beach-dune (**NC006**) and dry-mesic Great Lakes sandplain (**NC007**) are the terrestrial communities. Over 3,000 species of flora and fauna inhabit these natural communities, including 440 species of prokaryotes, algae, and fungi; 882 species of vascular plants; 1,251 invertebrate species; and 434 vertebrate species (Campbell et al., In press).

Of the 3,000 species that occur in the **Presque Isle BDA/OHA**, 130 species of special concern occurrences have been confirmed to a precision that allows their inclusion in the inventory (80 species), while 50 reported species of special concern occurrences are still being investigated by PNDI. These species of special concern include vascular plants and invertebrate and vertebrate fauna. In addition to the species of special concern occurrences within the PNDI database, several other species of special concern are reported which inhabit the **Presque Isle BDA/OHA** on a permanent or temporary basis, including three insects, eight fishes, two reptiles, and 36 birds (Campbell et al., In press).

Within the **Presque Isle BDA/OHA**, 63 confirmed vascular plant species of special concern occur within these natural communities (J. Nelson, DER Bureau of Forestry, memo., 2/17/93). Of these 63 species, 49 were available for the inventory via the PNDI database; the other 14 species were only recently confirmed, which prevented listing these species with their natural community habitats. In addition to the confirmed special plant species, reported occurrences of 50 special plant species are being investigated.

Special animal species also occur in the natural communities that comprise the **Presque Isle BDA/OHA**. PNDI indicates that eight mollusks, classified as species of special concern inhabit both the Eastern Great Lakes bay community (**NC008**) and Eastern Great Lakes sandspit pond and bay community (**NC002**). Of these eight mollusks, the occurrences of three species have been confirmed to a precision that allows their inclusion in the inventory. The Pennsylvania Fish and Boat Commission reports 12 fishes that occur in Presque Isle Bay that are species of special concern (R. Kenyon, Pa. Fish Comm., correspondence, 7/1/92). The fish species are addressed in the description of the Eastern Great Lakes Bay (i.e., Presque Isle Bay) natural community (**NC008**). Campbell et al. (In press) reports 36 birds considered by the Pennsylvania Game Commission to be state species of special concern. Of these 36 species three have been confirmed to a precision that allows their inclusion in the inventory. There are six insects of special concern reported to utilize the natural communities within the Presque Isle sandspit. One of these insect species occurrences have been confirmed to a precision that allows inclusion in the inventory. Two reptiles that are species of special concern, a snake and a turtle, may inhabit the **Presque Isle BDA/OHA** (Campbell et al., In press). While the habitat for the snake is present, the occurrence of this species has not been confirmed. The turtle has been observed within the **BDA/OHA**, however, the occurrence is suspected to be accidental.

As noted above, the overall occurrence of faunal species that permanently or temporarily utilized the **Presque Isle BDA/OHA**'s natural communities is equally impressive. Three hundred twenty-one (321) species of birds have been reported in the vicinity of and on the sandspit. More than a third of these bird species prefer aquatic habitats. The lacustrine natural communities (**NC001** and **NC008**), Great Lake sandspit pond and bay communities (**NC002**), and palustrine natural communities (**NC003**, **NC004**, and **NC005**) account for much of the **BDA/OHA**'s avian diversity (Campbell et al., In press). Many of the natural communities within the **BDA/OHA** provide or have the potential to provide habitat for migratory shorebirds and raptors. One of these shorebirds and two raptors are federally endangered species that historically inhabited **Presque Isle BDA/OHA**. **Presque Isle BDA/OHA** is a critical staging area for

migratory birds (Sullivan, 1991), including passerines, waterfowl, water birds, and shorebirds. The **BDA/OHA** also provides permanent habitat for a number of birds. More than one half of the fish species known in Lake Erie utilize the waters within the **BDA/OHA** (Campbell et al., In press). Game fish (17 species) and commercial fish species (15 species) occur in the waters of this natural heritage area (Sullivan, 1991).

The exceptional natural communities, wildlife, and aquatic life diversity within the **BDA/OHA**, as well as other natural attributes have made **Presque Isle BDA/OHA** a popular recreational area. As noted in the **Presque Isle State Park** Managed Land description on page 96, numerous recreational opportunities are available and extremely high recreational use occurs throughout most of the **BDA/OHA**. Efforts by the Pennsylvania DER Bureau of State Parks, municipalities, public/private organizations to accommodate recreational use of **Presque Isle BDA/OHA** has resulted in the partial loss or modification of the natural communities that make this natural heritage area an exceptional ecological resource. Significant portions of natural communities have been lost by the development of waterfront and recreational facilities. (The general effects of development on natural heritage areas are described on pages 56 to 58.) Over use of some natural communities (**NC002** through **NC008**) can damage or degrade these natural communities and associated vegetation communities. Aerial reconnaissance conducted for the inventory confirms that the **BDA/OHA** has been extensively modified by development. These modifications are addressed in the descriptions of the Eastern Great Lakes littoral zone (**NC001**), Eastern Great Lakes bay (**NC008**), and the recurved sandspit which contains natural communities **NC002** through **NC007**.

Available research pertaining to biotic and abiotic conditions/trends and effects of recreational activities on biota in the **BDA/OHA** suggests that, while the **BDA/OHA**'s ecological resources are still exceptional, the integrity of the natural communities (**NC001** through **NC008**) is jeopardized to various degrees (Campbell et al., In press; Potomac-Hudson, Inc., 1991; Kline, 1984). Although a few of the threats are not attributable to intensive recreational use many of them are. The environmental effects of these threats jeopardizes the ecological integrity and exceptional biodiversity of the **Presque Isle BDA/OHA**. Consequently, the quality of recreational experiences and, hence, the tourist attraction value provided by these natural communities appears jeopardized. Environmentally sound land/water use practices need to be implemented within the **BDA/OHA**, which protect and/or restore each of the natural communities, as well as the integrity of the entire ecosystem. The general recommendations for the protection and management

of Biological Diversity Areas (page 52) should be applied to the **Presque Isle BDA/OHA** with the exception of those natural communities that retain nearly pristine conditions. These areas need to be managed per the general recommendations for Natural Areas on page 52. For example: As described below the natural communities that inhabit the interior of the sandspit retain a nearly pristine condition despite isolated recent disturbances from development and infiltration by exotic/weedy species. These natural communities need to be managed as Natural Areas in order to enable restoration and preservation of their unique ecology and exceptional biodiversity. In addition to the general recommendations on page 52, the specific recommendations made for the protection of the ecological resources that comprise the **Presque Isle BDA/OHA** need also be applied.

The Eastern Great Lakes littoral zone (**NC001**) consists of the shallow, near-shore region of the lake. This area is subject to fluctuating temperatures and erosion via wave action and grinding ice (Cole, 1983). The **NC001** littoral zone extends from zero depth to the outer limits of benthic algae. Algae rather than benthic macroflora characterizes the vegetation of the littoral zone because extreme wave action prevents the establishment of rooted vegetation. A variety of benthic habitats are provided in the littoral zone. Benthos diversity and productivity tend to be greater in the littoral zone due to a greater variety of habitats than found in deeper benthic zones (Cole, 1983). The Eastern Great Lakes littoral zone (**NC001**) substrate consists of sand and cobble. Until recently, the littoral substrate was entirely derived from the naturally occurring beach sediments transported via littoral drift along the southern lake shoreline. (Refer to page 87 for additional information on this geophysical process). The annual beach replenishment project implemented on the peninsula's lake side beaches deposits sands which differ in size and composition from the water sorted sands provided via littoral transport. There is concern that the entrance of these sands into the littoral zone via shoreline erosion adversely modifies the littoral habitat and, consequently, the benthos that utilize this habitat. The disruption of a geophysical process (i.e., erosion) intended by the recently constructed breakwater shoreline control structures may also adversely modify the habitats within littoral zone (**NC001**) and the geologic integrity of the sandspit, thereby eliminating or degrading natural communities **NC002** through **NC007**. (Additional information on the adverse effects of shoreline control systems on shoreline habitats is on page 79.) Aerial reconnaissance conducted for the inventory revealed that the erosion and deposition pattern characteristic of shoreline control structures constructed perpendicular to shore has been induced by the recently constructed breakwater shoreline control structures.

The result is an inversely "scalloped" shoreline from the neck of the sandspit to the end of eastern most breakwater, where induced erosion is causing shoreline loss in the area known as Gull Point.

The Eastern Great Lakes littoral zone (**NC001**) contains a special species habitat for a fish (**SA001**) that requires a specific type of sand substrate. The species is classified as critically imperiled in the state, as well as a candidate for federal protection. Within Erie County the occurrence of **SA001** is rare and limited to the **Presque Isle BDA/OHA**, and a few streams. Lack of substrate habitat is the primary reason for the species' state and federal status.

Presque Isle Sandspit is considered to be one of Pennsylvania's outstanding geological features (Geyer and Bolles, 1979). **Presque Isle Sandspit** is a northeast tending approximately 3,200 acre recurved sandspit peninsula that extends about seven miles into Lake Erie and varies in width from several hundred feet to about 1.25 miles. The sandspit began to develop less than 13,000 years ago after the final retreat of glacial ice from northwestern Pennsylvania. The beach gravels and sands of the sandspit originated from glacial deposits. Lake bluffs near Ashtabula, Ohio are the richest source of these beach sands and gravels and a primary source of the beach sands and gravel in the county's shoreline waters. Erosion of these bluffs adds beach sediment to the littoral zone of Lake Erie. Lacustrine sediments are also derived from elsewhere on the south Lake Erie shoreline. Prevailing westerly winds and the resulting wave action create the predominant west to east littoral drift that transports the beach sediments along the south lake shoreline (Campbell et al., In press; Kormandy, 1969).

The process by which lacustrine sediments are transported, deposited, eroded, and supplemented to form shoreline habitats is described on page 78. Kormandy (1969) indicates that a large shoal about five miles up current from the present location of the sandspit was where the sandspit first formed. The shoal obstructed beach sediment transport enabling the development of the sandspit from coalescing shoreline habitats. Like all the shoreline habitats on the Erie County shoreline, the sandspit is a dynamic landform. Since formation, the physical forces of wave action, wind, grinding ice, shoreline currents, and fluctuating lake levels supplemented by lacustrine sediments have constantly modified the sandspit's lake shoreline configuration via erosion and deposition. Over time these geophysical forces have transported the sandspit to its current location.

Both terrestrial and palustrine habitats occur on the sandspit. Ponds and bays are formed by the complete or partial enclosure of portions of the lake littoral zone by the formation of sandplains and beach-

dunes along the shoreline. This is a continual process. Hence, the lake side of the sandspit contains newly formed natural communities. Inland from the dynamic lake shoreline the natural communities are stabilized by vegetation. The vegetation which characterizes these natural communities varies with the range of geophysical conditions present on the sandspit: age (one to several hundred years), hydrology (inundated to xeric), chemistry (alkaline to acidic), topography, and the extent of soil development. Given the porous substrate of which the sandspit is composed, hydrologic conditions present are closely associated with fluctuating lake levels. As lake levels fluctuate, groundwater tables and surface water levels fluctuate. Hydrologic changes induce changes in the vegetation assemblages within the sandspit's palustrine natural communities (**NC002** through **NC005**). Changes in vegetation composition of these natural communities vary with the extent and duration of lake water level changes (i.e., hydroperiod), as well as the ability of plant species to adapt to changes in hydric conditions. Given the proper conditions, seedbanks will also respond to hydrologic changes. Seedbanks associated with certain **Presque Isle BDA/OHA** habitats can remain viable for up to a century (C. Bier, Western Pa. Conservancy, pers. commun.). These seedbanks likely contain species of special concern, as well as more common species characteristic of the peninsula's natural communities. So, in addition to the dynamic palustrine and terrestrial shoreline natural communities that characterize the lake side periphery of the sandspit, the natural fluctuations in hydrology make the vegetation assemblages associated with palustrine natural communities located in the interior and on the Presque Isle Bay side of the sandspit dynamic natural communities.

Generally speaking, the natural communities on the sandspit are progressively older toward the Presque Isle Bay side and on the western end of Presque Isle Peninsula. The result is a mosaic of natural communities (i.e., habitats) supporting a diverse assemblage of flora that represents a continuum of successional seral stages, tending from palustrine ponds and bays (i.e., hydric) to a terrestrial (i.e., xeric) climatic climax community (Kormandy, 1984; 1969). Floral diversity in combination with natural community diversity provides habitats for exceptional faunal diversity.

The natural communities contained within the sandspit consist of the sandspit pond and bay community (**NC002**), Great Lakes palustrine sandplain (**NC003**), robust/graminoid emergent marsh (**NC004**), circumneutral shrub swamp (**NC005**), Eastern Great Lakes beach-dune (**NC006**), and dry-mesic Great Lakes sandplain (**NC007**). Each of these natural communities provides habitat for plant and/or animal species of special concern. In keeping with the aforementioned seral biotic diversity present on the sandspit,

the six natural communities are themselves characterized by a high diversity of vegetation assemblages per Bissell and Bier (1987).

The sandspit pond and bay communities (**NC002**) are located along the bay shoreline and within interior sandspit ponds. The ponds contain aquatic beds in various stages of development. Those with well developed aquatic beds are sometimes sparsely covered with spatterdock (Nuphar advena), fragrant water lily (Nymphaea odorata), water-shield (Brasenia schreberi), and a pondweed (Potamogeton natans). Within the state, **NC002** communities are unique to Erie County. **NC002** communities provide habitat for 12 species of special concern: six special plant species populations (**SP001** through **SP006**) and six special animal species (i.e., mollusks and fishes) populations (**SA002** through **SA007**). Seven of these species of concern (**SP001**, **SP002**, **SA002** through **SA005**, **SA007**) are classified as critically imperiled in the state. **SA002** is a considered to be globally rare or local throughout its range and is a federal candidate species. Two special plant species (**SP004** and **SP005**) are imperiled in Pennsylvania and considered endangered and threatened in the state. **SP003** and **SP005** occurrences are rare to uncommon in Pennsylvania. In Pennsylvania, **SA006** is known only to occur within the sandspit pond and bay communities (**NC002**).

The Great Lakes palustrine sandplain (**NC003**) is a sparsely vegetated, moist sandy flat. Standing water is seasonally present, however, the water table usually drops below the surface in the summer. These plant species characterize **NC003** communities: a sedge (Juncus articulatus), baltic rush (J. balticus), Richardson's rush (J. alpinus), a flatsedge (Cyperus rivularis), (C. flavescens), small-flowered false-foxglove (Agalinis paupercula), green sedge (Carex viridula), elk sedge (C. garberi), and larger Canadian St. John's-wort (Hypericum majus). Several special plant species (**SP007** through **SP025**) occur within the palustrine sandplain communities (**NC003**). Ten of these special plant species (**SP007** through **SP010**, **SP013** through **SP016**, **SP023**, and **SP025**) are critically imperiled in the state and six (**SP011**, **SP017** through **SP019**, **SP020** and **SP022**) are classified at imperiled in the state. The last three special plant species (**SP013**, **SP021**, **SP023**) are rare or uncommon in the state. All of these special plants species are also rare in Erie County, as palustrine sandplains (**NC003**) are restricted to Presque Isle.

Robust/graminoid emergent marshes community (**NC004**) consists of an emergent wetland complex that contains cattail (Typha) marshes, sedge (Carex) meadows, bluejoint grass (Calamagrostis) marshes, water lily-pickerelweed (Nuphar/Nymphaea-Pontideria) marshes and maple-oak-blackgum-buttonbush (Acer-Quercus-Nyssa-Cephalanthus) savannahs with extensive mixed herbaceous marsh openings. **NC004**

is one of two areas on the Presque Isle sandspit that is recognized as an unique ecosystem (Sullivan, 1991). The robust/graminoid emergent marsh community provides habitat for 12 species of special concern: three special animal species (**SA008**, **SA009**, and **SA010**) and nine special plant species (**SP026** through **SP034**). Animal species **SA010** is a sedge feeding insect that is critically imperiled in the state. **SA008** and **SA009** are bird species that are endangered and threatened in Pennsylvania, respectively. The special plant species are all of state significance: **SP026**, **SP029**, **SP016**, and **SP032** are critically imperiled; **SP027**, **SP028**, **SP030**, and **SP033** are imperiled; and **SP034** is rare to uncommon in the state.

NC005 consists of three types of circumneutral shrub swamps vegetation assemblages: mixed circumneutral deciduous swamp, buttonbush-water willow (Decodon verticillatus) shrub swamp, and mixed broadleaf shrub-broadleaf tree swamp savannah. **NC005** provides habitat for a special animal species (**SA011**) - a bird that is considered to be imperiled in the state.

The Eastern Great Lakes beach-dune community (**NC006**) is the other natural community on Presque Isle considered to be a unique ecosystem (Sullivan, 1991). **NC006** consists of sparsely vegetated sand dunes and the shifting sands of open beaches. (Ammophila breviligulata) and common cottonwood (Populus deltoides) are the most frequent dune builders. Active dunes are best developed from the Light House to the tip of the sandspit (i.e., Gull Point). Populations of special plant species **SP037** and **SP042** are dominant plant species in the beach-dune community (**NC006**). Special plant species **SP035** is a dominant plant on sand dunes. In addition to these three special plant species the beach-dune community (**NC006**) provides habitat for six other plant species of special concern **SP036**, **SP038** through **SP041**, and **SP043**. Of the nine species of special concern that inhabit **NC006**, two special plant species (**SP036** and **SP043**) are classified as critically imperiled in the state, five species (**SP035**, **SP037**, **SP038**, **SP040**, and **SP042**) are critically imperiled in the state, and two (**SP039** and **SP041**) are rare or uncommon in the state.

The dry-mesic Eastern Great Lakes sandplain community (**NC007**) is an open, dry grassland usually dominated by wood-grass (Sorghastrum nutans), a panic grass (Panicum virgatum), and a beardgrass (Andropogon scorparius). Other species common to the dry-mesic sandplain community are: Muhlenberg's sedge (Carex muhlenbergii), shaved sedge (C. tonsa), sheep sorrel (Rumex acetosella), and a panic grass (Dichanthelium sabulorum). **NC007** consists of seven distinct natural vegetation assemblages and a mixed pine plantation that was planted in one of the **NC007** communities. The natural vegetation assemblages include: a mixed graminoid sandplain vegetation assemblage; mixed forest sandplain savannah dominated

by a black oak-sassafras-black cherry (Quercus velutina-Sassafras-Prunus serotina) savannah; a shrub thicket sandplain vegetation assemblage dominated by common cottonwood-wax-myrtle-morrow honeysuckle (Populus deltoides-Myrica-Lonicera Morrowi) shrub thicket; a shrub savannah sandplain dominated by wood-grass (Sorgastrum nutans); a Great Lakes broadleaf sandplain forest consisting of a common cottonwood loam forest; a crack willow-white willow (Salix fragilis-S. alba) forest; and oak-black cherry-red maple (Quercus-Prunus serotina-Acer rubrum) forest. Five special plant species (**SP044** through **SP048**) occur within the dry-mesic sandplain community (**NC007**). In the state, the occurrences of these special plants ranges from critically imperiled (**SP047**), critically imperiled/imperiled (**SP046**), imperiled (**SP044**), imperiled/rare or uncommon (**SP048**), and rare or uncommon/apparently secure (**SP045**).

Threats to the sandspit's ecological integrity are the basis for recent research (Campbell et al., In press; Bissell, 1992; Bissell and Bier, 1987; Kline, 1984). This research focuses on biodiversity trends, the effects of recreational activities on wildlife and aquatic life habitat, and the threats posed to natural communities and species of special concern by recreational use, exotic species, and water quality degradation. Aerial reconnaissance of the Presque Isle sandspit indicates that development has significantly modified this natural heritage area. As noted on page 86, the lake shoreline has been effected by the two primary shoreline control systems -- beach replenishment and the off shore breakwater system. These erosion control methods appear to adversely effect shoreline natural communities by modification of substrate or disruption of the geophysical processes that form these habitats. The Presque Isle bay shoreline has also been significantly modified by a riprap shoreline control system that extends along most of the shoreline. (Refer to page 79 for the effects of shoreline control systems on shoreline habitats/natural communities.) Both natural communities and associated species of special concern, as well as the extent and quality of wildlife/aquatic life habitats have been adversely effected or lost due to these shoreline control systems. Development of recreational facilities and associated infrastructure has resulted in the partial loss and fragmentation of natural communities. (Refer to pages 56 to 64 for information of the general effects of development and fragmentation on natural heritage areas.) East of Long Pond, within the road that encircles the sandspit's interior, a considerable portion of the sandspit's interior natural communities remain in essentially pristine condition.

Protection of the exceptional biodiversity represented in the natural communities (**NC002** through **NC007**) on the sandspit and their associated species of special concern requires that the ecological integrity

of each natural community and the entire sandspit be protected from recreational overuse, and that the geophysical processes that are responsible for sandspit formation and, hence, creation of lake side natural communities not be disrupted by shoreline control systems. Protection of the natural communities and numerous species of special concern also requires that excess inputs of nutrients, sediments, and contaminants from on-site and off-site land uses be controlled and as necessary remediated. Thus, water quality and palustrine and lacustrine substrate integrity for the entire **Presque Isle BDA/OHA** needs to be maintained or enhanced by remediation. Exotic plant species that are invading the natural communities need to be controlled per Bissell (1992) and Bissell and Bier (1987). Exotic plant species pose a threat to the ecological integrity of several of the **BDA/OHA**'s natural communities (e.g., common reed (Phragmites) has invaded natural communities, resulting in community degradation). Current efforts to limit/prevent deer damage to natural communities, and associated special plant species, needs to be continued. Existing shoreline habitats for waterfowl, shorebirds, and waterbirds need to be maintained and those degraded or lost by development and shoreline control systems should be restored. Management plans implemented by **Presque Isle State Park** and **Coast Guard Station Erie** need to address the aforementioned threats via natural community ecosystem monitoring and protection, recreational use management, and natural community restoration.

The Eastern Great Lakes bay community (**NC008**) component of the **Presque Isle BDA/OHA** is commonly known as Presque Isle Bay. This natural community (**NC008**) consists of the open waters of the bay and the bay shoreline, including contiguous lake bluff habitat. As a natural community **NC008** is classified as critically imperiled in the state due to rarity. Like the other components of the **BDA** the bay has several biotic resources that are of themselves of ecological significance. These natural resources include exceptional aquatic biotic assemblages, partially intact shoreline habitats, an exemplary natural community that occupies a portion of the lake bluff, and special species habitats. **NC008** is represented on the Erie North and Swanville Quadrangles. The following description of **NC008** contains general information on the natural community's natural characteristics as well as specific information regarding the biotic resources represented on the Erie North Quadrangle. (Refer to pages 158 for a description of the portion of the Eastern Great Lakes bay community represented on the Swanville Quadrangle.)

NC008 has a small drainage basin, consisting of the Scott Run, Mill Creek, and Cascade Creek watersheds. The primary sources of water are precipitation and the Mill Creek and Cascade Creek

watersheds. Both of these streams have been modified to various degrees by channelization. While water does enter the bay (**NC008**) from Lake Erie, the flushing rate indicates that the lake is not a constant source of water. However, occasional changes in prevailing lake currents does result in water exchange between the lake and bay. Despite these water exchanges, the bay is a relatively closed aquatic system. Most of the **NC008** drainage basin is densely developed. As a consequence, wastewaters (domestic and industrial) and storm waters are now generally discharged into the municipal wastewater treatment plant. In the past this was not the case. Even now, below capacity municipal infrastructure discharges untreated wastewaters into **NC008,** during and after precipitation events. Permitted wastewater discharges are also permitted (Potomac-Hudson, Inc., 1991). Remarkably, Presque Isle Bay (**NC008**) retains many significant biotic resources, however, the effects of past and present untreated wastewater discharges on water quality and substrate contamination by various types of pollutants compromises the preservation of the natural community's ecological resources.

Presque Isle Bay is approximately 3,718 acres in size. The embayment is a shallow estuary with a substrate largely composed of organic sediments, although sand is a dominant substrate at the mouth of streams and near the navigational channel (Potomac-Hudson Engineering, Inc., 1991). Because the bay is shallow the annual circulation pattern is cold monomictic (i.e., wind and wave action mixes the entire water column except when the water is covered by ice) (Potomac-Hudson Engineering, Inc., 1991; Cole, 1983). The annual circulation pattern of Presque Isle Bay, coupled with an extensive littoral zone, promotes primary productivity.

Per aerial reconnaissance, the embayment's (**NC008**) littoral zone contains an extensive aquatic bed of floating and submerged aquatic vegetation, as well as large areas of robust/graminoid emergent marshes. The **NC008** littoral zone is a transition area between the natural communities that occupies the sandspit shoreline and the lacustrine portion of the Eastern Great Lakes bay (**NC008**). Thus, the palustrine natural communities located along the bay/sandspit shoreline and in the western end of the bay contain the vegetative characteristics of these palustrine sandspit natural communities: sandspit pond and bay community (**NC002**), robust/graminoid emergent marshes community (**NC004**), and circumneutral deciduous shrub swamp community (**NC005**). The extensive aquatic bed and large robust/graminoid emergent marsh areas respectively represent natural communities **NC002** and **NC004**. (Refer to the

description of **NC002**, **NC004**, and **NC005** on pages 89 and 90for the vegetation assemblages that characterizes these natural communities.)

Like the sandspit bays, the littoral zone of Presque Isle Bay (**NC008**) contains viable mollusk populations, including three special animal species of special concern -- **SA013**, **SA014**, and **SA015**. Two of these special animal species, **SA013** and **SA015**, are critically imperiled in the state. **SA014** is classified as rare or uncommon/apparently secure in the state. Protection of these special animal species requires at least the maintenance of water quality and protection of substrate habitat from damage/degradation related to untreated wastewater discharges and water-based recreational activities. Zebra mussels are a serious threat to all the mollusk species in **NC008** and elsewhere in the **Presque Isle BDA/OHA**.

Extensive areas of aquatic vegetation provides habitat for water dependent wildlife and creates a viable estuary within the embayment (**NC008**). The western end of Presque Isle Bay is considered to be ".. viable, productive and thusly, valuable spawning area for a number of species...", including **SA003**, largemouth bass, northern pike, yellow perch, gar, and number of centrarchids and cyprinids. Overall, 63 fish species use the bay habitat (R. Kenyon, Pa. Fish Comm., correspondence, 7/1/92). Seven of these species are classified as species of special concern. Of the seven species of special concern reported by the Pennsylvania Fish and Boat Commission, one special animal (fish) species (**SA016**) occurs at three separate locations in the bay community (**NC008**) and has been confirmed to a precision that enables inclusion in the inventory. **SA016** is classified as critically imperiled in the state and a federal candidate species. Lack of available habitat is the primary reason this special animal species is imperiled from both a state and national perspective. Even within **NC008** the sandy substrate this species requires is limited to areas of the littoral zone along the southern bay shoreline. As noted in the general description of the **Presque Isle BDA/OHA**, **NC008** contains a noteworthy sport and commercial fishery, as well as habitat for water dependent wildlife.

Protection of the natural communities (**NC002** and **NC003**) that occur within the **NC008** littoral zone, the special plants and animals (**SP049** and **SA012** through **SA016**) that inhabit **NC008**, and the viable estuary that supports an exemplary fishery is essential for the preservation/conservation of this component of the **Presque Isle BDA**. An excellent literature review of the general effects of water-based recreational activities on freshwater flora and fauna is provided by Liddle and Scorgie (1989). The general effects of development and fragmentation described on pages 56 and 64 are evident within the lacustrine and palustrine natural communities that comprise the section of **NC008** depicted on the Erie North Quadrangle,

as well as natural communities **NC002**, **NC003**, and **NC008**, the lake bluff mesic central forest community and shoreline habitats depicted on the Swanville Quadrangle.

Specific recommendations for the protection of the exceptional biodiversity represented in natural communities **NC002** through **NC007** are addressed on page 92. In addition to those recommendations, the following recommendations need to be implemented to maintain existing ecological integrity and enable restoration of natural characteristics that would enhance the ecological integrity of **NC008** and the entire **Presque Isle BDA/OHA**:

(1) The lacustrine, palustrine (i.e., littoral), and shoreline habitats need to be protected from recreational overuse and the direct and indirect effects of development;

(2) Existing shoreline habitats need to be preserved and remediation should be implemented to restore shoreline habitats where development has not resulted in irreversible habitat loss;

(3) Protection of the natural communities and numerous species of special concern also requires that excess inputs of nutrients, sediments, and contaminants from on-site and off-site land uses be controlled and as necessary remediated. As the drainage basin for the embayment (**NC008**) is primarily urban, permitted point-source and nonpoint-source discharges that enter the **NC008** from the drainage basin need to be monitored, and remediation needs to be implemented, which addresses ecosystem contamination from historical discharges of pollutants (Potomac-Hudson, Inc., 1991), and the on-going investigation of existing unpermitted discharges (R. Wellington, Erie Co. Dept. of Health, pers. commun.) needs to be continued. Such efforts are necessary to maintain/improve water quality and palustrine and lacustrine substrate integrity for the entire **Presque Isle BDA/OHA**, as well as **NC008**;

(4) Exotic plant species invading the natural communities within the bay (**NC008**) need to be controlled per Bissell (1992) and Bissell and Bier (1987);

(5) Control of the zebra mussel is essential to the protection of the rare and common mollusk populations within **NC008**, however, any method implemented to control/eradicate this exotic species must not adversely affect indigenous species; and

(6) Land use plans need to be formulated and implemented by the municipalities that border **NC008** which protects **NC008** natural communities from additional development, recreational overuse, and fragmentation.

Two Managed Lands are an integral part of the **Presque Isle BDA/OHA**. These Managed Lands are **Presque Isle State Park** and **Coast Guard Station Erie**. Together they occupy nearly the entire sandspit

peninsula. Of the two Managed Lands, **Presque Isle State Park** occupies all but 35 acres of the sandspit peninsula. The park is owned by the Commonwealth of Pennsylvania and managed by the Pennsylvania Department of Environmental Resources Bureau of State Parks. **Presque Isle State Park** is a major tourist attraction and a wide variety of recreational activities are permitted within the park. Over time the facilities developed to accommodate many of these recreational activities have adversely effected both the ecological integrity of the **Presque Isle BDA/OHA** and the quality of the natural resources within the **BDA/OHA**. Despite extensive disturbance, part of the **BDA/OHA** still retains essentially pristine natural communities and many of the affected ecosystems could recover, if the state agency that manages the park implements remediation. Such action would conform to the stated outdoor recreation goal of the Bureau of State Parks to design programs and facilities "...to protect the natural character of parks..." (Bureau of State Parks, 1992). **Coast Guard Station Erie** occupies 35 acres of property owned by the U.S. Coast Guard and is located on the southeast tip of Presque Isle contiguous with the state park. The U.S. Coast Guard facility partially occupies **Coast Guard Station Erie**, however, part of this Managed Land retains natural communities and associated species of special concern.

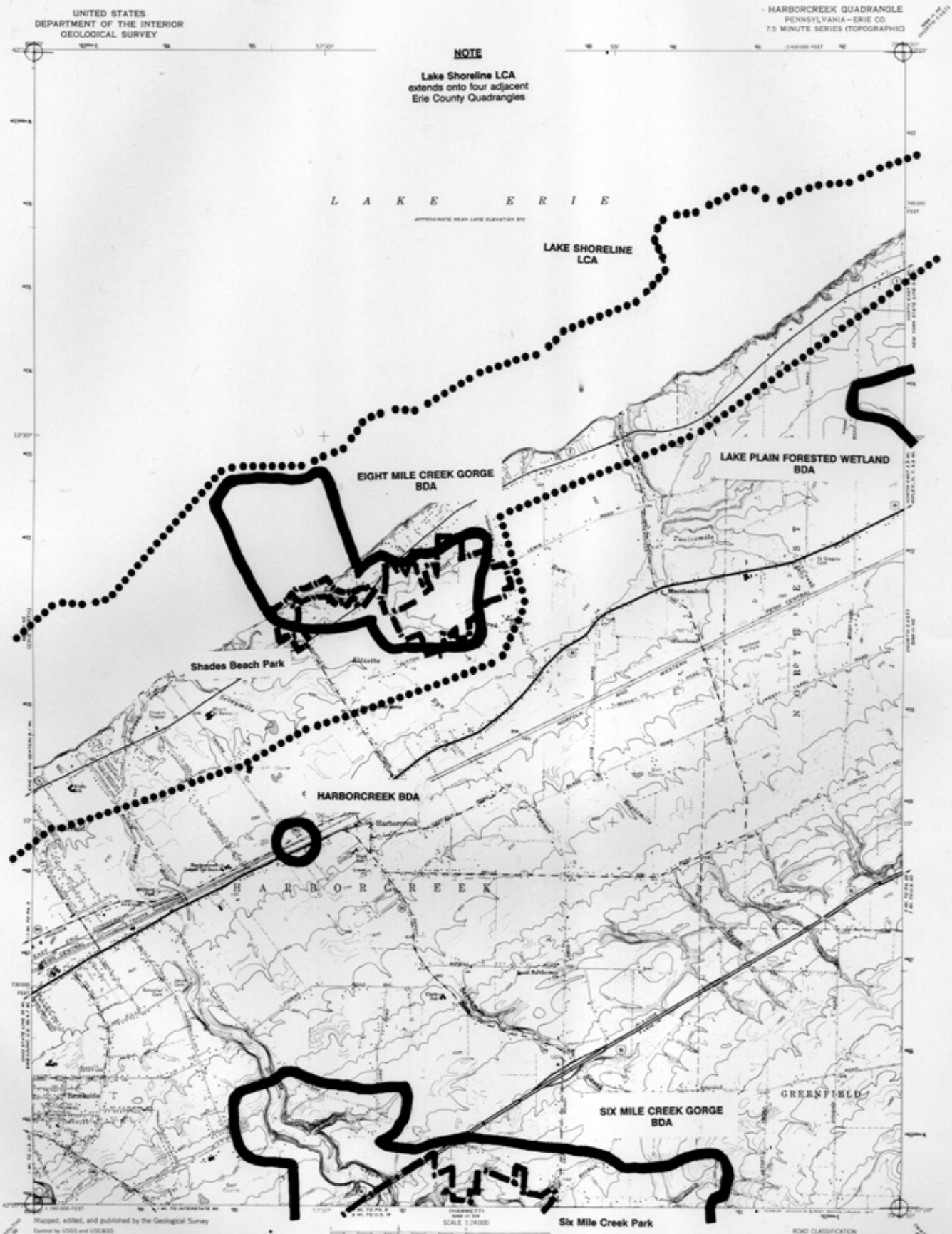
As described above, **Presque Isle BDA/OHA** contains an outstanding geological formation, a flying sandspit peninsula, (Geyer and Bolles, 1979), as well as a rare and an unusual ecosystem composed of natural communities which in Pennsylvania are unique to Erie County. This ecological resource is also rare within the Great Lakes Basin. To preserve and restore the exceptional biological resources of **Presque Isle BDA/OHA** and protect the natural attributes that have made the **BDA/OHA** a popular recreational area, the specific recommendations on pages 86, 92, 95 and 96 for the protection and management of this natural heritage area should be implemented by the Bureau of State Parks and U.S. Coast Guard. In addition, as **Presque Isle BDA/OHA** is part of the **Lake Shoreline LCA** the general recommendations on page 53 regarding Landscape Conservation Area site protection, and recommendations on page 81 for the overall management and protection of the **Lake Shoreline LCA** should be applied.

HARBORCREEK QUADRANGLE

	PNDI Rank Global	State	Legal Status Fed.	State	Last Seen
LAKE SHORELINE LCA *High Significance*					
EIGHT MILE CREEK GORGE BDA *High Significance*					
NATURAL COMMUNITY: NC001	G?	S2	N	N	1992
NATURAL COMMUNITY: NC002	G?	S1	N	N	1992
SPECIAL PLANT: SP001	G5	S1	N	PE	1986
SPECIAL PLANT: SP002	G5	S1	N	PE	1986
SIX MILE CREEK GORGE BDA *Exceptional Significance*					
NATURAL COMMUNITY: NC003	G?	S3	N	N	1992
NATURAL COMMUNITY: NC004	G?	S2	N	N	1992
NATURAL COMMUNITY: NC005	G?	S1	N	N	1992
SPECIAL PLANT: SP003	G5	S1	N	PE	1992
LAKE PLAIN FORESTED WETLAND BDA *High Significance*					
NATURAL COMMUNITY: NC006	G?	S2S3	N	N	1992
SPECIAL PLANT: SP004	G3G5	S3	N	PT	1992
SPECIAL PLANT: SP005	G5	S1	N	PE	1992
HARBORCREEK BDA *Notable Significance*					
SPECIAL PLANT: SP006	G5T?	S3S4	N	PT	1992

MANAGED LANDS:

Shades Beach Park
Six Mile Creek Park


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
HARBORCREEK QUADRANGLE
PENNSYLVANIA—ERIE CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NOTE
Lake Shoreline LCA
extends onto four adjacent
Erie County Quadrangles
L A K E E R I E
LAKE SHORELINE
LCA
EIGHT MILE CREEK GORGE
BDA
LAKE PLAIN FORESTED WETLAND
BDA
Shades Beach Park
HARBORCREEK BDA
H A R B O R C R E E K
SIX MILE CREEK GORGE
BDA
Six Mile Creek Park
GREENFIELD
NORTH EAST
Mapped, edited, and published by the Geological Survey
SCALE 1:24000
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
ROAD CLASSIFICATION
HARBORCREEK, PA.
1960
PHOTOREVISED 1970

HARBORCREEK QUADRANGLE

The **Lake Shoreline LCA** extends along the entire 7.8 miles of Lake Erie shoreline on the Harborcreek Quadrangle. Based on aerial reconnaissance, this section of the **LCA** contains both vegetated and unvegetated areas. The unvegetated portion of the lake bluff retains the habitat needed to permit establishment of seral vegetation stages provided measures are taken to promote lake bluff stability.

The lake bluff in the vicinity of Eight Mile Creek contains near vertical slopes that are sparsely vegetated, as well as a section that has a more gradual slope vegetated by woody species. Extensive areas of the bluff are unvegetated. A narrow beach borders the bluff base. Shale is exposed at the base of the lake bluff. No groundwater seeps occur on the bluff, although the substrate was mesic in part. On the primarily unvegetated portions of the bluff the dominant vegetation was coltsfoot (Tussilago farfara) and a meadow-grass (Poa sp.). These species dominate the lake bluff slope, where woody species occur: flowering raspberry (Rubus odoratus), green ash (Fraxinus pennsylvanica), late goldenrod (Solidago gigantea), riverbank grape (Vitis riparia), coltsfoot, tulip poplar (Liriodendron tulipifera), sour cherry (Prunus cerasus), common fleabane (Erigeron philadelphicus).

The bluff crests on either side of the Eight Mile Creek stream mouth contain different plant communities. The bluff crest east of the stream mouth is narrow as the crest is paralleled by the stream valley. The dominant vegetation on the northwest facing bluff crest is beech (Fagus grandifolia), eastern hemlock (Tsuga canadensis), black oak (Quercus velutina), meadow-grass (Poa sp.), and a moss. This portion of the bluff crest contains vegetation indicative of a bluff crest unaffected by human disturbance. The bluff crest on the west side of the stream mouth has been modified. An exotic species, common privet (Ligustrum vulgare), is included among the dominant species on this portion of the bluff crest. The other species that dominate the relatively young open forest on the bluff crest are ash (Fraxinus sp.), black cherry (Prunus serotina), hophornbeam (Ostrya virginiana), jewelweed (Impatiens sp.), flowering raspberry, late goldenrod, Virginia creeper (Parthenocissus quinquefolia), and may apple (Podophyllum peltatum). For more information on the **LCA** refer to the **Lake Shoreline LCA** site description on pages 75 to 79.

Residential and commercial development, and agriculture are located at or near the bluff crest throughout the section of the **LCA** on the Harborcreek Quadrangle. Shoreline control structures are scattered along the base of the lake bluff. Occasionally, stairways descend to the beach bordering the bluff. In one area a significant amount of trash has been dumped on the lake bluff from the bluff crest. Residential

development is occurring near the bluff crest west of the mouth of Eight Mile Creek. A road accesses a boat ramp on the beach west of the mouth of the stream where a shoreline control structure, a groyne, is also located. Litter and trash were rarely observed on the beach.

To preserve the natural character of that portion of the **Lake Shoreline LCA** located along the Lake Erie shoreline and the **Eight Mile Creek Gorge BDA** located within the **LCA** on the Harborcreek Quadrangle, the general recommendations for Landscape Conservation Areas on page 53 need to be applied. Specific recommendations for the overall protection and management of the **Lake Shoreline LCA** are on page 81. In addition to the specific recommendations for the entire **LCA**, the following recommendations for this particular section of the **Lake Shoreline LCA**:

(1) Ordinances that restrict trash disposal on the bluff should be enforced or, if appropriate, enacted. Trash that has been dumped on the lake bluff should be removed and properly disposed; (2) Where appropriate, property owners should remove exotic vegetation and enable revegetation by native species; and

(3) Property owners should encourage the proper disposal of trash and discourage the marking or damage of trees.

The **LCA** on the Harborceek Quadrangle also extends further inland to include another portion of Harborcreek Township. Harborcreek Township is one of six municipalities within the drainage basin of Presque Isle Bay -- an component of the **Presque Isle BDA**. **The six urban municipalities within the drainage basin of Presque Isle Bay are included in the LCA boundary, as land use activities within these municipalities can significantly effect the embayment's limnology (Potomac-Hudson, Inc., 1991).** For more information on the **Lake Shoreline LCA** and the past and present effects of land use activities within the Presque Isle Bay drainage basin on the **Presque Isle BDA/OHA** refer to pages 75 to 78, 92 and 93. For this section of the **LCA** on the Harborcreek Quadrangle, the general recommendations regarding Landscape Conservation Area site protection (page 53) and recommendations for the overall management and protection of the **Lake Shoreline LCA** (page 81) should be applied.

The section of the **Lake Shoreline LCA** located along the Lake Erie shoreline on the Harborcreek Quadrangle contains a natural heritage area and a managed land. The natural heritage area is **Eight Mile Creek Gorge BDA**, which is approximately 790 acres in size. The Managed Land is **Shades Beach Park**.

Eight Mile Creek Gorge BDA is a high diversity area that contains two natural communities considered to be of ecological significance from both a state and county perspective. The two natural communities are

a mesic central forest (**NC001**) and lake sediment slump habitat (**NC002**). The relatively mature mesic central forest community (**NC001**) is located within the Eight Mile Creek and Scott Run stream valleys. This natural community (**NC001**) is imperiled in Pennsylvania. Because the forest community is dominated by beech and sugar maple (Acer saccharum), the mesic central forest community is also uncommon in Erie County. Sub-dominant species observed within **NC001** are American basswood (Tilia americana) in the tree canopy and early meadow rue (Thalictrum dioicum), baneberry (Actaea sp.), jack-in-the-pulpit (Arisaema sp.), jewelweed, aster (Aster sp.), wild lily-of-the-valley (Maianthemum canadense) in the herbaceous layer. The mesic central forest community (**NC001**) contains a core area of 101 acres. **NC001** is bordered by about 225 acres of younger relatively undisturbed forest of various ages that provides area for the expansion of the mesic central forest community. Thus, **Eight Mile Creek Gorge BDA** contains a nearly 326 acre forest. Most of the natural heritage site is owned by Harborcreek Township and is part of **Shades Beach Park**.

Eight Mile Creek Gorge BDA contains a high gradient clearwater creek. The stream has a bedrock substrate with a few short riffles and shallow pools. Sand has accumulated in the shallow pools. The stream contains a few vegetated narrow sand and gravel bars. Although some siltation was observed within Eight Mile Creek, the stream retains its natural characteristics and qualities.

The mesic central forest community (**NC001**) bordering Eight Mile Creek is presently bordered by a wooded buffer that ranges from very narrow to extensive. Despite the lack of an adequate vegetative buffer for part of the **BDA**, **NC001** is of sufficient ecological significance to qualify as a natural heritage area. Residential and park development contiguous with and in the **Eight Mile Creek Gorge BDA** poses a threat to the ecological integrity of the site. As a result of development, little to no buffer exists adjacent to **NC001** north of and just south of State Route 5. The mesic central forest community (**NC001**) is crossed by State Route 5, fragmenting **NC001**. Maintenance of the highway right-of-way may also pose a threat to protection of the natural heritage site. (The general effects of development, fragmentation, and right-of-ways on natural heritage sites are described on pages 56, 59, and 64.) A limited amount of natural community modification has occurred within the site adjacent to the residential development located along the top of the west valley wall. Contiguous with these residences, forest vegetation has been removed from the valley wall. As a result a section of the mesic central forest community (**NC001**) has been temporarily modified. Although these vegetation modifications presently effect the quality of a section of **Eight Mile**

Creek Gorge BDA, the habitat remains to allow restoration of the forest community. Some evidence of excess sediments entering the stream were observed. Rare instances of tree carving and intentional bark removal were observed.

To preserve the mesic central forest (**NC001**) the general recommendations for Biological Diversity Areas on page 52 need to be applied. The approximately 326 acre forest within the site should be protected and allowed to develop undisturbed into a mature forest community. More specific recommendations for the protection and management of this section of **Eight Mile Creek Gorge BDA** are:

(1) Additional development within site boundaries should be prohibited. Where natural community modification has occurred near the west mouth of Eight Mile Creek, the property owners should allow natural community restoration within the stream valley;

(2) From the mouth of the stream to just above the confluence of Scott Run and Eight Mile Creek property owners that border the top of the stream valleys should permit the growth of a natural vegetation buffer within the area's boundary;

(3) The section of **Shades Beach Park** containing the **BDA** should be managed to allow the undisturbed expansion and maturation of the site's mesic central forest community (**NC001**). Management should also promote the development and/or maintenance of an adequate vegetation buffer;

(4) Within the vicinity of the natural heritage area, herbicides should not be used to maintain the State Route 5 right-of-way. Right-of-way maintenance should be conducted in a manner that protects site integrity, while meeting public safety requirements; and

(5) To protect the stream, excess input of sediments and nutrients must be avoided.

Eight Mile Creek Gorge BDA also contains lake sediment slump habitat (**NC002**). **NC002** is located on a sparsely vegetated northwest facing bluff east of the mouth of the stream. The lake sediment slump (**NC002**) that provides habitat for two special concern plant populations (**SP001** and **SP002**). **SP001** and **SP002** consist of a commonly occurring plant population and a very small plant population, respectively. Both plant species are considered to be endangered in the state. **SP001** and **SP002 are** uncommon in the county, as lake sediment slump habitat is limited. (Refer to page 77 for additional information on lake sediment slumps.)

NC002 is located within both **Eight Mile Creek Gorge BDA** and **Shades Beach Park**. The special species habitat area is located within a lake bluff area that has experienced minor disturbance -- a footpath is

in close proximity to the special species habitat area. The general recommendations on page 77 for the protection of Biological Diversity Areas need to be applied. Also, protection of **NC002** requires maintaining contiguous lake bluff habitat (i.e., protected from human-influenced processes within the site boundaries that artificially promote shoreline erosion and bluff recession). These activities are described on page 79. Bluff stability would protect the lake sediment slump habitat (**NC002**) and, thereby, protect the special species habitat for **SP001** and **SP002**.

Shades Beach Park is an approximately 301 acre Managed Land owned and managed by Harborcreek Township. This Managed Land provides recreational facilities and extensive green space for area residents. North of State Route 5 and west of the mouth of Eight Mile Creek, **Shades Beach Park** has been partially developed to provide public recreational facilities. However, nearly all of the park is forested. Most of **Eight Mile Creek Gorge BDA** (described on pages 102 to 104) is located within **Shades Beach Park** and within the Lake Erie active erosion zone. The manner in which the forest within the park is managed is critical to maintaining the integrity of the **BDA**. **Shades Beach Park** is also located within the **Lake Shoreline LCA**. To maintain the ecological integrity and natural character of the **BDA** and **LCA,** of which the park is an integral part, the specific recommendations for the overall protection and management of **Eight Mile Creek Gorge BDA** and the **Lake Shoreline LCA** on pages 103 and 81 should be applied to the management of **Shades Beach Park**.

Six Mile Creek Gorge BDA is a high diversity area that is represented on the Harborcreek and Hammett Quadrangles. The entire natural heritage area is about 3,104 acres in size, 1,056 acres of which are located on the Harborcreek Quadrangle. The portion of the **BDA** represented on the Harborcreek Quadrangle is described below. Refer to the **Six Mile Creek Gorge BDA** description on pages 133 to 136 for additional information on this exceptional natural heritage area.

The section of **Six Mile Creek Gorge BDA** represented on the Harborcreek Quadrangle contains three natural communities of ecological significance: a high gradient clearwater creek community (**NC003**), an extensive mesic central forest community (**NC004**), and a lake sediment slump habitat (**NC005**). **NC005** provides habitat for a special plant species (**SP003**) that is endangered in Pennsylvania. Each of the natural communities (**NC003**, **NC004**, and **NC005**) and the special plant species (**SP003**) are of ecological significance within the county and the state. In addition to exceptional biotic resources, **Six Mile Creek**

Gorge BDA has remarkable aesthetic qualities. Natural hazards associated with the **BDA** are high, near vertical escarpments and steeply sloped valley walls.

As the name of the natural heritage area suggests, the **BDA** contains Six Mile Creek. Six Mile Creek is a high gradient clearwater creek (**NC003**) that originates on the sloping ridge of glacial deposits that separates the lake plain and the glaciated section of the Appalachian Plateau in Erie County. The high gradient stream has cut through the glacial deposits of the ridge and lake plain to underlying Upper Devonian shales and sandstones. As the stream eroded the ridge a series of stream meanders formed creating an unusual topographic feature, as well as a deep steeply sloped stream valley. The Six Mile Creek stream valley is characterized by steeply sloped forested valley walls with a number of high near vertical shale escarpments along the stream meanders. On the Harborcreek Quadrangle steeply sloped valley walls rise about 150 feet above the stream bed (U.S. Geological Survey, 1970). Groundwater seeps on the valley walls create saturated areas and small watercourses.

Within the section of **Six Mile Creek Gorge BDA** represented on the Harborcreek Quadrangle, Six Mile Creek (**NC003**) has a shale stream bed containing gravel, boulders, and partially vegetated gravel bars. The high gradient clearwater creek (**NC003**) exhibits outstanding natural characteristics and qualities.

On the Harborcreek and Hammett Quadrangles, **Six Mile Creek Gorge BDA** contains an extensive, diverse mesic central forest community (**NC004**), approximately 551 acres in size. This forest community type is ranked as imperiled in the state. The section of the **BDA** field surveyed contained a mesic central forest community dominated by sugar maple (Acer saccharum) and American basswood (Tilia americana). Other tree species associated with the natural community dominants include shagbark hickory (Carya glabra), hophornbeam (Ostrya virginiana), red maple (Acer rubrum), eastern hemlock (Tsuga canadensis), black locust (Robina pseudo-acacia), tulip poplar (Liriodendron tulipifera), elm (Ulmus sp.), yellow birch (Betula lutea), and oak (Quercus sp.). The forest canopy is nearly closed except where wind thrown trees have created openings in the canopy. These forest openings are dominated by pale jewelweed (Impatiens pallida). The forest understory covers about 50 percent of the west valley wall surveyed. The shrub layer is sparse. The herb layer is dominated by heart-leaved aster (Aster cordifolius), pale jewelweed, and yellow mandarin (Disporum lanuginosum). The composition of the forest understory changes on the floodplain. Floodplain shrub and herbaceous strata vegetation are dominated by bramble (Rubus sp.), wild leek (Allium tricoccum), grape (Vitis sp.), and pale jewelweed.

Two lake sediment slump habitats occur in the **Six Mile Creek Gorge BDA**. One of the lake sediment slump habitats (**NC005**) is located in the meandering channels section of the **BDA** depicted on the Harborcreek Quadrangle. **NC005** consists of shallow clayey soils over shale on the lower slope of an open shale escarpment within the stream valley. **NC005** provides habitat for a rarely occurring special plant species (**SP003**) classified as critically imperiled in Pennsylvania and rare in Erie County, as the habitat (**NC005**) for **SP003** is rare in the state and the county (B. Danielson and J. Bissell, Cleveland Museum of Natural History, pers. commun.).

Six Mile Creek Gorge BDA contains special species habitats in which three occurrences of a special plant species are located. Two of these occurrences are located within the **BDA** depicted on the Hammett Quadrangle; the other occurrence of this special plant species (**SP003**) is located within the section of the **BDA** represented on the Harborcreek Quadrangle. **SP003** consists of a rarely occurring population within the meandering stream channels section of **Six Mile Creek Gorge BDA**. The **SP003** population is located on the lower slope of a stream valley wall (J. Bissell, Cleveland Museum of Natural History, pers. commun.). **SP003** is classified as critically imperiled in Pennsylvania.

For a summary of potential threats to the protection of the **Six Mile Creek Gorge BDA** and the corresponding recommendations for site protection, refer to pages 136 through 138.

The boundary of the **Six Mile Creek Gorge BDA** encompasses **Six Mile Creek Park**. **Six Mile Creek Park** is a Managed Land owned by the County of Erie and managed by the Erie County Conservation District. The entire park is 450 acres in size. A portion of **Six Mile Creek Park** is represented on the Harborcreek Quadrangle. The park extends onto the Hammett Quadrangle where most of this Managed Land is depicted. Refer to page 133 for additional information on **Six Mile Creek Park**, as well as recommendations for park management.

The **Lake Plain Forested Wetland BDA**, located in North East Township, is a high diversity area approximately 146 acres in size. This natural heritage area is represented on both the Harborcreek and North East Quadrangles. The **Lake Plain Forested Wetlands BDA** contains a circumneutral broadleaf swamp community (**NC006**) and two special plant species -- **SP004** and **SP005**. Circumneutral broadleaf swamp communities are classified as imperiled/rare in the state and are also uncommon in the lake plain of the county. **NC006** is a second growth forested swamp located on poorly drained lake plain flats. Spring seeps are the primary source of hydrology and the associated ground water discharges form watercourses

within the circumneutral broadleaf swamp community (**NC006**). The tree canopy of **NC006** is dominated by green ash (Fraxinus pensylvanica), black ash (F. nigra), American elm (Ulmus americana), sugar maple (Acer saccharum), red maple (A. rubrum), yellow birch (Betula lutea), eastern hemlock (Tsuga canadensis), and basswood (Tilia sp.). Locally common in the understory of **NC006** are spicebush (Lindera benzoin) and meadows of marsh marigold (Caltha sp.). Spring fed watercourses within **NC006** contains a locally common population of **SP004**, which is a special plant species classified as threatened in Pennsylvania and possibly very rare on a global basis. Small ponds are located within **NC006**. One of these ponds contains open water and is vegetated by narrow-leaved cattail (Typha angustifolia) with scattered pussy willow (Salix discolor), black willow (S. nigra), peach-leaved willow (S. amygdaloides) and contains a large population of a species of special concern -- **SP005**. **SP005** is special plant classified as critically imperiled in the state (Bissell and Danielson, 1992; J. Bissell and B. Danielson, Cleveland Museum of Natural History, pers. commun.).

Protection of ground water quality and quantity associated with the ground water discharges (i.e., spring seeps) located in the southern portion of the **Lake Plain Forested Wetland BDA** is essential to preserve the **BDA**. These springs are the primary source of hydrology for the natural community (**NC006**) and the species of special concern (**SP004** and **SP005**) that comprise the **Lake Plain Forested Wetland BDA**. Water quality could be jeopardized depending upon the methods and practices implemented on the adjacent agricultural fields and the gravel pit. And water quantity could be effected should mineral extraction activities interrupt or divert ground water flow. Review of recent aerial imagery (Erie County Department of Planning, 1991) indicates that fragmentation is a potential threat to the **BDA**. (Refer to pages 54 to 64 for information on the potential threats that mineral extraction and agricultural activities pose to water quality and quantity, as well as the threat pose by fragmentation to the ecological integrity of natural heritage areas.)

The 1991 aerial imagery also indicates that reverting farm land on part of the north side of the natural heritage area is creating an improved buffer for the site. General recommendations regarding Biological Diversity Area site protection and management are addressed on page 52. Recommendations for the overall management and protection of the **Lake Plain Forested Wetland BDA** are synonymous with these general recommendations. In addition to these recommendations, these more specific recommendations are provided: (1) a vegetated buffer should be allowed to develop within the entire site boundary; and (2) land

owners within and adjacent to the natural heritage area need to protect the area's water quality and quantity and avoid site fragmentation.

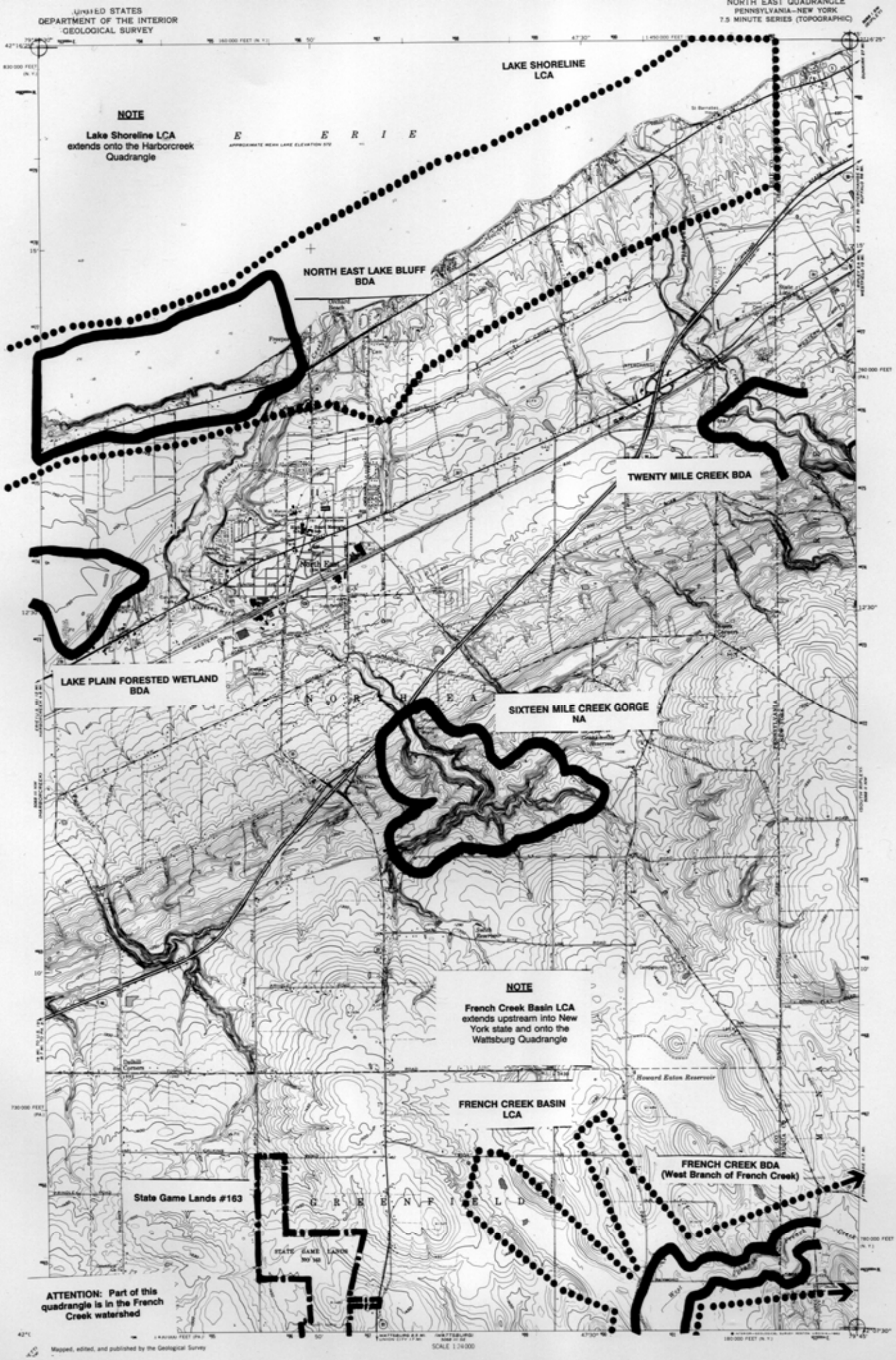
Harborcreek BDA is an approximately 18 acre special species habitat for an occasionally occurring special plant species population (**SP006**) that inhabits an area of disturbed soils. The **SP006** occurrence is consistent with the species habitat needs, as **SP006** grows well in open dry disturbed soils. Special plant species **SP006** is classified as threatened in Pennsylvania. The primary threat to the special plant within the **Harborcreek BDA** is right-of-way maintenance for the infrastructures that border the population. Use of herbicides within the **BDA** should be avoided to protect **SP006**. (Refer to page 59 for general information regarding the threats posed to natural heritage areas by [utility] right-of-way maintenance.)

NORTH EAST QUADRANGLE

	PNDI Rank Global	State	Legal Status Fed.	State	Last Seen
LAKE SHORELINE LCA *Exceptional Significance*					
NORTH EAST LAKE BLUFF BDA *Exceptional Significance*					
NATURAL COMMUNITY: NC001	G?	S2	N	N	1992
NATURAL COMMUNITY: NC002	G?	S1	N	N	1992
SPECIAL PLANT: SP001	G5	S3	N	PT	1986
SPECIAL PLANT: SP002	G5	S2	N	PT	1986
FRENCH CREEK BASIN LCA *High Significance*					
FRENCH CREEK BDA *High Significance*					
NATURAL COMMUNITY: NC003	G?	S2S3	N	N	1992
SIXTEEN MILE CREEK GORGE NA *Exceptional Significance*					
NATURAL COMMUNITY: NC004	G?	S3S4	N	N	1974
TWENTY MILE CREEK BDA *Exceptional Significance*					
NATURAL COMMUNITY: NC005	G?	S1	N	N	1992
SPECIAL PLANT: SP003	G5	S1	N	PE	1992
SPECIAL PLANT: SP004	G5	S1	N	PE	1992
LAKE PLAIN FORESTED WETLAND BDA *High Significance*					

MANAGED LAND:

State Game Lands #163


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
NORTH EAST QUADRANGLE
PENNSYLVANIA—NEW YORK
7.5 MINUTE SERIES (TOPOGRAPHIC)
LAKE SHORELINE LCA
NOTE
Lake Shoreline LCA extends onto the Harborcreek Quadrangle
E R I E
NORTH EAST LAKE BLUFF BDA
TWENTY MILE CREEK BDA
LAKE PLAIN FORESTED WETLAND BDA
SIXTEEN MILE CREEK GORGE NA
NOTE
French Creek Basin LCA extends upstream into New York state and onto the Wattsburg Quadrangle
FRENCH CREEK BASIN LCA
FRENCH CREEK BDA (West Branch of French Creek)
State Game Lands #163
ATTENTION: Part of this quadrangle is in the French Creek watershed
Howard Eaton Reservoir
Mapped, edited, and published by the Geological Survey
SCALE 1:24 000

NORTH EAST QUADRANGLE

The **Lake Shoreline LCA** extends along the entire 6.5 miles of Lake Erie shoreline represented on the North East Quadrangle. Based on aerial reconnaissance, approximately 80 percent of the lake bluff is vegetated. Little to no buffer exists behind the bluff crest where agriculture and scattered residences are the primary land uses. For more information on the **LCA** refer to the **Lake Shoreline LCA** site description on pages 75 to 79. General recommendations regarding Landscape Conservation Area site protection and management are addressed on page 53. Recommendations for the overall management and protection of the **Lake Shoreline LCA** are detailed on page 81.

North East Lake Bluff BDA is located on a north-north-west facing lake bluff along about 1.5 miles of lake shoreline west of the mouth of Sixteen Mile Creek. The **BDA** is a community/ecosystem conservation area, containing habitats unique to the county and imperiled in Pennsylvania. These habitats are lake bluff habitat (**NC001**) and lake sediment slump habitat (**NC002**). Based on aerial reconnaissance, **NC001** contains the longest stretch of vegetated lake bluff dominated by woody vegetation. **NC002** is a special species habitat area. The lake sediment slump (**NC002**) provides palustrine wetland habitat for two species of special concern plant populations (**SP001** and **SP002**). In addition to these natural communities, **North East Bluff BDA** has outstanding aesthetic qualities.

The **North East Lake Bluff BDA** is located on a steeply sloped substrate that extends from the shoreline to the bluff crest. Bluff height is about 170 feet. Numerous groundwater seeps occur at various heights on the lake bluff creating extensive saturated areas. Occasionally these seeps form watercourses on the bluff slope that drain onto the narrow beach that borders almost the entire shoreline. Occasional wind thrown trees are scattered on the bluff slope and the beach. Although a portion of the bluff slope is severely eroded and only sparsely vegetated, about 80 percent of the bluff slope is vegetated. Vegetation is extensively dominated by woody species, which is indicative of relative bluff stability.

The **North East Lake Bluff BDA** contains a mosaic of herb, shrub, and tree dominated seral stages. The dominant species in the herbaceous seral stage are horsetail (Equisetum littorale), a sedge (Carex sp.), a bullrush (Scirpus sp.), late goldenrod (Solidago gigantea), and coltsfoot (Tussilago farfara). The shrub seral stage is dominated by red-osier dogwood (Cornus stolonifera), speckled alder (Alnus rugosa), sandbar willow (Salix longifolia), blue-leaf willow (S. glaucophylloides) and common cottonwood (Populus deltoides). The forested seral stage dominants are sugar maple (Acer saccharum) and hophornbeam (Ostrya

virginiana) with flowering raspberry (Rubus odoratus), early meadow rue (Thalictrum dioicum), marginal wood fern (Dryopteris marginalis), heart-leaved aster (Aster cordfolius) and horsetail (Equisetum littorale) dominating the understory.

The special species habitat area within the **BDA** is a lake sediment slump (**NC002**), consisting of clayey and sandy lacustrine sediments saturated by groundwater seeps. (Refer to page 77 for additional information on lake sediment slumps.) The lake sediment slump provides habitat for two plant species of special concern (**SP001** and **SP002**). Both plant species are uncommon in the county, as the habitat is limited. **SP001** and **SP002** consist respectively of an occasional occurring plant population and a medium-sized plant population. These populations were observed within the herb dominated seral stage described in the preceding paragraph.

Erie County's lake bluff habitat and the factors that could jeopardize bluff integrity are described on pages 75 to 80. Protection of the **North East Lake Bluff BDA** site requires maintaining lake bluff habitat. Bluff integrity needs to be protected from human-induced processes within the natural heritage area that artificially promote shoreline erosion and bluff recession. These activities are described on pages 79 to 80. The bluff crest contiguous with the site is primarily used for agriculture. There are also scattered residences bordering the natural heritage area. Natural vegetation on the bluff crest has been almost entirely removed, except for a narrow band of trees along most of the crest edge. Thus, little natural vegetative buffer for the site exists behind the bluff crest. Property owners are encouraged to allow natural vegetation to inhabit an additional area behind the bluff crest. This would promote lake bluff stability. Bluff stability would protect the **North East Lake Bluff BDA**, as well as reduce the potential for property loss due to bluff erosion and recession. Groundwater hydrology needs to be protected to ensure that the quantity and quality of water entering the site is maintained. This would protect the special species habitat for **SP001** and **SP002** within the lake sediment slump (**NC002**), as well as hydrology for the rest of the **BDA**.

A portion of the **French Creek Basin LCA** is represented on the North East Quadrangle. The **LCA** includes part of the **French Creek BDA**. Refer to page 119 for a holistic description of the biotic communities and the ecological significance of the natural resources within the **French Creek Basin LCA** and the **French Creek BDA**.

On the North East Quadrangle, the **French Creek Basin LCA** includes both a component of the **French Creek BDA** (i.e., the West Branch of French Creek), the partially vegetated riparian corridor

contiguous with the **BDA**, and two unnamed tributaries to the West Branch of French Creek. The **French Creek BDA** contains the West Branch of French Creek because this stream is a primary tributary to French Creek in Erie County and is a riparian system that retains much of its natural character with biotic resources of county and state import.

The section of the West Branch of French Creek represented in the North East Quadrangle originates in New York state and extends onto the Wattsburg Quadrangle. The West Branch of French Creek is a medium gradient clearwater creek (**NC003**) which retains natural characteristics and qualities. (Refer to page 124 for additional information on **NC003**.) Although a section of the **NC003** riparian corridor has been cleared for agricultural and development activities, about three-quarters of the riparian corridor contains natural vegetation communities. These communities are primarily located on the floodplain of the stream. Forest occupies most of the vegetated floodplain. However, about one-half mile of the riparian corridor contains a structurally diverse mosaic of shrub and forest communities which enhances the wildlife habitat value of the riparian ecosystem. Per aerial reconnaissance, two tributaries to **NC003** also retain riparian ecosystem characteristics and exhibit natural community diversity important for both biodiversity and wildlife habitat. One of these unnamed tributaries contains a partially buffered mosaic of terrestrial and wetland communities, including forested, shrub, and herbaceous communities, open water, and snag swamp. The other unnamed tributary contains beaver impoundments and a composite of emergent and shrub wetlands partially bordered by forest.

Threats to the portions of the **French Creek Basin LCA** and **French Creek BDA** on the North East Quadrangle include water quality degradation from agricultural, development, and mineral extraction activities contiguous with and within these natural heritage areas. Refer to pages 55, 56, and 58 for information on the potential threats posed by these land use activities to natural heritage areas and pages 223 and 224 for information on the potential threats posed to the aquatic systems within the **French Creek BDA** by stream modification and changes in hydrology.

General recommendations regarding Landscape Conservation Area and Biological Diversity Area site protection and management are addressed on pages 52 and 53. The recommendations for the overall management and protection of the entire **French Creek Basin LCA** and the entire **French Creek BDA** are synonymous with the general recommendations for LCA's and BDA's. (See pages 52-54.) (Note: Areas with heavy disturbance may be included within a LCA boundary when watershed protection is the intent of

all or part of the LCA.) Refer to the recommendations on page 124 for guidance regarding the protection of the **BDA** on the North East Quadrangle. (Note: The conditions by which the general recommendations for the protection and management of the **French Creek Basin LCA** and **French Creek BDA** can be modified are on page 124.)

Sixteen Mile Creek Gorge NA is an approximately 652 acre recovering natural area that is roughly 600 acres in size. The gorge has been created by a high gradient creek that cut through the sloping ridge of glacial deposits that separates the lake plain and the glaciated section of the Appalachian Plateau in Erie County. The high gradient stream has cut through glacial deposits to underlying shales, resulting in meandering stream corridors with steep shale cliffs. The steeply sloped walls of the gorge contain numerous lake sediment slumps and, hence, potential habitat for species of concern plants. The high gradient stream contains numerous small waterfalls and riffle areas. Except where steep slopes prohibit, **Sixteen Mile Creek Gorge NA** contains an extensive northern hardwood forest community (**NC004**) composed of mature and old growth forest stands (Aerial reconnaissance, 1992; Wiegman, 1974). Sycamore (Plantanus occidentalis) dominates on floodplains scattered in the gorge, per aerial reconnaissance conducted for the inventory. Part of **NC004** contains stands dominated by beech (Fagus grandifolia) and maple (Acer sp.) (Wiegman, 1974). Due to past extensive timber harvesting, beech-maple dominated forests are now uncommon in Erie County. Some past timber harvesting has effected parts of the **NA**. **NC004** contains a diverse herbaceous stratum, including silver athyrium (Athyrium thelypteriodes), trillium (Trillium sp.), mayflower (Epigaea sp.), partridgeberry (Mitchella repens), and several fern species (Wiegman, 1974). The size, natural community characteristics, and outstanding aesthetic qualities exhibited within the **Sixteen Mile Creek Gorge NA** make the **NA** a natural heritage area of exceptional county significance.

The primary threats posed to **Sixteen Mile Creek Gorge NA** are timber harvesting and development, including the loss of habitat from erosion promoted by the removal of vegetation along the top of or on the face of the highly erodible soils on the stream valley walls. (Refer to pages 56 and 61 for information on the potential threats that development and forestry practices pose to natural heritage areas.) General recommendations regarding Natural Area site protection and management are addressed on page 52. Recommendations for the overall management and protection of **Sixteen Mile Creek Gorge NA** are synonymous with those on page 52, plus the following recommendations:

(1) A vegetated buffer should be allowed to develop within the entire site boundary; and

(2) Development and timber harvesting within the natural heritage area should be avoided.

The **Lake Plain Forested Wetland BDA** located in North East Township is a high diversity area approximately 146 acres in size. This natural heritage area is represented on both the Harborcreek and North East Quadrangles. Refer to the site description on page 107 for information on the biotic resources that comprise the **Lake Plain Forested Wetland BDA**.

Twenty Mile Creek BDA is an approximately 92 acre community/ecosystem conservation area located in North East Township. Aerial reconnaissance indicates the **BDA** also extends into New York state. The **BDA** contains at least one large calcareous seep community (**NC005**). Calcareous seep communities are classified as critically imperiled in Pennsylvania. **NC005** provides habitat for two special plant species (**SP003** and **SP004**) that are endangered in the state. The calcareous seep community (**NC005**) is located on a naturally eroded sheer shale stream valley wall that extends up to 130 feet above the high gradient creek that flows through the gorge. Ground water seepages are scattered near the top of the shale valley wall. Below these seepages the entire face of the valley wall is saturated. The sheer shale valley wall is approximately 50 percent vegetated. Herbaceous vegetation dominates **NC005** and the dominant species in the natural community is **SP004**. Associated species within **NC005** include **SP003**, goldenrod (Solidago sp.), boneset (Eupatorium perfoliatum), St. John's-wort (Hypericum sp.), and coltsfoot (Tussilago farfara). **SP004** is a special plant species that requires alkaline conditions and inhabits damp calcareous ledges, as well as calcareous marshes and fens (Fernald, 1989). **SP004** rarely occurs in western Pennsylvania. **SP003** is another special plant species that requires wet alkaline conditions and is a characteristic species of calcareous seep communities. **SP003** is a Pennsylvania endangered plant species.

Potential threats to the calcareous seep community (**NC005**) are habitat loss resulting from human-induced erosion due to removal of natural vegetation cover along the crest of the valley wall and ground water and/or surface water quality degradation due land use activities (i.e., agricultural fields) that border the top of the stream valley. (Refer to page 58 for additional information on the potential threats posed to natural heritage areas by certain agricultural activities.)

General recommendations regarding Biological Diversity Area site protection and management are addressed on page 52. These general recommendations are applicable to the **Twenty Mile Creek BDA**. More specific recommendations for protection of the **Twenty Mile Creek BDA** are as follows:

(1) A natural vegetation buffer should be allowed to develop along the stream valley crest within the site's boundary in order to reduce the threat of human-induced erosion and to protect surface water quality and quantity entering the **BDA**; and

(2) Property owners could also contribute to ground water quality and quantity protection by reducing or avoiding the application of pesticides and/or fertilizers within site boundaries and avoiding artificial drainage of subsurface waters.

State Game Lands #163 is a Managed Land is represented on the southwest quadrant of the North East Quadrangle and extends onto the Wattsburg Quadrangle. **State Game Lands #163** is about 342 acres in size. Approximately 333 acres of **State Game Lands #163** are represented on the North East Quadrangle. **State Game Land #163** contains woodlands, tree plantation(s), and reverting fields (R. Haibach, Pa. Game Comm., pers. commun.).

WATTSBURG QUADRANGLE

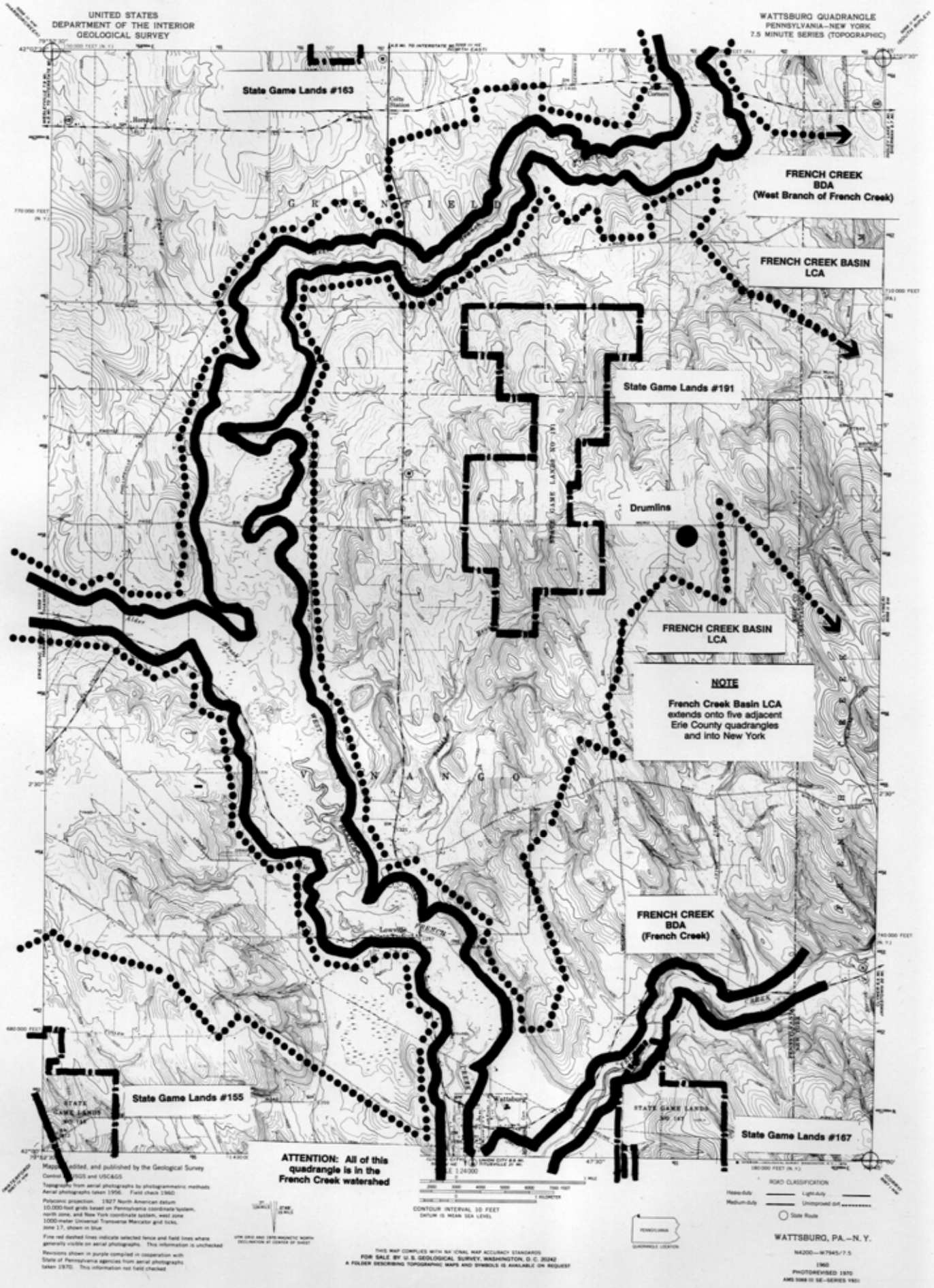
	PNDI Rank Global	State	Legal Status Fed.	State	Last Seen
FRENCH CREEK BASIN LCA *Exceptional Significance*					
FRENCH CREEK BDA *Exceptional Significance*					
NATURAL COMMUNITY: NC001	G?	S1S2	N	N	>1980
NATURAL COMMUNITY: NC002	G?	S2S3	N	N	1992
NATURAL COMMUNITY: NC003	G2G3	S1	N	N	1992
SPECIAL PLANT: SP001	G5	S2	N	PT	1992
SPECIAL PLANT: SP002	G5	S1	N	PE	1992
SPECIAL PLANT: SP003	G5	?	N	TU	1992
SPECIAL PLANT: SP004	G5	S2S3	N	TU	1992
NATURAL COMMUNITY: NC004	G5	S2S3	N	N	1992
SPECIAL PLANT: SP005	G5	S2S3	N	TU	1992
SPECIAL PLANT: SP006	G5	?	N	TU	1992
NATURAL COMMUNITY: NC005	G?	S1	N	N	1992
NATURAL COMMUNITY: NC006	G?	S2	N	N	1992
SPECIAL PLANT: SP007	G5	S2S3	N	TU	1992
NATURAL COMMUNITY: NC007	G?	S3	N	N	1992

MANAGED LANDS:

State Game Lands #155
State Game Lands #163
State Game Lands #167
State Game Lands #191

GEOLOGIC FEATURES/FOSSIL LOCALITIES

Drumlins


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATTSBURG QUADRANGLE
PENNSYLVANIA—NEW YORK
7.5 MINUTE SERIES (TOPOGRAPHIC)
State Game Lands #163
FRENCH CREEK
BDA
(West Branch of French Creek)
FRENCH CREEK BASIN
LCA
State Game Lands #191
Drumlins
FRENCH CREEK BASIN
LCA
NOTE
French Creek Basin LCA
extends onto five adjacent
Erie County quadrangles
and into New York
FRENCH CREEK
BDA
(French Creek)
State Game Lands #155
State Game Lands #167
ATTENTION: All of this
quadrangle is in the
French Creek watershed
CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
ROAD CLASSIFICATION
WATTSBURG, PA.—N. Y.
N4200—W7945/7.5
1960
PHOTOREVISED 1970

WATTSBURG QUADRANGLE

The ecological import of the biotic resources within French Creek cannot be overstated. In Pennsylvania and New York, portions of French Creek continue to support a high diversity of aquatic flora and fauna native to the stream. Many of these native aquatic species are now endangered in Pennsylvania, the northeastern United States, and the North American continent.

Why French Creek contains such an exceptional biodiversity of native flora and fauna is unclear. Speculation as to the reason for this biodiversity relates to the geologic history of the stream and the glaciation of northwestern Pennsylvania. Prior to the last glacial period, French Creek flowed north into the Great Lakes. After the last glacial period, glacial scour and deposition changed the drainage basin of French Creek. The stream became part of the Allegheny River watershed. Despite this change, French Creek and other aquatic ecosystems within the stream's drainage basin retained biota representative of the Great Lakes drainage. Another possible reason for the exemplary biodiversity within French Creek is that stream piracy in the Allegheny River drainage basin has fostered biotic exchanges between aquatic systems.

Presently, French Creek is part of the Ohio River drainage basin and, hence, in the Allegheny watershed. The stream originates in western New York and courses through four Pennsylvania counties before entering the Ohio River. In Erie County, the French Creek drainage basin retains a remarkable faunal diversity because portions of this part of the French Creek drainage have the necessary habitats and water quality conditions. The unique biological diversity within French Creek and its drainage basin are represented by two groups of fauna that require high quality stream environments -- mussels and fishes.

Freshwater mussels inhabit aquatic systems that have high water quality and requisite substrate habitats. Portions of French Creek retain both the water quality and substrate habitats required to support freshwater mollusks. Fifty-six (56) percent of Pennsylvania's surviving mussel species inhabit the French Creek watershed and nearly all of these species have been recorded in the main stem of French Creek. Degradation of streams elsewhere in the state has adversely effected freshwater mollusks, however, French Creek still harbors a diversity of freshwater mollusks, including seven species found almost nowhere else in the state. Three of these seven mollusk species are also imperiled throughout their entire ranges in North America. Due to lack of habitat, two of these three freshwater mussel species were recently listed as federal endangered species. Yet, in French Creek and its tributaries these mollusks and other aquatic species continue to find suitable, largely pristine habitats.

Fish biodiversity in French Creek has been described as unique. Of all the fish species recorded in French Creek, 66 species are still extant. Of these 66 species, six fish species are classified as endangered or threatened in the state. One of these six species has been recommended as a federally endangered species. In addition to those fish species already known to be endangered or threatened, four fish species found in French Creek are considered to be imperiled and may be included on the state's endangered and threatened species list. In Erie County, French Creek and LeBoeuf Creek provide habitat for endangered and threatened fishes and freshwater mollusks. Twenty-five (25) occurrences of these special animal species have been confirmed in these two streams. (Barlett, 1993; 1992; Davis, 1992; Crisswell, 1992; Western Pennsylvania Conservancy, 1990a; 1990b).

In addition to aquatic faunal diversity, the Erie County portion of the French Creek drainage basin contains numerous natural communities and special plant species populations that are of global and/or state biological significance. The French Creek drainage basin in Erie County contains a total of 61 ecologically significant natural communities and 200 occurrences of species of special concern. French Creek's primary tributaries (i.e., LeBoeuf Creek, West Branch of French Creek, South Branch of French Creek) retain not only their stream community integrity but areas of extensive, often diverse vegetated riparian corridors that exhibit the natural character and biological values of riparian systems. Glacial lakes (i.e., Lake Pleasant, Edinboro Lake, Lake LeBoeuf) and nearly pristine and unusual headwater wetlands in the county's glacially influenced topography (e.g., Hubbell Run) characterize the other components of the French Creek drainage basin in Erie County. The numerous biotic resources that comprise the portion of the French Creek basin in Erie County also function as landscape linkages critical to the protection of the county's floral and faunal diversity.

As evidenced by existing information and the inventory, the French Creek drainage basin in Erie County is indeed an exceptional ecological resource. Two interdependent natural heritage areas are used to identify the biotic resources of natural heritage significance and are designed to protect the ecological integrity of those biotic resources. The two natural heritage areas are the **French Creek Basin LCA** and the **French Creek BDA**.

The boundaries for the **French Creek Basin LCA** were determined based upon field surveys, interpretation of aerial imagery (Erie County Department of Planning, 1991), and aerial reconnaissance. **Per the definition of Landscape Conservation Areas, the French Creek Basin LCA contains those areas of**

the French Creek drainage basin in Erie County that retain the natural character of this exceptional aquatic system, as well as the entire watersheds of the main stem of French Creek and LeBoeuf Creek. The watersheds of these two streams are included within the LCA boundary as the protection of these streams' ecological integrity is paramount to retain the aquatic faunal biodiversity and occurrences of special animal species therein. Retention of the natural character of French Creek and LeBoeuf Creek requires that particular attention be paid to the type and location of land use activities that occur within the watersheds of these two streams. The **French Creek Basin LCA** is generally represented on Figure 5 on the next page. The actual boundaries of the **LCA** are depicted on the corresponding USGS quadrangles.

The intent of the **French Creek BDA** is to protect both the overall ecological integrity of the exceptional biotic resources within the Erie County portion of the French Creek drainage basin and individual components of that drainage basin which are of biological significance in their own right. Protection of the hydrologic conditions (i.e., water quality, quantity, flow, etc.) and natural communities located within the **BDA** is essential to protecting the aquatic and terrestrial resources that comprise the **French Creek BDA**. The **BDA** boundary was established to provide this protection. The buffers established for the aquatic resources within the **French Creek BDA** were determined per the criteria addressed on pages 66 and 67 and per Brown and Schaefer et al. (1987). To protect surface water quality entering the aquatic components of the **BDA** the recommendations of Brown and Schaefer et al. were used. These recommendations are summarized here: The 300 feet from the edge of a stream or the terrestrial boundary of wetlands contiguous/adjacent to a stream is the zone that most influences surface water quality. Therefore, portions of the **BDA** where surface water quality protection is the primary concern the **BDA** boundary extends 300 feet from the edge of the stream or 300 feet from the wetland(s) adjacent to that stream.

Figure 5: French Creek Basin Landscape Conservation Area

Together the inter-related natural resources contained within the boundaries of the **LCA** and **BDA** significantly contribute to the ecological integrity of French Creek drainage basin within Erie County. As stated before, the French Creek drainage basin is an ecological resource not only of county and state significance but of global significance. The natural heritage areas, **French Creek Basin LCA** and **French Creek BDA**, identify the components of the French Creek drainage basin that are recognized as ecologically significant per the natural heritage program criteria. It is worth emphasizing that, like in any watershed, activities that occur outside the boundaries of the aforementioned natural heritage areas may adversely or beneficially effect the resources of the **LCA** and **BDA**. For this reason the watershed boundaries for the main stem of French Creek and LeBoeuf Creek are indicated on the **French Creek Basin LCA** map on page 122.

Aerial imagery (Erie County Department of Planning, 1991) was used to assess the land use activities in proximity to or within the **French Creek Basin LCA** and **French Creek BDA**. As one might expect given the size of these natural heritage areas, a variety of land use activities are in proximity to these sites. Those most commonly occurring land use activities are development, mineral extraction, utility right-of-ways, and agriculture. Field surveys conducted for the inventory indicate that timber harvesting also poses a potential threat to portions of the **LCA** and **BDA**. Additional fragmentation, as a result of the aforementioned land use practices, also poses a threat to the ecological integrity of the natural resources within the **French Creek Basin LCA** and **French Creek BDA**. Refer to pages 54 through 66 for information regarding the potential threats the aforementioned land use activities, fragmentation, and other land use practices pose to the **French Creek BDA** and **French Creek Basin LCA**. Stream modifications (e.g., channelization, dredging, impoundment, etc.) could also adversely effect the natural resources and overall biodiversity of the aquatic resources contained within the French Creek drainage basin. Changes in water quality and quantity can also directly effect these same biotic resources. Degradation of water quality and/or significant changes in stream water volume and/or flow could adversely effect aquatic biota (Darnell, 1976). In-keeping with the intention of protecting the aquatic biodiversity of the **BDA,** the use of aquatic pesticides (e.g., lampricides or aquatic herbicides) within the aquatic systems that comprise the **French Creek BDA** should be avoided.

General recommendations regarding Landscape Conservation Area and Biological Diversity Area site protection and management are addressed on pages 52 and 53. The recommendations for the overall

management and protection of the entire **French Creek Basin LCA** and the entire **French Creek BDA** are synonymous the respective recommendations for LCA's and BDA's, unless site specific recommendations cited in the inventory modify the recommendations on pages 52 and 53 or an on-site assessment of the actual effects of the proposed activity enable those recommendations to be modified.

Portions of both the **French Creek Basin LCA** and the **French Creek BDA** are represented on the Wattsburg Quadrangle. The **French Creek Basin LCA** includes a portion of the watershed of the main stem of French Creek, portions of the **French Creek BDA**, the extensively vegetated riparian corridor along the West Branch of French Creek, and two Managed Lands -- **State Game Lands #167** and **State Game Lands #155**. The **French Creek BDA** includes the main stem of French Creek (**NC001**), the West Branch of French Creek (**NC002**), and five ecologically significant natural communities (**NC003** through **NC007**) within the riparian corridor of **NC002**.

French Creek is a medium gradient clearwater river (**NC001**) that enters Erie County from New York in Venango Township. **NC001** is a natural community with a watershed greater than 200 square miles, a fall of one to ten feet per mile with a bottom of coarse sand and gravel, riffles, raceways, and occasional sandbars (Smith, 1983). **NC001** is an aquatic system that is considered to be critically imperiled/imperiled in Pennsylvania. The segment of French Creek represented on the Wattsburg Quadrangle is partially bordered by naturally vegetated stream banks. However, the vegetation presently located within the riparian corridor is fragmented, primarily by agriculture and development activities, and for the most part the riparian corridor is less than the width preferable to protect the water quality of **NC001**.

The West Branch of French Creek is a medium gradient clearwater creek (**NC002**) that meanders through Greenfield and Venengo Townships before entering French Creek (**NC001**). Medium gradient clearwater creeks are natural communities with a watershed less than 200 square miles, a fall of between one and ten feet per mile, occasional riffles, and a stream bottom primarily of coarse sand and gravel (Smith, 1983). The segment of **NC002** observed during the inventory field surveys contained a partially vegetated silt/organic matter substrate. Bur-reed (Sparganium sp.) dominated the aquatic vegetation within that segment of **NC002**. Freshwater mussel populations occur within the segment of the stream (**NC002**) field surveyed, indicating high water quality in the stream. An historic record indicates that the segment of **NC002** represented on the Wattsburg Quadrangle may provide habitat for a fish species classified as globally rare and imperiled in Pennsylvania. **NC002** retains natural community characteristics and qualities

that warrant recognition as a natural heritage area. The quality of this biological resource is further augmented by the existence of a largely naturally vegetated riparian corridor that includes exemplary wildlife and aquatic life habitats, as well as natural communities of state significance.

Per aerial reconnaissance and aerial imagery interpretation, both Darrow Brook and West Branch French Creek (**NC002**) are part of an exemplary riparian ecosystem approximately three miles in length. Both Darrow Brook and **NC002** meander through a structurally diverse and vegetatively diverse riparian corridor containing forested, shrub, emergent, and snag dominated wetland communities, terrestrial forest, and oxbow ponds. The quality of this section of **NC002** and the entire length of Darrow Brook in Erie County warrant the inclusion of the riparian ecosystem in the **French Creek Basin LCA**.

In Venango Township, **NC002** meanders through an extensively vegetated stream basin that contains five noteworthy natural communities (**NC003** through **NC007**). One of these natural communities, **NC003**, is of both global and state significance. **NC003** is an approximately one to two acre shrub fen that provides habitat for four special plant species (**SP001** through **SP004**) of state significance. The plant species that characterize **NC003** are peatmoss (Sphagnum), a rush (Juncus articulatus), bog twayblade (Liparis loeselii), green woodland orchid (Plantanthera clavellata), **SP002**, eastern hemlock (Tsuga canadensis), and **SP004** (Isaac, 1992a). Although evidence of disturbance from past agricultural activities and an existing utility right-of-way occurs in part of **NC003** the natural community exhibits biological integrity and harbors a variety of notable plant species, including **SP001** through **SP004**. These species are largely restricted to the habitat provided by shrub fens, a natural community that is globally imperiled/rare. Natural communities **NC004** through **NC007** are located within the same section of the West Branch of French Creek (**NC002**) stream basin as **NC003**.

NC004 is a northern conifer swamp community -- a natural community considered to be critically imperiled/imperiled in Pennsylvania. Much of **NC004** has been disturbed by past timber harvesting, however, the remaining undisturbed portion of **NC004** retains high floral diversity and provides habitat for two special plant species, **SP005** and **SP006**. The undisturbed portion of **NC004** is a red maple (Acer rubrum)-eastern hemlock dominated forested swamp with a partially open canopy. Alder (Alnus sp.), cinnamon fern (Osmunda cinnamomea), and skunk cabbage (Symplocarpus foetidus) dominate the forest's understories. Openings in the forest canopy are frequent and vegetated by a high diversity of plant species characteristic of northern conifer swamp communities, including **SP005**. **SP005** is a plant species classified

as imperiled/rare in the state. A small population of **SP005** occurs within **NC004**, as does a rarely occurring population of **SP006**. Although disturbed by past timbering harvesting and hydrologically modified by a nearby beaver impoundment, the primary source of hydrology for **NC004**, groundwater seepage, is intact. Thus natural community restoration is possible and recommended.

A natural community considered to be critically imperiled in Pennsylvania is located within this section of the **French Creek BDA**. This is a highly diverse floodplain swamp community (**NC005**) that occurs within both the West Branch of French Creek stream basin and the stream basin of Alder Brook, a tributary to the West Branch of French Creek (**NC002**). **NC005** contains areas of saturated and inundated soils. The primary sources of hydrology for the floodplain swamp community are a high ground water table and floodwaters. **NC005** is partially forested, however, the tree and understory species dominating **NC005** vary with hydrologic conditions. The dominant and locally dominant species within **NC005** include red maple, silver maple (Acer saccharinum), American elm (Ulmus americana), and black willow (Salix nigra), speckled alder (Alnus rugosa), northern and southern arrowwood (Viburnum dentatum and V. recognitum), nannyberry (V. lentago), spicebush (Lindera benzoin), rice cutgrass (Leersia oryzoides), and duckweed (Lemna minor). The part of **NC005** bordering Alder Brook is less diverse than the section along the West Branch of French Creek. Along Alder Brook, the floodplain swamp community consists of a black willow and American elm dominated canopy with dense shrub thickets characterized by the shrub species cited above. Timber harvesting has modified part of the floodplain swamp but recovery is likely with time, as the hydrology is intact. Beaver impoundments have influenced the hydrology of the swamp (**NC005**). However, community diversity seems to have been improved as a result of the beaver activity.

Between **NC005** and the West Branch of French Creek (**NC002**) is a highly diverse, at least five acre, forest floodplain community (**NC006**) dominated by elm (Ulmus sp.), swamp white oak (Quercus bicolor), spicebush, ironwood (Carpinus caroliniana), hawthorn (Crataegus sp.). Canopy openings within **NC006** are dominated by sensitive fern (Onoclea sensibilis), rice cutgrass, and ostrich fern (Matteuccia struthiopteris). Within one of these openings is a rarely occurring population of **SP007**, a special plant species classified as imperiled/rare in the state. Past timber harvesting and pasturing within **NC005** has modified community composition, however, given protection and time the natural community can recover.

The Alder Brook stream basin contains an extensive and highly diverse graminoid marsh community (**NC007**) of exemplary quality. **NC007** has a saturated, partially floating organic mat substrate dominated by a sedge (Carex sp.) and three-way sedge (Dulichium arundinaceum) with scattered shrub thickets dominated by speckled alder, northern arrowwood, and meadow-sweet (Spiraea alba).

In addition to the six aforementioned natural communities within the **French Creek BDA**, other more common vegetation communities are located within the **BDA** and contribute to the biological diversity of the natural heritage area. These vegetation communities include a young aspen (Populus sp.) forest; kames forested by northern hardwoods and conifers; and several beaver meadows, containing open water areas, as well as areas dominated by shrubs, emergents, herbaceous, and aquatic bed vegetation.

Two Managed Lands are located within the **French Creek Basin LCA** represented on the Wattsburg Quadrangle -- **State Game Lands #167** and **State Game Lands #155**.

State Game Lands #167 is a Managed Land located in Venango Township. **State Game Lands #167** is located on the southeast quadrant of the quadrangle and extends onto the Union City Quadrangle. **State Game Lands #167** is about 627 acres in size. Approximately 294 acres of **State Game Lands #167** are represented on the Wattsburg Quadrangle. **State Game Lands #167** contains a diversity of habitat types, including woodlands, reverting fields, hedgerows, streams, and young miscellaneous forest, and food plots (R. Haibach, Pa. Game Comm., pers. commun.).

State Game Lands #155 is a Managed Land located in Venango Township. **State Game Lands #155** is about 391 acres in size. The game land property is represented on three quadrangles -- Wattsburg, Hammett, and Union City. Approximately 207 acres of **State Game Lands #155** are located on the Wattsburg Quadrangle. **State Game Lands #155** contains food plots, reverting fields, and woodlands. All state game lands in Erie County are managed for both game and nongame wildlife, although particular species may be given emphasis. On **State Game Lands #155** management emphasizes providing habitat for rabbit (Sylvilagus sp.) and American woodcock (Philohela minor) (R. Haibach, Pa. Game Comm., pers. commun.). A portion of **State Game Lands #155** is located within the **French Creek BDA**. Refer to the **BDA** description on the Hammett Quadrangle for further information regarding this Managed Land.

General recommendations regarding Landscape Conservation Area and Biological Diversity Area site protection and management are addressed on pages 53-55. The recommendations for the overall management and protection of the entire **French Creek Basin LCA** and the entire **French Creek BDA** are

synonymous with the general recommendations for LCA's and BDA's. (Note: Areas with heavy disturbance may be included within a LCA boundary when watershed protection is the intent of all or part of the LCA.) Refer to the recommendations on page 123 for guidance regarding the protection of the **BDA** on the Wattsburg Quadrangle. (Note: The conditions by which the general recommendations for the protection and management of the **French Creek Basin LCA** and **French Creek BDA** can be modified are on page 124.)

State Game Lands #191 is a Managed Land located in Greenfield and Venango Townships. **State Game Lands #191** is about 1,224 acres in size. **State Game Lands #191** contains reverting fields, streams, woodlands, wetlands, beaver impoundments, and a few food plots (U.S. Department of Agriculture, 1981; National Wetland Inventory, 1977b; R. Haibach, Pa. Game Comm., pers. commun.).

Another Managed Land depicted on the Wattsburg Quadrangle is **State Game Lands #163** in Greenfield Township. A small portion of **State Game Lands #163** is located on the northwest quadrant of the Wattsburg Quadrangle and extends onto the North East Quadrangle. **State Game Lands #163** is about 342 acres in size. Approximately nine acres are represented on the Wattsburg Quadrangle. Refer to page 116 for a brief description of the biotic resources within **State Game Lands #163**.

Drumlins is a geologic feature recognized as a nearly textbook example of a glacial formation common in northwestern Pennsylvania (Geyer and Bolles, 1979).

HAMMETT QUADRANGLE

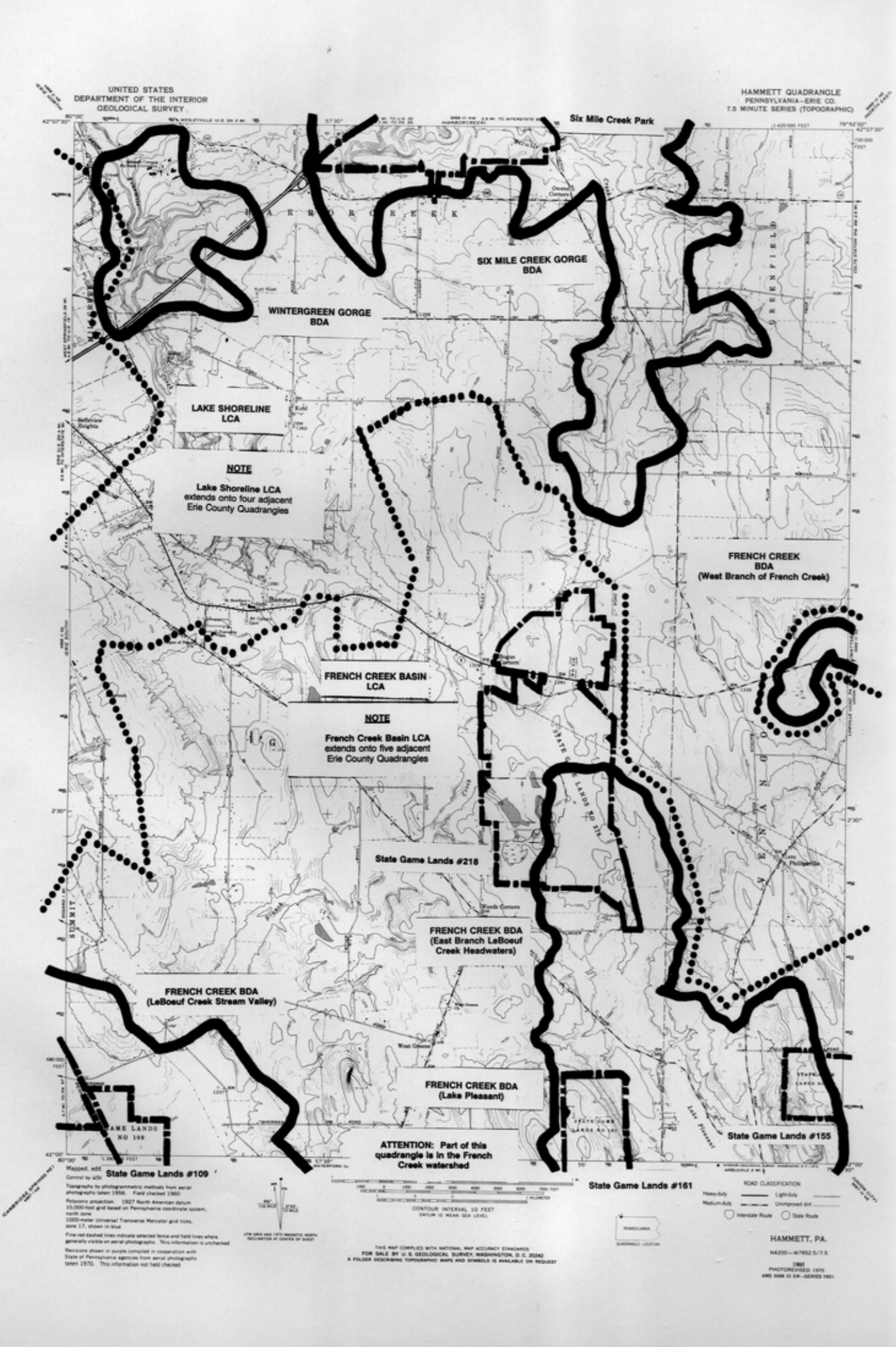
	PNDI Rank		Legal Status		Last
	Global	State	Fed.	State	Seen
SIX MILE CREEK GORGE BDA *Exceptional Significance*					
NATURAL COMMUNITY: NC001	G?	S2	N	N	1992
NATURAL COMMUNITY: NC002	G?	S3	N	N	1992
SPECIAL PLANT: SP001	G5	S1	N	PE	1992
NATURAL COMMUNITY: NC003	G?	S2S3	N	N	1992
NATURAL COMMUNITY: NC004	G?	S1	N	N	1992
SPECIAL PLANT: SP002	G?	S1	N	PE	1992
LAKE SHORELINE LCA *Notable Significance*					
WINTERGREEN GORGE BDA *Exceptional Significance*					
NATURAL COMMUNITY: NC005	G?	S2	N	N	1992
NATURAL COMMUNITY: NC006	G?	S1	N	N	1986
SPECIAL PLANT: SP003	G5	S3	N	PE	1986
SPECIAL PLANT: SP004	G?	S1	N	PE	1986
NATURAL COMMUNITY: NC007	G?	S1	N	N	1986
SPECIAL PLANT: SP005	G5	S1	N	PE	1986
SPECIAL PLANT: SP006	G5	S1	N	PE	1986
FRENCH CREEK BASIN LCA *Exceptional Significance*					
FRENCH CREEK BDA *Exceptional Significance*					
NATURAL COMMUNITY: NC008	G?	S1	N	N	1989
SPECIAL ANIMAL: SA001	G5	S1	N	PC	1989
SPECIAL PLANT: SP007	G4G5	S1	N	PE	1987
SPECIAL PLANT: SP008	G5	S2	N	PE	1987
SPECIAL PLANT: SP009	G5	S2S3	N	TU	1987
SPECIAL PLANT: SP010	G5	S2	N	PT	1987

SPECIAL PLANT: SP011	G4	S1	N	PE	1986
SPECIAL PLANT: SP012	G5	S2S3	N	PT	1986
SPECIAL PLANT: SP013	G5	S2	N	PR	1978
SPECIAL PLANT: SP014	G?	S?	N	?	1988
SPECIAL PLANT: SP015	G5	S?	N	TU	1988
NATURAL COMMUNITY: NC009	G?	S1	N	N	1987
SPECIAL PLANT: SP017	G5	S1	N	PE	1987
SPECIAL PLANT: SP018	G5?	S2S3	N	PE	1987
SPECIAL PLANT: SP019	G5	S1	N	PE	1987
SPECIAL PLANT: SP020	G5	S2	N	PT	1987
SPECIAL PLANT: SP021	G5	S2	N	PT	1987
SPECIAL PLANT: SP022	G5?	S2	N	PT	1987
SPECIAL PLANT: SP023	G5	S1	N	PE	1987
SPECIAL PLANT: SP024	G5	S2S3	N	TU	1987
SPECIAL PLANT: SP025	G5	S1	N	PT	1987
SPECIAL PLANT: SP026	G5	S2S3	N	PT	1987
SPECIAL PLANT: SP027	G5T4T5	S2	N	PE	1992
NATURAL COMMUNITY: NC010	G2G3	S1	N	N	1981
SPECIAL PLANT: SP028	G5	S2	N	PT	1987
NATURAL COMMUNITY: NC011	G?	S3S4	N	N	1992
SPECIAL PLANT: SP029	G5	S2	N	PT	>1990
SPECIAL PLANT: SP030	G5	S1	N	PE	>1990
SPECIAL PLANT: SP031	G5	S1	N	PE	>1990
SPECIAL PLANT: SP032	G5	S1	N	PT	>1990
SPECIAL PLANT: SP033	G4G5	S1	N	PE	>1990
SPECIAL PLANT: SP034	?	?	N	TU	>1990
SPECIAL PLANT: SP035	G5	?	N	TU	>1990
SPECIAL PLANT: SP036	G5	S2	N	PT	>1990
SPECIAL PLANT: SP037	G5	S2S3	N	TU	>1990
SPECIAL PLANT: SP038	G5	S3	N	TU	>1990
NATURAL COMMUNITY: NC012	G?	S1	N	N	1992
SPECIAL PLANT: SP039	G5	S2	N	PT	1991
NATURAL COMMUNITY: NC013	G?	S3	N	N	1991
SPECIAL PLANT: SP040	G5	S2	N	PT	>1990
SPECIAL PLANT: SP041	G5	S1	N	PE	>1990
SPECIAL PLANT: SP042	G5	S2	N	PR	>1990
SPECIAL PLANT: SP043	G?	S2S3	N	PE	>1990
SPECIAL PLANT: SP044	?	?	N	PE	>1990

NATURAL COMMUNITY: NC014	G?	S3S4	N	N	1992
SPECIAL PLANT: SP045	G5	S2S3	N	PT	1991
SPECIAL PLANT: SP046	G5	SU	N	TU	1991
SPECIAL PLANT: SP047	G3G5	S3	N	PT	1991
SPECIAL PLANT: SP048	G3	S1	3C	PE	1992
SPECIAL PLANT: SP049	G5	SU	N	TU	1991
SPECIAL PLANT: SP050	G3	S1	3C	PE	1991
SPECIAL PLANT: SP051	G3	S1	N	PE	1991
SPECIAL PLANT: SP052	G5	S2	N	PE	1991
NATURAL COMMUNITY: NC015	G?	S2S3	N	N	1991
SPECIAL PLANT: SP053	G3	S1	3C	PE	1992
SPECIAL PLANT: SP054	G5	?	N	TU	1992
NATURAL COMMUNITY: NC016	G?	S3	N	N	1992
SPECIAL PLANT: SP055	G5	S2S3	N	TU	1991
SPECIAL PLANT: SP056	G5	S1	N	PT	1991
SPECIAL PLANT: SP057	G5	?	N	TU	1991
NATURAL COMMUNITY: NC017	G?	S2S3	N	N	1992
SPECIAL PLANT: SP058	G5	S1	N	PE	1991
SPECIAL PLANT: SP059	G5	S2	N	PT	1991
NATURAL COMMUNITY: NC018	G?	S3S4	N	N	1992
SPECIAL PLANT: SP060	?	?	N	TU	1992
SPECIAL PLANT: SP061	G?	?	N	TU	1992

MANAGED LANDS:

Six Mile Creek Park
State Game Lands #109
State Game Lands #155
State Game Lands #161
State Game Lands #218


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
HAMMETT QUADRANGLE
PENNSYLVANIA—ERIE CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
Six Mile Creek Park
SIX MILE CREEK GORGE BDA
WINTERGREEN GORGE BDA
LAKE SHORELINE LCA
NOTE
Lake Shoreline LCA extends onto four adjacent Erie County Quadrangles
FRENCH CREEK BDA (West Branch of French Creek)
FRENCH CREEK BASIN LCA
NOTE
French Creek Basin LCA extends onto five adjacent Erie County Quadrangles
State Game Lands #218
FRENCH CREEK BDA (East Branch LeBoeuf Creek Headwaters)
FRENCH CREEK BDA (LeBoeuf Creek Stream Valley)
FRENCH CREEK BDA (Lake Pleasant)
ATTENTION: Part of this quadrangle is in the French Creek watershed
State Game Lands #109
State Game Lands #155
State Game Lands #161
HARBOR CREEK
GREENFIELD
CONNEAUT
UNION
CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
ROAD CLASSIFICATION
HAMMETT, PA.
1960
PHOTOREVISED 1970

HAMMETT QUADRANGLE

The Hammet Quadrangle includes a portion of the **Lake Shoreline LCA**. The **LCA** extends into portions of Millcreek, Harborcreek, and Greene Townships. **Portions of these municipalities are included in the LCA, as they are in the watershed of Presque Isle Bay. The bay is an integral component of the Presque Isle BDA. Land use activities within these municipalities can significantly effect the embayment's limnology (Potomac-Hudson, Inc., 1991)**. For more information on the **Lake Shoreline LCA** and the past and present effects of land use activities within the Presque Isle Bay drainage basin on **Presque Isle BDA/OHA** refer pages 75 to 78 and 92 to 93. Part of the **Wintergreen Green Gorge BDA** is located within the **LCA**, as part of the **BDA** is within the watershed of Presque Isle Bay. (Refer to page 138 for a description of **Wintergreen Gorge BDA**.) For the section of the **Lake Shoreline LCA** on the Hammett Quadrangle, the general recommendations regarding Landscape Conservation Area site protection (page 53) and recommendations for the overall management and protection of the **Lake Shoreline LCA** (page 81) should be applied. Recommendations specific to the protection and management of the **Presque Isle BDA/OHA** and **Wintergreen Gorge BDA** are addressed on pages 86, 92, and 95 to 97, and 140, respectively.

Six Mile Creek Park is a Managed Land owned by the County of Erie and managed by the Erie County Conservation District. The 450 acre park is managed to maintain natural conditions and to provide passive recreation (L. Gross, Erie Co. Cons. Dist., pers. commun.) A portion of **Six Mile Creek Park** is represented on the Hammett Quadrangle. **Six Mile Creek Park** is almost completely forested. The park has been undisturbed for about 30 years. Prior to the early 1960's part of the park had been farmed and most of the forest had been cut. As a result of these past disturbances, the forest contains about 30 or 40 woodland stands of various ages and species composition. A few inaccessible areas within the gorge have not been timbered, however, the rest of the forest within **Six Mile Creek Park** is at most 50 to 60 years old (T. Erdman, DER Bur. of Forestry, pers. commun.). The park is reported to provide high quality wildlife habitat (T. Erdman, DER Bur. of Forestry, pers. commun.). **Six Mile Creek Park** is entirely contained within the **Six Mile Creek Gorge BDA**. Refer to the following description of the **BDA** for natural heritage area information, as well as recommendations for management and protection of both **Six Mile Creek Park** and **Six Mile Creek Gorge BDA**.

Six Mile Creek Gorge BDA is a high diversity area that is represented on the Hammett and Harborcreek Quadrangles. The entire natural heritage area is about 3,104 acres in size, of which 2,048 acres are located on the Hammett Quadrangle. **Six Mile Creek Gorge BDA** contains four natural communities of ecological significance - a high gradient clearwater creek community (**NC001**), an extensive mesic central forest community (**NC002**), a circumneutral cliff community (**NC003**), and lake sediment slump habitats (**NC004**). Two of these natural communities, **NC002** and **NC004**, provide habitat for special plant species populations (**SP001** and **SP002**). In addition to exceptional biotic resources, **Six Mile Creek Gorge BDA** has remarkable aesthetic qualities. Natural hazards associated with the **BDA** are high, near vertical escarpments and steeply sloped valley walls. The area of **Six Mile Creek Gorge BDA** depicted on the Hammett Quadrangle is described below. Refer to page 104 for a description of the portion of the natural heritage area depicted on the Harborcreek Quadrangle.

Six Mile Creek is a high gradient clearwater creek (**NC001**) that originates on the sloping ridge of glacial deposits that separates the lake plain and the glaciated section of the Appalachian Plateau in Erie County. The high gradient stream has cut through the glacial deposits of the ridge and lake plain to underlying Upper Devonian shales and sandstones. As the stream eroded the ridge a series of stream meanders formed creating an unusual topographic feature, as well as a deep steeply sloped stream valley in the lake plain. The Six Mile Creek stream valley is characterized by moderately to steeply sloped forested valley walls with a number of high near vertical shale escarpments along the stream meanders. Valley walls rise about 90 to 250 feet above the stream bed (U.S. Geological Survey, 1970). The high gradient clearwater creek community (**NC001**) has a shale stream bed that contains riffle areas, scattered boulders, and gravel bars. The gravel bars are vegetated to varying degrees. This high gradient clearwater creek (**NC001**) retains outstanding natural characteristics and qualities.

Six Mile Creek Gorge BDA contains an extensive mesic central forest community (**NC002**). A natural community ranked as imperiled in the state. Based on information collected for the inventory mesic central forest communities are uncommon in the county.

The variety of aspects and topography within the entire **Six Mile Creek Gorge BDA** has produced an extensive and diverse mesic central forest community (**NC002**). The forest canopy ranges from open to nearly closed varying with the age of woodland stands. Per aerial reconnaissance, scattered areas of old growth forest occur within **Six Mile Creek Gorge BDA**. Sugar maple (Acer saccharum) is the dominant or

a co-dominant species in the canopy throughout most of the mesic central forest (**NC002**). However, the variety of aspects, topography, and various ages of forest stands in the valley has produced a diversity of local variations in canopy co-dominants. Local forest canopy co-dominants include: beech (Fagus grandifolia), tulip poplar (Liriodendron tulipifera), oak (Quercus sp.), and eastern hemlock (Tsuga canadensis). Other tree species associated with the canopy of **NC002** include ash (Fraxinus sp.), cucumber magnolia (Magnolia accuminata), American basswood (Tilia americana), red maple (Acer rubrum), and cherry (Prunus sp.).

The portion of **Six Mile Creek Gorge BDA** on the Hammett Quadrangle reflects the local variations in **NC002** forest composition. Beech (Fagus grandifolia), sugar maple (Acer saccharum), oak (Quercus sp.), and eastern hemlock (Tsuga canadensis) dominate a section of the forest located on a steeply sloped and terraced southeast facing valley wall. Eastern hemlock dominates the forest at the base of the valley wall and the other tree species dominate the upper slopes of the valley walls. This section of the mesic central forest (**NC002**) has a fairly dense shrub layer dominated by mapleleaf viburnum (Viburnum acerfolium) and a partially vegetated herbaceous layer containing wildflowers, ground pine (Lycopodium sp.), and ferns. Sugar maple and tulip poplar (Liriodendron tulipifera) dominate the mesic central forest community (**NC002**) on a steeply sloping terraced north facing valley wall. Both the shrub and herb layers are sparse in this section of the forest where mapleleaf viburnum dominates the understory. The forested high floodplain at the base of the aforementioned north facing valley wall is dominated by sugar maple in the canopy and shrub strata. Sugar maple and aster (Aster sp.) are co-dominants in the herb layer. Ash (Fraxinus sp.) is a common species on the floodplain.

Along the crest of the meandering channel section of the stream valley, where soils are drier and shallow, the mesic central forest community (**NC002**) is dominated by widely scattered northern red oak (Quercus rubra) and hemlock (Tsuga sp.). This valley ridge crest section of **NC002** provides habitat for a locally common special plant species population (**SP001**) that is endangered in Pennsylvania (Bissell and Danielson, 1992).

Six Mile Creek Gorge BDA contains a circumneutral cliff community (**NC003**) on the near vertical shale escarpments created during stream valley formation. Groundwater seeps are located on the escarpment providing a constant source of hydrology for a significant portion of the escarpment. **NC003** is

partially vegetated. Dominant vegetation includes tulip poplar, coltsfoot, flowering raspberry (Rubus odoratus), aster (Aster sp.), and grasses (Poa spp.).

Two lake sediment slump habitats occur in the **Six Mile Creek Gorge BDA**. One of the lake sediment slumps (**NC004**) is located in the meandering channels section of the **BDA** depicted on the Hammett Quadrangle. **NC004** consists of shallow clayey soils over shale on the lower slope of an open shale escarpment within the stream valley. **NC004** provides habitat for a rarely occurring special plant species (**SP002**) classified as critically imperiled in Pennsylvania and rare in Erie County, as the habitat (**NC004**) for this plant species is rare in the county and the state (B. Danielson and J. Bissell, Cleveland Museum of Natural History, pers. commun.).

Due to the ecological significance of the natural communities (**NC001**, **NC002**, **NC003**, and **NC004**) and the special plant species (**SP001** and **SP002**) contained within **Six Mile Creek Gorge BDA**, the natural heritage area is considered to be of exceptional significance in the county.

Threats to the protection of **Six Mile Creek Gorge BDA** include (1) Stream valley wall erosion, induced by development or by the removal or lack of natural vegetation buffer within site boundaries, could result in the loss or degradation of natural communities within the **BDA**; (2) Degradation of natural communities (**NC001**, **NC002**, and **NC003**) due to changes in groundwater and/or surface water quantity and quality, resulting from existing development and agriculture within the **BDA**; (3) Loss or modification of that portion of natural community **NC002** located outside of **Six Mile Creek Park** due to timber harvesting; (4) Utility right-of-ways have the potential to fragment or alter the composition of the mesic central forest (**NC002**); (5) Although restricted from **Six Mile Creek Park**, off road vehicles commonly access extensive areas of the park and, hence, **Six Mile Creek Gorge BDA**. Off road vehicles can damage and/or eliminate vegetation and compact the substrate, thereby inhibiting revegetation and promoting erosion. The extent of natural community damage resulting from off road vehicles is positively related with their occurrence (i.e., the more use the more damage). Use of the stream bed by off road vehicles to access different areas within the **BDA** was observed during the inventory. Also, the noise from these vehicles disrupts various types of wildlife habitat use (Brown and Schaefer et al., 1987);

(6) Because the gorge is bridged by a highway significant fragmentation has not occurred. However, depending upon the species, noise associated with highways can disrupt various types of wildlife habitat uses up to about one mile on either side (Brown and Schaefer et al., 1987). Forested buffers reduce noise to

a greater extent than no canopy or developed buffers. Although various factors need to be taken into account, forested buffers can reduce arterial traffic noise to background levels and protect wildlife habitat quality (Brown and Schaefer et al., 1987); and (7) Litter and trash disposal were observed within portions of the site. Litter and trash disposal are aesthetically displeasing and can cause environmental degradation. (Refer to pages 54 through 66 for general information on the potential threats posed to natural heritage areas by development, utility right-of-ways, timber harvesting, agriculture, and fragmentation.)

To preserve and protect the ecological resources that comprise the **Six Mile Creek Gorge BDA** the general recommendations for Biological Diversity Areas on page 52 should be implemented. More specific recommendations for the protection and management of the **BDA** are as follows:

(1) To maintain the ecological integrity and natural character of the **BDA**, the Erie County Conservation District should continue "hands off" management of **Six Mile Creek Park**, except as provided in the general recommendations for BDA's on page 52;

(2) The prohibition on off road vehicle use within **Six Mile Creek Park** needs to be maintained and, to the extent possible, enforced;

(3) Most of **Six Mile Creek Gorge BDA** is well buffered by natural vegetation and this vegetation buffer should be retained. Where applicable, property owners should allow restoration of natural vegetation contiguous with and adjacent to the stream valley wall crests within the **BDA** in order to provide the minimum buffer necessary to protect the site from human-induced erosion and protect ground and surface water quality;

(4) No timber harvesting should occur within the **BDA**;

(5) Within the vicinity of the natural heritage site, pesticides should not be used to maintain either the highway or utility right-of-ways. Right-of-way maintenance should be conducted in a manner that protects site integrity. (Recommendations for alternatives to common ROW maintenance practices are on pages 60 and 61.);

(6) To protect each of the natural communities and the special plant populations within the **BDA**, the existing quality and quantity of groundwater and surface water entering the site needs to be maintained or improved. Land use activities within **Six Mile Creek Gorge BDA** should be conducted to manage storm water and avoid erosion, "nonpoint-source" pollution, and wastewater discharges that can adversely effect water quality; and

(7) Ordinances that restrict trash disposal on the valley wall should be enforced or, if appropriate, enacted. The trash that is presently dumped on the valley wall should be removed and properly disposed.

Wintergreen Gorge BDA is a high diversity area containing noteworthy natural communities, species of special concern, and exceptional aesthetic qualities. **Wintergreen Gorge BDA** is located within the Four Mile Creek stream valley and is about 790 acres in size. Within **Wintergreen Gorge BDA** a high gradient clearwater creek meanders through a deep gorge containing a mesic central forest community (**NC005**), calcareous seep community (**NC006**), and lake sediment slump habitat (**NC007**). The natural communities within the **BDA** are of ecological significance from both a state and county perspective. And two of these natural communities (**NC006** and **NC007**) harbor species of special concern in Pennsylvania. Natural hazards are associated with the **BDA** as the high, near vertical escarpments and steeply sloped valley walls.

Four Mile Creek is a tributary to Lake Erie. The stream bed is shale with scattered gravel deposits and small boulders. Several waterfalls are located within the surveyed stream segment. Gravel deposits are located on the inside of stream meanders and in mid-channel. These stream gravel beds are sparsely vegetated with jewelweed (Impatiens sp.), coltsfoot (Tussilago farfara), mint (Mentha sp.), and dock (Rumex sp.). Several species of minnows are reported to inhabit the stream (O'Kelly and Masteller, 1972). Four Mile Creek exhibits characteristics that may qualify the stream as a natural community per natural heritage criteria, however, additional research would be necessary to make this determination.

Four Mile Creek has created a deep stream valley with valley walls that rise from about 150 to 350 feet above the stream. The valley walls are mostly steeply sloped, however, terraces and an extensive high floodplain are also located within the area surveyed. Most of the stream valley is forested. The approximately 165 acre forest is mostly second growth with some mature stands (Wiegman, 1978). The forest within **Wintergreen Gorge BDA** is a natural community classified as imperiled in Pennsylvania -- a mesic central forest community (**NC005**). Because the forest community is in part dominated by beech (Fagus grandifolia) and sugar maple (Acer saccharum), the mesic central forest community is also uncommon in Erie County.

A variety of aspects, terrain, and hydrology on the stream valley walls has produced a diverse mesic central forest community (**NC005**). A high floodplain along the bottom of part of the east valley wall contains a mature forest. The canopy of the forest on the floodplain is dominated by sugar maple. The

shrub layer is sparse on the floodplain. A diverse herb layer covers the high floodplain and is dominated by pale jewelweed (Impatiens pallida) and wild leek (Allium tricoccum). Forest openings caused by wind thrown trees are dominated by sugar maple saplings and jewelweed. The steeply sloped east valley wall within the **Wintergreen Gorge BDA** contains a relatively mature forest (**NC005**) dominated by beech and sugar maple. Beech and sugar maple are dominants in all vegetation strata. In addition to beech and sugar maple, pale jewelweed and heart-leaved aster (Aster cordifolius) are co-dominants in the herbaceous layer. Early meadow rue (Thalictrum dioicum) is a local dominant. The mesic central forest community (**NC005**) on the floodplain and east valley wall has a highly diverse understory, including numerous species of wildflowers. Groundwater seepages are located at various elevations throughout the forested east valley wall.

Groundwater seepages are also a primary source of hydrology for the section of mesic central forest (**NC005**) on the very steeply sloped west valley wall. The section of forest on the west valley wall has a tree canopy dominated by sugar maple. Eastern hemlock (Tsuga canadensis) is a common species in the canopy. Forest openings caused by wind thrown and storm damaged trees are common. These openings are dominated by sugar maple and American basswood saplings, as well as pale jewelweed. Pale jewelweed, foamflower (Tiarella cordifola), and wood fern (Dryopteris spp.) are the dominant species in the herbaceous layer. The section of the mesic central forest community (**NC005**) on the west valley wall has a highly diverse understory, including numerous species of wildflowers and mosses.

Wintergreen Gorge BDA contains a calcareous seep community (**NC006**) located on steeply sloped shale valley wall containing a large groundwater seepage area (Bissell, 1986). **NC006** provides habitat for two special plant species (**SP003** and **SP004**) that require a high pH and alkaline conditions. **SP003** population is locally common within the calcareous seep community (**NC006**). The legal status of **SP003** is endangered in Pennsylvania. The **SP004** population occurs locally within **NC006**. Calcareous seep communities are rare in Erie County and ranked as critically imperiled in the state.

Adjacent to the calcareous seep community (**NC006**) within the **BDA** is another natural community that is uncommon in the county and critically imperiled in the state. The natural community is a lake sediment slump habitat (**NC007**). **NC007** provides habitat for a rarely occurring special plant population (**SP005**) and a local to occasionally occurring special plant population (**SP006**). Both **SP005** and **SP006** are species

classified as critically imperiled in the state. Because the habitat for **SP005** and **SP006** is rare, both species are uncommon in the county.

Due to the ecological significance of the natural communities (**NC005**, **NC006**, and **NC007**) and the special plant species (**SP003**, **SP004**, and **SP005**) within **Wintergreen Gorge BDA**, the natural heritage area is of exceptional county significance.

Threats to the protection of **Wintergreen Gorge BDA** include (1) Stream valley wall erosion, induced by development or by the removal or lack of natural vegetation within site boundaries, which could result in partial loss or degradation of each of the natural communities within the **BDA**; (2) Degradation of natural communities (**NC005, NC006**, and **NC007**) due to changes in groundwater and/or surface water quantity and quality, resulting from existing adjacent development, agriculture, and timber harvesting. The erodibility of stream valley soils and maintenance of groundwater quality and quantity were the primary factors in establishing the **BDA**'s buffer; (3) Natural community (**NC005**) loss or modification from timber harvesting; (4) Right-of-way maintenance that would either fragment or alter the composition of the mesic central forest (**NC005**); and (5) forest fragmentation which would either adversely effect the mesic central forest community (**NC005**) or eliminate the ecological integrity of **NC005**. Depending upon the species, noise associated with highways disrupts various types of wildlife habitat uses up to about one mile on either side (Brown and Schaefer et al., 1987). Forested buffers reduce noise to a greater extent than no canopy or developed buffers. Although various factors need to be taken into account, forested buffers can reduce arterial traffic noise to background levels (Brown and Schaefer et al., 1987). (Refer to pages 54 through 66 for general information on the potential threats posed to natural heritage areas by development, right-of-way maintenance, timber harvesting, agriculture, and fragmentation.)

To preserve and protect the ecological resources that comprise the **Wintergreen Gorge BDA**, the general recommendations for Biological Diversity Areas on page 52 should be implemented. More specific recommendations for the protection and management of the **BDA** are

(1) In order to provide the minimum buffer necessary to protect the ecological resources within the **BDA**, property owners should retain or, to the extent possible, restore natural vegetation contiguous with and along the crests of the stream valley walls;

(2) Maintenance or expansion of vegetation along the valley wall crests serve to prevent human-induced erosion within the **BDA**;

(3) No timber harvesting should occur within the **BDA**;
(4) Within the vicinity of the natural heritage site, herbicides should not be used to maintain either the highway or utility right-of-ways. Right-of-way maintenance should be conducted in a manner that protects site integrity. (Recommendations for alternatives to common ROW maintenance practices are on pages 60 and 61.); and
(5) To protect each of the natural communities and the special plant populations within the **BDA**, the existing quality and quantity of groundwater and surface water entering the site needs to at least be maintained. Land use activities within **Wintergreen Gorge BDA** should be conducted to manage storm water and avoid erosion, "nonpoint-source" pollution, and wastewater discharges that can adversely effect water quality.

Portions of the **French Creek Basin LCA** and **French Creek BDA** are represented on the Hammett Quadrangle. A description of the portion of the **LCA** on the Hammett Quadrangle follows. Refer to pages 119 and 120 for a holistic description of the biotic communities and the ecological significance of the natural resources within the **French Creek Basin LCA** and the **French Creek BDA**.

The portion of the **French Creek LCA** represented on the Hammett Quadrangle includes part of the watershed of LeBoeuf Creek, part of the watershed of the main stem of French Creek, a portion of the **French Creek BDA**, and four Managed Lands -- **State Game Lands #109**, **#155**, **#161**, and **#218**. The **French Creek Basin BDA** contains 11 noteworthy natural communities, **NC008** through **NC018**, that contain a total of 55 occurrences of species of special concern.

The glacial kettle lake, commonly known as Lake Pleasant, is a calcareous glacial lake community (**NC008**) and is one of five such communities in western Pennsylvania. In the state, **NC008** is classified as a critically imperiled natural community. **NC008** contains two natural communities noteworthy in their own right -- a basin graminoid-forb fen (**NC009**) and a shrub fen community (**NC010**). Like the calcareous glacial lake community, **NC009** is a critically imperiled natural community. **NC010** is a globally imperiled/very rare natural community and is considered to be the best example of a glacial lake in northwestern Pennsylvania and northeastern Ohio (de Maynadier, 1989). **NC008**, **NC009**, and **NC010** each provide habitat species of special concern. A total of 23 occurrences of special animal and special plant species have been confirmed within these three natural communities. The calcareous glacial lake (**NC008**) discharges into an area known as Lake Pleasant Outlet. Lake Pleasant Outlet contains a composite of

natural communities that are also components of the **French Creek BDA**. Most of Lake Pleasant Outlet is represented on the Waterford Quadrangle. Refer to pages x-y for a description of the natural communities contained within Lake Pleasant Outlet.

Lake Pleasant (**NC008**) is an approximately 64 acre oval-shaped glacial lake located at the head of a glacially carved valley. **NC008** is recharged by subsurface seepage from the surrounding uplands. The lake (**NC008**) is reported to be 35 to 40 feet deep in the middle with a gravelly bottom covered by silt. The open water area of **NC008** is surrounded on the north and south ends by wetlands. Within these wetlands are natural communities **NC009** and **NC010**. The east shore is bordered by a public road and the west shore is shrub edged with some development along the northwest shoreline (de Maynadier, 1989). **NC008** provides habitat for ten species of special concern -- one special animal (**SA001**) and nine special plants (**SP007** through **SP015**). The special animal (**SA001**) is a fish classified as critically imperiled in the state. Protection of **SA001** requires that lake water quality and quantity be maintained or improved. The same is true for the protection of all the special plant species. All but two of the special plant species (**SP007** through **SP009**, **SP011**, **SP012**, **SP013**, and **SP015**) inhabiting **NC008** are aquatic bed species. The remaining two special plant species (**SP010** and **SP014**) are emergent wetland species. In addition to water quality and quantity protection, the latter two species (**SP010** and **SP014**) need to be protected from trampling.

The basin graminoid-shrub fen community (**NC009**) located in the wetlands on the south side of **NC008** is a diverse, although fairly small, lake side seepage wetland exhibiting both alkaline and acidic characteristics. The substrate is hydric peaty-muck. **NC009** contains pools, rivulets, fennish openings, and shrub thickets. **NC009** is dominated by **SP022**, cattail (Typha sp.), peatmoss (Sphagnum sp.), pitcher-plant (Sarracenia sp.), speckled alder (Alnus rugosa), willows (Salix spp.), and **SP024**. In addition to the special plant species that are dominants in **NC009**, the basin graminoid-shrub fen community provides habitat for nine other special plant species (**SP016** through **SP021**, **SP023**, **SP025** through **SP027**). The special plant species are classified as either critically imperiled, imperiled, or rare in Pennsylvania. Protection of **NC009** and the associated species of special concern requires protecting the quality and quantity of water entering the fen (**NC009**).

The wetland that borders the open waters of **NC008** on the north side is about 30 acres in size and dominated by red-osier dogwood (Cornus stolonifera), silky dogwood (C. amomum), and alder (Alnus sp.)

with scattered openings dominated by cattail (Typha sp.) and scattered red maple (Acer rubrum) and white pine (Pinus strobus). Poison sumac (Rhus vernix) is also present and is a natural hazard for the unwary (Rimmel, 1981). This wetland is a shrub fen community (**NC010**), which is a natural community classified as globally imperiled/very rare. **NC010** provides habitat for a special plant species (**SP028**) threatened in Pennsylvania. As with **NC008** and **NC009**, preservation of **NC010** requires the protection of water quality and quantity entering the fen.

Land use activities that threaten the ecological resources of Lake Pleasant (**NC008**, **NC009**, and **NC010**) include mineral extraction, and residential and industrial development. (Refer to pages 55 and 56 for information on the threats these land use activities pose to natural heritage areas.) The restriction on motorboats using the lake should be maintained.

Another natural heritage area contained within the **French Creek BDA** is located immediately north of Lake Pleasant on the other side of the watershed divide. This site occurs within another glacially carved valley and extends from the head of the valley north into **State Game Lands #218**. A composite of eight natural communities (**NC011** through **NC018**) occupies most of the valley basin and provides habitat for 33 occurrences of 18 special plant species (**SP029** through **SP061**). The primary sources of hydrology for this extensive and exceptional wetland system are groundwater seepages and a low gradient clearwater creek (i.e., the headwaters of the East Branch of LeBoeuf Creek).

At the northern end of the valley, containing natural communities **NC011** through **NC018**, is an exemplary northern conifer swamp community (**NC011**). **NC011** is located along the lower slopes of the valley walls. **NC011** contains areas of saturated and inundated soils. The northern conifer swamp community (**NC011**) is dominated by eastern hemlock (Tsuga canadensis), cinnamon fern (Osmunda cinnamomea), and mosses, including peatmoss (Sphagnum sp.). Local dominants within **NC011** include yellow birch (Betula lutea), red maple, witch hazel (Hamamelis virginiana), wild lily-of-the-valley (Maianthemum canadensis), **SP034**, wood fern (Dryopteris sp.), blueberry (Vaccinium sp.), goldthread (Coptis groenlandica), sedges (Carex spp.), and jewelweed (Impatiens sp.). **NC011** provides habitat for ten special plant species occurrences (**SP029** through **SP038**). Nine of these ten special plants (**SP029** through **SP033** and **SP036** through **SP038**) are classified as critically imperiled, imperiled, or rare in the state.

NC011 borders a significant part of the upper stream valley basin. This portion of the stream basin contains a mosaic of four noteworthy natural communities (**NC012** through **NC015**).

NC012 is a calcareous marsh community -- a natural community critically imperiled in the state. **NC012** consists of a sparsely vegetated palustrine meadow dominated by soft bulrush (Scirpus validus) and rushes (Juncus spp.) (Bissell and Danielson, 1991). **NC012** provides habitat for local and rarely occurring populations of **SP039**. **SP039** is a special plant species that is threatened in the state.

NC013 is a circumneutral shrub swamp community -- a rare/uncommon community in the state. **NC013** is dominated by speckled alder (Alnus rugosa), willow (Salix sericea), pussy willow (S. discolor), and sedges (Carex spp.) with scattered peatmoss (Sphagnum) hummocks (Bissell and Danielson, 1991). The circumneutral shrub swamp community (**NC013**) provides habitat for five special plant species (**SP040** through **SP044**). In Pennsylvania, these special plant species are classified as either endangered, threatened, or rare.

The East Branch of LeBoeuf Creek originates within the stream basin. The stream is a low gradient clearwater creek community (**NC014**) that is partly free flowing. Fed primarily by groundwater seepages, the narrow creek (**NC014**) meanders through the stream basin except where interrupted by old beaver dams. The area of the stream surveyed for the inventory contained submerged and floating aquatic vegetation, including bur-reed (Sparganium sp.), bladderwort (Utricularia sp.), duckweed (Lemna minor), water cress (Nasturtium sp.), water purslane (Ludwigia sp.), and leafy pondweed (Potamogeton foliosus). Further downstream in **State Game Lands #218**, a segment of **NC014** has been partly modified by ditching and the construction of dikes. However, below these disturbances the stream is again free-flowing until reaching the upper end of an impoundment created for waterfowl management. **NC014** provides habitat for eight special plant species occurrences (**SP045** through **SP052**). These special plant species occur in both the natural stream corridor (**SP045** through **SP048**) and the modified stream corridor (**SP049** through **SP052**). Three of the special plant species (**SP048**, **SP050**, and **SP051**) are considered to be very rare on a global basis.

As mentioned previously, several old beaver dams are located within this portion of the **French Creek BDA**. The impoundments created by these dams are considered to be natural communities (i.e., natural ponds) (Smith, 1983). Natural ponds (**NC015**) are imperiled/rare in the state. Within one of these ponds occur two special plant species occurrences -- **SP053** and **SP054**. One of these special plant species (**SP053**) is a globally very rare species. In addition, to providing habitat for special plant species, the natural ponds add to the diversity of habitats within the stream valley basin where natural communities **NC011** through **NC015** are located.

Part of the East Branch of LeBoeuf Creek stream basin contained in the **French Creek BDA** is located within a Managed Land, **State Game Lands #128**. A general description of the Managed Land is provided below. However, that portion of the state game land that contains natural communities **NC016** through **NC018**, which are part of the **French Creek BDA**, is addressed here. **NC016** is a circumneutral shrub swamp community dominated by speckled alder, yellow birch, and dogwood (Bissell and Danielson, 1991). Three species of special concern occur within **NC016 -- SP055**, **SP056**, and **SP057**. Each of these special plant species are of state significance.

Two exemplary natural communities are located at the northern end of the East Branch of LeBoeuf Creek section of the **French Creek BDA** in **State Game Lands #218**. These two natural communities are a mixed graminoid-robust emergent marsh community (**NC017**) bordered in part by a broadleaf-conifer swamp (**NC018**) located along the lower slope of the stream valley wall. **NC017** is dominated by rice cutgrass (Leersia oryzoides), arrow-leaved tearthumb (Polygonum sagittatum), and soft bulrush with scattered shrub thickets dominated by silky dogwood. **NC017** provides habitat for two special plant populations -- **SP058** and **SP059**. Both plant species are endangered in Pennsylvania. The broadleaf-conifer swamp community (**NC018**) is highly diverse and fairly extensive. The forested swamp (**NC018**) has a partly open canopy which contributes to species diversity, as does a variable hydrology. The mucky organic substrate ranges from saturated to inundated. The tree canopy of **NC018** is dominated by eastern hemlock, red maple, and yellow birch. Dominants in the shrub and herbaceous strata are **SP060**, jewelweed, sensitive fern, cinnamon fern, and halberd-leaved tearthumb (Polygonum arifolium). Openings in the tree canopy are dominated by the aforementioned shrub (**SP060**), ferns, and herbs. A forested knoll within **NC018** contains a special plant species (**SP061**) population. **SP061** dominates the shrub layer. The tree canopy is dominated by eastern hemlock, red maple, and yellow birch.

In addition to the natural communities described above, the section of the **French Creek BDA** in which **NC011** through **NC018** are located also contains more commonly occurring herb, shrub, and tree dominated communities. While these communities do not warrant individual recognition per inventory ranking criteria, the occurrence of these communities in proximity to the natural communities within this portion of the **BDA** increases the ecological integrity and wildlife and aquatic life habitat value of the biological resources located within the East Branch of LeBoeuf Creek stream valley basin.

Most of the **French Creek BDA**, where **NC011** through **NC015** are located, has an adequate forested buffer, although disturbance associated with mineral extraction and development has occurred on the south side of the site. Disturbance associated with mineral extraction and habitat management activities has adversely effected part of **NC014**, **NC016**, **NC017**, and **NC018**. However, the undisturbed portions of these natural communities remain exemplary. Threats to the protection of **NC011** through **NC018** are degradation of water quality and quantity due to adjacent mineral extraction and industrial development or additional hydrologic modification related to habitat management on **State Game Lands #218**. **NC011** has retained notable characteristics despite past selective timber harvesting, however, additional timber removal would jeopardize the biological integrity of the community and special plant species that inhabit **NC011**. An exotic species, reed canary grass (Phalaris arundinacea) has become well established at the very southern end of **State Game Lands #218** and poses a threat to special species habitats.

At the southwest corner of the Hammett Quadrangle another part of the **French Creek Basin LCA** is represented. Located within this portion of the **LCA** is part of another component of the **French Creek BDA** -- an extensive wetland system that occupies a considerable portion of the LeBoeuf Creek stream valley basin. This **French Creek BDA** component is largely represented on the Waterford Quadrangle. Refer to pages 221 through 223 for a detailed description of this exceptional natural heritage area.

Within the portion of the **French Creek Basin LCA** depicted on the Hammett Quadrangle are four Managed Lands: **State Game Lands #109**, **State Game Lands #218**, **State Game Lands #161**, and **State Game Lands #155**.

Part of **State Game Lands #109** is represented on the Hammett Quadrangle. **State Game Lands #109** is also represented on three other Quadrangles: Erie South, Cambridge Springs NE, and Waterford. **State Game Lands #109** is 1,639 acres in size. The portion of **State Game Lands #109** on the Hammett Quadrangle is about 239 acres in size. Refer to page 218 for a brief description of the Managed Land attributes of **State Game Lands #109**.

The portion of **State Game Lands #109** on the Hammett Quadrangle is contained entirely within the **French Creek BDA** and the **French Creek Basin LCA**. The portion of the **French Creek BDA** on the Hammett Quadrangle that includes **State Game Lands #109** is described on page 221.

State Game Lands #218 is another Managed Land represented on the Hammett Quadrangle. Locally known as Siegal Marsh, the Pennsylvania Game Commission property is 1,343 acres in size. State game lands management may emphasize a particular species. **State Game Lands #218** is one game land in Erie County where this emphasis is apparent. **State Game Lands #218** was formerly managed as a propagation area for the Canada goose (Branta canadensis). As a result, this game land is the most manipulated state game land in the county. Food plots and a 143 acre propagation area, consisting of mowed field and impoundments, occupy a significant portion of the property. Because of overwhelming success, the Canada Goose propagation and refuge program is no longer implemented at the game land. Now, **State Game Lands #218** management seeks to provide habitat for a diversity of nongame and game wildlife, emphasizing habitat for wood duck (Alix sponsa), American black duck (Anas rubripes), mallard (A. platyrhynchos), and other duck species (R. Haibach, Pa. Game Comm., pers. commun.). The southwest portion of **State Game Lands #218** retains natural communities and special species habitats of significance in the county and the state. This portion of **State Game Lands #218** is part of the **French Creek BDA** described above.

Another Managed Land on the Hammett Quadrangle is **State Game Lands #155** in Venango Township. A portion of **State Game Lands #155** is located on the southeast quadrant of the Wattsburg quadrangle and extends onto the Wattsburg and Union City Quadrangles. **State Game Lands #155** is about 391 acres in size. Approximately 156 acres are represented on the Hammett Quadrangle. Refer to page 127 for a brief

description of the biotic resources within **State Game Lands #155**. A portion of this Managed Land is included in the **French Creek BDA** because the state game land is partly located within the Lake Pleasant (**NC008** through **NC010**) watershed.

State Game Lands #161 is a Managed Land located in Greene and Waterford Townships. **State Game Lands #161** is represented on the southeast quadrant of the Hammett Quadrangle and extends onto the Waterford Quadrangle. **State Game Lands #161** is about 235 acres in size. Approximately 226 acres are represented on the Hammett Quadrangle. The game land is located on mostly forested hilly terrain (U.S. Geological Survey, 1970). Portions of the game land contains reverting fields and food plots (R. Haibach, Pa. Game Comm., pers. commun.).

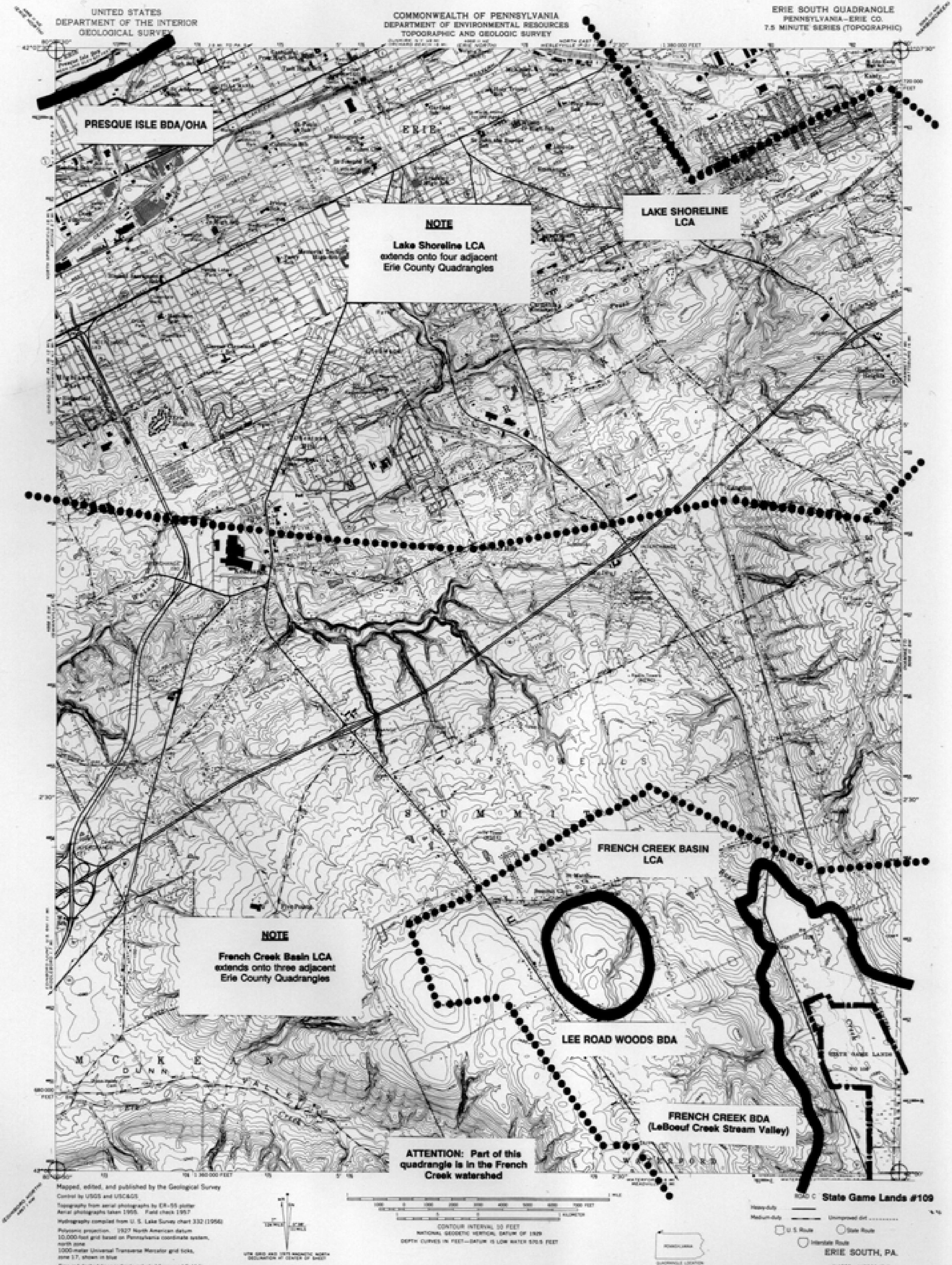
General recommendations regarding Landscape Conservation Area and Biological Diversity Area site protection and management are addressed on pages 52 and 53. The recommendations for the overall management and protection of the entire **French Creek Basin LCA** and the entire **French Creek BDA** are synonymous with the general recommendations for LCA's and BDA's. Refer to the recommendations on page 124 for guidance regarding the protection of the **BDA** on the Hammett Quadrangle. (Note: The conditions by which the general recommendations for the protection and management of the **French Creek Basin LCA** and **French Creek BDA** can be modified are on page 124.)

ERIE SOUTH QUADRANGLE

	PNDI Rank Global	State	Legal Status Fed.	State	Last Seen
LAKE SHORELINE LCA *Notable Significance*					
PRESQUE ISLE BDA/OHA *Exceptional Significance*					
NATURAL COMMUNITY: NC001	G?	S1	N	N	1992
FRENCH CREEK BASIN LCA *High Significance*					
LEE ROAD WOODS BDA *Notable Significance*					
SPECIAL ANIMAL: SA001	G5	S3S4	N	N	1992
FRENCH CREEK BDA *High Significance*					
NATURAL COMMUNITY: NC002	G?	S2S3	N	N	1992
SPECIAL PLANT: SP001	G5	?	N	TU	1992

MANAGED LAND:

State Game Lands #109


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
TOPOGRAPHIC AND GEOLOGIC SURVEY
ERIE SOUTH QUADRANGLE
PENNSYLVANIA—ERIE CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
PRESQUE ISLE BDA/OHA
NOTE
Lake Shoreline LCA extends onto four adjacent Erie County Quadrangles
LAKE SHORELINE LCA
FRENCH CREEK BASIN LCA
NOTE
French Creek Basin LCA extends onto three adjacent Erie County Quadrangles
LEE ROAD WOODS BDA
FRENCH CREEK BDA (LeBoeuf Creek Stream Valley)
ATTENTION: Part of this quadrangle is in the French Creek watershed
State Game Lands #109
CONTOUR INTERVAL 10 FEET
ERIE SOUTH, PA.

ERIE SOUTH QUADRANGLE

The **Lake Shoreline LCA** on the Erie South Quadrangle includes a portion of the **Presque Isle BDA/OHA**, the City of Erie, Lawrence Park Borough, Wesleyville Borough, as well as portions of Millcreek, Harborcreek, and Greene Townships. **In whole or in part, these municipalities are within the drainage basin of Presque Isle Bay (NC001) -- a component of the Presque Isle BDA/OHA. The LCA boundary includes the urban areas within the bay's drainage basin, as land use activities within these municipalities can significantly effect the embayment's limnology (Potomac-Hudson, Inc., 1991).** For more information on the **Lake Shoreline LCA** and the past and present effects of drainage basin on **Presque Isle BDA/OHA**, refer to pages 75 to 78 and 92 to 93. For the section of the **LCA** on the Erie South Quadrangle, the general recommendations regarding Landscape Conservation Area site protection (page 53) and recommendations for the overall management and protection of the **Lake Shoreline LCA** (page 81) should be applied.

A small portion of the **Presque Isle BDA/OHA** is represented on the Erie South Quadrangle. This portion of the **BDA/OHA** includes the lake bluff, southern bay shoreline, and the open waters of the embayment. For a description of the ecological resources that comprise the **Presque Isle BDA/OHA** and their biological significance refer the natural heritage area descriptions for the Erie North Quadrangle (pages 82 to 95) and the Swanville Quadrangle (pages 156 to 159). The specific recommendations on pages 86, 92, and 95 to 97 for the **Presque Isle BDA/OHA** are applicable to the portion of **BDA/OHA** represented on the Erie South Quadrangle.

On the Erie South Quadrangle, a portion of the **French Creek Basin LCA** is represented. A description of the portion of the **LCA** on the Erie South Quadrangle follows. Refer to pages 119 and 120 for a holistic description of the biotic communities and the ecological significance of the natural resources within the **French Creek Basin LCA** and the **French Creek BDA**.

The portion of the **French Creek LCA** represented on the Erie South Quadrangle includes the watershed of LeBoeuf Creek, the **Lee Road Woods BDA**, and a portion of a **French Creek BDA** component that contains an extensive wetland system located in another glacially carved valley --the LeBoeuf Creek stream valley.

The LeBoeuf Creek stream valley component of the **French Creek BDA** depicted on the Erie South Quadrangle is largely represented on the Waterford Quadrangle. Therefore, this portion of the **French**

Creek BDA is primarily addressed on pages 220 to 223. However, one of the natural communities (**NC002**) within the **BDA** represented on the Erie South Quadrangle deserves special attention and is described below.

Lee Road Woods BDA is a special species habitat area that provides breeding habitat for a bird (**SA001**) whose breeding colonies are tracked by the natural heritage program when the colonies consist of more than 15 nests. The natural heritage state ranking for **SA001** indicates that the bird species is rare to uncommon/apparently secure, however, breeding colonies for the bird are classified as rare/uncommon in the state. The Pennsylvania Biological Society considers the **SA001** species to be threatened in the state. **Lee Road Woods BDA** is a forested tract of about 321 acres. In 1992, the **SA001** colony located within the **Lee Road Woods BDA** contained approximately 129 nests in 55 trees. Approximately 110 birds were using the nests during incubation in spring 1992. The **SA001** nesting colony is roughly 73 acres in size (L. Smith, Pa. Game Commission, pers. commun.). The size of the **BDA**, vegetation structure, the presence of a 820 foot buffer zone free of human disturbance, and the presence of water (i.e., streams) provides a nesting habitat highly suitable for the **SA001** colony (Short and Cooper, 1985). Proximity of the nesting area to forage area(s) and other potential nests sites are also habitat variables of import for **SA001**, however, assessing these variables is outside the scope of the inventory. Timber harvesting within the colony and reduction in the buffer zone would threaten the viability of the nesting colony for **SA001**. General recommendations regarding Biological Diversity Area site protection and management are addressed on page x. Refer to these recommendations for guidance regarding the protection of the **Lee Road Woods BDA** on the Erie South Quadrangle. In addition to the recommendations on page x, the habitat variables present within the **Lee Road Woods BDA** mentioned above need to be protected.

Within the **French Creek BDA** represented on the Erie South Quadrangle is **NC002**. **NC002** is a circumneutral broadleaf swamp community. The primary source of hydrology for **NC002** is groundwater seepages. Circumneutral broadleaf swamp communities are classified as imperiled/rare in the state. Based upon the field surveys conducted for the inventory, **NC002** is also a rare natural community in Erie County and retains exemplary characteristics, despite the presence of disturbance (i.e., **NC002** is bisected by a unpaved secondary road). The entire circumneutral broadleaf swamp (**NC002)** has an open canopy dominated by red maple (Acer rubrum), black ash (Fraxinus nigra), and snags. However, the dominants within the shrub and herbaceous strata vary markedly on either side of the road that bisects the roughly 30 acre site. The shrub and herb layers in the southern section of **NC002** contains northern arrowwood

(Viburnum recognitum) and speckled alder (Alnus rugosa) dominated shrub thickets scattered within a royal fern (Osmunda regalis), cinnamon fern (O. cinnamomea), and a sedge (Carex sp.) dominated herb stratum. The northern section of **NC002** contains silky dogwood (Cornus amomum) dominated shrub thickets scattered within a herbaceous stratum dominated by spotted jewelweed (Impatiens capensis), wood horsetail (Equisetum sylvaticum), rice cutgrass (Leersia oryzoides), swamp buttercup (Ranunculus septentrionalis), sensitive fern (Onoclea sensibilis), and various grasses. This latter section of **NC002** provides habitat for a special plant species (**SP001**). **NC002** is bordered by a second growth terrestrial forest of varying widths. Further development on private land adjacent to **State Game Lands #109**, where most of **NC002** is located, poses a threat to the protection of the natural community via habitat loss resulting from development activities, as well as water quality and quantity degradation.

Part of **State Game Lands #109** is represented on the Erie South Quadrangle, as well as the Hammett, Cambridge Springs NE, and Waterford quadrangles. About 275 acres of the 1,639 acre state game land are represented on the Erie South Quadrangle. A brief description of the Managed Land attributes of **State Game Lands #109** are on page 218. The portion of **State Game Lands #109** on the Erie South Quadrangle is contained entirely within the section of the **French Creek BDA** that contains the LeBoeuf Creek stream valley.

General recommendations regarding Landscape Conservation Area and Biological Diversity Area protection and management are addressed on pages 52 and 53. The recommendations for the overall management and protection of the entire **French Creek Basin LCA** and the entire **French Creek BDA** are synonymous with these general recommendations. Refer to the recommendations on page 124 for guidance regarding the protection of the **French Creek BDA** on the Erie South Quadrangle. (Note: The conditions by which the general recommendations for the protection and management of the **French Creek Basin LCA** and **French Creek BDA** can be modified are on page 124.)

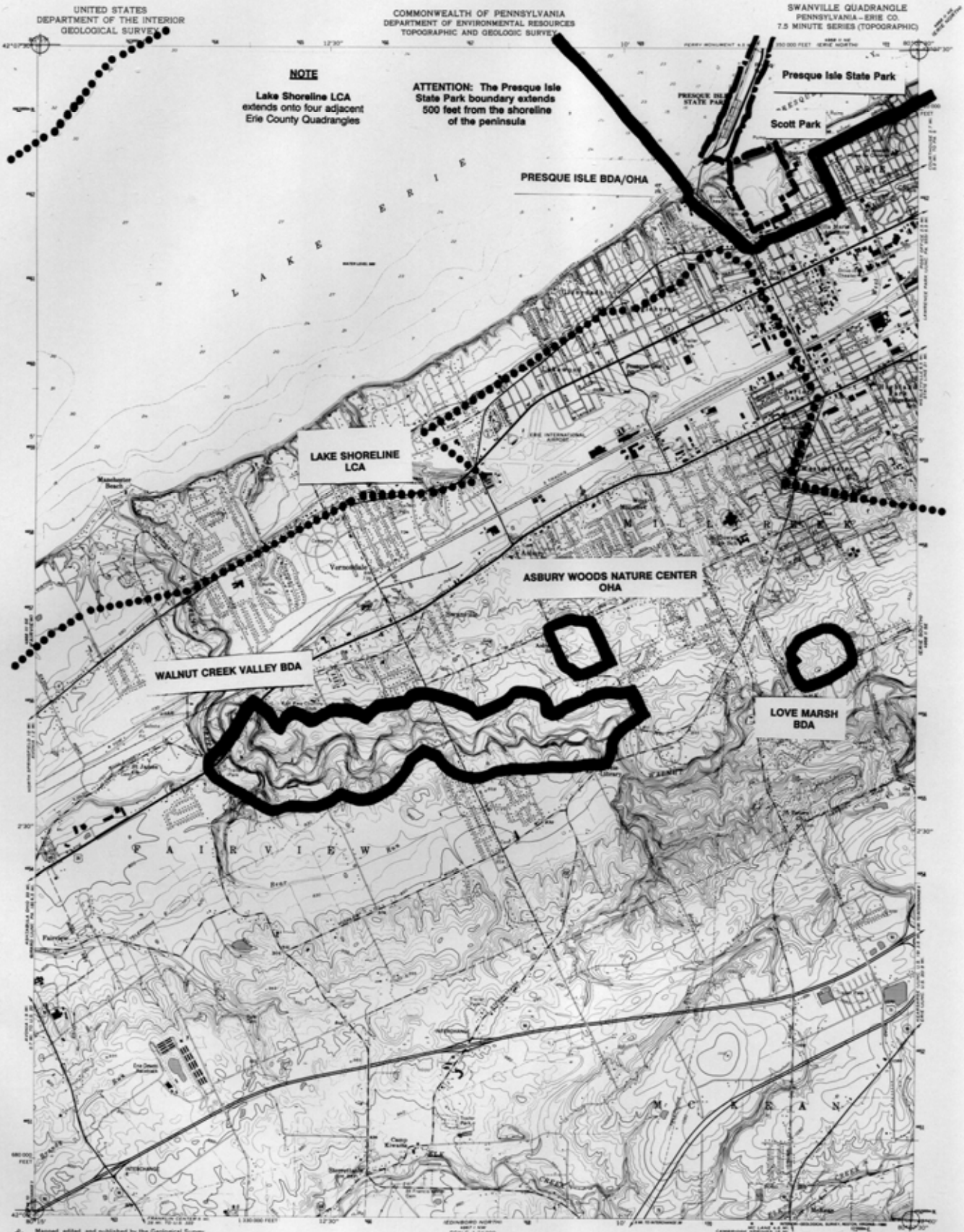
SWANVILLE QUADRANGLE

	PNDI Rank		Legal Status		Last
	Global	State	Fed.	State	Seen
LAKE SHORELINE LCA *High Significance*					
PRESQUE ISLE BDA/OHA *Exceptional Significance*					
NATURAL COMMUNITY: NC001	G?	S2	N	N	1992
NATURAL COMMUNITY: NC002	G?	S1	N	N	1992
SPECIAL PLANT: SP001	G5	S2	N	PR	1987
SPECIAL PLANT: SP002	G4Q	S3	N	PE	1987
SPECIAL PLANT: SP003	G5	S1	N	PE	1985
SPECIAL PLANT: SP004	G5	S2S3	N	PT	1987
SPECIAL PLANT: SP005	G5	S2	N	PR	1987
LOVE MARSH BDA *Exceptional Significance*					
SPECIAL PLANT: SP006	G5	S1	N	PE	1992
WALNUT CREEK VALLEY BDA *Exceptional Significance*					
NATURAL COMMUNITY: NC003	G?	S1	N	N	1990
SPECIAL PLANT: SP007	G5	S1	N	PE	1990
SPECIAL PLANT: SP008	G5	S1	N	PE	1990
NATURAL COMMUNITY: NC004	G?	S2	N	N	1992
ASBURY WOODS NATURE CENTER OHA *Notable Significance*					

MANAGED LANDS:

Presque Isle State Park
Scott Park

GEOLOGIC FEATURES/FOSSIL LOCALITIES
Presque Isle Sandspit


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
TOPOGRAPHIC AND GEOLOGIC SURVEY
SWANVILLE QUADRANGLE
PENNSYLVANIA—ERIE CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NOTE
Lake Shoreline LCA
extends onto four adjacent
Erie County Quadrangles
ATTENTION: The Presque Isle
State Park boundary extends
500 feet from the shoreline
of the peninsula
Presque Isle State Park
Scott Park
PRESQUE ISLE BDA/OHA
LAKE ERIE
LAKE SHORELINE
LCA
ASBURY WOODS NATURE CENTER
OHA
WALNUT CREEK VALLEY BDA
LOVE MARSH
BDA
FAIRVIEW
MILLCREEK
Manchester Beach
Fairview
Mapped, edited, and published by the Geological Survey
Control by USGS, USC&GS.
Topography from aerial photographs by ER-55
Aerial photographs taken 1955. Field check 1957
Hydrography compiled from U. S. Lake Survey charts 33
and 332 (1956). This information is not intended for navigational purposes
Polyconic projection. 1927 North American datum
10,000-foot grid based on Pennsylvania coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 17,
shown in blue
To place on the predicted North American Datum 1983
move the projection lines 1 meter south and
18 meters west as shown by dashed corner ticks
Red tint indicates area in which only landmark buildings are shown
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
DEPTH CURVES AND SOUNDINGS IN FEET
REFERENCE DATUM: 569.5 FEET INTERNATIONAL GREAT LAKES DATUM
THE RELATIONSHIP BETWEEN THE TWO DATUMS IS VARIABLE
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
UTM GRID AND 1990 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET
ROAD CLASSIFICATION
Heavy-duty
Light-duty
Medium-duty
Unimproved dirt
U.S. Route
State Route
Interstate Route
PENNSYLVANIA
QUADRANGLE LOCATION
Revisions shown in purple and woodland compiled in cooperation
with Commonwealth of Pennsylvania agencies from aerial photographs
taken 1988 and other sources. This information not field checked
Map edited 1990
Purple tint indicates extension of urban areas
SWANVILLE, PA.
42080-A2-TF-024
1957
PHOTOREVISED 1990
DMA 4066 II SW—SERIES V831

SWANVILLE QUADRANGLE

The **Lake Shoreline LCA** extends 7.6 miles along the entire Lake Erie shoreline and includes that section of the **Presque Isle BDA/OHA** represented on the Swanville Quadrangle.

On the Swanville Quadrangle the **Lake Shoreline LCA** extends landward to include that portion of the City of Erie represented on the quadrangle, as well as a portion of Millcreek Township. **In whole or in part, these municipalities are within the drainage basin of Presque Isle Bay (NC001) -- an integral component of the Presque Isle BDA/OHA. The LCA boundary includes the urban areas within the bay's drainage basin, as land use activities within these municipalities can significantly effect the embayment's limnology (Potomac-Hudson, Inc., 1991).** For more information on the **Lake Shoreline LCA** and the past and present effects of drainage basin on **Presque Isle BDA/OHA**, refer to pages 75 to 78 and 92 to 93. For the section of the **LCA** on the Swanville Quadrangle, the general recommendations regarding Landscape Conservation Area site protection (page 53) and recommendations for the overall management and protection of the **Lake Shoreline LCA** (page 81) should be applied. For the section of the **LCA** that contains the **Presque Isle BDA/OHA** the recommendations for the **BDA/OHA** on pages 86, 92, 95 and 96 are also applicable.

West of the **Presque Isle BDA/OHA** the **LCA** contains these shoreline habitats: beaches, lake bluff, and tributaries to the lake that bisect the lake bluff. The vegetation seral stages that typify the lake bluff in this section of the **LCA** are similar to those observed between Crooked Creek and Elk Creek, as described on page 175. West of the mouth of Walnut Creek an extensive beach borders the lake shore. Along this section of the **LCA**, shoreline habitats are bordered by or directly disturbed by development. Residences have been constructed near the bluff crest, and, occasionally, on the bluff slope and toe. Roads, residential, and other types of urban development activities have modified the lake bluff and other shoreline habitats. However, to the extent that the lake bluff habitat and hydrology remain intact the restoration of natural vegetation communities is possible.

Lake bluff habitat within the **Presque Isle BDA/OHA** has been modified by development, however, a portion of the bluff within the **BDA/OHA** contains a noteworthy mesic central forest community **(NC001**), an extensive vegetated shallows (**NC002**) within Presque Isle Bay, and the "neck" of the Presque Isle sandspit. Refer to pages 82 to 95 for an overall description of the **Presque Isle BDA/OHA**, which includes a review of the natural communities and biological resources that occur on the sandspit.

NC001 is a community/ecosystem conservation area on a north-northwest facing bluff along nearly 1,900 feet of bay shoreline that is contiguous with the neck of Presque Isle peninsula. **NC001** contains a 14 acre mature mesic central forest located on the lake bluff's slope and toe. The mesic central forest community (**NC001**) is bordered on the bluff crest by 50 acres of a younger relatively undisturbed woodland, providing area for expansion of the mature mesic central forest. Thus, **NC001** consists of an almost 64 acre forested bay shoreline lake bluff. **NC001** is the only area of naturally vegetated bay shoreline lake bluff in the county and, hence the state, that retains ecological integrity.

The mesic central forest community (**NC001**) is located on a relatively steep bluff slope, containing narrow terraces. Small gullies formed by erosion associated with occasional groundwater seeps and wind thrown trees are scattered on the bluff slope. The mesic central forest community (**NC001**) has a nearly closed to relatively open tree canopy with corresponding sparse to fairly dense and diverse understory areas. The mesic central forest community is dominated by beech (Fagus grandifolia) and sugar maple (Acer saccharum). Gaps formed by wind thrown trees are dominated by beech, red elderberry (Sambucus pubens), and may apple (Podophyllum peltatum). In addition, groundwater seeps create small jewelweed (Impatiens sp.) dominated herbaceous openings in the woodland.

Within Pennsylvania, lake bluff habitat is unique to Erie County. The mesic central forest community (**NC001**) is a natural community considered to be imperiled in the state. Protection of **NC001** requires that the approximately 64 acre forest be preserved and managed to allow development of a viable mature forest community on the bluff and behind the bluff crest. The structural integrity of the bluff needs to be maintained in order to preserve the natural heritage area.

The western portion of the lake bluff where **NC001** is located contains beach habitat along the base of the bluff. **NC001** and the narrow beach area are representative of the natural communities and wildlife/aquatic life habitat that once characterized the southern shoreline of Presque Isle Bay. A narrow band of wet forest is located between the beach and **NC002** which is dominated by green ash (Fraxinus pennsylvanica) and black willow (Salix nigra). The narrow sand beach that borders the forest along the entire bay shoreline is partially vegetated by shrubs, herbs and graminoids. Wind thrown trees and snags are scattered along the beach. The partially submerged wind thrown trees provide basking habitat for turtles and rest areas for waterfowl. Erie County's lake bluff system and the factors that could jeopardize the system's integrity are generally described on pages 75 to 78. More specifically, activities that would promote bluff

erosion and recession, as well as promote increase forest fragmentation would be detrimental to the mesic central forest community (**NC001**). The site is bordered by urban development, partially developed municipal lands, and a small marina. Additional urban development within the site would fragment the forest and prevent the establishment of a viable mature mesic central forest community (**NC001**). The naturally vegetated areas contiguous with the site should be protected to promote site stability by allowing the establishment of a natural vegetation buffer.

Contiguous with **NC001** is the extensively vegetated littoral zone at the western end of the Eastern Great Lakes bay community (**NC002**). **NC002** is known as Presque Isle Bay. **NC002** contains a mosaic of aquatic bed and mixed graminoid/robust emergent marsh vegetation. Two large stands of emergent aquatic vegetation, probably cattail (Typha) or bur-reed (Sparganium), are located within **NC002**. Within the area surveyed for the inventory, the open water portion of the littoral zone vegetation contains a aquatic bed dominated by big duckweed (Spirodela polyrhiza), a water milfoil (Myriophyllum sp.), a pondweed (Potamogeton crispus), leafy pondweed (P. epihydrus var. ramosa), and bullhead-lily (Nuphar variegatum). Bordering the aquatic bed along the shoreline is an emergent zone dominated by arrowhead (Sagittaria sp.), a bur-reed (Sparganium eurycarpum), and softstem bulrush (Scirpus validus).

As other areas within **NC002**, the portion of the bay represented on the Swanville Quadrangle contains special species habitats. Five special plant species (**SP001** through **SP005**) occur within **NC002**. One of these special plant species (**SP003**) is classified as critically imperiled in the state and two of the special plants, **SP001** and **SP005**, are imperiled in the state. Special plant **SP002** is considered to be imperiled/rare or uncommon in Pennsylvania. **SP004** is a plant species of special concern with rare to uncommon occurrences in the state.

In addition to containing special plant species habitat, the western end of Presque Isle Bay (**NC002**) contains important fishery habitat. **NC002** is considered by the Pennsylvania Fish and Boat Commission to be a viable and valuable fishery spawning and nursery area for a number of species, including 12 species of special concern (R. Kenyon, Pa. Fish Comm., correspondence, 7/1/92). (Refer to page 94 for additional information on the fishery habitat provided by Presque Isle Bay.) During the inventory field survey water dependent wildlife were observed utilizing habitats within **NC001** and **NC002**, including great blue heron (Ardea herodias), belted kingfisher (Megaceryle alcyon), gray catbird (Dumetella carolinensis), and a mallard (Anas platyrhynchos) brood.

Disturbance from development activities located outside the areas field surveyed was observed via aerial reconnaissance. Along the western bay shoreline development has resulted in the partial loss of shoreline habitats. Heavy sedimentation was observed entering **NC002** where the municipal water facility is located and at the mouth of the channelized stream on the west end of **NC002**. On-site observations indicate that the vegetation assemblages along the western most end of the bay (**NC002**) have been degraded by the invasion of at least one exotic species (i.e., common reed [Phragmites]). Within the area surveyed, shoreline habitat has been adversely modified by an extensive riprap shoreline control system along part of the peninsula's neck. (Refer to page 92 for additional information on the effects of exotic vegetation and shoreline control systems on **Presque Isle BDA/OHA** habitats/natural communities. Waterfront development and water-based recreational activities (i.e., motor boats and waterskiing) were also observed which pose a threat to the aquatic vegetation, including the special plant species, that occur within this portion of Presque Isle Bay (**NC002**). Liddle and Scorgie (1980) addresses the adverse effects of the aforementioned recreational activities on water quality, as well as littoral zone and shoreline vegetation. Degradation of water quality and vegetation habitats within **NC002** can also adversely effect the exceptional fishery habitat within this part of the embayment.

In addition to the general recommendations on page 52 for the protection and management of Biological Diversity Areas, these recommendations should be applied to protect the mesic central forest community (**NC001**) and the bay community (**NC002**) within the **BDA/OHA**:

(1) Bluff integrity needs to be protected from activities within the natural heritage area that would promote bluff erosion and recession. These activities include human-induced stormwater sheet flow runoff onto the bluff, removal of existing natural vegetation bordering the site on the bluff and on the bluff crest, artificially induced drainage onto the bluff face, and offshore dredging that would result in loss of all or part of the beach protecting the bluff base from erosion and/or that would steepen the offshore slope in a manner that would promote beach or bluff erosion;

(2) Groundwater hydrology needs to be protected to ensure that the quantity and quality of water entering the site is maintained;

(3) Litter, trash disposal, and tree carving observed within portions of the site should be discouraged by property owners. Litter and trash disposal are aesthetically displeasing and can cause environmental degradation. Tree carving can result in tree disease and mortality and should be discouraged; and

(4) Existing water dependent wildlife, aquatic life, vegetation habitats need to be maintained. When feasible, restoration of shoreline habitats should be pursued and exotic vegetation controlled. Littoral zone vegetation and fishery habitat needs to be protected from water quality degradation and habitat loss associated with existing development and water-based recreational activities. Water-based recreational activities that damage/degrade habitats should be prohibited from this section of **NC002**, as well as other vegetated littoral habitats within **NC002**. (Refer to the description of the Eastern Great Lakes bay community on page 94 for information regarding the vegetated littoral zone represented on the Erie North Quadrangle.)

The Managed Land **Scott Park** is an approximately 128 acre community park owned by Millcreek Township and managed by the Millcreek Township Parks and Recreation Department. Part of the park contains recreation facilities, including a fitness trail and basketball court. The rest of **Scott Park** contains a relatively undisturbed forest which is part of a natural heritage area -- **Presque Isle BDA/OHA**. The approximately 64 acre forest within the **Presque Isle BDA/OHA** is located almost entirely within **Scott Park** on the lake bluff face and crest. In order to protect the natural community (**NC001**) located in **Scott Park**, the recommendations specified on page x for the protection and enhancement of this portion of the **Presque Isle BDA/OHA** should be implemented by Millcreek Township.

A portion of **Presque Isle State Park** is represented on the Swanville Quadrangle. Refer to the Erie North Quadrangle page 96 for a description of this Managed Land. The sandspit peninsula known as Presque Isle is a geologic feature recognized by Geyer and Bolles (1979) as an outstanding geologic feature in the state. Refer to pages 87 to 88 for information on the geophysical processes and geological characteristics of the sandspit peninsula.

Love Marsh BDA contains an approximately two acre special species habitat located in Millcreek Township. The special plant species population (**SP006**) that occurs within the marsh is a Pennsylvania endangered plant. **SP006** was considered to be extirpated from the state prior to discovery of an abundant population within the roughly two acre marsh. In other words, **SP006** is known to occur at only one place in the state -- **Love Marsh BDA**. And the special plant species rarely occurs in the northeastern United States (J. Bissell, Cleveland Museum of Natural History, pers. commun.). **Love Marsh BDA** is located on a gently sloping hillside and natural hydrology consists of ground water seepage. The marsh is dominated by **SP006**, common cattail (Typha latifolia), rice cutgrass (Leersia oryzoides), jewelweed (Impatiens sp.), and

sensitive fern (Onoclea sensibilis) with scattered shrub thickets dominated by red-osier dogwood (Cornus stolonifera), Missouri willow (Salix eriochephala), and northern arrowwood (Viburnum recognitum). Water quality and quantity maintenance, hydrologic conditions, and habitat preservation is required to protect **SP006**.

Observations made during the inventory indicate that the construction activities immediately bordering **Love Marsh BDA** are likely to adversely effect the special species habitat. Storm water will be directly discharged into **Love Marsh BDA** from the adjacent housing development. Storm water from development can both modify hydrologic conditions and contains suspended sediments and pollutants that could degrade the habitat that supports **SP006**, as well as the **SP006** population. Refer to page 56 for additional information regarding the potential threats that development pose to natural heritage areas. Future development and property owners in the existing residential development should plan and manage development in a manner that protects **Love Marsh BDA**. At present the **BDA** is not adequately buffered from the contiguous residential development and the **BDA** appears to be part of the development's storm water management system. Prior to planning or implementing additional development, the property owner is strongly encouraged to confer with the Western Pennsylvania Conservancy to design a buffer to protect **Love Marsh BDA** and avoid use of the natural heritage area as a storm water management system. On-site reduction of storm water flow that does not utilize the wetland should be pursued.

General recommendations regarding Biological Diversity Area site protection and management are addressed on page 52. Recommendations for the overall management and protection of the **Love Marsh BDA** are in-keeping with those recommendations. Also, per existing conditions within **Love Marsh BDA**, the following general recommendations per Newton (1989) are offered:

(1) Raw storm water should not pass untreated into the wetland ecosystem;

(2) Methods to avoid and mitigate runoff effects and/or avoid ground water contamination should be implemented. References containing such methods can be found in King County Department of Public Works (1989); and

(3) If the wetlands continues to be used as a storm water control system, the developer should be required to undertake long-term maintenance, including monitoring of storm water effects on the marshes hydrology and vegetation community. If monitoring indicates that the marsh habitat and/or **SP006** are adversely affected, appropriate measures should be taken to mitigate adverse effects.

Another natural heritage area located on the Swanville Quadrangle is the **Walnut Creek Valley BDA**. **Walnut Creek Valley BDA** is approximately 900 acres in size. The valley was formed after the retreat of the last glacier. The Walnut Creek stream valley contains a meandering medium gradient stream entrenched in glacial rubble and shale bedrock. **Walnut Creek Valley BDA** is a high diversity area that contains two exceptional natural communities (**NC003** and **NC004**). **NC003** is a series of calcareous seep communities. Calcareous seep communities are classified as critically imperiled in Pennsylvania. In addition to the rarity of **NC003**, the calcareous seep communities within **Walnut Creek Valley BDA** provide habitat for two special plant species (**SP007** and **SP008**) that are Pennsylvania endangered species. **NC004** is a mesic central forest community -- a natural community classified as imperiled in the state. In addition to these biotic resources, **Walnut Creek Valley BDA** exhibits exceptional scenic qualities.

The calcareous seep communities (**NC003**) located within the **Walnut Creek Valley BDA** are located on the steep south-facing valley walls where ground water flows from glacial till exposed during valley formation. The calcareous seep community (**NC003**) vegetation is characterized by mosses, rushes (Juncus spp.), coltsfoot (Tussilago farfara), aster (Aster sp.), ragwort (Senecio sp.), willow (Salix sp.), throughwort (Eupatorium sp.), **SP007**, and **SP008**. The calcareous seep communities (**NC003)** provide habitat for two special plant species (**SP007** and **SP008**). Both of which require a high pH and alkaline conditions.

Potential threats to the calcareous seep communities (**NC003**) are habitat loss resulting from human-induced erosion due to development or removal of the natural vegetation cover along the crest of the valley wall and the degradation of ground water and surface water quality related to the primary land use activities bordering the site (i.e., pesticide use associated with adjacent agricultural fields, golf course, and residential areas) (Bier, 1990).

Walnut Creek Valley BDA is largely forested. The stream valley walls are both steeply and gently sloped. An extensive forested high floodplain is located in the area. The forest is mostly second growth with some maturing stands and old growth (Bier, 1990). The mesic central forest community (**NC004**) within **Walnut Creek Valley BDA** is in part dominated by beech (Fagus grandifolia) and sugar maple (Acer saccharum). Beech-sugar maple dominated forests are uncommon in Erie County (T. Erdman, DER Bur. of Forestry, pers. commun.; J. Bissell, Cleveland Museum of Natural History, pers. commun.). Associated species in the canopy of **NC004** include: oak (Quercus sp.), ash (Fraxinus sp.), red maple (A. rubrum), basswood (Tilia sp.), yellow birch (Betula lutea), tulip poplar (Liriodendron tulipifera), and eastern hemlock

(Tsuga canadensis). The dominant species in the other vegetation strata of **NC004** are: star flower (Trientalis borealis), spreading wood fern (Dryopteris campyloptera), intermediate wood fern (D. intermedia), and blue cohosh (Caulophyllum thalictroides). Selective timber harvesting has occurred within the area of **NC004** surveyed.

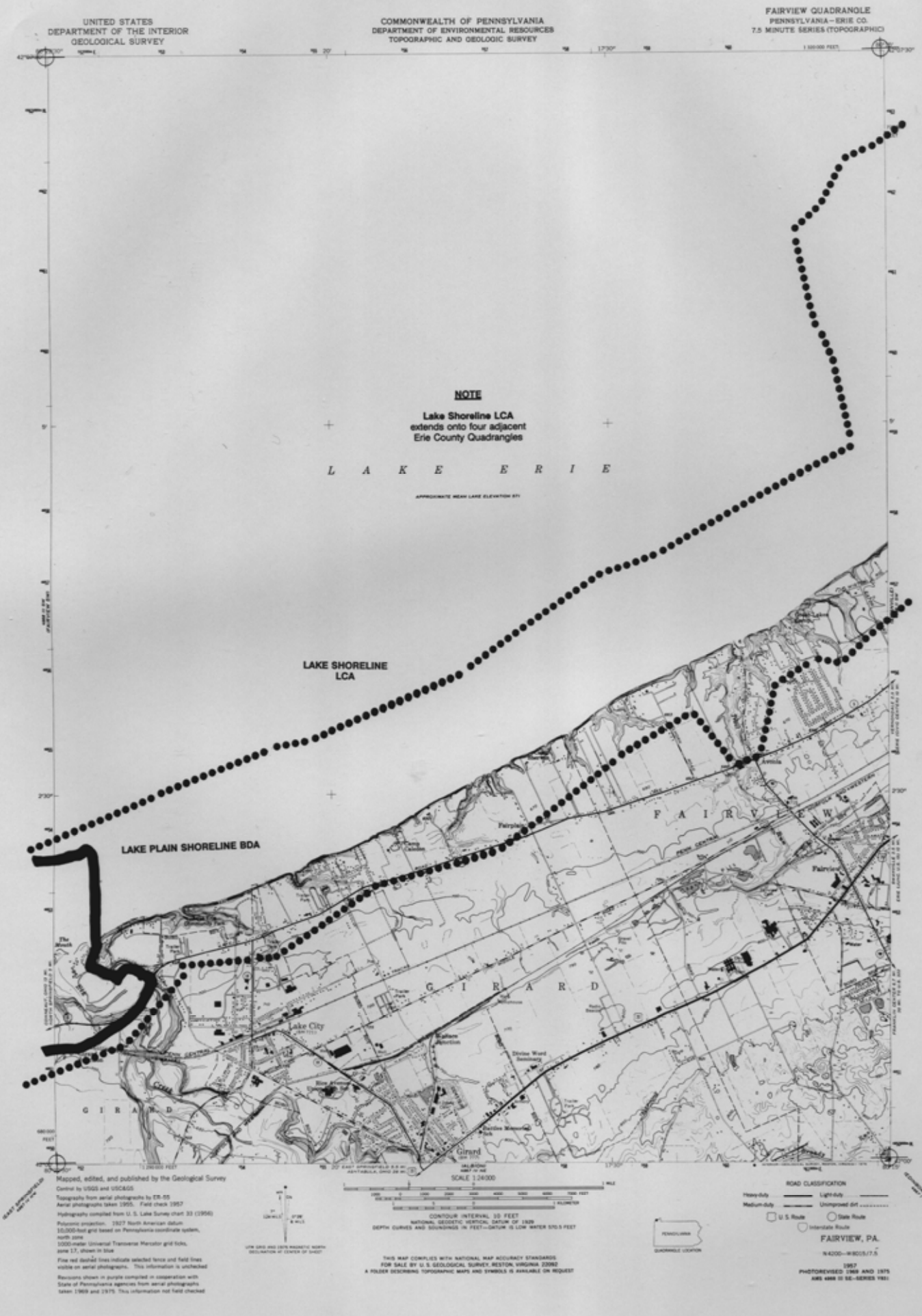
The primary potential threats to the mesic central forest community (**NC004**) are timber harvesting, habitat loss or degradation and fragmentation. Habitat loss or degradation could occur due to development or human-induced erosion caused by the lack of adequate natural vegetation cover along the crest of the valley wall.

General recommendations regarding Biological Diversity Area site protection and management are addressed on page 52. The recommendations for the overall management and protection of the **Walnut Creek Valley BDA** are synonymous with those recommendations, plus these site specific recommendations:
(1) Property owners should allow the growth of natural vegetation within the area's boundary to protect surface water quality and quantity entering the **BDA** and to reduce the threat of human-induced erosion of the stream valley walls; and
(2) Property owners could also contribute to ground water quality protection by reducing or avoiding the application of pesticides and/or fertilizers.

About 50 acres in size, **Asbury Woods Nature Center OHA** is an educational area located in Millcreek Township and operated by the Millcreek Township School District. The **OHA** contains a diversity of natural and managed vegetation communities. These communities represent a variety of successional stages, ranging from ponds to mature woodlands. **Asbury Woods Nature Center OHA** is open to the public and is regularly visited by area school students for environmental study.

FAIRVIEW QUADRANGLE

	PNDI Rank		Legal Status		Last
	Global	State	Fed.	State	Seen
LAKE SHORELINE LCA *High Significance*					
LAKE PLAIN SHORELINE BDA *Exceptional Significance*					
NATURAL COMMUNITY: NC001	G?	S2	N	N	1992
NATURAL COMMUNITY: NC002	G?	S1	N	N	1992
SPECIAL PLANT: SP001	G?	S2	N	PR	1992


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
TOPOGRAPHIC AND GEOLOGIC SURVEY
FAIRVIEW QUADRANGLE
PENNSYLVANIA—ERIE CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NOTE
Lake Shoreline LCA
extends onto four adjacent
Erie County Quadrangles
L A K E E R I E
LAKE SHORELINE
LCA
LAKE PLAIN SHORELINE BDA
F A I R V I E W
G I R A R D
Lake City
Girard
Mapped, edited, and published by the Geological Survey
SCALE 1:24000
CONTOUR INTERVAL 10 FEET
ROAD CLASSIFICATION
FAIRVIEW, PA.
1957
PHOTOREVISED 1969 AND 1975

FAIRVIEW QUADRANGLE

The **Lake Shoreline LCA** extends along the approximately 7.4 mile shoreline on the Fairview Quadrangle. Per the USGS Quadrangle map the lake bluff ranges in height from about 30 to over 80 feet. From the east side of Elk Creek to just west of the mouth of Walnut Creek the lake bluff contains ecological seral stages that appear similar to those observed between Crooked Creek and Elk Creek (see page 175). Development is located on or near the lake bluff crest throughout this section of the **LCA**. Development consists of scattered to high density residential structures, scattered shoreline control structures, and stairs from the bluff crest that access the beach at the base of the lake bluff. For more information on the **LCA** refer to the site description on page 75. For the section of the **LCA** on the Fairview Quadrangle, the general recommendations regarding Landscape Conservation Area site protection on page 53 and recommendations for the overall management and protection of the **Lake Shoreline LCA** on page 81 should be applied. In addition, the recommendations for the other natural heritage areas which are located in this portion of the **LCA** are also applicable to the portion of the **LCA** they occupy.

The **Lake Plain Shoreline BDA** is a high diversity area located within Girard and Springfield Townships and is as represented on the Fairview, Fairview SW, East Springfield, and Albion Quadrangles. This natural heritage site is a composite of the ecological resources that were once characteristic of the Erie County lake shoreline. **Lake Plain Shoreline BDA** contains six natural communities and five special species habitats. The natural communities located on the portion of the **BDA** represented on the Fairview Quadrangle are a mesic central forest (**NC001**) and an upper beach habitat (**NC002**). **NC001** occupies part of the Elk Creek stream valley and extends westward onto the lake plain represented on the Fairview SW Quadrangle. In Pennsylvania **NC002** is a habitat unique to Erie County. Mesic central forest communities (**NC001**) are classified as imperiled in the state.

The mesic central forest community (**NC001**) is largely represented on the Fairview SW Quadrangle. Refer to pages 179 to 182 for a description of the mesic central forest community and recommendations for the protection and management of **NC001**.

Approximately 46 acres of the floodplain within the **Lake Plain Shoreline BDA** is undisturbed and contains both low and high floodplain areas. The mesic central forest community (**NC001**) extends onto the high floodplain that borders Elk Creek and is dominated by sugar maple (Acer saccharum), green ash, multiflora rose (Rosa multiflora), Virginia creeper (Parthenocissus quinquefolia), jewelweed (Impatiens sp),

moneywort (Lysimachia nummularia), aster (Aster sp.), and common blue violet (Viola papilionacea). Different topography and hydrologic conditions in the low and high floodplain areas results in vegetation differences within the floodplain. While the naturally vegetated low floodplain on the west stream bank of Elk Creek is not of sufficient size to be considered a natural community, the dominant vegetation is noted as it differs from that represented in the mesic central forest (**NC001**). Green ash (Fraxinus pennsylvanica), common cottonwood (Populus deltoides), spicebush (Lindera benzoin), speckled alder (Alnus rugosa), American black currant (Ribes americanum), skunk cabbage (Symplocarpus foetidus), and jewelweed dominate the low floodplain.

Roughly one-third of the floodplain on the west side of Elk Creek has been modified or lost as result of development and agriculture. Within this area of the **Lake Plain Shoreline BDA** a public access area has been developed. Elk Creek Public Access Area is managed by Girard Township as a recreational and conservation site. The access area is used for hiking, fishing, and nature study. A road, small boat ramp, picnic area, and two parking lots are located within the public access area. The road that accesses the public facility dissects the eastern end of the mesic central forest community (**NC001**). The rest of the recreational facilities are primarily within the low floodplain. Both the public access area and an agricultural field fragment the floodplain. Development of the public access area has resulted in some permanent loss of habitat. An above ground utility line crosses **NC001**. (The potential threats that fragmentation, development, agriculture, and utility right-of-ways pose to natural heritage areas are described on pages 54 to 66.)

The broad floodplain on the east Elk Creek stream bank has been significantly modified. About 70 percent of the natural vegetation has been removed. A narrow band of forest trees borders the stream bank. At the mouth of the stream, remnants of the natural community still exist within the residential area that presently occupies the floodplain. Most of this 55 acre floodplain now contains an extensive meadow, which was once an agricultural field. Despite this disturbance, restoration of the natural communities is possible, and, to some degree, is currently underway.

The Pennsylvania Fish and Boat Commission recently purchased most of the floodplain on the east side of Elk Creek and the lake shoreline at the mouth of Elk Creek. The Commission is gradually removing residential structures from their property. Eventually, all the residences will be removed from the portion of the floodplain and shoreline owned by the Commission. The floodplain meadow located primarily on the

Pennsylvania Fish and Boat Commission property has begun to revegetate with natural vegetation. Now an idle agricultural field, the meadow is dominated by horsetail (Equisetum palustre). If the Pennsylvania Fish and Boat Commission and other owners of floodplain property would allow natural revegetation of this portion of the **Lake Plain Shoreline BDA**, natural communities could be restored to the floodplain in time. Restoration of these communities would significantly improve the ecological integrity of this portion of the Elk Creek stream valley. In conjunction with the other natural communities that comprise the **Lake Plain Shoreline BDA**, restoration of the mouth of Elk Creek stream valley would restore to the Erie County a composite of ecological resources that once characterized the lake shoreline.

Elk Creek is a high gradient stream with a bedrock substrate covered by gravel. Occasional short riffles and shallow pools are within the stream. The stream contains a few small sparsely vegetated sand bars. The stream is annually stocked with trout (Pennsylvania Fish Commission, 1989). Although some siltation was observed within Elk Creek, the stream retains natural characteristics.

For the section of the **Lake Plain Shoreline BDA** depicted on the Fairview Quadrangle, the general recommendations regarding Biological Diversity Area site protection on page 52 should be applied. More specific recommendations for the protection and management of the natural community are:

(1) The mesic central forest community (**NC001**) needs to be protected and managed to allow the undisturbed recovery, maturation and expansion of the forest. Development within the **Lake Plain Shoreline BDA** poses a threat to the ecological integrity of the site. Additional development within and/or fragmentation of the mesic central forest community (**NC001**) should be avoided;

(2) Where natural community elimination has occurred in the floodplain on the east side of Elk Creek property owners should allow natural community restoration; and

(3) Maintenance of the highway and utility right-of-ways within the **Lake Plain Shoreline BDA** poses a threat to the protection of the natural heritage site. Right-of-way maintenance should be conducted in a manner that protects site integrity while meeting public safety requirements. Within the vicinity of the natural heritage site, herbicides should not be used to maintain either the highway or utility right-of-ways. (Suggestions for maintaining right-of-ways in environmentally sensitive areas are addressed on page 60.).

There are five special species habitats within the **Lake Plain Shoreline BDA**. One of these special species habitats is represented on the Fairview Quadrangle. This special species habitat contains a special plant species **(SP001**) considered to be imperiled in Pennsylvania. The rarity of **SP001** is in large part due

to a lack of habitat. **SP001** grows on upper beach habitat (**NC002**). In Erie County and Pennsylvania, this habitat is restricted to the Lake Erie shoreline. To date, **SP001** is known to occur at only two locations in Erie County - on Presque Isle peninsula and within the **Lake Plain Shoreline BDA**. (Refer to page 78 for a description of upper beach habitat formation and general characteristics.) The upper beach habitat is located on a sandspit roughly 900 feet long at the mouth of Elk Creek. On the lakeward side, the sandspit is almost completely covered by cobble with scattered driftwood. The crest and interior side is primarily sand. The interior side of the sandspit is sparsely vegetated. Willows (Salix spp.) and sweet white clover (Melilotus alba) are the dominant species. The sandspit also provides habitat for the rarely occurring **SP001** plant population.

NC002 shows no evidence of significant past or present disturbance. The upper beach habitat (**NC002**) is located in the Elk Creek Public Access Area. Among the recreational facilities within the public access area is a public boat ramp which provides access to Lake Erie waters. Dredging activities associated with maintenance of existing boating facilities could pose a serious threat to **SP001** and its habitat. Considerable litter was observed within the site. Litter can cause environmental degradation.

To secure the plant species of special concern and its habitat, the general recommendations for Biological Diversity Area protection and management described on page 52 need to be applied to the **Lake Plain Shoreline BDA**. In addition to these general recommendations, the following specific recommendations need to implemented to ensure the protection of **SP001** and its habitat (**NC002**):

(1) Dredging activities or other efforts to maintain the existing boat facility should be planned and implemented in a manner that does not jeopardize the **SP001** population or destroy critical habitat; and

(2) Protection of the upper beach habitat (**NC002**) requires that the longshore current and littoral transport of beach sands be maintained.

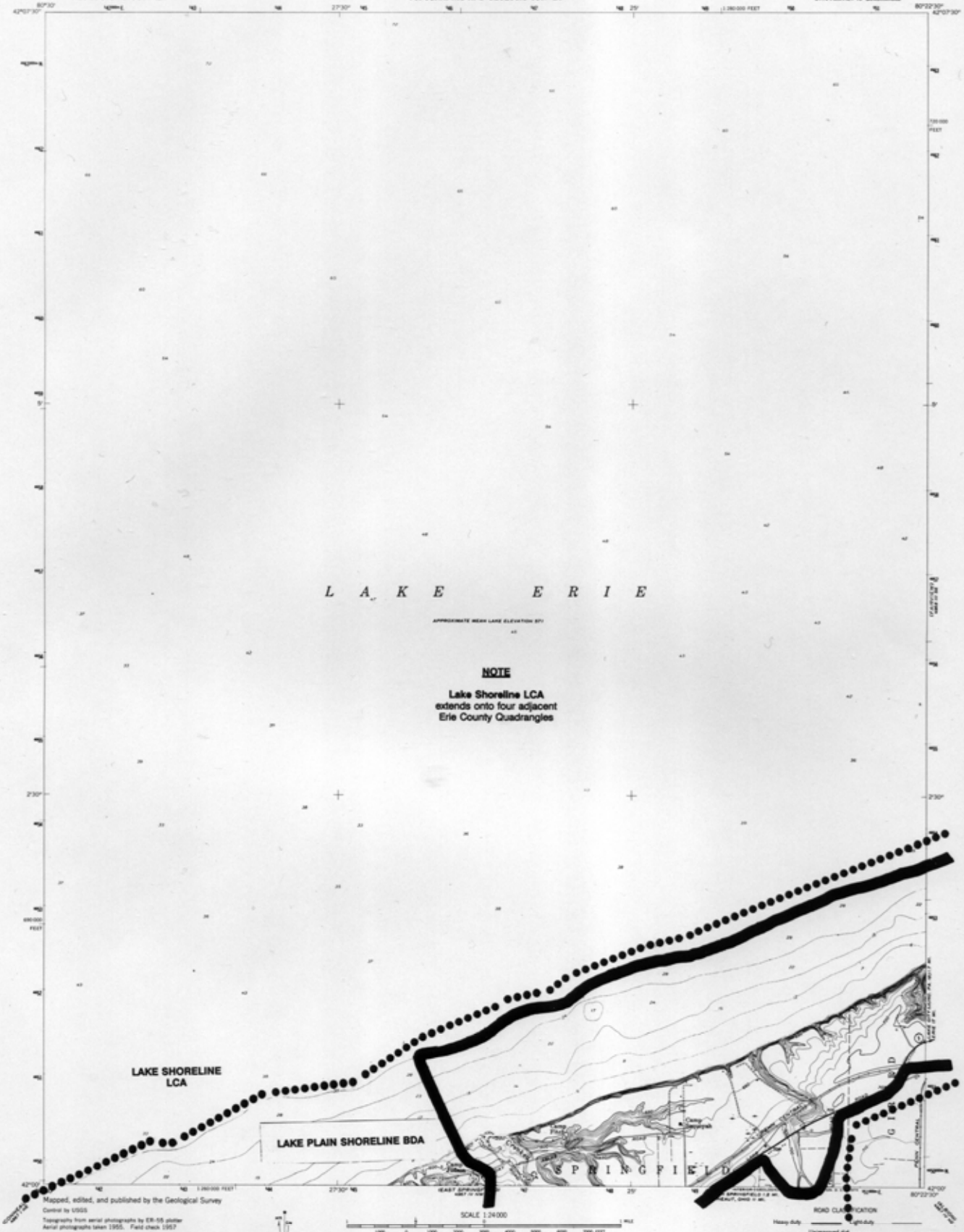
FAIRVIEW SW QUADRANGLE

	PNDI Rank		Legal Status		Last
	Global	State	Fed.	State	Seen
LAKE SHORELINE LCA *Exceptional Significance*					
LAKE PLAIN SHORELINE BDA *Exceptional Significance*					
NATURAL COMMUNITY: NC001	G?	S2	N	N	1992
NATURAL COMMUNITY: NC002	G?	S1	N	N	1992
SPECIAL PLANT: SP001	G5	S3	N	PT	1986
NATURAL COMMUNITY: NC003	G?	S1	N	N	1992
SPECIAL PLANT: SP002	G5T?	S3S4	N	PR	1992
SPECIAL PLANT: SP003	G?	S1	N	PE	1992
NATURAL COMMUNITY: NC004	G?	S2	N	N	1992
NATURAL COMMUNITY: NC005	G?	S2S3	N	N	1992
SPECIAL PLANT: SP004	G?	S?	N	N	1992

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF PENNSYLVANIA
DEPARTMENT OF INTERNAL AFFAIRS
TOPOGRAPHIC AND GEOLOGIC SURVEY

FAIRVIEW SW QUADRANGLE
PENNSYLVANIA—ERIE CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SW/4 FAIRVIEW 15' QUADRANGLE



Mapped, edited, and published by the Geological Survey

Control by USGS

Topography from aerial photographs by ER-55 plotter
Aerial photographs taken 1955. Field check 1957

Hydrography compiled from U. S. Lake Survey chart 33 (1956)

Polyconic projection. 1927 North American datum
10,000-foot grid based on Pennsylvania coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 17, shown in blue

Fine red dashed lines indicate selected fence and field lines visible on aerial photographs. This information is unchecked

Revisions shown in purple compiled in cooperation with State of Pennsylvania agencies from aerial photographs taken 1969. This information not field checked

UTM GRID AND 1966 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24000

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

PENNSYLVANIA
QUADRANGLE LOCATION

ROAD CLASSIFICATION
Heavy duty
Light duty
Unimproved dirt
State Route

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, WASHINGTON, D. C. 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

FAIRVIEW SW, PA.
SW/4 FAIRVIEW 15' QUADRANGLE
N4200—W8022.5/7.5

1957
PHOTOREVISED 1969
AMS 4868 II SW—SERIES V851

FAIRVIEW SW QUADRANGLE

The **Lake Shoreline LCA** extends along the entire 4.4 mile Lake Erie shoreline represented on the Fairview SW Quadrangle. Per the U.S. Geological Survey topographic map, the lake bluff ranges in height from about ten to 100 feet. The bluff is lowest at the mouth of Crooked Creek where the stream bisects the lake bluff. For more information on the characteristics of the **LCA** refer to the site description on page 75. General recommendations regarding Landscape Conservation Area site protection and management are described on page 53. Recommendations for the overall protection and management of the **Lake Shoreline LCA** are on page 81.

The **Lake Plain Shoreline BDA** is a high diversity area located in Girard and Springfield Townships and depicted on the Fairview, Fairview SW, East Springfield, and Albion Quadrangles. This natural heritage site is a composite of the ecological resources that were once characteristic of the Erie County lake shoreline. **Lake Plain Shoreline BDA** contains six natural communities and five special species habitats occur within the **BDA**. Five of these natural communities are represented on the Fairview SW Quadrangle, including lake bluff habitat (**NC001**), lake sediment slump habitat (**NC002**), dune habitat (**NC003**), a mesic central forest community (**NC004**), and a circumneutral broadleaf swamp community (**NC005**). Within the state, three of the natural communities, **NC001**, **NC002**, and **NC003**, are unique to Erie County. The other two communities are considered to be imperiled in Pennsylvania. Special plants species (**SP001** through **SP004**) populations occur within natural communities **NC002**, **NC003**, and **NC005**. A special animal habitat is also contained within the **Lake Plain Shoreline BDA**. Crooked Creek provides habitat for a fish species that is critically imperiled in the state. (Refer to the East Springfield Quadrangle for a description of this special animal species.) Protection of the **Lake Plain Shoreline BDA** requires that the general recommendations regarding Biological Diversity Area site protection (page 52) be implemented. Recommendations for the protection and management of the natural communities within the **BDA** are specified below with each natural community description.

The lake bluff habitat (**NC001**) is located on the northwest facing bluff along nearly 2.9 miles of shoreline west of the mouth of Elk Creek. **NC001** is a community/ecosystem conservation area that contains an extensive stretch of diversely vegetated lake bluff. The natural heritage site is located on steeply sloped glacial till and lacustrine sediment substrate that extends from bluff toe to crest. Bluff height ranges from about 50 to 100 feet. Numerous groundwater seeps occur at various heights on the lake bluff creating

extensive zones of saturation. These seeps frequently form watercourses, sometimes associated with gullies on the bluff face, that drain onto the beach that borders the site's entire shoreline. Approximately 30 percent of the lake bluff is severely eroded, apparently due to natural forces, and either unvegetated or sparsely vegetated. Bluff erosion has created near vertical slopes on the bluff face from crest to mid-slope at various locations. The exposed sandy sediments provide habitat for breeding colonies of bank swallows (Riparia riparia). About 70 percent of the bluff is vegetated. Wind thrown trees are scattered on the bluff crest, slope, toe, and along the beach. Driftwood is also scattered on the narrow sand and cobble beach.

The lake bluff habitat (**NC001**) component of the **Lake Plain Shoreline BDA** consists of a mosaic of ecological seral stages dominated by herbaceous and woody (shrub and tree) species. The herb dominated seral stage appears to occupy bluff slope areas that have experienced recent substrate movement -- slides and slumping. The dominant species in the herbaceous seral community are common horsetail (Equisetum arvense) and coltsfoot (Tussilago farfara). Occasionally, the herbaceous seral stage contains speckled alder (Alnus rugosa) and willow (Salix sp.). The seral stage dominated by woody species (trees and shrubs) occupies more stable portions of the bluff face. Throughout **NC001** numerous seeps create a composite of saturated areas and mesic conditions. As a result, the woody species seral stage contains an assemblage of species adapted to both saturated and mesic conditions intricately juxtaposed to one another. The dominant species in this seral community are tulip poplar (Liriodendron tulipifera), yellow birch (Betula lutea), green ash (Fraxinus pennsylvanica), and speckled alder (Alnus rugosa).

A lake sediment slump habitat (**NC002**) occurs within the lake bluff habitat (**NC001**). **NC002** is a special species habitat area and represents an uncommon habitat in Erie County. (Refer to page x for additional information on lake sediment slump formation.) **NC002** consists of a clayey lacustrine sediment slump saturated by groundwater seeps. The lake bluff slump provides habitat for a plant species of special concern **(SP001)**. **SP001** is considered threatened in the state. The plant species is uncommon in the county, since the habitat is limited. The **SP001** population was observed within a herbaceous seral stage dominated by the species mentioned above.

Primary threats to **NC001** and **NC002** are bluff development, shoreline erosion and bluff recession, and invasion by exotic vegetation. An extensive natural vegetation buffer exists behind the entire bluff crest which promotes bluff stability. Scattered residential and camping areas are located within this buffer, as well as other natural heritage areas. In some instances, property owners have removed natural vegetation

adjacent to and on the bluff crest. Shoreline control structures near the mouth of Crooked Creek have resulted in beach erosion and accretion patterns typical of these structures. Beach loss and interruption of longshore sediment transport are effects of shoreline control structures that pose a threat to the lake bluff and lake sediment slump habitats. The placement of additional shoreline control systems within the **Lake Plain Shoreline BDA** could increase existing shoreline erosion and bluff recession. An exotic species, common reed (Phragmites communis), occurs in small patches within some of the palustrine seral stage areas within the lake bluff habitat (**NC001**).

Protection of the **NC001** and **NC002** natural communities within the **Lake Plain Shoreline BDA** requires protection of these lake bluff habitats. Bluff integrity needs to be protected from human-influenced processes within the **BDA** that artificially promote shoreline erosion and bluff recession. These activities are described on page 79. The following are more specific recommendations for the protection of **NC001** and **NC002**:

(1) Property owners should be discouraged from constructing additional structures on or near the bluff;

(2) Property owners should be encouraged allow natural vegetation to occupy the area on and behind the bluff crest. Expansion of the natural vegetation buffer would reduce the potential for property loss due to bluff erosion and recession. This would promote lake bluff stability and preservation of the lake bluff habitats (**NC001** and **NC002**);

(3) Groundwater hydrology needs to be protected to ensure that the quantity and quality of water entering the lake bluff habitat (**NC001**) and lake sediment slump habitat (**NC002**) is maintained. Maintenance of groundwater hydrology is of particular importance for the protection of **SP001**; and

(4) Removal of the common reed is recommended to retain the exemplary quality of this community/ecosystem conservation area.

NC003 contains a sand dune formed more than 12,000 years ago. The dune habitat (**NC003**) formed during a post glacial period when lake elevations were higher and the shoreline was located on the county's present lake plain. (Refer to the Physiographic Section (page 36) for additional information on lake plain formation.) The county soil survey (Taylor, 1960) indicates that the occurrence of sand dune habitat in the county is rare. Per Bissell (Cleveland Museum of Natural History, pers. commun.), lake plain dune habitats in the region have been lost due to land use activities, such as mineral extraction and road construction. The sand dune within the **Lake Plain Shoreline BDA** has been subjected to human-induced disturbances. These

disturbances have reduced the extent of naturally vegetated habitat and partially modified the landform's configuration. Yet, the approximately nine acre dune habitat (**NC003**) retains structural integrity and the biotic resources occupying this habitat are of ecological significance.

Not only is the dune habitat (**NC003**) rare within the county and the state, **NC003** contains a rare black oak (Quercus velutina) savannah community. The only other place in Erie County where this community can be found is Presque Isle peninsula. However, the black oak savannah community within **NC003** is older than those at Presque Isle. The black oak savannah community is the largest and best quality natural community of this type in the region outside of the peninsula (J. Bissell, Cleveland Museum of Natural History, pers. commun.). The black oak savannah community occupies a dune ridge about 1,640 feet long, 82 feet wide, and six to nine feet high. Some of the vegetation occupying the dune ridge is indicative of past and present disturbance. As a result of disturbance, weedy/exotic species dominate portions of the dune habitat. Regardless, a significant portion of the sand dune habitat (**NC003**) contains a black oak savannah community dominated by various grasses, legumes, mosses, lichens, and low, spreading black oak trees.

The sand dune also provides habitat for two plant species of special concern plant populations (**SP002** and **SP003**). Although demonstrably secure on a global basis, **SP002** is considered to be rare in Pennsylvania. On the dune ridge (**NC003**), the **SP002** population is common. While the **SP003** population is small, the occurrence of special plant species **NC003** is significant. The general range of **SP003** is the southeastern United States. **SP003** is known to occur at only one location in Pennsylvania -- the **Lake Plain Shoreline BDA** dune habitat (**NC003**). Consequently, **SP003** is considered to be critically imperiled in Pennsylvania. Within the state, the habitat for **SP003** is unique to Erie County and in the county that habitat is rare (Taylor, 1960).

The dune habitat (**NC003**) has the potential to provide habitat for another species of special concern plant, (Polygala polygama), which is rare in Pennsylvania (J. Bissell, Cleveland Museum of Natural History, pers. commun.), and may provide habitat for tiger beetles (Cicindela spp.). Some tiger beetles are species of special concern. Depending on the species, the confirmed occurrence of tiger beetles could be of global or state significance.

As noted above, the dune habitat within **NC003** has been subjected to disturbance. Excavation has resulted in complete loss of habitat on the eastern end of the sand dune. As a result of past and present disturbance, the dune habitat (**NC003**) has been partially invaded by weedy and exotic vegetation. The most

noteworthy are thickets and young stands of black locust (Robinia pseudo-acacia) and thick colonies of bramble (Rubus flagellaris) scattered on the dune ridge. Presently, the dune habitat (**NC003**) is surrounded by cropland located on the lower slopes of the dune. Cropland encroaches onto the lower slopes of the dune ridge. These agricultural activities adversely effect **NC003**. The fertilizers used on the croplands and habitat disturbance from cultivation promote the growth of weedy vegetation at the edge of the dune habitat (**NC003**). An unpaved sand road has been developed along one side of the dune. Along a portion of **NC003**'s south side are utility and railroad right-of-ways. (The general effects of utility right-of-ways on natural heritage sites are described on pages 59 to 61. As noted above, the ecological integrity of **NC003** has been retained despite past and present disturbances. Although farmed for several years, the lower slopes of the dune and the corresponding natural communities could be restored. To preserve and protect the sand dune habitat (**NC003**), the general recommendations for Biological Diversity Areas on page 52 need to be applied. More specific recommendations for the natural community are as follows:

(1) The property owner should allow for restoration of dune habitat by permitting native vegetation to occupy the entire sand dune. The county soil survey (Taylor, 1960) indicates that dune habitat is about 87 acres in size. Most of the dune is presently being cultivated. If agricultural land use were discontinued, simple remedial measures could be implemented to rid the soil of excess fertilizers and to restore the sand dune habitat. Habitat restoration would enable vegetation characteristic of sand dunes to become established, as well as provide a buffer for the site;

(2) Weedy vegetation (e.g., black locust) within the **NC003** needs to be removed. Removal would maintain the integrity of the black oak savannah community and restore disturbed habitat;

(3) Recovery of the dune habitat (**NC003**) is strongly recommended. Dune habitat (**NC003**) is extremely rare, as are the plant community and special plant species occupying this habitat; and

(4) Under no circumstances should herbicides be used either to maintain the existing railroad and utility right-of-ways that border a portion of the natural community. Recommendations for utility right-of-way maintenance on page 60 should be applied to the site.

Lake Plain Shoreline BDA also contains a large diverse mesic central forest community (**NC004**) -- a forest community considered to be imperiled in the state. Large diverse lake plain forests are uncommon in Erie County (J. Bissell, Cleveland Museum of Natural History, pers. commun.). The mesic central forest community is about 193 acres in size. Forest diversity can be attributed in part to the various habitats within

the **BDA**. The mesic central forest (**NC004**) is located on the lake plain, within a stream ravine, and on the west valley wall of Elk Creek. **NC004** contains four areas of biotic significance.

One of these areas exhibits the characteristics of a mature primary forest (Braun, 1967). This forest is located within a ravine. The ravine has near vertical to steeply sloped walls. At the bottom of the ravine, floodplains border a meandering tributary to Lake Erie. The mature primary forest is about 28 acres in size. Sugar maple (Acer saccharum), red maple (A. rubrum), and eastern hemlock (Tsuga canadensis) dominate the forest canopy. The shrub and herbaceous layers are dominated by spicebush (Lindera benzoin), mapleleaf viburnum (Viburnum acerfolium), witch hazel (Hamamelis virginiana), intermediate wood fern (Dryopteris intermedia), and foamflower (Tiarella cordifolia). Occasional wind thrown trees and woody debris are scattered within the forest.

A terrestrial and wetland forest mosaic is located on the lake plain contiguous with the forested ravine. This is the second forested area within **NC004** of biotic significance. The topography and wetland community present make this forested area noteworthy. Most of the nearly level area retains a crest and swale topography associated with a few areas of beach ridge soils in the lake plain (Taylor, 1960). The crests and swales range in size from about ten square feet to several acres. A high water table in conjunction with the crest and swale topography produces a mosaic of habitats. A terrestrial forest community dominates the crests; a wetland forest community dominates the swales. The terrestrial forest community is a mesic central forest community (**NC004**) dominated by oaks (Quercus spp.), including red oak (Q. rubra), sugar maple, spicebush, tulip poplar (Liriodendron tulipifera), yellow birch (Betula lutea), and red maple. The wetland forest is a circumneutral broadleaf swamp community (**NC005**).

Circumneutral broadleaf swamp communities are considered to be rare or uncommon in the state. Per field surveys conducted for the natural heritage inventory, circumneutral broadleaf swamp communities are uncommon in Erie County. The swamp (**NC005**) is about 18 acres in size. The crest and swale topography within the circumneutral broadleaf swamp (**NC005**) results in a range of hydrologic conditions. Saturated and inundated soils predominate. The saturated and inundated soils in **NC005** are dominated by ash (Fraxinus spp.), red maple, yellow birch, speckled alder (Alnus rugosa), spicebush, cinnamon fern (Osmunda cinnamomea), sensitive fern (Onoclea sensibilis), jewelweed (Impatiens sp.), and skunk cabbage (Symplocarpus foetidus). Tulip poplar, northern red oak, white ash (Fraxinus americana) and yellow birch dominate forested patches of slightly higher ground and crests where mesic conditions exist.

NC005 contains a special plant species (**SP004**) which is at the extreme northern limit of its range. The general range of **SP004** is the southeastern United States. During 1992 this plant species was discovered to occur as far north as lake plain swamps in Ohio and Pennsylvania. To date, **SP004** is known to occur at only three locations in Pennsylvania. All three locations are in swamps on the Erie County lake plain. One of these locations is the circumneutral swamp community (**NC005**) in the **Lake Plain Shoreline BDA**. The **SP004** special plant population dominates the canopy in the wettest portion of the swamp and occurs locally elsewhere in **NC005**. In January 1993, the Pennsylvania Biological Survey (PBS) classified **SP004** as a plant species believed to be in danger of population decline in the state. However, additional data are needed to more accurately classify this species. While the PBS classification does not have official status, the PBS ranking of **SP004** is worthy of consideration.

The third forest area within the **Lake Plain Shoreline BDA** of biological significance is located within the Elk Creek stream valley. The west stream valley wall of Elk Creek contains a relatively mature mesic central forest community (**NC004**) dominated by sugar maple (Acer saccharum) and eastern hemlock (Tsuga canadensis). Tulip poplar (Liriodendron tulipifera) is a local dominant. Associated species in the forest canopy include beech (Fagus grandifolia), American basswood (Tilia americana), oak (Quercus sp.), and yellow birch. Sugar maple and black cherry (Prunus serotina) dominate the forest canopy along the valley wall crest. Wind thrown trees, rotting logs, woody debris, and snags are common. Due to a nearly closed canopy, the shrub layer is scarce. Wood fern (Dryopteris sp.) is a local dominant in the herb layer. The forest is locally known for its abundance and diversity of wildflowers. During the field survey conducted for the inventory, these wildflowers were observed: may apple (Podophyllum paltatum), false mermaid (Floerkea proserpinacoides), cut-leaved toothwort (Dentaria laciniata), violets (Viola spp.), common blue violet, trout lily (Erythronium americanum), jack-in-the-pulpit (Arisaema sp.), blue cohosh (Caudophyllum thalectroides), white baneberry (Actacea pachypoda), trillium (Trillium spp.), large white trillium (T. grandiflorum), wild geranium (Geranium maculatum), and false solomon's seal (Smilacina racemosa). Of these wildflowers, false mermaid and common blue violet are dominants in the herb layer. Wild geranium, blue cohosh, and may apple are local dominants.

Topography significantly contributes to the ecology of this section of the mesic central forest community (**NC004**). Numerous gullies and several ravines created by natural erosional processes are located on the

valley wall. Groundwater seeps and intermittent streams are common within these gullies and ravines. The variety of substrates and hydrologic conditions have created numerous micro-habitats within the forest.

The largest of the forested ravines surveyed contains a small stream fed by groundwater seeps. On either side of the stream, the ravine bottom and lower walls are dominated by skunk cabbage. The upper ravine walls are dominated by sugar maple, eastern hemlock, and tulip poplar in the canopy. The herbaceous layer is dominated by false mermaid, blue cohosh, may apple, and common blue violet. Several other wildflowers and ferns, including wood fern (Dryopteris sp.) and christmas fern (Polystichum acrostichoides), characterize the vegetation on the upper ravine walls.

Each of the forest areas described above have been disturbed by timbering. Yet each has sufficiently recovered and contains exceptional vegetation communities. The remainder of the mesic central forest community (**NC004**) within the **Lake Plain Shoreline BDA** has been timbered more recently. This section of the forest is presently dominated by sugar maple and tulip poplar. Red maple and oaks, including northern red oak, black oak, and scarlet oak (Quercus coccinea), are sub-dominants. At the south edge of this forest is an area of particular interest. Roughly one acre in size, this area is now too small to be considered a community. However, the DBH of a few oaks within this area suggests that it is a remnant of the forest that vegetated the more xeric sandy soils within the **Lake Plain Shoreline BDA** prior to disturbance. The tree canopy is dominated by black oak. Associated tree species include northern red oak, white oak (Quercus alba), and hickory (Carya sp.). Chestnut (Castanea dentata) saplings occur rarely in a shrub layer dominated by mapleleaf viburnum. The soil within the black oak forest remnant is sand, covered by a thin layer of leaf litter. Taylor (1960) indicates that at least a portion of this woodland occupies dune sand soils. The woodland is located on the periphery of the dune sand soils where the sand dune habitat (**NC003**) and black oak savannah community described above are located.

Disturbance has occurred within the **Lake Plain Shoreline BDA** mesic central forest community (**NC004**) and circumneutral broadleaf swamp community (**NC005**). Timber harvesting has taken place in both communities. A few undeveloped roads are located in the mesic central forest. With time and protection, the forest (**NC004**) and swamp (**NC005**) can recover from these disturbances. Agricultural fields border **NC004** and **NC005**. Cropland cultivation has almost entirely removed the natural communities that once occupied the dune sand soils in the **BDA**. The black oak "forest" remnant described in the preceding

paragraph is believed to be representative of a natural community that once vegetated a portion of the dune sand soils.

To preserve and protect the mesic central forest (**NC004**) and circumneutral broadleaf swamp (**NC005**) communities, the general recommendations for Biological Diversity Areas on page 52 need to be applied. More specific recommendations for the protection and management of the **NC004** and **NC005** natural communities are:

(1) The mesic central forest community (**NC004**) needs to be protected and managed to allow the undisturbed recovery and maturation of the forest;

(2) Natural communities eliminated by present land uses should be restored. Cessation of cropland cultivation within the **BDA** would either enable the expansion of the mesic central forest community (**NC004**) or permit the restoration of natural communities indigenous to the sandy lake plain soils of Erie County. Restoration of these natural communities would significantly contribute to the ecological integrity and importance of the **Lake Plain Shoreline BDA**;

(3) Development within or adjacent to the mesic central forest (**NC004**) and circumneutral broadleaf swamp (**NC005**) must be avoided to protect these communities and the entire **BDA**;

(4) Maintenance of the utility right-of-ways within and adjacent to the mesic central forest community (**NC004**) should be conducted in a manner that protects the community's biological resources. Within the vicinity of **NC004** and **NC005**, herbicides should not be used to maintain right-of-ways. (Suggestions for maintaining right-of-ways in environmentally sensitive areas are addressed on page 60.); and

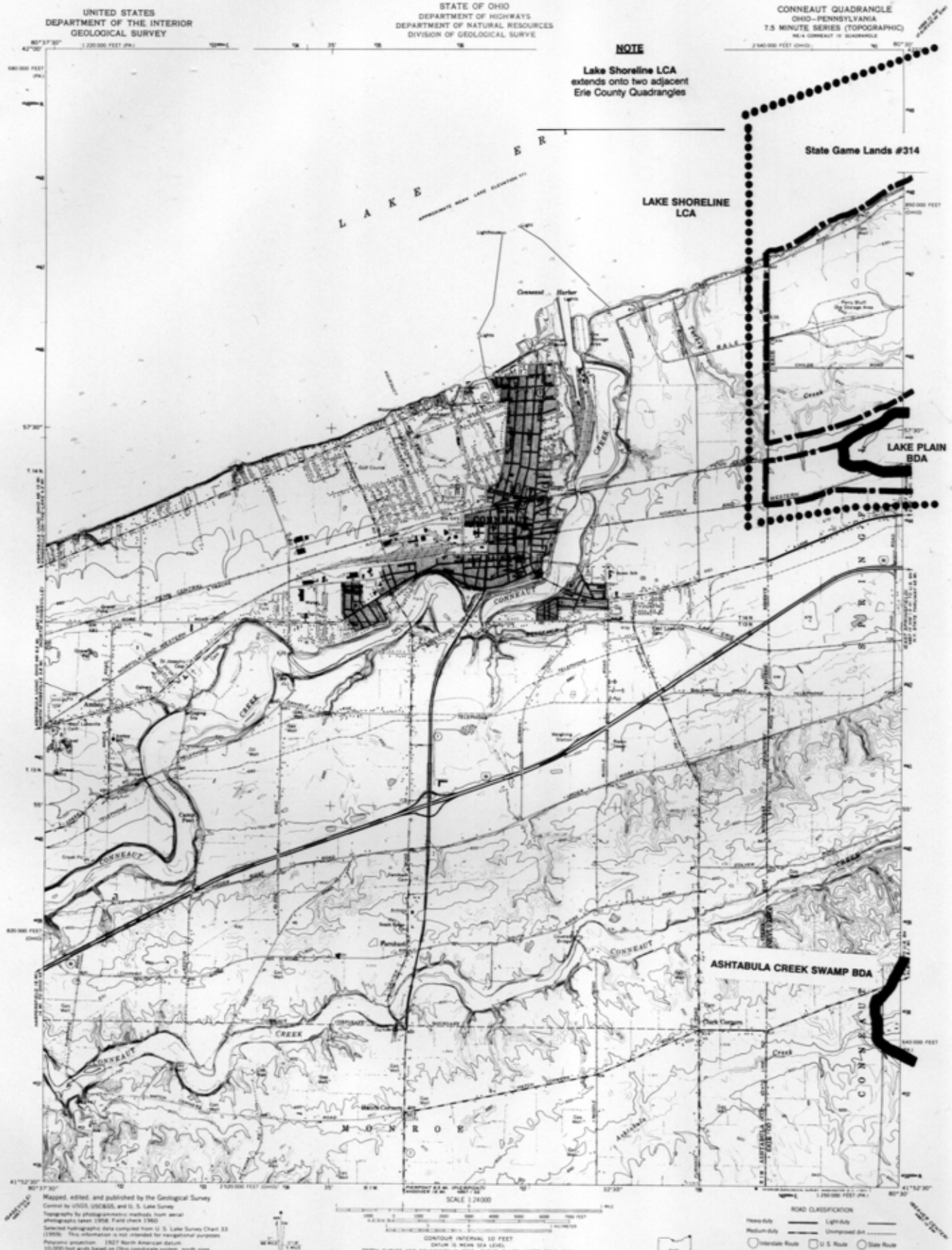
(5) The quantity and quality of water entering the circumneutral broadleaf swamp (**NC005**) must be maintained. Ground water seeps are the primary source of hydrology. Excess nutrients entering the swamp via ground water from the adjacent agricultural fields could alter the vegetation community. Development activities could reduce, degrade or eliminate the hydrology necessary to preserve **NC005**.

CONNEAUT QUADRANGLE

	PNDI Rank		Legal Status		Last
	Global	State	Fed.	State	Seen
LAKE SHORELINE LCA *High Significance*					
LAKE PLAIN BDA *High Significance*					
ASHTABULA CREEK SWAMP BDA *Exceptional Significance*					
NATURAL COMMUNITY: NC001	G?	S1	N	N	1992

MANAGED LAND:

State Game Lands #314


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
STATE OF OHIO
DEPARTMENT OF HIGHWAYS
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL SURVE
CONNEAUT QUADRANGLE
OHIO—PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
NOTE
Lake Shoreline LCA
extends onto two adjacent
Erie County Quadrangles
State Game Lands #314
LAKE SHORELINE
LCA
LAKE PLAIN
BDA
ASHTABULA CREEK SWAMP BDA
LAKE ERIE
CONNEAUT
MONROE
SCALE 1:24000
CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
ROAD CLASSIFICATION
CONNEAUT, OHIO—PA.
1960
PHOTOREVISED 1970

CONNEAUT QUADRANGLE

The **Lake Shoreline LCA** represented on the Conneaut Quadrangle extends from the Ohio border eastward along the entire Lake Erie shoreline. The almost 1.1 mile long shoreline is part of what is believed to be the longest single uninhabited section of Lake Erie shoreline on the south side of the lake that still retains natural conditions (Wiegman, Undated). All of **State Game Lands #314** is contained within the **Lake Shoreline LCA**.

State Game Lands #314 is a Managed Land located in the northeast quadrant of the Conneaut Quadrangle and extends onto the East Springfield Quadrangle. **State Game Lands #314** is 3,206 acres in size (Bier, 1988a). Approximately 1,244 acres are depicted on the Conneaut Quadrangle and 1,956 acres on the East Springfield Quadrangle. While portions of the property are naturally vegetated, on a majority of the game land past disturbances have either modified the vegetation or resulted in a permanent loss of habitat. Past disturbances that have modified vegetation include timbering and agriculture (Bier, 1988a; R. Haibach, Pa. Game Comm., pers. commun.). These areas are recovering from the disturbances and have succeeded to shrub thickets and young forests. Some permanent habitat loss has resulted primarily from the development of rail lines, ore storage and loading yards, and roads (Bier, 1988a).

The entire game land is on a relatively flat lake plain, except for the valleys formed by streams that flow into Lake Erie. Segments of Raccoon Creek and Turkey Creek are located within the property. **State Game Lands #314** is mostly deciduous forest. While the property contains a few areas of mature forest, most of the forest is young. The majority of young forest is characterized by red maple (Acer rubrum) and aspen (Populus spp.) (Oliver, 1988). Extensive shrub thickets are located in the game land. These thickets are characterized by silky dogwood (Cornus amomum), alder (Alnus sp.), sumac (Rhus sp.), and blackberry (Rubus allegheniensis) (Oliver, 1988). Roughly 52 percent of **State Game Lands #314** contains wetlands. Wetlands of various sizes and types are scattered throughout **State Game Lands #314** (National Wetland Inventory, 1989; 1977c). The Pennsylvania Game Commission maintains about 40 acres of food plots in former agricultural fields.

The lake bluff within **State Game Lands #314** has an outstanding aesthetic quality (Wiegman, Undated). Per aerial reconnaissance, the lake bluff is sparsely vegetated. The vegetation present is primarily herbaceous, although narrow bands of woody vegetation occur on less steep slopes. Part of the lake bluff contains lacustrine deposits eroded into a near vertical bluff slope. Other portions of the lake bluff

are comprised largely of clay lake sediment slumps. The beach along the toe of the bluff consists of sand, stone, and cobble with occasional small boulders (Bier, 1988a). The lake bluff within **State Game Lands #314** may be partially influenced by erosional forces induced by the jetties at Conneaut Harbor. However, this portion of the lake bluff retains the habitat to permit establishment of seral vegetation stages, provided measures are taken to promote lake bluff stability.

All state game lands in Erie County are managed for both game and nongame wildlife, although particular species may be given emphasis. At **State Game Lands #314** management efforts to restore American woodcock (Philohela minor) habitat have been successful. The state game land also provides natural and managed habitats for a variety of fauna, including ruffed grouse (Bonasa umbelus), wild turkey (Meleagris gallopavo), rabbit (Sylvilagus sp.), white-tailed deer (Ododcoileus virginianus), eastern bluebird (Sialia sialis) and other passerines (R. Haibach, Pa. Game Comm., pers. commun.).

Located within the **Lake Shoreline LCA** and **State Game Lands #314** are two special species habitats -- **Lake Plain Wetland BDA** and the **Lake Plain BDA**. Both of these special species habitats are described on page 191, as these **BDA**'s are, for the most part, depicted on the East Springfield Quadrangle. A small portion of the **Lake Plain BDA** extends onto the Conneaut Quadrangle. Refer to page 191 for descriptions of the **BDAs** within **State Game Lands #314**.

The biotic resources within **State Game Lands #314** represent the natural character of the Erie County lake shoreline. Present property management provides the potential for the enhancement of these natural characteristics. For these reasons, all of **State Game Lands #314** is included within the **Lake Shoreline LCA**. Information on the natural characteristics of the **Lake Shoreline LCA** is contained on pages 75 to 78. General recommendations regarding Landscape Conservation Area site protection and management are addressed on page x and the recommendations for the overall management and protection of the **Lake Shoreline LCA** are specified on page 81. These recommendations are applicable to **State Game Lands #314**.

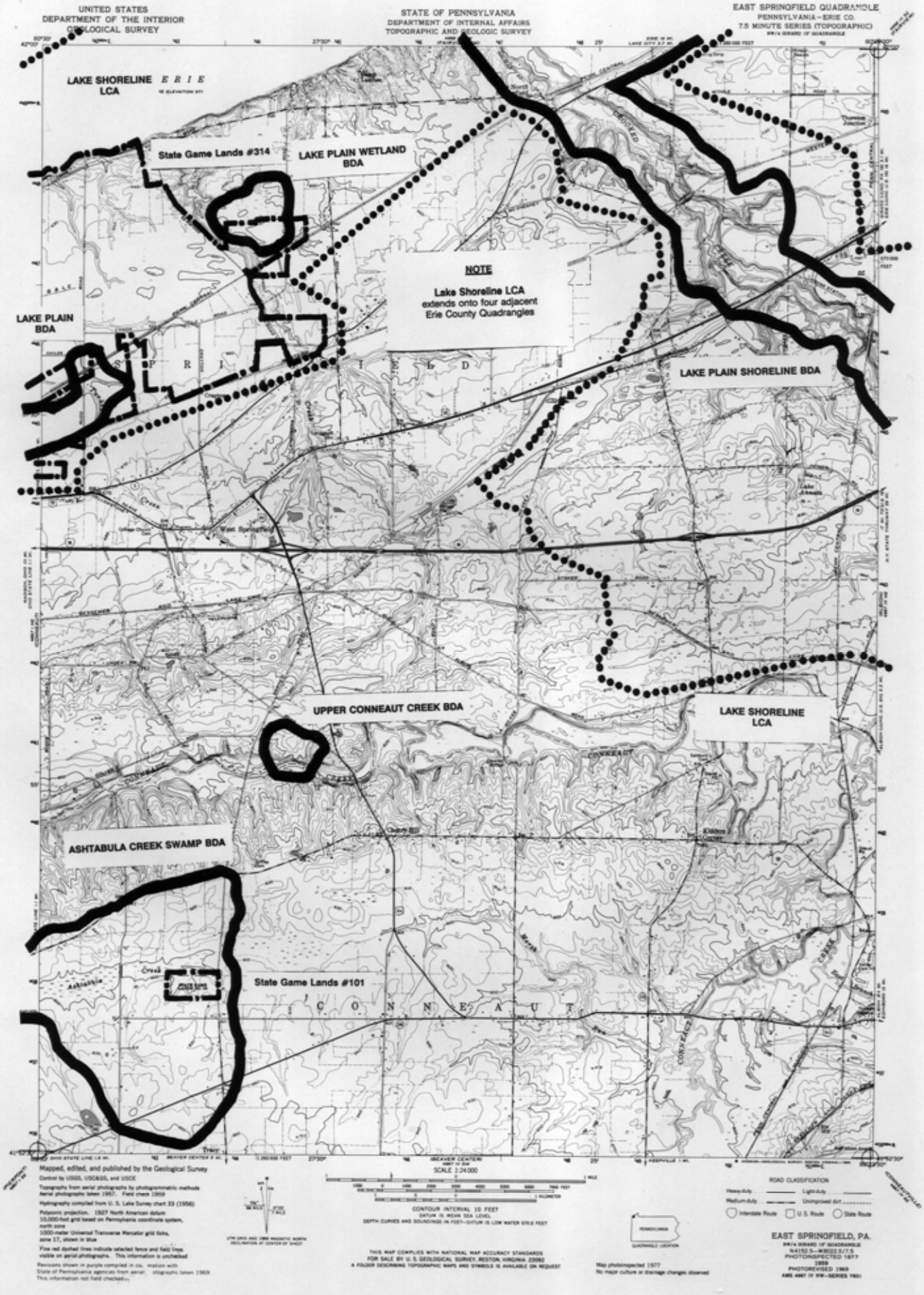
Ashtabula Creek Swamp BDA is a community/ecosystem conservation area represented on the East Springfield and Pierpont Quadrangles. **Ashtabula Creek Swamp BDA** contains a floodplain swamp community (**NC001**). As the **BDA** is largely represented on the East Springfield Quadrangle, refer to page 193 for a description of the **Ashtabula Creek Swamp BDA**.

EAST SPRINGFIELD QUADRANGLE

	PNDI Rank Global	State	Legal Status Fed.	State	Last Seen
LAKE SHORELINE LCA *High Significance*					
LAKE PLAIN SHORELINE BDA *High Significance*					
SPECIAL ANIMAL: SA001	G5	S1	N	PC	1987
LAKE PLAIN WETLANDS BDA *Notable Significance*					
SPECIAL PLANT: SP001	G?	S?	N	N	1992
LAKE PLAIN BDA *High Significance*					
SPECIAL PLANT: SP002	G?	S?	N	N	1992
SPECIAL PLANT: SP003	G5T5	S2	N	PE	1988
SPECIAL PLANT: SP004	G5T5	S?	N	PE	1992
ASHTABULA CREEK SWAMP BDA *Exceptional Significance*					
NATURAL COMMUNITY: NC001	G?	S1	N	N	1992
UPPER CONNEAUT CREEK BDA *Notable Significance*					
SPECIAL PLANT: SP005	G5	S2	N	TU	1992

MANAGED LANDS:

State Game Lands #101
State Game Lands #314


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
STATE OF PENNSYLVANIA
DEPARTMENT OF INTERNAL AFFAIRS
TOPOGRAPHIC AND GEOLOGIC SURVEY
EAST SPRINGFIELD QUADRANGLE
PENNSYLVANIA—ERIE CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
LAKE SHORELINE LCA
State Game Lands #314
LAKE PLAIN WETLAND BDA
NOTE
Lake Shoreline LCA
extends onto four adjacent
Erie County Quadrangles
LAKE PLAIN BDA
LAKE PLAIN SHORELINE BDA
UPPER CONNEAUT CREEK BDA
LAKE SHORELINE LCA
ASHTABULA CREEK SWAMP BDA
State Game Lands #101
Mapped, edited, and published by the Geological Survey
Control by USGS, USC&GS, and USCE
Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1957. Field check 1959
Hydrography compiled from U. S. Lake Survey chart 33 (1956)
Polyconic projection. 1927 North American datum
10,000-foot grid based on Pennsylvania coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 17, shown in blue
Fine red dashed lines indicate selected fence and field lines visible on aerial photographs. This information is unchecked
Revisions shown in purple compiled in co. mation with State of Pennsylvania agencies from aerial. otographs taken 1969
This information not field checked.
SCALE 1:24 000
CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS LOW WATER 570.5 FEET
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST
Map photoinspected 1977
No major culture or drainage changes observed
ROAD CLASSIFICATION
Heavy-duty
Light-duty
Medium-duty
Unimproved dirt
Interstate Route
U. S. Route
State Route
EAST SPRINGFIELD, PA.
PHOTOINSPECTED 1977
1959
PHOTOREVISED 1969

EAST SPRINGFIELD QUADRANGLE

The **Lake Shoreline LCA** extends along the entire Lake Erie shoreline and includes all of **State Game Lands #314**. In this section of the **LCA,** the lake bluff ranges in height from about 20 to 70 feet (U.S. Topographic Survey, 1977). Per aerial reconnaissance, the entire 2.2 mile stretch of lake bluff is sparsely vegetated. Yet, this portion of the lake bluff retains the habitat to permit establishment of seral vegetation stages, provided measures are taken to promote lake bluff stability. For more information on the natural characteristics of the **Lake Shoreline LCA**, refer to the site description on page 75. General recommendations regarding Landscape Conservation Area site protection and management are addressed on page 53. The recommendations for the overall management and protection of the **Lake Shoreline LCA** are detailed on page 81.

Contained within the **Lake Shoreline LCA** represented on the East Springfield Quadrangles are three special species habitats. These special species habitats are located within the **Lake Plain Shoreline BDA**, the **Lake Plain Wetland BDA**, and the **Lake Plain BDA**.

The portion of the **Lake Plain Shoreline BDA** represented on the East Springfield Quadrangle contains habitat for a special animal species -- **SA001**. **SA001** occurs within Crooked Creek. The **SA001** population that inhabits Crooked Creek is a fish species classified as critically imperiled in the state and a Pennsylvania candidate species (i.e., a species that could become threatened or endangered in the future). Protection of **SA001** requires protection of the aquatic habitat (i.e., stream substrate and access to the stream), and water quality, quantity, and flow needs to at least be maintained. **SA001** requires specific substrate and stream flow conditions for breeding. Also, the life cycle of **SA001** requires unimpeded access to lake tributaries for spawning, while the rest of the time **SA001** lives in the open waters of the Great Lakes. Stream modification via channelization, dredging, impoundment, or culverting could adversely effect **SA001** by restricting access to spawning areas and/or by reducing/eliminating stream habitats. Also, the application of lampricides in Crooked Creek should be avoided.

Within or contiguous with **State Game Lands #314** are two special species habitats -- **Lake Plain Wetland BDA** and **Lake Plain BDA**.

Lake Plain Wetland BDA is an approximately 119 acre forested swamp located on hummock-hollow topography that grades into black water ponds. The black water ponds are locally dominated by **SP001**. The

rest of the forested swamp is dominated by silver maple (Acer saccharinum), yellow birch (Betula lutea), and tupelo (Nyssa sp.) (Bissell and Danielson, 1992).

Lake Plain BDA is an approximately 156 acre forested swamp located on lake plain flats and is dominated by **SP002**, silver maple (Acer saccharinum), tupelo (Nyssa sp.), and American elm (Ulmus americana). The **SP002** population is locally common in pools within the swamp (Bissell and Danielson, 1992). The **Lake Plain BDA** also provides habitat for two special plant species (**SP003** and **SP004**), both of which are classified as endangered in Pennsylvania. **SP003** is located in pools within the **BDA**. **SP004** consists of a rarely occurring population inhabiting open, exposed small mud flats along Turkey Creek (Bier, 1988b).

SP001 and **SP002** represent two occurrences of a plant species which is at the extreme northern limit of its range. The general range of **SP001** and **SP002** is the southeastern United States. During 1992, this plant species was discovered to occur as far north as the lake plain swamps in Ohio and Pennsylvania. To date, this special plant species is known to occur at only three locations in Pennsylvania. All three locations are in swamps on the Erie County lake plain. Two of the locations are within the **BDA**s in **State Game Lands #314** -- the **Lake Plain Wetland BDA** and the **Lake Plain BDA**. The third location of this special plant species is within the **Lake Plain Shoreline BDA**. (Refer to the Fairview SW Quadrangle for information regarding this special plant within the **Lake Plain Shoreline BDA**.) In January 1993, the Pennsylvania Biological Survey (PBS) classified **SP001 and SP002** as a plant species believed to be in danger of population decline. However, additional data are needed to more accurately classify the species. While PBS classification does not have official status, the PBS ranking of **SP001** and **SP002** is worthy of consideration until a more definite determination can be made regarding the status of this species in Pennsylvania.

No apparent threats were noted regarding the **Lake Plain Wetland BDA** and **Lake Plain BDA** special species habitats (Bissell and Danielson, 1992; Bier, 1988). The general recommendations regarding Biological Diversity Area site protection and management on page x are applicable to both **BDA**'s.

State Game Lands #314 is one of two Managed Lands represented on the East Springfield Quadrangle. **State Game Lands #314** is located in the northwest quadrant of the East Springfield Quadrangle and extends onto the Conneaut Quadrangle.

State Game Lands #314 is about 3,206 acres in size (Bier et al., 1988). Approximately 1,962 acres are depicted on the East Springfield Quadrangle. Refer to page 186 for a description of the Managed Land attributes of **State Game Lands #314**.

A section of **State Game Lands #101** is represented on the East Springfield Quadrangle. **State Game Lands #101** is located on three Quadrangles: East Springfield, Beaver Center, and Pierpont. The total acreage of **State Game Lands #101** is approximately 836 acres. The approximately 37 acre portion of **State Game Lands #101** on the East Springfield Quadrangle is part of the **Ashtabula Creek Swamp BDA** described below.

Ashtabula Creek Swamp BDA is a community/ecosystem conservation area depicted on the East Springfield and Pierpont Quadrangles. **Ashtabula Creek Swamp BDA** contains a floodplain swamp community (**NC001**) -- a natural community that is critically imperiled in the state. Within Erie County, **NC001** is an exemplary example of a natural community that is rare in the county per inventory field surveys. The floodplain swamp community (**NC001**) is located in the low-lying plain depression in which Ashtabula Creek is located. Surface drainage and ground water discharge appear to be the primary sources of hydrology for the swamp. The area included within the **Ashtabula Creek Swamp BDA** contains the headwaters of Ashtabula Creek. Per review of aerial imagery (Erie County Department of Planning, 1991), the stream meanders through **NC001** via a braided stream channel. **NC001** is an inundated swamp with widely scattered trees and snags, shrub thickets, and a diverse herbaceous layer. The dominant species within **NC001** are red maple (Acer rubrum), buttonbush (Cephalanthus occidentalis), lizard tail (Saururus cernuus), water pepper (Polygonum hydropiper), arrow arum (Peltandra virginica), halberd-leaved tearthumb (Polygonum arifolium), and moneywort (Lysimachia mummularia). Local dominants include snags, ash (Fraxinus sp.), silky dogwood (Cornus amomom), and rice cutgrass (Leersia oryzoides).

Ashtabula Creek Swamp BDA is partially buffered by vegetated uplands and a wet woods. No apparent threats were observed to the floodplain swamp community (**NC001**). A landowner indicated that there has been discussion about "opening up" the area to improve stream flow. Maintenance of culverts under the road that crosses the natural heritage area or the road that borders the west end of the **BDA** would not adversely effect this exemplary natural community. However, modification of hydrology via stream channelization or dredging could adversely effect the **BDA**. General recommendations regarding Biological Diversity Area site protection and management are addressed on page 52. These recommendations are

applicable to the **Ashtabula Creek Swamp BDA**, as well as the more specific recommendation that the ecosystem's hydrology should remain intact. Also, surface water and ground water quality within the **BDA**'s watershed should at least be maintained.

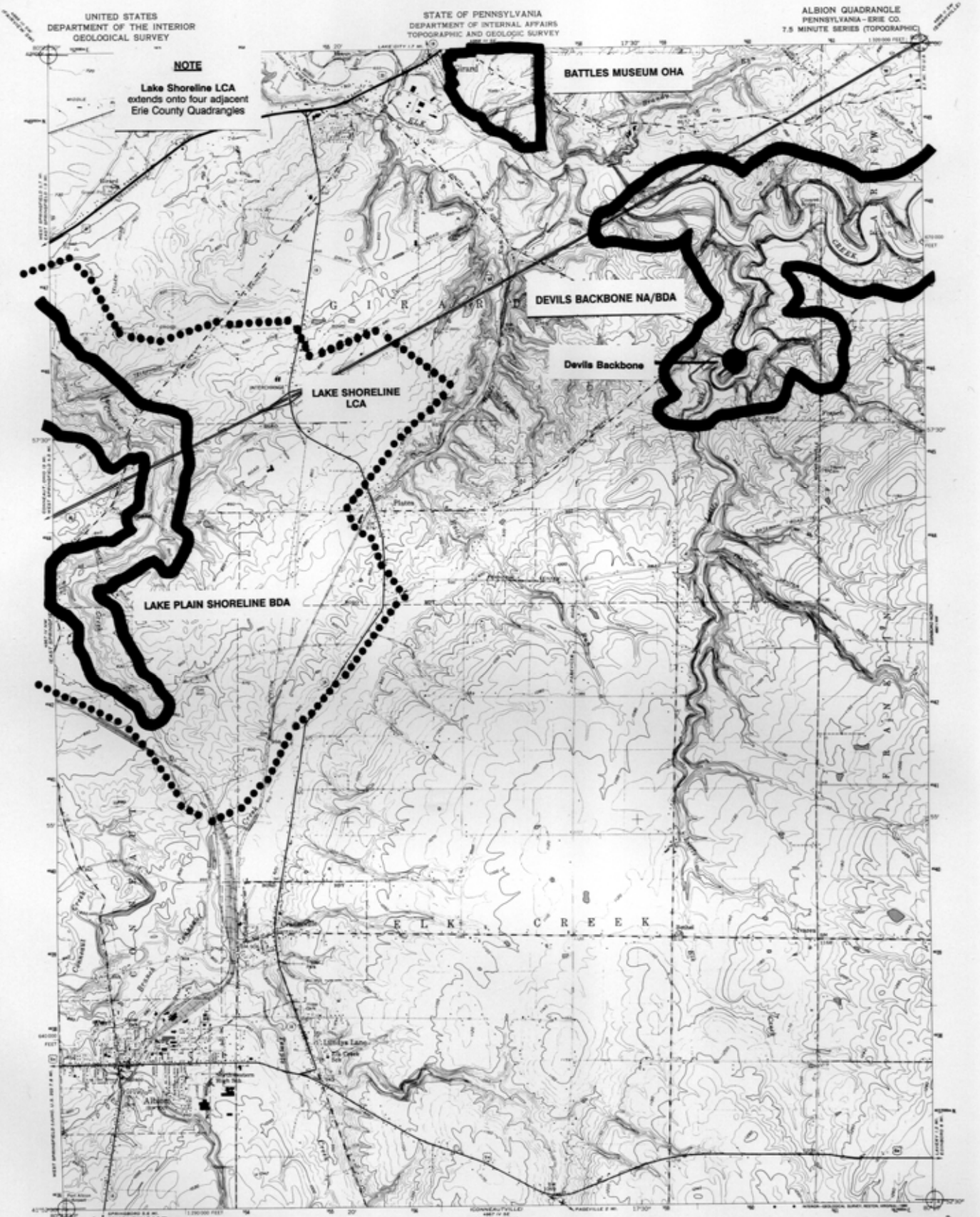
Upper Conneaut Creek BDA is a special species habitat located in Springfield and Conneaut Townships. A special plant species (**SP005**) population is widely scattered on mud flats adjacent to Conneaut Creek within the **BDA** (Bissell and Danielson, 1992). **SP005** is classified as tentatively undetermined in the state, as data is still being collected and evaluated to determine the status of the species. Protection of **SP005** requires maintenance of habitat and hydrology. General recommendations regarding Biological Diversity Area site protection and management are addressed on page 52. These recommendations are applicable to the **Upper Conneaut Creek BDA**.

ALBION QUADRANGLE

	PNDI Rank		Legal Status		Last
	Global	State	Fed.	State	Seen
LAKE SHORELINE LCA *Notable Significance*					
LAKE PLAIN SHORELINE BDA *High Significance*					
DEVILS BACKBONE NA/BDA *Exceptional Significance*					
NATURAL COMMUNITY: NC001	G?	S2	N	N	1992
SPECIAL PLANT: SP001	G5	S1	N	N	1985
SPECIAL PLANT: SP002	G?	S?	N	TU	1992
SPECIAL PLANT: SP003	G?	S?	N	TU	1992
NATURAL COMMUNITY: NC002	G?	S3	N	N	1992
NATURAL COMMUNITY: NC003	G?	S?	N	N	1988
NATURAL COMMUNITY: NC004	G?	S2	N	N	1988
SPECIAL PLANT: SP004	G5	S1	N	PE	1988
SPECIAL PLANT: SP005	G5	S1	N	PE	1988
SPECIAL PLANT: SP006	G5	S1	N	PE	1988
SPECIAL PLANT: SP007	G5	S1	N	PE	1988
BATTLES MUSEUM OHA *Notable Significance*					

GEOLOGIC FEATURES/FOSSIL LOCALITIES

Devils Backbone


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
STATE OF PENNSYLVANIA
DEPARTMENT OF INTERNAL AFFAIRS
TOPOGRAPHIC AND GEOLOGIC SURVEY
ALBION QUADRANGLE
PENNSYLVANIA - ERIE CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NOTE
Lake Shoreline LCA
extends onto four adjacent
Erie County Quadrangles
BATTLES MUSEUM OHA
DEVILS BACKBONE NA/BDA
Devils Backbone
LAKE SHORELINE
LCA
LAKE PLAIN SHORELINE BDA
G I R A R D
E L K C R E E K
Albion
Mapped, edited, and published by the Geological Survey
Control by USGS, USC&GS, and USCE
Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1955 and 1957. Field check 1959
Polyconic projection. 1927 North American datum
10,000-foot grid based on Pennsylvania coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 17, shown in blue
To place on the predicted North American Datum 1983 move the projection lines 2 meters south and 18 meters west as shown by dashed corner ticks
Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked
SCALE 1:24000
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
UTM GRID AND 1990 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
Interstate Route
U. S. Route
State Route
Revisions shown in purple and woodland compiled in cooperation with Commonwealth of Pennsylvania agencies from aerial photographs taken 1987 and other sources. This information not field checked
Map edited 1990
ALBION, PA.
41080-H3-TF-024
1959
PHOTOREVISED 1990

ALBION QUADRANGLE

The **Lake Shoreline LCA** extends from the Lake Erie shoreline inland onto the Albion Quadrangle to encompass the portion of the **Lake Plain Shoreline BDA** that includes Crooked Creek. Crooked Creek is a special species habitat. This tributary to Lake Erie provides critical habitat for a special animal species that is critically imperiled in the state. As Crooked Creek is largely represented on the East Springfield Quadrangle, the special animal species and recommendations for its protection are addressed on page 191.

Devils Backbone NA/BDA is an approximately 3,655 acre high diversity area that includes portions of Elk Creek and Little Elk Creek stream valleys, and most of the Falk Run stream valley. Within the **NA/BDA** are located four natural communities of ecological significance, as well as seven occurrences of five plant species of special concern. **Devils Backbone NA/BDA** is represented on the Albion Quadrangle and extends onto the Edinboro North Quadrangle.

The stream valleys located within **Devils Backbone NA/BDA** contain deeply entrenched high gradient streams that have eroded meandering stream channels through glacial deposits and shale bedrock. Steep forested valley walls and sheer, sparsely vegetated and unvegetated shale cliffs characterize these stream valleys. The natural communities within **Devils Backbone NA/BDA** consist of an extensive mesic central forest community (**NC001**), a high gradient clearwater creek (**NC002**), and meandering stream channels (**NC003**) which contain lake sediment slumps. Both the mesic central forest community (**NC001**) and the lake sediment slump habitats (**NC004**) provide habitats for special plant species.

The extensive mesic central forest community (**NC001**) located within the **Devils Backbone NA/BDA** contains areas of maturing forest, and an area that exhibits primary growth characteristics. Small groves of old growth beech-maple (Fagus grandifolia-Acer) occur within the **NA/BDA**, as do groves of eastern hemlock (Tsuga canadensis) (Wiegman, 1977). The forest occupies most of the stream valleys within the **NA/BDA**, except where slope and substrate prohibit. Sugar maple (Acer saccharum) is a canopy dominant throughout **NC001**. Local canopy dominants include beech, eastern hemlock, northern red oak (Quercus rubra), ash (Fraxinus sp.), and yellow birch (Betula lutea). One portion of **NC001** field surveyed for the inventory contained a maturing second growth forest dominated by beech and sugar maple. Associated species in the **NC001** forest canopy include basswood (Tilia sp.), tulip poplar (Liriodendron tulipifera), and red maple (Acer rubrum). **NC001** contains species of special concern. One of the special plant species (**SP001**) is classified as endangered in Pennsylvania. The status of the other special plant species is

tentatively undetermined. Two occurrences of this latter special plant (**SP002** and **SP003**) are contained within the mesic central forest community (**NC001**).

Although selective timber harvesting has occurred within the portion of **NC001** within the Falk Run stream valley, this part of **NC001** exhibits qualities characteristic of a recovering natural area. Also located within the portion of the **Devils Backbone NA/BDA** that contains the Falk Run stream valley is a high gradient clearwater creek (**NC002**) that merits recognition. **NC002** is commonly known as Falk Run. **NC002** is a shale bottomed stream with numerous waterfalls, riffle:pool complexes, and notable stream bed formations caused by water eroding the stream's shale substate. Vegetated and unvegetated gravel bars commonly occur on the inside bends of the meandering stream. The high gradient clearwater creek (**NC002**) retains its natural characteristics and qualities throughout nearly the entire length of the stream.

A section of the **NA/BDA** is recognized as a geologic feature of state significance by Geyer and Bolles (1979). The name of the geologic feature, **Devils Backbone**, derives from the shape of that part of Little Elk Creek stream valley where meanders in the stream resemble a backbone. Geyer and Bolles (1979) consider **Devils Backbone** to be a unique topographic feature resulting from stream erosion. **NC003** is part and parcel of the geologic feature called **Devils Backbone**. **NC003** consists of largely open, steep, eroding, silty-clay ancient lake sediment slumps and glacial till on the upper slopes of the meandering stream channels known as **Devils Backbone**. While **NC003** is partly forested, the lake sediment slump lacks trees. The ground water seepages that saturate the slumps and the surface gradient of the slumps prohibit the establishment of trees. Herbaceous growth develops in response to the lack of canopy and alkaline seepages (Wiegman, 1988). The result is lake sediment slump habitats (**NC004**) that provide rarely occurring habitat conditions for four special plants classified as endangered in Pennsylvania -- **SP004** through **SP007**.

Threats to the protection of **Devils Backbone NA/BDA** include (1) Stream valley wall erosion, induced by development or by the removal or lack of natural vegetation within the site's boundary, which could result in partial loss or degradation of natural communities within the **NA/BDA**; (2) Degradation of natural communities (**NC002** and **NC004**) due to changes in groundwater and/or surface water quantity and quality resulting from development, agriculture, and timber harvesting. The erodibility of stream valley soils and maintenance of groundwater quality and quantity were the primary factors in establishing the **NA/BDA**'s buffer; (3) Natural community (**NC001**) loss or modification from timber harvesting; (4) Right-of-way maintenance that would either fragment or alter the composition of the mesic central forest (**NC001**); and (5)

Forest fragmentation which would either adversely effect the mesic central forest community (**NC001**) or eliminate the ecological integrity of **NC001**. (Refer to pages 54 to 66 for general information on the potential threats posed to natural heritage areas by development, right-of-way maintenance, timber harvesting, agriculture, and fragmentation.)

To preserve and protect the natural communities (**NC001** through **NC004**) that comprise the **Devils Backbone NA/BDA** the general recommendations for Biological Diversity Areas on page 52 need to be applied, except within the Falk Run stream valley. For that portion of **NC001** that is located within the Falk Run stream valley, the general recommendations for protection and management of Natural Areas on page 52 are applicable. More specific recommendations for protection and management of the **NA/BDA**'s natural communities are:

(1) The mesic central forest community (**NC001**) needs to be protected and managed to allow the undisturbed recovery and maturation of the forest;

(2) Maintenance of the utility right-of-ways within and adjacent to the mesic central forest community (**NC001**) should be conducted in a manner that protects the natural community's biological resources. (Suggestions for maintaining right-of-ways in environmentally sensitive areas are addressed on page 60.); and

(3) The quantity and quality of water entering the lake sediment slumps (**NC004**) via ground water seepages and the high gradient clearwater creek (**NC002**) via surface flow must be maintained. Land use activities that would adversely effect these hydrologic conditions should be avoided.

Located in Girard Borough and Girard Township, the **Battles Museum OHA** educational area is 175 acres in size. The **OHA** provides ecological education opportunities to adults and children on a regional basis. Owned and managed by the Erie County Historical Society, the **OHA** contains a variety of biotic resources. These biological resources include a 41 acre woodland, 39 acres of meadows, as well as a pioneer successional woodland, wetlands, an ancient beach ridge, and a small portion of the Elk Creek stream valley. A focus of the **OHA** is to preserve and, as applicable, to restore the biotic resources within the **Battles Museum OHA** (S. Hansen, Erie Co. Hist. Soc., pers. commun.; S. Hansen, memo., Erie Co. Hist. Soc. Erie, Pa., 6/21/93; J. Leuenberger, correspondence, Tri-Co. Intermediate Unit, Erie, Pa., 6/8/92; T. Erdman, correspondence, DER Bur. of Forestry, Waterford, Pa., 7/25/88; Erie County Historical Society, Undated).

EDINBORO NORTH QUADRANGLE

	PNDI Rank		Legal Status		Last
	Global	State	Fed.	State	Seen
FRENCH CREEK BASIN LCA *Exceptional Significance*					
FRENCH CREEK BDA *Exceptional Significance*					
NATURAL COMMUNITY: NC001	G?	S1	N	N	1992
SPECIAL ANIMAL: SA001	G5	S2	N	PT	1992
SPECIAL PLANT: SP001	G5	S1	N	PE	1988
SPECIAL PLANT: SP002	G5	S1	N	PE	1988
SPECIAL PLANT: SP003	G4	S1	N	PE	1991
SPECIAL PLANT: SP004	G5	S2	N	PR	1987
SPECIAL PLANT: SP005	G?	S?	N	PE	1988
SPECIAL PLANT: SP006	G5	S2	N	PR	1987
SPECIAL PLANT: SP007	G5	S2	N	PR	1987
SPECIAL PLANT: SP008	G5	S2S3	N	PT	1987
SPECIAL PLANT: SP009	G5	S2S3	N	PT	1987
SPECIAL PLANT: SP010	G5	SU	N	TU	1991
SPECIAL PLANT: SP011	G5	S2S3	N	PT	1987
NATURAL COMMUNITY: NC002	G2G3	S1	N	N	1992
SPECIAL PLANT: SP012	G5	S1	N	PE	1988
SPECIAL PLANT: SP013	G5	S2	N	PT	1988
SPECIAL PLANT: SP014	G5	S2	N	PT	1988
SPECIAL PLANT: SP015	G5?	S2	N	PT	1988
SPECIAL PLANT: SP016	G5	S1	N	PE	1988
SPECIAL PLANT: SP017	G5	S3	N	PT	1988
SPECIAL PLANT: SP018	G5	S1	N	PE	1988
SPECIAL PLANT: SP019	G5	S4	N	PR	1988
SPECIAL PLANT: SP020	G5	S2S3	N	TU	1988
SPECIAL PLANT: SP021	G4	S2	N	PT	1988
SPECIAL PLANT: SP022	G5	S2S3	N	PT	1988
SPECIAL PLANT: SP023	G5T4T5	SU	N	PE	1988
SPECIAL PLANT: SP024	?	?	N	PE	1989
SPECIAL PLANT: SP025	G5	S1	N	PE	1991
SPECIAL PLANT: SP026	G4	S1	N	PE	1991
SPECIAL PLANT: SP027	G5	S2	N	PR	1991
SPECIAL PLANT: SP028	G5	?	N	N	1991

NATURAL COMMUNITY: NC003	G?	S2S3	N	N	1992
SPECIAL PLANT: SP029	G5	S2	N	PR	1987

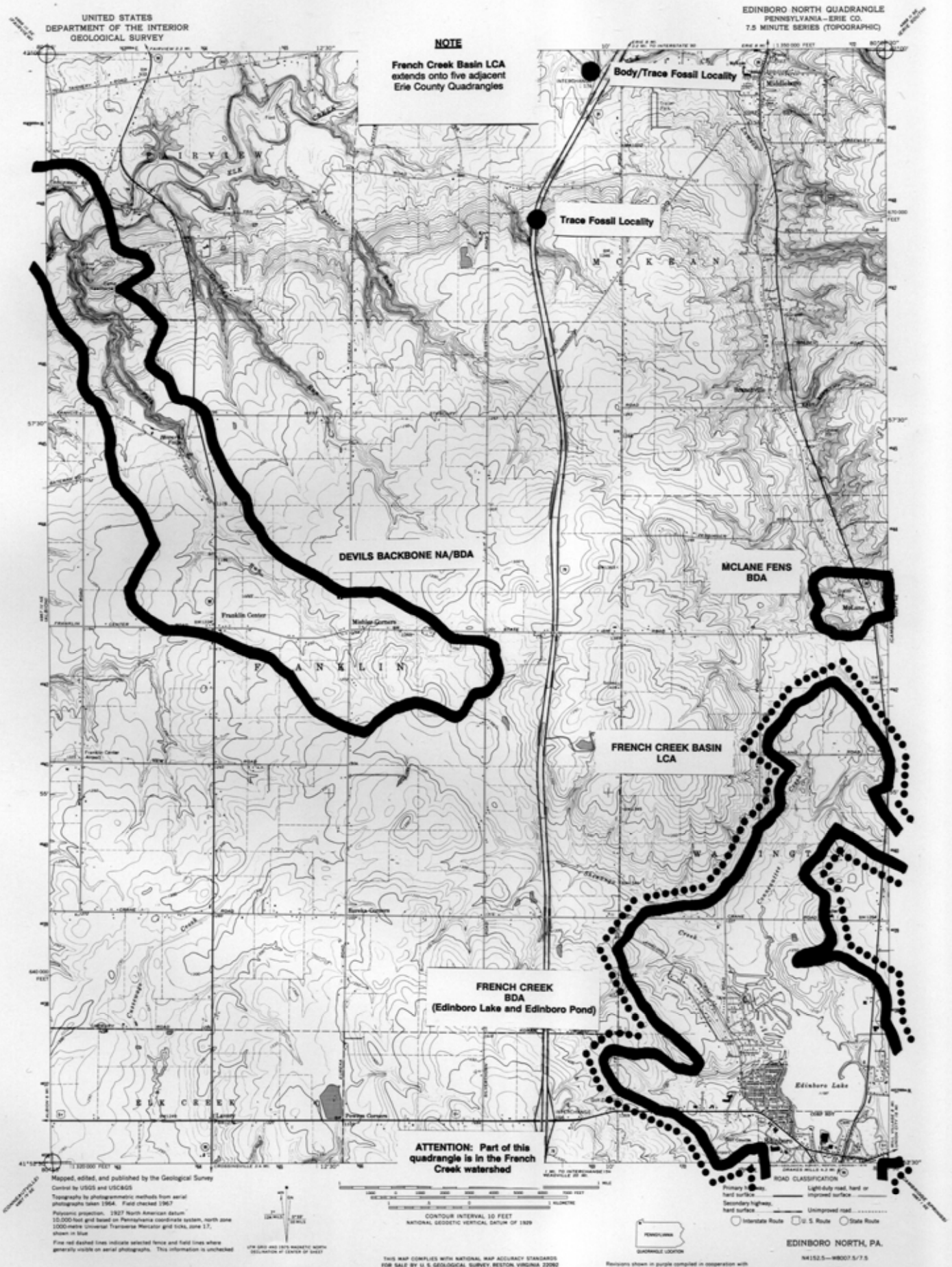
McLANE FENS BDA *Exceptional Significance*

NATURAL COMMUNITY: NC004	G?	S1	N	N	1991
SPECIAL PLANT: SP030	G5	S1	N	PT	1991
SPECIAL PLANT: SP031	?	?	N	TU	1991
SPECIAL PLANT: SP032	G5	S2S3	N	TU	1991
SPECIAL PLANT: SP033	?	?	N	TU	1991
NATURAL COMMUNITY: NC005	G2G3	S1	N	N	1991
SPECIAL PLANT: SP034	G5?	S2S3	N	PE	1991
SPECIAL PLANT: SP035	G4	S2	N	PT	1991
SPECIAL PLANT: SP036	G5	S1	N	PE	1991

DEVILS BACKBONE NA/BDA *Exceptional Significance*

GEOLOGIC FEATURES/FOSSIL LOCALITIES

Body/Trace Fossil Locality
Trace Fossil Locality


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
EDINBORO NORTH QUADRANGLE
PENNSYLVANIA—ERIE CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NOTE
French Creek Basin LCA
extends onto five adjacent
Erie County Quadrangles
Body/Trace Fossil Locality
Trace Fossil Locality
DEVILS BACKBONE NA/BDA
MCLANE FENS
BDA
FRENCH CREEK BASIN
LCA
FRENCH CREEK
BDA
(Edinboro Lake and Edinboro Pond)
ATTENTION: Part of this
quadrangle is in the French
Creek watershed
FAIRVIEW
MCKEAN
FRANKLIN
WASHINGTON
ELK CREEK
Franklin Center
McLane
Edinboro Lake
Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS
Topography by photogrammetric methods from aerial photographs taken 1964. Field checked 1967
Polyconic projection. 1927 North American datum
10,000-foot grid based on Pennsylvania coordinate system, north zone
1000-metre Universal Transverse Mercator grid ticks, zone 17, shown in blue
Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST
Revisions shown in purple compiled in cooperation with State of Pennsylvania agencies from aerial photographs taken 1975. This information not field checked
ROAD CLASSIFICATION
Primary highway, hard surface
Light-duty road, hard or improved surface
Secondary highway, hard surface
Unimproved road
Interstate Route
U. S. Route
State Route
EDINBORO NORTH, PA.
N4152.5—W8007.5/7.5
1967
PHOTOREVISED 1975
AMS 4967 I NW—SERIES V851

EDINBORO NORTH QUADRANGLE

On the Edinboro North Quadrangle a portion of the **French Creek Basin Landscape LCA** is represented, as well as a section of the **French Creek BDA**. A description of the portions of the **French Creek Basin LCA** and **French Creek BDA** on the Edinboro North Quadrangle follows. Refer to pages 119 and 120 for a holistic description of the biotic communities and the ecological significance of the natural resources within the **French Creek Basin LCA** and the **French Creek BDA**.

The portion of the **French Creek Basin LCA** represented on the Edinboro North Quadrangle contains that part of the **French Creek BDA** in which Edinboro Lake (**NC001**) is located. Within the emergent marsh at the northeast end of **NC001** is an exceptional shrub fen (**NC002**). Both **NC001** and **NC002** provide habitat for several species of special concern. Also contained within the **BDA** is a special species habitat (**NC003**).

Edinboro Lake is a calcareous glacial lake community (**NC001**)-- a natural community critically imperiled in the state due to rarity. **NC001** is a natural kettle lake about 240 acres in size. The lake (**NC001**) has a mean depth of ten feet and a maximum depth of 30 feet (Wellington, Undated). The primary sources of inflow into **NC001** are Shenango and Conneauttee Creeks (Wellington, 1991). The shallowness of **NC001** promotes the occurrence of extensive areas of aquatic vegetation, including emergent, submerged, and floating vegetation. Eleven occurrences (**SP001** through **SP011**) of nine special plant species have been confirmed within **NC001**. All but one of these species is classified as endangered, threatened, or rare in the state. The extensive emergent marsh located along the northeastern lake shoreline provides habitat for a special animal species (**SA001**). **SA001** is a bird classified as Pennsylvania threatened (C. Bier, Western Pa. Conservancy, pers. commun.). The emergent marsh is dominated by arrowhead (Sagittaria), cow lily (Nuphar sp.), cattails (Typha spp.), and purple loosestrife (Lythrum salicaria) with scattered and sometimes dense shrub thickets dominated by buttonbush (Cephalanthus occidentalis) and willow (Salix). (Note: Access to this emergent marsh on foot is hazardous.)

NC001 is an exceptional ecological resource, which is a seriously threatened by development and agriculture. Except for the northeastern shoreline of the lake, nearly the entire shoreline has been developed. Only narrow strips of natural vegetation occur along most of the shoreline. Consequently, **NC001** lacks the buffer needed to protect the community's exceptional ecological resources. Point-source and nonpoint-source pollution entering the **NC001** from development within the watershed has accelerated

eutrophication by the input of excess nutrients. Aerial reconnaissance conducted for the inventory indicates that heavy sediment loads enter the lake (**NC001**) via Conneauttee Creek. Presumably this sedimentation is related to agriculture, which is the primary land use within the creek's watershed. Accelerated eutrophication and water quality degradation, from heavy sediment loads and excess nutrient input, degrades fishery habitats, natural community biodiversity, and the aesthetic qualities of this component of the **French Creek BDA**. Those land uses that threaten the ecological integrity of **NC001** also threaten **NC002**. To various degrees, both **NC001** and **NC002** are threatened by the infiltration of exotic plant species. (Refer to pages 56, 58, and 64 for information on the threats posed to natural heritage areas by agriculture, development, and fragmentation.)

The extensive emergent marsh described above contains a shrub fen community (**NC002**). **NC002** is a natural community of global and state significance. The ecological significance of **NC002** is further augmented by the occurrence of 17 special plant species (**SP012** through **SP028**). Nearly all of these special plants are classified as endangered, threatened, or rare in the state. While the primary source of water for **NC002** is Edinboro Lake (**NC001**), the shrub fen community (**NC002**) also receives water from groundwater seepages along the shoreline that form watercourses in **NC002**. These watercourses are vegetated by cow lily (Nuphar), spikerushes (Eleocharis spp.), bur-reed (Sparganium sp.), arrowhead, and water milfoil (Myriophyllum). **NC002** contains a mosaic of shrub thickets dominated by willow, red-osier dogwood (Cornus stolonifera), alder (Alnus sp.), and scattered red maple. Openings in the shrub thickets are dominated by sedges (Carex spp.) and royal fern (Osmunda regalis). Cattail (Typha), marsh cinquefoil (Potentilla palustris), and marsh St. John's-wort (Hypericum virginicum) are local dominants within these openings. (Note: Access to **NC002** is hazardous due to the fragility of the organic mat.)

NC003 is a natural pond community that provides habitat for a critically imperiled special plant species (**SP029**). Removal of the natural vegetation surrounding the pond has severely degraded the quality of **NC003**. Restoration of this natural vegetation would not only provide a buffer for the special species habitat, but would significantly enhance the biotic resource value of **NC003**.

General recommendations regarding Landscape Conservation Area and Biological Diversity Area site protection and management are addressed on pages 52 and 53. The recommendations for the overall management and protection of the entire **French Creek Basin LCA** and the entire **French Creek BDA** are synonymous with the general recommendations for LCA's and BDA's. Refer to the recommendations on

page 124 for guidance regarding the protection of the **BDA** on the Edinboro North Quadrangle. (Note: The conditions by which the general recommendations for the protection and management of the **French Creek Basin LCA** and **French Creek BDA** can be modified are on page 124.)

McLane Fens BDA is a natural heritage area that contains two natural communities (**NC004** and **NC005**) that are critically imperiled in Pennsylvania. Both natural communities also provide habitat for special plant species. **McLane Fens BDA** contains a calcareous swamp community (**NC004**) dominated by eastern hemlock (Tsuga canadensis), black ash (Fraxinus nigra), yellow birch (Betula lutea), spicebush (Lindera benzoin), and **SP032**. Four special plant species populations (**SP030** through **SP033**) occur within the calcareous swamp community (**NC004**). The shrub fen community (**NC005**) in the **McLane Fens BDA** is dominated by willow, sedges, and a rush (Juncus articulatus). Eastern hemlock is scattered in the fen (**NC005**) and is a local dominant in the center of the shrub fen community. **NC005** provides habitat for three special plant species populations (**SP034**, **SP035**, and **SP036**) (Bissell and Danielson, 1991). Two of these species of special concern (**SP034** and **SP036**) are endangered in the state; **SP035** is a plant species considered to be threatened in Pennsylvania. Groundwater seepages are the primary sources of hydrology for natural communities **NC004** and **NC005**. Groundwater quality and quantity must be protected to preserve **NC005** and **NC006**. Land use activities that pose a threat to the shrub fen community (**NC005**) and the calcareous swamp community (**NC004**) are development, a utility right-of-way that bisects the **BDA**, and a nearby over-crowded livestock pasture. Fragmentation also poses a serious threat to the site (Bier, 1991). (Refer to pages 56 to 61 for information on the general threats posed by the aforementioned land uses and page 64 for the adverse effects of fragmentation.)

The general recommendations regarding Biological Diversity Area site protection and management addressed on page 52 are applicable to the **McLane Fens BDA**. More specific site specific recommendations are:

(1) Property owners are encouraged to allow a natural vegetation buffer to develop within the entire boundary of the **McLane Fens BDA**;

(2) Utility right-of-way (ROW) maintenance should adhere to the suggestions on page 60 for maintaining ROWs in environmentally sensitive areas; and

(3) The density of livestock usage in the pasture and pond adjacent to and up-gradient of the site should be reduced to eliminate the possibility of ground water quality degradation.

Devils Backbone NA/BDA is an approximately 3,655 acre high diversity area that includes portions of Elk Creek and Little Elk Creek stream valleys, and most of the Falk Run stream valley. Within the **NA/BDA** are located four natural communities of ecological significance, as well as seven occurrences of five plant species of special concern. **Devils Backbone NA/BDA** is represented on the Albion and Edinboro North Quadrangles. Refer to page 197 for a description of this natural heritage area and recommendations for the protection and management of the **NA/BDA**.

Because glacial deposits cover most of the county and bedrock exposures containing fossiliferous rocks are rare, the **Trace Fossil Locality** in McKean Township is recognized by Hoskins et al. (1983). The **Trace Fossil Locality** consists of sandstone exposed by highway construction. The sandstone contains numerous trace fossils (i.e., molds of once living organisms). As the fossil locality is located along an interstate highway, extreme caution should be used when accessing the site.

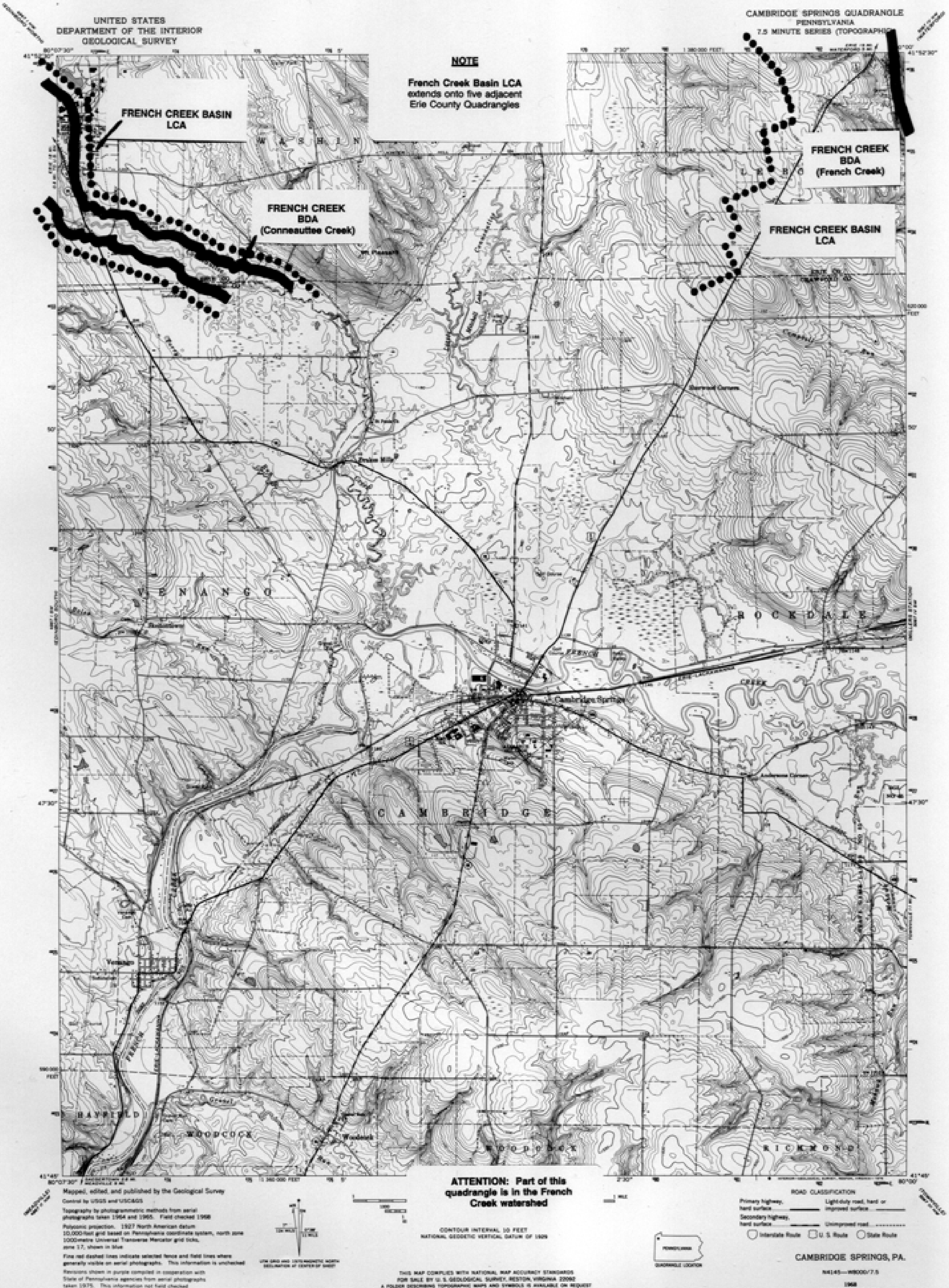
The **Body/Trace Fossil Locality**, in McKean Township, consists of bedrock rich in fossils that have been exposed by highway construction. Both body and trace fossils occur at the **Body/Trace Fossil Locality**. Unlike trace fossils, body fossils are three-dimensional stone replicas of once living organisms. Invertebrate organisms, including brachipods and pelycypods, are well represented at this fossil locality. As the **Body/Trace Fossil Locality** is located along an interstate highway, extreme caution should be used when accessing the site. In addition, Hoskins et al. (1983) indicate that parking is not permitted on the highway berm at the **Body/Trace Fossil Locality**.

CAMBRIDGE SPRINGS NE QUADRANGLE

	PNDI Rank		Legal Status		Last
	Global	State	Fed.	State	Seen
FRENCH CREEK BASIN LCA *Exceptional Significance*					
FRENCH CREEK BDA *Exceptional Significance*					
NATURAL COMMUNITY: NC001	G2G3	S1	N	N	1992
NATURAL COMMUNITY: NC002	G?	S3	N	N	1992
NATURAL COMMUNITY: NC003	G?	S1S2	N	N	1992
NATURAL COMMUNITY: NC004	G?	S1S2	N	N	1992
SPECIAL PLANT: SP001	G5	?	N	TU	1992
SPECIAL PLANT: SP002	G5?	S2	N	PT	1992

MANAGED LANDS:

State Game Lands #109
State Game Lands #192


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CAMBRIDGE SPRINGS QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
NOTE
French Creek Basin LCA
extends onto five adjacent
Erie County Quadrangles
FRENCH CREEK BASIN
LCA
FRENCH CREEK
BDA
(Conneauttee Creek)
FRENCH CREEK
BDA
(French Creek)
FRENCH CREEK BASIN
LCA
VENANGO
ROCKDALE
CAMBRIDGE
Cambridge Springs
HAYFIELD
WOODCOCK
RICHMOND
ATTENTION: Part of this
quadrangle is in the French
Creek watershed
Mapped, edited, and published by the Geological Survey
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
ROAD CLASSIFICATION
CAMBRIDGE SPRINGS, PA.
1968
PHOTOREVISED 1975

CAMBRIDGE SPRINGS NE QUADRANGLE

A portion of the **French Creek Basin Landscape LCA** is represented on the Cambridge Springs NE Quadrangle, as well as sections of the **French Creek BDA**. A description of the portions of the **French Creek Basin LCA** and **French Creek BDA** on the Cambridge Springs NE Quadrangle follows. Refer to pages 119 and 120 for a holistic description of the biotic communities and the ecological significance of the natural resources within the **French Creek Basin LCA** and the **French Creek BDA**.

The **French Creek Basin LCA** depicted on the Cambridge Springs NE Quadrangle includes the watersheds of LeBoeuf Creek and the main stem of French Creek, as well as three components of the **French Creek BDA**. The three components of the **BDA** include a small area of the **BDA** component located in the LeBoeuf Creek stream valley (see page 220), the wetlands and associated habitats located in the headwaters of Elk Creek and Trout Run, and a small area of the **French Creek BDA**, which contains a segment of the main stem of French Creek. Refer to the Waterford Quadrangle for a description of the French Creek and LeBoeuf Creek stream valley components of the **French Creek BDA**.

The primary component of the **French Creek BDA** represented on the Cambridge Springs NE Quadrangle encompasses four noteworthy wetland natural communities (**NC001** through **NC004**). **NC001** through **NC004** are located in the headwaters of Elk Creek and Trout Run. These four natural communities together with contiguous terrestrial habitats comprise an exceptional natural heritage area. The section of the **French Creek BDA** in which natural communities **NC001** through **NC004** are located also contains part of the immediate watershed of another **French Creek BDA** component -- Lake LeBoeuf. (Refer to the Waterford Quadrangle for a description of the natural community known as Lake LeBoeuf.) The wetlands located in the vicinity of the watershed divide between Elk Creek and Trout Run contain natural communities that are classified as globally imperiled/very rare (**NC001**), critically imperiled/imperiled in the state (**NC003** and **NC004**), and uncommon in Pennsylvania (**NC002**). The primary source of hydrology for these four natural communities is groundwater seepage. In addition to natural communities **NC001** through **NC004**, this approximately 358 acre portion of the **French Creek BDA** contains a diverse mosaic of terrestrial and aquatic communities, including deciduous and coniferous woodlands, streams, beaver impoundments, and a variety of palustrine wetlands. This natural heritage area exhibits high community diversity per aerial reconnaissance conducted for the inventory. Per field surveys, natural communities **NC001** through **NC004** each contain highly diverse vegetation communities.

NC001 is a calcareous shrub fen community. Groundwater seepages are the primary source of hydrology for this roughly one acre natural community. Shrub thickets encircle and are scattered within a diverse wet meadow. Dominant species in the shrub thicket are dogwood (Cornus sp.), willow (Salix sp.), and alder (Alnus sp.). Bayberry (Myrica pennsylvanica) occurs within the shrub thicket on the periphery of the shrub fen (**NC001**). Spikerushes (Eleocharis spp.), sedges (Carex spp.), marsh fern (Thelypteris palustris), cinquefoil (Potentilla sp.), cattail (Typha sp.), and skunk cabbage (Sympolcarpus foetidus) are dominants in the wet meadow. Eastern hemlock (Tsuga canadensis) and red maple (Acer rubrum) are widely scattered within **NC001**.

Bordering **NC001** is a large diverse circumneutral shrub swamp (**NC002**) containing dogwood, red-osier dogwood (Cornus stolonifera), alder, willow, common winterberry holly (Ilex verticillata), and swamp rose (Rosa palustris) dominated shrub thickets with numerous openings dominated by cattails (Typha spp.), joe pye weed (Eupatorium macutlatum), sedges, cinnamon fern (Osmunda cinnamomea), golden saxifrage (Chrysosplenium americanum), and marsh fern. Contiguous with **NC002** is a natural community (**NC003**) rarely encountered during the county inventory, except in this component of the **French Creek BDA**.

NC003 is a northern circumneutral broadleaf-conifer swamp community. This natural community is classified as critically imperiled/imperiled in the state. **NC003** is unusual, as the species that characterize this natural community represent a "hybrid" of the temperate and boreal types of broadleaf-conifer swamp (Smith, 1991). **NC003** is dominated by red maple, eastern hemlock, common winterberry holly, alder, cinnamon fern, skunk cabbage, and ground nut (Apios americana). Numerous moss species occur within **NC003**. Tamarack (Larix larcinia) are widely scattered along the border between **NC003** and the circumneutral shrub swamp community (**NC002**).

A forested hill separates **NC003** from another northern circumneutral broadleaf-conifer swamp community (**NC004**). **NC004** is located in the headwaters of Trout Run. Ground water seepage is the primary source of hydrology for **NC004**. The prevalence of snags in **NC004** suggests that a beaver dam has impounded part of the swamp. The tree canopy of **NC004** ranges from nearly closed on the periphery to thinly wooded toward the center. This highly diverse natural community is dominated by eastern hemlock, white pine (Pinus strobus), red maple, snags, skunk cabbage, cinnamon fern, jewelweed (Impatiens sp.), water primrose (Jussiaea sp.), and mosses, including peatmoss (Sphagnum). Other species characteristic of **NC004** are tamarack, blueberry (Vaccinium), red-osier dogwood, and sedges (Isaac, 1992b). **NC004**

provides habitat for two special plant species -- **SP001** and **SP002**. **SP002** represents a rarely occurring population of a special plant classified as critically imperiled in the state.

Protection of water quality and quantity is essential to the protection of natural communities **NC001** through **NC004**, associated special plant species (**SP001** and **SP002**), as well as the other wetlands contained within this section of the **French Creek BDA**. Surrounding land uses that pose a threat to water quality in this section of the **BDA** include mineral extraction (i.e, wells and gravel mining), development, and nonpoint-source pollution from adjacent agricultural lands. Development and agriculture border the periphery of the **BDA**. Fragmentation and/or habitat loss are threats posed by these land use activities. (Refer to pages 54 to 66 for information regarding the potential threats posed by mineral extraction, agriculture, development, and fragmentation.) Minor intrusions of exotic species into **NC002** were observed.

Located at the southeastern corner of the Cambridge Springs NE Quadrangle is a small portion of the **French Creek BDA** component that contains a segment of French Creek and which, for the most part, is depicted on the adjacent Waterford Quadrangle. Refer to page 223 for a description of this component of the **French Creek BDA**.

Located in the northwestern quadrant of the Cambridge Springs NE Quadrangle is a portion of the **French Creek BDA** that is primarily represented on the adjacent Edinboro North Quadrangle and contains these **BDA** components: Edinboro Lake and a special species habitat. Refer to pages 119 and 120 for a description of this portion of the **French Creek BDA**.

Within the section of the **French Creek Basin LCA** represented on the Cambridge Springs NE Quadrangle are two Managed Lands: **State Game Lands #109** and **State Game Lands #192**.

The portion of **State Game Lands #109** on the Cambridge Springs NE Quadrangle is entirely contained within the **French Creek BDA**. The portion of the **French Creek BDA** on the Cambridge Springs NE Quadrangle that includes **State Game Lands #109** is described on pages 220 to 223. The following paragraph provides general information regarding **State Game Lands #109**.

The portion of **State Game Lands #109** represented on the Cambridge Springs NE Quadrangle is about nine acres in size. **State Game Lands #109** is also represented on three other Quadrangles: Hammett, Erie South, and Waterford. **State Game Lands #109** is 1,639 acres in size. Refer to page 218 for a description of the Managed Land attributes of **State Game Lands #109**.

State Game Lands #192 is a Managed Land located in Washington and Waterford Townships. The total size of **State Game Lands #192** is about 303 acres. **State Game Lands #192** contains woodlands and streams located on hilly terrain, as well as a few food plots (R. Haibach, Pa. Game Comm., pers. commun.).

General recommendations regarding Landscape Conservation Area and Biological Diversity Area site protection and management are addressed on pages 52 and 53. The recommendations for the overall management and protection of the entire **French Creek Basin LCA** and the entire **French Creek BDA** are synonymous with the general recommendations for LCA's and BDA's. Refer to the recommendations on page 124 for guidance regarding the protection of the **BDA** on the Cambridge Springs NE Quadrangle. (Note: The conditions by which the general recommendations for the protection and management of the **French Creek Basin LCA** and **French Creek BDA** can be modified are on page 124.)

WATERFORD QUADRANGLE

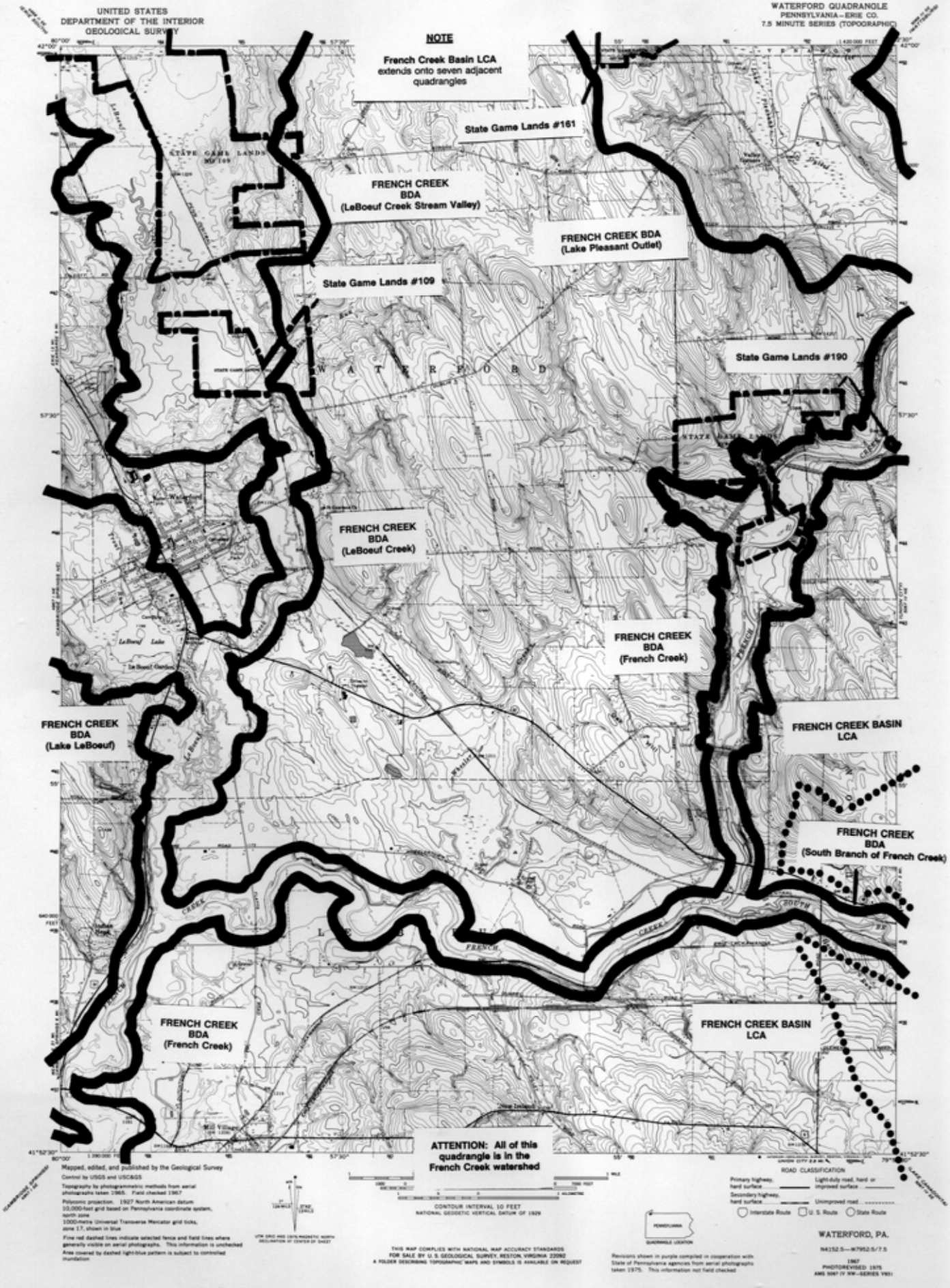
	PNDI Rank Global	State	Legal Status Fed.	State	Last Seen
FRENCH CREEK BASIN LCA *Exceptional Significance*					
FRENCH CREEK BDA *Exceptional Significance*					
NATURAL COMMUNITY: NC001	G?	S2S3	N	N	1992
NATURAL COMMUNITY: NC002	G?	S3	N	N	1992
NATURAL COMMUNITY: NC003	G?	S3	N	N	1992
NATURAL COMMUNITY: NC004	G?	S1	N	N	1992
NATURAL COMMUNITY: NC005	G?	S1	N	N	1985
SPECIAL PLANT: SP001	G4	S2	N	PT	1985
NATURAL COMMUNITY: NC006	G?	S1	N	N	1992
SPECIAL PLANT: SP002	G4	S2	N	PT	1992
NATURAL COMMUNITY: NC007	G?	S3S4	N	N	1985
SPECIAL PLANT: SP003	G5	S2S3	N	TU	1992
SPECIAL PLANT: SP004	G5	S2S3	N	TU	1992
SPECIAL PLANT: SP005	G5	?	N	TU	1992
SPECIAL PLANT: SP006	G5	?	N	TU	1992
NATURAL COMMUNITY: NC008	G2G3	S1	N	N	1992
SPECIAL PLANT: SP007	G4	S2	N	PT	1985
SPECIAL PLANT: SP008	G5	S2S3	N	TU	1992
NATURAL COMMUNITY: NC009	G?	S3	N	N	1987
SPECIAL PLANT: SP009	G5?	S2S3	N	PE	1987
SPECIAL PLANT: SP010	G3G5	S3	N	PT	1987
NATURAL COMMUNITY: NC010	G?	S1	N	N	1987
SPECIAL PLANT: SP011	G5?	S2S3	N	PE	1987
SPECIAL PLANT: SP012	G3G5	S3	N	PT	1987

NATURAL COMMUNITY: NC011	G?	S1	N	N	1987
SPECIAL PLANT: SP013	G5?	S2S3	N	PE	1987
SPECIAL PLANT: SP014	G5	S3	N	PT	1987
SPECIAL PLANT: SP015	G5	S1	N	PT	1987
NATURAL COMMUNITY: NC012	G?	S2	N	N	1990
SPECIAL PLANT: SP016	G5	S2S3	N	PT	1987
SPECIAL PLANT: SP017	G5	S1	N	PE	1990
SPECIAL PLANT: SP018	G5	S2S3	N	PT	1987
NATURAL COMMUNITY: NC013	G?	S3S4	N	N	1990
SPECIAL PLANT: SP019	G5	S1	N	PT	1990
SPECIAL PLANT: SP020	G5	S2S3	N	TU	1990
SPECIAL PLANT: SP021	G5	S?	N	TU	1990
SPECIAL PLANT: SP022	G5	S1	N	PE	1990
SPECIAL PLANT: SP023	G5	S2	N	PR	1990
NATURAL COMMUNITY: NC014	G?	S2S3	N	N	1990
NATURAL COMMUNITY: NC015	G?	S3S4	N	N	1990
SPECIAL PLANT: SP024	G4G5	S1	N	PE	1990
NATURAL COMMUNITY: NC016	G?	S1S2	N	N	1992
SPECIAL ANIMAL: SA001	G3	S2	N	PT	1987
SPECIAL ANIMAL: SA002	G5	S2	N	PT	1987
SPECIAL ANIMAL: SA003	G5	S2	N	PT	1992
SPECIAL ANIMAL: SA004	G5	S2	N	PC	1985
SPECIAL ANIMAL: SA005	G3	S2	N	PT	1986
SPECIAL ANIMAL: SA006	G3	S2	N	PT	1992
SPECIAL ANIMAL: SA007	G2	S2	N	PE	1987
SPECIAL ANIMAL: SA008	G2	S2	N	PE	1985
SPECIAL ANIMAL: SA009	G3	S1	C2	PE	1987
SPECIAL ANIMAL: SA010	G3	S1	C2	PE	1977
SPECIAL ANIMAL: SA011	G3	S1	C2	PE	1992
SPECIAL ANIMAL: SA012	G2	S2	N	PE	1992
SPECIAL ANIMAL: SA013	G3	S2	N	PT	1992
SPECIAL ANIMAL: SA014	G5	S1	N	N	1988
NATURAL COMMUNITY: NC017	G?	S3S4	N	N	1992
SPECIAL ANIMAL: SA015	G3	S2	N	PT	1985/86
SPECIAL ANIMAL: SA016	G3	S1S2	N	N	1991
SPECIAL ANIMAL: SA017	G5	S1	N	N	1988
SPECIAL ANIMAL: SA018	G1	S1	LE	N	1991

SPECIAL ANIMAL: SA019	G2T2	S1	LE	N	1991
SPECIAL ANIMAL: SA020	G3	S2	C2	PE	1992
SPECIAL ANIMAL: SA021	G3	S1	C2	PE	1992
SPECIAL ANIMAL: SA022	G3G4	S2S3	N	N	1989
SPECIAL ANIMAL: SA023	G5	S1	N	N	1989
SPECIAL PLANT: SP025	G5	S2	N	PR	1989
NATURAL COMMUNITY: NC018	G?	S1	N	N	1989
SPECIAL PLANT: SP026	G3G5	S3	N	PT	1989
SPECIAL PLANT: SP027	G5	S2S3	N	PT	1989
SPECIAL PLANT: SP028	G5	S2S3	N	PT	1989
NATURAL COMMUNITY: NC019	G?	S3	N	N	1992

MANAGED LANDS:

State Game Lands #109
State Game Lands #161
State Game Lands #190


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATERFORD QUADRANGLE
PENNSYLVANIA—ERIE CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NOTE
French Creek Basin LCA
extends onto seven adjacent
quadrangles
State Game Lands #161
FRENCH CREEK
BDA
(LeBoeuf Creek Stream Valley)
FRENCH CREEK BDA
(Lake Pleasant Outlet)
State Game Lands #109
State Game Lands #190
W A T E R F O R D
FRENCH CREEK
BDA
(LeBoeuf Creek)
FRENCH CREEK
BDA
(French Creek)
FRENCH CREEK
BDA
(Lake LeBoeuf)
FRENCH CREEK BASIN
LCA
FRENCH CREEK
BDA
(South Branch of French Creek)
FRENCH CREEK
BDA
(French Creek)
FRENCH CREEK BASIN
LCA
ATTENTION: All of this
quadrangle is in the
French Creek watershed
Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS
Topography by photogrammetric methods from aerial
photographs taken 1965. Field checked 1967
Polyconic projection. 1927 North American datum
10,000-foot grid based on Pennsylvania coordinate system,
north zone
1000-metre Universal Transverse Mercator grid ticks,
zone 17, shown in blue
Fine red dashed lines indicate selected fence and field lines where
generally visible on aerial photographs. This information is unchecked
Area covered by dashed light-blue pattern is subject to controlled
inundation
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST
Revisions shown in purple compiled in cooperation with
State of Pennsylvania agencies from aerial photographs
taken 1975. This information not field checked
ROAD CLASSIFICATION
Primary highway, hard surface
Secondary highway, hard surface
Light-duty road, hard or improved surface
Unimproved road
Interstate Route
U. S. Route
State Route
WATERFORD, PA.
N4152.5—W7952.5/7.5
1967
PHOTOREVISED 1975
AMS 5967 IV NW—SERIES V851

WATERFORD QUADRANGLE

A portion of **State Game Lands #109** is represented on the Waterford Quadrangle. **State Game Lands #109** is also represented on three other Quadrangles: Hammett, Erie South, and Cambridge Springs NE. The total acreage of **State Game Lands #109** is 1,639 acres. The portion of **State Game Lands #109** on the Waterford Quadrangle is about 1,116 acres in size. Passive wildlife habitat management is currently practiced on nearly all of **State Game Lands #109**. Habitat management in the game land is limited to a few food plots and apple tree release. The food plots within the game land are border cut to produce edge habitat (R. Haibach, Pa. Game Comm., pers. commun.).

The section of **State Game Lands #109** represented on the Waterford Quadrangle is entirely contained within the **French Creek BDA** and is, therefore, part of the **French Creek Basin LCA**. The portions of the **French Creek Basin LCA** and the **French Creek BDA** represented on the Waterford Quadrangle are described below. Refer to pages 119 and 120 for a holistic description of the biotic communities and the ecological significance of the natural resources within the **French Creek Basin LCA** and the **French Creek BDA**.

On the Waterford Quadrangle, the **French Creek Basin LCA** covers the entire quadrangle and contains five components of the **French Creek BDA** -- Lake Pleasant Outlet, LeBoeuf Creek stream valley, segments of French Creek, and LeBoeuf Creek, and Lake LeBoeuf. This portion of the **French Creek BDA** contains 19 biologically significant natural communities (**NC001** through **NC019**) that provide habitats for 38 species of special concern occurrences (**SP001** through **SP025** and **SA001** through **SA022**). Several globally significant natural communities and species of special concern occur within the portion of the **French Creek BDA** depicted on the Waterford Quadrangle.

Natural communities **NC001** through **NC004** are located within that part of the **French Creek BDA** that is known as Lake Pleasant Outlet. The lake outlet consists of a low gradient clearwater creek formed by water outflow from Lake Pleasant. The stream is classified as a high quality cold water fishery by the Pennsylvania Department of Environmental Resources (T. Klester, DER Bureau of Water Quality, pers. commun.). Lake Pleasant Outlet meanders and occasionally braids through a shallow basin, containing very poorly drained soils formed from silt and clay deposited by still or slack water (Taylor, 1960). The broad bottomlands that border the stream contain an extensive wetland complex that is contiguous with the open waters of Lake Pleasant and extends nearly to the stream's confluence with French Creek. As an aquatic

system, Lake Pleasant and the natural communities in Lake Pleasant Outlet (**NC001** through **NC004**) are certainly an exceptional component of the **French Creek BDA**. Refer to page 141 for a description of the natural communities that comprise Lake Pleasant.

Lake Pleasant Outlet is a composite of at least four natural communities that together produce a highly diverse biological resource. The natural communities within the outlet include a circumneutral broadleaf swamp community (**NC001**), a graminoid marsh community (**NC002**), a circumneutral shrub swamp community (**NC003**), and a floodplain swamp community (**NC004**).

The circumneutral broadleaf swamp (**NC001**) has been modified by increased hydrology. The community is in transition as a result of hydrology dynamics. Located on a low floodplain, **NC001** is dominated by snags and widely scattered red maple (Acer rubrum), red-osier dogwood (Cornus stolonifera), speckled alder (Alnus rugosa), arrowwood (Viburnum recognitum), spotted jewelweed (Impatiens capensis), and ground nut (Apios americana).

The graminoid marsh community (**NC002**) is both extensive and diverse. Dominant species in **NC002** are three-way sedge (Dulichium arundinaceum), bur-reed (Sparganium eurycarpum), arrow-arum (Peltandra virginica), peppermint (Mentha piperita), broad-leaved arrowhead (Sagittaria latifolia), blue joint grass (Calamagrostis canadensis), and rice cutgrass (Leersia oryzoides). Shrub thickets scattered within **NC002** are dominated by narrow-leafed spirea (Spiraea alba) and swamp rose (Rosa palustris). The circumneutral shrub swamp community (**NC003**) contains dense shrub thickets, dominated by silky willow (Salix sericea) and speckled alder, and a herb layer dominated by sedges (Carex spp.) and a grass (Poa sp.). A narrow floodplain swamp community (**NC004**) borders part of the Lake Pleasant Outlet contiguous with **NC003.** This natural community (**NC004**) is dominated by silver maple (Acer saccharinum), white pine (Pinus strobus), sensitive fern (Onoclea sensibilis), and swamp buttercup (Ranunculus septentrionalis). Preservation of that portion of the **French Creek BDA** containing **NC001** through **NC004** requires that water quality and water quantity entering the aquatic system be protected. The primary land use surrounding Lake Pleasant Outlet is agriculture. A gravel mine is located in close proximity to the aquatic system. Refer to pages 55 and 58 for the potential threats posed by these land use activities (i.e., agriculture and mineral extraction) to natural heritage areas.

Natural communities **NC005** through **NC015** are located within another broad stream valley basin -- LeBoeuf Creek stream valley. In addition to natural communities **NC005** through **NC015**, the stream valley

retains a high diversity of more common types of vegetation communities that cover an extensive portion of the stream basin. A variety of hydrologic conditions occur within the basin. The primary sources of hydrology to this extensive wetland system are derived from ground water seepages, high ground water tables, and surface drainage (e.g., meandering and braided stream channels). These hydrologic conditions coupled with the large areas of somewhat poorly and very poorly drained soils (Taylor, 1960), have produced an exceptional composite of palustrine wetlands within this component of the **French Creek BDA**.

Of the 11 natural communities (**NC005** through **NC015**) contained within the LeBoeuf Creek stream valley component of the **French Creek BDA** ten are wetlands. Most of these natural communities are of state or global significance. In addition, natural communities (**NC005** through **NC015**) provide habitat for 24 plant species of special concern (**SP001** through **SP024**).

The section of the **French Creek BDA** within the LeBoeuf Creek stream valley contains three different types of fens (**NC005**, **NC006**, and **NC008**). Each of these fens are natural communities classified as critically imperiled in the state. One is a globally imperiled/very rare natural community (**NC008**).

The vegetation that characterizes **NC005**, a hillside graminoid-forb fen community, includes sundew (Drosera), cottongrass (Eriophorum), a fringed orchid (Habernaria sp.), and bog twayblade (Liparis loeselii) (Anonymous, 1985). Ground water seepage is the primary hydrologic source for this natural community. **NC005** contains a rarely occurring special plant population (**SP001**). This special plant is a Pennsylvania threatened species.

NC006 is a forb fen community located within a bottomland floodplain. The characteristic vegetation associated with this natural community includes white pine, American elm (Ulmus americana), birch (Betula sp.), red maple, witch hazel (Hamamelis virginiana), willow, and jewelweed. **NC006** also provides habitat for special plant population (**SP002**). **SP002** is a Pennsylvania threatened plant species. Reportedly, timber harvesting and brine discharge from a nearby mineral extraction well threatens **NC006** and associated special plant populations (Isaac, 1992a).

NC008 is a shrub fen community bordered by terrestrial woodlands and a large shrub dominated beaver impoundment. The shrub fen (**NC008**) is dominated by silky dogwood (Cornus amomum), narrow-leaved spirea, sedges, marsh fern (Thelypteris palustris), and sensitive fern. Eastern hemlock and red maple

dominate a sparse tree canopy. Two rarely occurring special plant species populations (**SP007** and **SP008**) inhabit **NC008**. **SP007** and **SP008** are imperiled and imperiled/rare to uncommon in the state, respectively.

A broadleaf-conifer swamp community (**NC007**) is located within the LeBoeuf Creek stream valley component of the **French Creek BDA**. **NC007** is dominated by red maple and slippery elm (Ulmus rubra) with scattered eastern hemlock. Speckled alder, cattail, and rice cutgrass dominate the understories of **NC007**. Four special plant species populations inhabit this swamp -- **SP003** through **SP006**. Two of the special plant occurrences (**SP003** and **SP004**) are a special plant considered to be imperiled/rare or uncommon in the state. Contiguous with **NC007** is an extensive beaver impoundment containing about 50 percent open water and dominated by cattail. Snags are scattered throughout the beaver impoundment.

The graminoid marsh community represented by **NC009** contains two special plant species populations (**SP009** and **SP010**). **SP009** is a special plant classified as endangered in the state. **SP010** is a Pennsylvania threatened plant species. The graminoid marsh community is dominated by a sedge (Carex lacustris), three-way sedge, and **SP010**. **NC009** is located within an extensive, open mixed emergent and herbaceous marsh with snags scattered throughout.

The **French Creek BDA** located within the LeBoeuf Creek stream valley contains two calcareous marsh communities -- **NC010** and **NC011**. Calcareous marsh communities are critically imperiled in the state. In addition to the ecological significance of the **NC010** and **NC011** natural communities within Pennsylvania, these two natural communities also provide habitat for plant species of special concern. **NC010** contains a mucky, somewhat peaty and partial floating mat substrate dominated by soft bulrush (Scirpus validus), broad-leaved arrowhead, a sedge (Carex comosa), speckled alder, and rice cutgrass. **NC010** contains two special plant species populations (**SP011** and **SP012**). These two special plant species are endangered and threatened in the state, respectively. **NC010** is located in proximity to a graminoid marsh and a mixed graminoid-robust emergent marsh bordered by northern hardwood forest. **NC011** is a calcareous marsh community hydrologically supported by ground water seepages. **NC011** vegetation varies from small trees to an open herb dominated marsh. **NC011** is dominated by cattail, sedges, ferns (Osmunda spp.), and rushes (Juncus spp.). **NC011** provides habitat for three plant species of special concern (**SP013**, **SP014**, and **SP015**). **NC011** is located within the fairly extensive northern hardwood forest that borders **NC010** and that is scattered throughout the LeBoeuf Creek stream valley component of the **French Creek BDA**.

NC012 is a robust emergent marsh community -- a natural community classified as imperiled in the state. **NC012** vegetation is characterized by a pondweed (Potamogeton natans) dominated pond with a border dominated by a sedge (Carex comosa) and broad-leaved cattail (Typha latifolia). **NC012** provides habitat for two locally abundant special plant species populations (**SP016** and **SP017**) that are respectively classified as threatened and endangered in Pennsylvania.

A special species habitat located within the LeBoeuf Creek stream valley component of the **French Creek BDA** consists of an approximately ten acre semi-natural pond created in part by groundwater seepage. However, this pond may be partly impounded by an adjacent artifact. The special plant species population (**SP018**) that occurs within the pond is an aquatic species classified as threatened in Pennsylvania.

A northern broadleaf-conifer swamp community (**NC013**) located within this component of the **French Creek BDA** contains five special plant species occurrences (**SP019** through **SP023)**. **NC013** contains a scattered savannah canopy dominated by white pine (Pinus strobus), eastern hemlock, yellow birch (Betula lutea), black ash (Fraxinus nigra), and red maple. This extensive swamp is primarily supported by ground water seepages. **NC013** provides habitat for four special plant species occurrences (**SP019**, **SP020**, **SP022**, and **SP023**) that are critically imperiled, imperiled and/or rare in the state.

The LeBoeuf Creek stream valley component of the **French Creek BDA** also contains natural ponds (**NC014**) -- a natural community imperiled or uncommon in the state. At least one of these natural ponds provides habitat for a plant species of special concern (**SP017**).

In addition to containing several noteworthy natural communities and habitats for special plant species, the LeBoeuf Creek stream valley component of the **French Creek BDA** contains a variety of more common terrestrial and aquatic habitats. The result is an exceptionally diverse biological resource that provides valuable habitat for wildlife and aquatic life.

The **French Creek BDA** contains a northern hardwood forest community (**NC015**) characterized by sugar maple (Acer saccharum) and black cherry (Prunus serotina) with scattered eastern hemlock. **NC015** is a secondary forest community that provides habitat for a special plant species (**SP024**). **SP024** is a terrestrial plant classified as critically imperiled in Pennsylvania.

Another component of the **French Creek BDA** represented on the Waterford Quadrangle is French Creek (**NC016**). **NC016** is a medium gradient clearwater river of particular ecological significance. The

segment of **NC016** represented on the Waterford Quadrangle provides habitat for 14 special animal species occurrences (**SA001** through **SA014**). Several of these species are aquatic animals (freshwater mollusks and fishes) of global significance. One of these special animals (**SA014**) is classified as federally endangered. Three of the special animals (**SA007**, **SA008**, and **SA012**) are classified as globally imperiled due to rarity. And seven special animal species (**SA001**, **SA005**, **SA006**, **SA009** through **SA011**, and **SA013**) are considered to be globally very rare. Each of these special animal species are also of state significance, as are special animals **SA002** through **SA004**. **SA002**, **SA003**, and **SA004** represent occurrences of two fish species that are imperiled in the state. (Refer to pages 119 to 120 for a holistic description of the ecological significance of the biological resources within the entire French Creek drainage basin, as well as the upper French Creek drainage basin located in Erie County.)

LeBoeuf Creek is another Erie County stream of particular ecological significance. LeBoeuf Creek (**NC017**) is a low gradient clearwater creek. Within the section of **NC017** represented on the Waterford Quadrangle, LeBoeuf Creek provides habitat for nine special animal species (**SA014** through **SA022**) and a plant species of special concern (**SP025**) (Davis, 1993; Criswell, 1992). Six of these species are freshwater mollusks and fishes of global significance. Two of these special animals (**SA018** and **SA019**) are classified as federally endangered. Four of the special animals (**SA015**, **SA016**, **SA021**, and **SA022**) are classified as globally imperiled due to rarity. Each of the nine special animal species are also of state significance. **NC017** provides habitat for an aquatic special plant species population that is rare in the state (**SP025**). (Refer to pages 119 to 120 for a holistic description of the ecological significance of the biological resources within the entire French Creek drainage basin, as well as the upper French Creek drainage basin located in Erie County.)

The special animal species (i.e., freshwater mollusks and fishes) that inhabit the portion of French Creek (**NC016**) and LeBoeuf Creek (**NC017**) represented on the Waterford Quadrangle are dependent upon the protection of water quality entering these streams. Sediments entering these aquatic systems as a result of human-induced erosion not only effect water quality, but also result in the loss of stream bottom habitats critical to the life history cycles of these aquatic species. (Refer to pages 54 to 66 for information on how land use activities can cause erosion and are thus potential threats to applicable natural heritage areas.) Information strongly suggests that Union City dry dam contributes significantly to sediment input in French Creek. Based on aerial reconnaissance by the Pennsylvania Fish and Boat Commission and the Soil

Conservation Service, the dry dam appears to trap and retain sediments entering the impoundment area following major precipitation events. These sediments are subsequently suspended following more frequently occurring minor precipitation events and result in frequent sediment loading (L. Steckler, USDA Soil Cons. Serv., pers. commun.). The dry dam may also adversely effect **NC016** in other ways given the intent of the dam to modify flow rates.

Per Darnell (1976) flow velocity is a key physical factor affecting stream life, as most stream species are adapted to and require particular flow velocities. Life history cycles are directly influenced by flow velocities. Flow velocity may indirectly effect food and habitat availability by influencing invertebrate life, turbidity, bottom erosion, and sedimentation. Existing research indicates that biological composition within a dam impoundment differs significantly from that of the pre-impoundment stream. Particularly relevant to French Creek (**NC016**) is the loss of mollusk diversity due to loss of habitat(s). Research on the effects of dams on downstream biota is somewhat limited. However, available information indicates that water flow and level fluctuations are important to maintaining biotic diversity (Darnell, 1976). Both point-source and nonpoint-source discharges from land use activities, such as development and related infrastructure, mineral extraction, agriculture, and timber harvesting, can also adversely effect the biodiversity of any aquatic system. Protecting the globally significant aquatic biodiversity represented within French Creek (**NC016**) and LeBoeuf Creek (**NC017**) requires that water quality at least be maintained. For this reason, the entire watershed of French Creek has been included in the boundary of the **French Creek Basin LCA**. And the boundaries for the **French Creek BDA** that solely address surface water quality are of the minimum width required to protect the quality of surface water entering the streams (Brown and Schaefer et al., 1987).

Another ecologically significant biological resource within the portion of the **French Creek BDA** represented on the Waterford Quadrangle is **NC018**. **NC018** is a calcareous glacial lake community known as Lake LeBoeuf. Calcareous glacial lake communities are critically imperiled in Pennsylvania due to the extreme rarity of these natural communities.

NC018 is a small, shallow moderately disturbed calcareous glacial lake with a relatively small drainage basin (C. Bier, Western Pa. Conservancy, memo., 7/25/89). Trout Run and a few short order streams flow into **NC018**. As indicated on the Waterford Quadrangle (U.S. Geological Survey, 1975a), LeBoeuf Creek may flow into **NC018** on an intermittent basis. The bottom of the calcareous glacial lake (**NC018**) is composed of rock and silt with little soft material (M. Campbell, Mercyhurst College, pers. commun.). The

calcareous glacial lake (**NC018**) has a zone of open water partially vegetated by an aquatic bed that contains water-milfoil (Myriophyllum spictatum), a pondweed (Potamogeton ampifolius), duckweed (Lemna minor), and big duckweed (Spirodella polyrhiza). An emergent marsh and tree savannah swamp are also contained within **NC018**. The lake-side emergent marsh is dominated by a water lily (Nuphar advena) and a smartweed (Polygonum coccineum) with common occurrences of buttonbush (Cephalanthus occidentalis) and black willow (Salix nigra). The open water of **NC018** is partly bordered by a shrub swamp. Adjacent to the shrub swamp is an extensive stunted tree savannah swamp. The canopy of the swamp is dominated by green ash (Fraxinus pensylvanica), silver maple (Acer saccharinum), and red maple. The stunted tree savannah swamp has a muck substrate containing hummocks of royal fern (Osmunda regalis) and pools vegetated by coontail (Ceratophyllum sp.), pondweed (Potamogeton sp.), and waterweed (Elodea sp.) (C. Bier, Western Pa. Conservancy, memo., 7/25/89). The calcareous glacial lake (**NC018)** provides habitat for three special plant species (**SP026**, **SP027**, and **SP028**). Each of these species is threatened in Pennsylvania.

Another component of the **French Creek BDA** represented on the Waterford Quadrangle is a medium gradient clearwater creek community (**NC019**) known as the South Branch of French Creek. As this stream is largely represented on the Union City and Corry Quadrangles, refer to pages 240 and 245 for a description of the biotic resources contained within this component of the **French Creek BDA**.

State Game Lands #190 and **State Game Lands #161** are included in the portion of the **French Creek Basin LCA** represented on the Waterford Quadrangle.

State Game Lands #190 is a Managed Land located in Amity and Waterford Townships. **State Game Lands #190** consists of three properties ranging in size from slightly over one-half acre to 236 acres. The total size of **State Game Lands #190** is about 392 acres. The Pennsylvania Game Commission recently acquired two properties located within the Union City Dam flood pool. One of these two properties contains a segment of French Creek. **State Game Lands #190** contains a wide diversity of wildlife habitats (R. Haibach, Pa. Game Comm., pers. commun.) -- woodlands, streams, beaver impoundments, open fields, reverting fields, food plots, and streams. The game land is managed for both game and nongame wildlife. Wildlife for which **State Game Lands #190** provides habitat include wild turkey (Meleagris gallopavo), ruffed grouse (Bonasa umbellus), red-tailed hawk (Buteo jamaicensis), white-tailed deer (Ododcoileus

virginianus), squirrel, passerines, rabbit (Sylvilagus sp.), raccoon (Procyon lotor), and beaver (Castor canadensis) (R. Haibach, Pa. Game Comm., pers. commun.).

Another Managed Land on the Waterford Quadrangle is **State Game Lands #161** located in Greene and Waterford Townships. **State Game Lands #161** is represented on the north edge of the Waterford Quadrangle and extends onto the Hammett Quadrangle. **State Game Lands #161** is about 235 acres in size, of which approximately nine acres are represented on the Waterford Quadrangle. Refer to page 148 for a brief description of the biotic resources within **State Game Lands #161**.

General recommendations regarding Landscape Conservation Area and Biological Diversity Area site protection and management are addressed on pages 52 and 53. The recommendations for the overall management and protection of the entire **French Creek Basin LCA** and the entire **French Creek BDA** are synonymous with the general recommendations for LCA's and BDA's. Refer to the recommendations on page 124 for guidance regarding the protection of the **BDA** on the Waterford Quadrangle. (Note: The conditions by which the general recommendations for the protection and management of the **French Creek Basin LCA** and **French Creek BDA** can be modified are on page 124.)

UNION CITY QUADRANGLE

	PNDI Rank		Legal Status		Last
	Global	State	Fed.	State	Seen
FRENCH CREEK BASIN LCA *Exceptional Significance*					
HUBBELL RUN BDA *Exceptional Significance*					
NATURAL COMMUNITY: NC001	G?	S2S3	N	N	1992
SPECIAL ANIMAL: SA001	G4G5	S2	N	N	1985
NATURAL COMMUNITY: NC002	G?	S1	N	N	1992
SPECIAL PLANT: SP001	G4	S1	N	PE	1987
SPECIAL PLANT: SP002	G5	S1	N	PE	1982
NATURAL COMMUNITY: NC003	G2G3	S1	N	N	1988
SPECIAL PLANT: SP003	G4	S2	N	PT	1987
SPECIAL PLANT: SP004	G5	S2	N	PT	1986
SPECIAL PLANT: SP005	G?	S2S3	N	PE	1986
SPECIAL PLANT: SP006	G4	S2	N	PT	1981
SPECIAL PLANT: SP007	G5	S1	N	N	1992
NATURAL COMMUNITY: NC004	G?	S3S4	N	N	1992
SPECIAL PLANT: SP008	G5	S2S3	N	TU	1992
SPECIAL PLANT: SP009	G5	S2S3	N	TU	1992
SPECIAL PLANT: SP010	G5	S1	N	PE	1992
SPECIAL PLANT: SP011	G5	S2S3	N	TU	1992
SPECIAL PLANT: SP012	?	?	N	TU	1992
NATURAL COMMUNITY: NC005	G?	S3	N	N	1992
SPECIAL PLANT: SP013	G5	S2S3	N	TU	1992
NATURAL COMMUNITY: NC006	G?	S2S3	N	N	1992
SPECIAL PLANT: SP014	G5	S1	3C	PE	1992
NATURAL COMMUNITY: NC007	G?	S3S4	N	N	1991
SPECIAL PLANT: SP015	G5	S2	N	PT	1991
SPECIAL PLANT: SP016	G3G5	S3	N	PT	1991
BENTLEY RUN/ALDER RUN BDA *Exceptional Significance*					

NATURAL COMMUNITY: NC008	G2G3	S1	N	N	1992
SPECIAL PLANT: SP017	G5	S2S3	N	TU	1992
SPECIAL PLANT: SP018	G5	?	N	TU	1992
SPECIAL PLANT: SP019	G4	S2	N	PT	1992
SPECIAL PLANT: SP020	G5	S1	N	PE	1987
SPECIAL PLANT: SP021	G4	S2	N	PE	1986
NATURAL COMMUNITY: NC009	G?	S2S3	N	N	1987
SPECIAL PLANT: SP022	G5	S1	N	PT	1987
SPECIAL PLANT: SP023	G5?	S2S3	N	PE	1987
SPECIAL PLANT: SP024	G5	S2	N	PT	1987
NATURAL COMMUNITY: NC010	G?	S1	N	N	1992
SPECIAL PLANT: SP025	G4	S2	N	PT	1992
SPECIAL PLANT: SP026	G5	?	N	TU	1992
SPECIAL PLANT: SP027	G5	S2S3	N	TU	1992
NATURAL COMMUNITY: NC011	G?	S2S3	N	N	1992
SPECIAL PLANT: SP028	G5	S2S3	N	TU	1992
SPECIAL PLANT: SP029	G5	S2S3	N	TU	1992
SPECIAL PLANT: SP030	G5	S2S3	N	TU	1992
NATURAL COMMUNITY: NC012	G?	S1	N	N	1992
SPECIAL PLANT: SP031	G5	S2S3	N	TU	1992
SPECIAL PLANT: SP032	G5	S2	N	PT	1992
SPECIAL PLANT: SP033	G5	?	N	PE	1992
SPECIAL PLANT: SP034	G5	S2	N	PT	1992

FRENCH CREEK BDA *Exceptional Significance*

NATURAL COMMUNITY: NC013	G?	S1S2	N	N	1992
NATURAL COMMUNITY: NC014	G?	S3	N	N	1992
NATURAL COMMUNITY: NC015	G?	S2S3	N	N	1992
SPECIAL PLANT: SP035	G5	?	N	TU	1992
SPECIAL PLANT: SP036	?	?	N	TU	1992
SPECIAL PLANT: SP037	?	?	N	TU	1992
NATURAL COMMUNITY: NC016	G2G3	S1	N	N	1992
SPECIAL PLANT: SP038	G5	?	N	TU	1992
SPECIAL PLANT: SP039	G4	S2	N	PT	1992

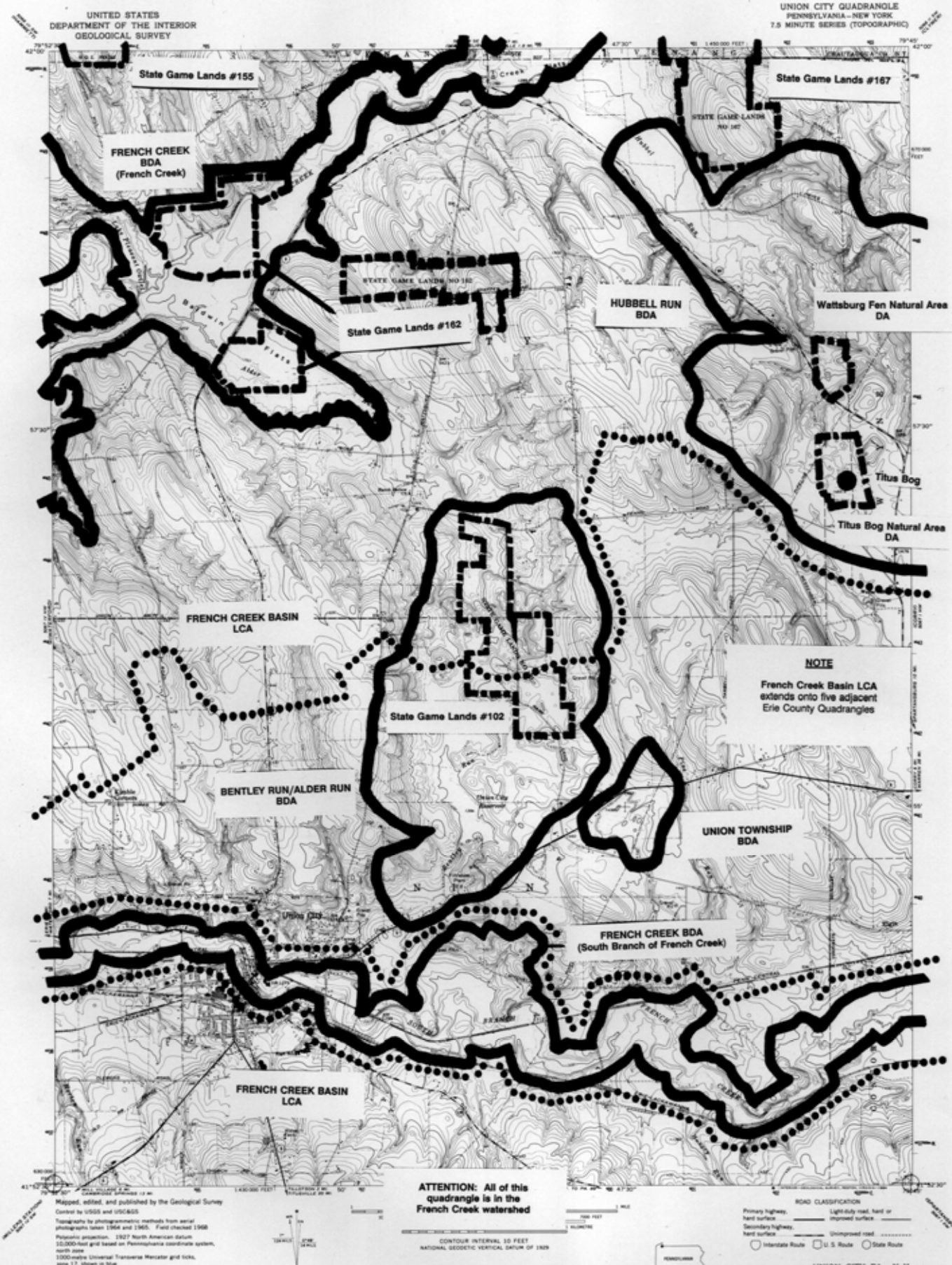
SPECIAL PLANT: SP040	G5	?	N	TU	1992

MANAGED LANDS:

State Game Lands #102
State Game Lands #155
State Game Lands #162
State Game Lands #167
Titus Bog Natural Area Dedicated Area
Wattsburg Fen Natural Area Dedicated Area

GEOLOGIC FEATURES/FOSSIL LOCALITIES

Titus Bog


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
UNION CITY QUADRANGLE
PENNSYLVANIA—NEW YORK
7.5 MINUTE SERIES (TOPOGRAPHIC)
State Game Lands #155
State Game Lands #167
FRENCH CREEK
BDA
(French Creek)
STATE GAME LANDS
NO 167
STATE GAME LANDS NO 102
State Game Lands #162
HUBBELL RUN
BDA
Wattsburg Fen Natural Area
DA
Titus Bog
Titus Bog Natural Area
DA
FRENCH CREEK BASIN
LCA
NOTE
French Creek Basin LCA
extends onto five adjacent
Erie County Quadrangles
State Game Lands #102
BENTLEY RUN/ALDER RUN
BDA
UNION TOWNSHIP
BDA
FRENCH CREEK BDA
(South Branch of French Creek)
FRENCH CREEK BASIN
LCA
ATTENTION: All of this
quadrangle is in the
French Creek watershed
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
ROAD CLASSIFICATION
UNION CITY, PA.—N. Y.

UNION CITY QUADRANGLE

Portions of the **French Creek Basin LCA** are represented on the Union City Quadrangle, as well as components of the **French Creek BDA**. These portions of the **LCA** and **BDA** are described below. Refer to pages 119 and 120 for a holistic description of the biotic communities and the ecological significance of the natural resources within the **French Creek Basin LCA** and the **French Creek BDA**.

The **French Creek Basin LCA** depicted on the Union City Quadrangle contains the entire watershed of the main stem of French Creek, part of the **French Creek BDA**, **Hubbell Run BDA**, part of **Bentley Run/Alder Run BDA**, and **State Game Lands #102**, **#155**, **#162**, and **#167**.

The upper reaches of Hubbell Run are classified as a high quality stream by the Pennsylvania DER Bureau of Water Quality (Department of Environmental Resources, 1979). **Hubbell Run BDA** is a high diversity area located in the headwaters and upper reaches of Hubbell Run. **Hubbell Run BDA** contains two Dedicated Areas - Titus Bog Natural Area and Wattsburg Fen Natural Area.

Titus Bog is located in the headwaters of Hubbell Run. The glacial bog community (**NC001**) is an approximately 50 acre acidic kettle hole bog that also contains a weakly minerotrophic basin graminoid-forb fen (**NC002**). Succession in **NC001** has proceeded so that the original lake is now covered by a basin graminoid-forb fen community (**NC002**), encircled by dense shrub thickets and widely scattered trees. The shrub thickets are locally dominated by buttonbush (Cephalanthus occidentalis), speckled alder (Alnus rugosa), willow (Salix sp.), leatherleaf (Chamedaphine calyculata), chokeberry (Aronia sp.), spirea (Spiraea sp.), and northern arrowwood (Viburnum recognitum). Dominant tree species in **NC001** include white pine (Pinus strobus), silver maple (Acer saccharinum), red maple (A. rubrum), and quaking aspen (Populus tremuloides). The basin graminoid-forb fen (**NC002**) consists of a thick mat of peatmoss (Sphagnum) on which the dominant species include large cranberry (Vaccinium macrocarpon), small cranberry (V. oxycoccus) and a yellow water lily (Nuphar microphyllum). Other species that characterize **NC002** are sedges (Carex spp.), cottongrass (Eriophorum sp.), and sundews (Drosera spp.). The glacial bog's basin graminoid-forb fen (**NC002**) provides habitat for two Pennsylvania endangered special species plant populations (**SP001** and **SP002**) and a special animal species (**SA001**). **SA001** is an insect classified as imperiled in the state.

The glacial bog community (**NC001**) is an imperiled/rare community in the state. **NC001** is one of only two glacial bog communities identified in Erie County by the inventory. Hence, the community is

considered to rarely occur in the county. **NC002** is a natural community classified as critically imperiled in the state. In addition to containing exceptional natural communities, Titus Bog is recognized as an outstanding geologic area in Pennsylvania (Geyer and Bolles, 1979). Titus Bog Natural Area is owned by the Presque Isle Audubon Society and the Botanical Society of Western Pennsylvania. These organizations own and manage the glacial bog with the purpose of protecting and maintaining the site's ecological integrity. Therefore, the property containing Titus Bog Natural Area is recognized as a Dedicated Area -- **Titus Bog Natural Area DA**.

Wattsburg Fen Natural Area is located in the headwaters of Hubbell Run at the confluence of two small streams. Wattsburg Fen Natural Area is a recovering natural area that contains a marl shrub fen community (**NC003**) with an acidic peat surface. Shrub fens are a natural community classified as imperiled/very rare on a global basis. The shrub fen (**NC003**) contains shrub-peatmoss, shrub-poplar, woodland, and herbaceous marsh habitats (de Maynadier, 1989), as well as several beaver ponds. **NC003** contains one of the richest orchid floras in the state (Erdman and Wiegman, 1974) and provides habitat for five plant species of special concern (**SP003** through **SP007**). Four of these special plants, **SP003** through **SP006**, are critically imperiled in the state. **SP007** is classified as critically imperiled in Pennsylvania.

The shrub fen (**NC003**) is part of the Wattsburg Fen Natural Area, which is owned by the Western Pennsylvania Conservancy. The Conservancy manages the property with the purpose of protecting and maintaining the ecological integrity of the shrub fen (**NC003**) and contiguous habitats. Therefore, the property containing Wattsburg Fen Natural Area is recognized as a Dedicated Area -- **Wattsburg Fen Natural Area DA**.

Just downstream of **Wattsburg Fen Natural Area DA** in the upper reaches of Hubbell Run is another recovering natural area. This recovering natural area is located within the stream valley of an unnamed tributary to Hubbell Run and within the Hubbell Run riparian corridor. These streams and ground water seepage are the primary sources of hydrology for this part of **Hubbell Run BDA**. This part of the **Hubbell Run BDA** contains an extensive and exemplary broadleaf-conifer swamp community (**NC004**), a graminoid marsh community (**NC005**), and natural pond communities (**NC006**). **NC004**, **NC005**, and **NC006** contain special plant species that are significant from a state perspective - **SP008** through **SP014**. In addition to being a Pennsylvania species of special concern, **SP014** is also a special plant of global significance. A

second growth northern hardwood forest is also located within and buffers most of natural communities **NC004**, **NC005**, and **NC006**. This forest contributes to the overall diversity of the **Hubbell Run BDA**.

The broadleaf-conifer swamp community (**NC004**) is recovering from past timber harvesting. **NC004** is a natural community dominated by widely scattered trees and shrub thickets, plus a very diverse herb layer. Dominant species within **NC004** include white pine, red maple, yellow birch (Betula lutea), common winterberry holly (Ilex verticillata), dogwood (Cornus sp.), blueberry (Vaccinium sp.), peatmoss (Sphagnum spp.), common cattail (Typha latifolia), narrow-leaved cattail (T. angustifolia), sensitive fern (Onoclea sensibilis), marsh fern (Thelyptris palustris), eastern hemlock (Tsuga canadensis), jewelweed (Impatiens spp.), and rice cutgrass (Leersia oryzoides). In addition to being an exemplary natural community, **NC004** provides habitat for five special plant species population occurrences -- **SP008** through **SP012**. Of these five species one is an orchid (**SP010**) classified as critically imperiled in the state.

Beaver activity has created a series of natural ponds (**NC006**) and at least one noteworthy graminoid marsh community (**NC005**). **NC005** borders the open water of a large beaver impoundment. Shrub thickets and snags are scattered within **NC005**. Bur-reed (Sparganium sp.) and soft rush (Juncus effusus) are the dominant species in the graminoid marsh community. Shrub thicket dominants are willow (Salix sp.) and arrowwood (Viburnum sp.). **NC005** provides habitat for a special plant species (**SP013**) population. **SP013** is a plant species considered to be imperiled/rare in the state.

The natural pond communities (**NC006**) within **Hubbell Run BDA** significantly contribute to the biological diversity of the **BDA** by creating a variety of wildlife and aquatic life habitats (e.g., open water and snags) in an already exceptional natural resource. One of the natural ponds (**NC006**) provides habitat for an abundant population of a special plant species (**SP014**). **SP014** is an aquatic plant that is classified as very rare on a global basis.

Another special species habitat within the **Hubbell Run BDA** is a mixed graminoid-robust emergent marsh community (**NC007**) that provides habitat for two plant species of special concern (**SP015** and **SP016**). Both **SP015** and **SP016** are classified as threatened species in Pennsylvania. The two special plant species populations are located within a sedge (Carex lacustris) and common cattail (Typha latifolia) dominated marsh (**NC007**) located down slope from speckled alder dominated shrub thickets and a white pine and eastern hemlock dominated forest (Bissell and Danielson, 1991).

The ecological integrity of **Hubbell Run BDA** requires that high quality surface and ground waters enter the **BDA**. The primary existing threat to water quality are the agricultural practices implemented on at least some croplands bordering the **BDA**. Examples of the threats posed by this land use activity are: (1) The quality of surface waters entering the glacial bog community (i.e., Titus Bog) is jeopardized by the lack of a sufficient vegetated buffer between the glacial bog and adjacent croplands, as well as frequent aerial application of pesticides on crop fields adjacent to Titus Bog. Aerial reconnaissance suggests that agricultural fields bordering Hubbell Run add significant amounts of sediment into the stream. This surface water quality degradation threatens the biological integrity of the special species habitat (**NC007**) within the **BDA**, as well as the persistence of the special plant species (**SP015** and **SP016**) within **NC007**. (2) Other threats to the ecological integrity of the **Hubbell Run BDA** are timber harvesting, development, mineral extraction, and fragmentation. (Refer to pages 54 to 66 for information on the potential threats agricultural, timber harvesting, development, mineral extraction, and fragmentation pose to natural heritage areas.)

The general recommendations for the protection and management of Natural Areas on page 52 are applicable to natural communities **NC001** through **NC006** in **Hubbell Run BDA**. Protection of the special species habitat (**NC007**) in **Hubbell Run BDA** requires implementing the general recommendations for Biological Diversity Areas specified on page 52. In addition, the following specific recommendations are applicable to the **BDA**:

(1) Where needed, property owners should allow the development of a larger natural vegetation buffer within the **BDA**;

(2) No timber harvesting should occur within the **BDA**'s forested natural communities or within the forested buffer, if timber harvesting in the buffer would adversely effect the natural communities in the **BDA**;

(3) The owners of the **DA**'s within the **BDA** should acquire additional property to develop an effective buffer for the natural areas on their properties; and

(4) Farmers who own land within the **BDA** should assess the types and amounts of pesticides, and the methods used to apply these pesticides in order to protect the quality of waters entering the natural heritage areas.

Bentley Run/Alder Run BDA is a natural heritage area that is partially located within the **French Creek Basin LCA**. This **BDA** is an exceptional natural heritage area comprised primarily of headwater wetlands, which contain natural communities that are rare from a state perspective. Five natural

communities (**NC008** through **NC012**) and a special species habitat are located within the **Bentley Run/Alder Run BDA**. Each of the five natural communities within this **BDA** provide habitats for special plant species. Thirteen (13) special plant species occurrences (**SP017** through **SP029**) are located in **NC008** through **NC012**. All of **State Game Lands #102** is located with this **BDA**.

A small shrub fen community (**NC008**) known as Boleratz Bog is part of the **Bentley Run/Alder Run BDA**. Shrub fens are natural communities classified as imperiled/very rare on a global basis. The **NC008** shrub fen community exhibits alkaline properties where marl exits under the acid Sphagnum mat. **NC008** contains a diversity of bog dependent plant species, including several rare plants (Wiegman, 1976). Recent site surveys conducted for PNDI have reconfirmed the ecological integrity of **NC008** and the continued presence of Pennsylvania species of special concern -- special plants **SP017** through **SP021**. Four of the five special plant species populations (**SP017** and **SP019** through **SP021**) are considered to be either critically imperiled, imperiled, or rare in the state. It should be noted that tornado damage that occurred in 1985 makes access to **NC008** both difficult and dangerous (Isaac, 1992c).

Also located within the **Bentley Run/Alder Run BDA** is a small glacial bog community (**NC009**) known as Hell's Half-Acre. Glacial bog communities are considered to be imperiled/rare in the state. Like Boleratz Bog, **NC009** is a small saturated and inundated wetland located in a glacially formed depression. **NC009** contains a small fen encircled by a shrub thicket dominated by chokeberry (Aronia). The shrub thicket is encircled by a ring of white pine. A birch-hemlock-maple (Betula-Tsuga-Acer) dominated swamp borders **NC009** (Bier, 1987). The glacial bog community (**NC009**) provides habitat for three species of special concern (**SP022**, **SP023**, and **SP024**) considered to be threatened in Pennsylvania. Past timber harvesting has occurred in proximity to the site.

NC010 is a shrub fen community -- a natural community classified as imperiled/very rare on a global basis. **NC010** is dominated by eastern hemlock, shrubs, forbs, and a peatmoss mat. **NC010** provides habitat for three occurrences of plant species of special concern (Isaac, 1992e). Two of these special plants, **SP025** and **SP027,** are classified as critically imperiled and imperiled/rare or uncommon in the state, respectively.

Bentley Run/Alder Run BDA contains a circumneutral broadleaf-conifer swamp community (**NC011**) -- a natural community that is considered to be imperiled/rare or uncommon in Pennsylvania. Part of **NC011** has been modified by past timber harvesting. The portion of the community located on **State Game Lands #102** and along the border of the timbered section of **NC011** is essentially in a pristine state and is of

exceptional quality. Within the undisturbed part of **NC011** are numerous microhabitats created within forest canopy openings and by variable hydrologic conditions. The result is an extremely diverse natural community. The **NC011** tree canopy is dominated by eastern hemlock. Associated species in the tree canopy include black ash (Fraxinus nigra), red maple, and yellow birch. The shrub and herb strata of **NC011** are dominated by spicebush (Lindera benzoin), skunk cabbage (Symplocarpus foetidus), jewelweed (Impatiens sp.), violets (Viola spp.), cinnamon fern (Osmunda cinamomea), and sedges (Carex spp.). Numerous mosses, including peatmoss, and liverwort species are local dominants in **NC011**. Species characterizing openings in the **NC011** tree canopy include saxifrage (Saxifraga pensylvanica), a grass (Glyceria sp.), yellow birch, aster (Aster sp.), a sedge, common winterberry holly (Ilex verticillata), alder (Alnus sp.), willow (Salix sp.), and eastern hemlock. **NC011** provides habitat for two occurrences of a special plant species (**SP028** and **SP029**). This special plant is classified as imperiled/rare or uncommon in the state.

The part of **NC011** that has been modified by timber harvesting contains a large, diverse emergent wetland dominated by true forget-me-not (Myosotis scorpoides), jewelweed, common cattail, and marsh fern with scattered areas dominated by mint (Mentha sp.), bur-reed, and three-way sedge (Dulichium arundinaceum). Widely scattered trees and shrubs within the emergent wetlands include red maple, river birch (Betula nigra), blueberry (Vaccinium), and northern arrowwood (Viburnum recognitum). Although disturbed by past timber harvesting, the hydrology of **NC011** is still intact. Therefore, given time and no additional disturbance, the community can recover.

In addition to the aforementioned natural communities, **Bentely Run/Alder Run BDA** contains a variety of terrestrial and aquatic communities -- forested, scrub-shrub, emergent, and snag dominated wetlands, deciduous forest, mixed deciduous and conifer forest, streams, beaver ponds, and beaver meadows (Isaac, 1992d). On an individual basis, these wetlands and terrestrial communities are not of ecological significance per inventory criteria. However, in juxtaposition with the other habitats in the **BDA**, they contribute to the overall ecological significance of the natural heritage area.

Bentley Run has been impounded as a water supply reservoir. Located within this impoundment is a special plant species -- **SP030**. **SP030** is an aquatic plant species that is classified as imperiled/rare or uncommon in the state.

Below the reservoir and bordering Bentley Run is a shrub fen community (**NC012**) -- a natural community classified as imperiled/very rare on a global basis. In addition to Bentley Run, ground water seepages are also a primary source of hydrology for the shrub fen. **NC012** is a diverse natural community dominated by cinnamon fern, narrow-leaved cattail (Typha angustifolia), peatmoss, sedges, rushes (Juncus spp.), skunk cabbage, and horsetail (Equisetum sp.). Trees and shrub thickets scattered within **NC012** are dominated by eastern hemlock, red maple, aspen (Populus sp.), and blueberry. **SP031** is a commonly occurring species in the shrub fen. **SP031** through **SP034** are special plant species populations that occur within the shrub fen (**NC012**). **SP033** is a Pennsylvania endangered species. **SP032** and **SP034** are classified as threatened in the state. **SP031** is a special plant species considered to be imperiled/rare or uncommon in the state.

Various types of development are in close proximity to **NC012** and agricultural fields are located up slope of the shrub fen. The natural community is bordered by a narrow band of broadleaf-conifer seepage swamp and shrub dominated wetlands. This natural vegetation provides a partial buffer for **NC012**. Protection of water quality and quantity are critical to protecting this globally uncommon natural community and the associated species of special concern.

Existing threats to the ecological integrity of **Bentley Run/Alder Run BDA** include timber harvesting, development within and adjacent to the site that would result in further fragmentation or habitat loss, and loss of water quality or quantity entering the natural heritage area from surrounding land uses (i.e., agricultural fields and development). (Refer to pages 54 to 66 for additional information regarding the potential threats these land use activities pose to natural heritage areas.)

Water quality and quantity protection, maintenance of the existing buffer, growth of a buffer in those limited areas where little or no buffer exists, and avoidance of any further fragmentation are key to preserving the biotic resources within the **Bentley Run/Alder Run BDA**. Also important for the protection of the **BDA** is management of natural communities **NC008** through **NC012** in accordance with the general recommendations for Biological Diversity Areas on page 52. In addition to the recommendations on page 52, these specific recommendations are offered for the protection of **Bentley Run/Alder Run BDA**:

(1) Adjacent landowners should be encouraged to protect the quality and quantity of water entering the natural heritage area and, where needed, to allow the growth of a natural vegetation buffer;

(2) When possible, the portions of the **BDA** adjacent to **State Game Lands #102** should be acquired by the Pennsylvania Game Commission; and

(3) The Pennsylvania Game Commission and Western Pennsylvania Conservancy should confer on habitat management/forestry activities implemented on or planned for **State Game Lands #102** to ensure that these activities do not adversely effect the **BDA**'s natural communities.

Four managed lands, **State Game Lands #162**, **State Game Lands #155**, **State Game Lands #167**, and **State Game Lands #102**, are located within the portion of the **French Creek Basin LCA** represented on the Union City Quadrangle. These managed lands are described below:

State Game Lands #162 is located in Amity Township. Recently, five properties were added to this game land. These properties are located within the Union City Dam flood area. As result of these acquisitions, **State Game Lands #162** consists of six properties ranging in size from one-quarter acre to 236 acres. (Only three of the six properties are depicted on the quadrangle, as three of the properties are too small to be mapped.) The total size of **State Game Lands #162** is about 582 acres. **State Game Lands #162** contains woodlands, various types of wetlands, food plots, and streams, including segments of French Creek and Alder Run. Management of **State Game Lands #162** is both active and passive. Because of frequent flooding passive management is practiced in the 376 acres of state game lands property within the Union City dam flood area.

State Game Lands #155 is located in Venango Township. The portion of **State Game Lands #155** is located on the north edge of the Union City Quadrangle and extends onto the Wattsburg and Hammett Quadrangles. **State Game Lands #155** is about 391 acres in size. Approximately 28 acres are represented on the Union City Quadrangle. Refer to page 127 for a brief description of the biotic resources within **State Game Lands #155**.

State Game Lands #167 is located in Amity and Venango Townships. **State Game Lands #167** is located on the northeast quadrant of the Union City Quadrangle and extends onto the Wattsburg Quadrangle. **State Game Lands #167** is about 627 acres in size. Approximately 333 acres of **State Game Lands #167** are represented on the Union City Quadrangle. For a brief description of the biotic resources within this managed land refer to page 127.

State Game Lands #102 is about 387 acres in size (Pennsylvania Game Commission, 1977). **State Game Lands #102** is one of the game lands in Erie County where passive management predominates. Natural conditions have largely been retained on this managed land. A few undeveloped roads exist within **State Game Lands #102**. Habitat management within the game land consists of a few food plots border cut to produce edge and apple tree release (R. Haibach, Pa. Game Comm., pers. commun.). **Bentley Run/Alder Run Headwater Wetlands BDA** encompasses all of **State Game Lands #102**. (Refer to page 235 for a description of the **BDA**).

The portion of the **French Creek BDA** represented on the Union City Quadrangle includes the lower portion of Lake Pleasant Outlet, French Creek (**NC013**), the South Branch of French Creek (**NC014**), and two natural communities **NC015** and **NC016**, which that are located within the riparian corridor of the South Branch of French Creek.

As Lake Pleasant Outlet is primarily represented on the Waterford Quadrangle this component of the **French Creek BDA** is described on page 218.

French Creek is a medium gradient clearwater river community (**NC013**) with a watershed greater than 200 square miles, a fall of one to ten feet per mile with a bottom of coarse sand and gravel, riffles, raceways, and occasional sandbars (Smith, 1983). **NC013** is an aquatic system that is considered to be critically imperiled/imperiled in Pennsylvania and recognized as an ecological resource of global significance (see page 119). That portion of the river located on the Union City Quadrangle is almost entirely contained within the flood pool of the Union City dry dam. Concerns regarding the adverse effect of sediment loading

attributed to the dam on **NC013** are addressed on page 224, as well as the potential threats posed to the river community (**NC013**) above and below the dam due to modification of flow velocities and volume.

The South Branch of French Creek is a medium gradient clearwater creek (**NC014**) -- a natural community that is considered rare/uncommon in the state. Medium gradient clearwater creeks are natural communities with a watershed less than 200 square miles, a fall of between one and ten feet per mile, occasional riffles, and a stream bottom primarily of coarse sand and gravel (Smith, 1983). Freshwater mussel populations, an indicator of high quality waters, occur within the segment of the stream surveyed during the inventory. **NC014** retains natural community characteristics and qualities that warrant recognition. The quality of this biological resource is further augmented by the existence of an extensive, naturally vegetated riparian corridor that contains exemplary wildlife and aquatic life habitats, plus natural communities of global and state significance. **NC014** and its riparian corridor also provide green space and passive recreational opportunities, such as hiking, canoeing, and bird watching. The recreational value of **NC014** is enhanced by in-season stocking of trout by the Pennsylvania Fish and Boat Commission (Pennsylvania Fish Commission, 1989). (Refer to page 245 for the biotic resources associated with the portion of the South Branch of French Creek depicted on the Corry Quadrangle.)

Located within part of the high floodplain of **NC014** is a high quality circumneutral broadleaf-conifer swamp community (**NC015**). **NC015** is a natural community classified as imperiled/rare or uncommon in the state. The primary sources of hydrology for **NC015** are short order tributaries to the South Branch of French Creek and ground water seepage. Floodplain scouring indicates that **NC015** is occasionally flooded by **NC014**. **NC015** is dominated by eastern hemlock with dense shrub thickets where frequent canopy openings occur. Shrub thickets are dominated by alder and spicebush. The herb stratum of **NC015** is dominated by skunk cabbage, sensitive fern, horsetail, and peat moss. **NC015** provides habitat for two plant species of special concern in the state. Two occurrences of one special plant species (**SP036** and **SP037**) were observed within the circumneutral broadleaf-conifer swamp (**NC015**). One occurrence of **SP035** was observed during the field survey conducted for the inventory. Each of the special plant species populations known to occur within **NC015** are species believed to be in danger of population decline. However, insufficient data exists to provide these special plants with another state classification status. The vegetation indicators observed within **NC015** suggest that the swamp may provide habitat for a plant species classified as threatened in the state, but the occurrence of this plant was not confirmed during the inventory.

One of the short order streams that provides surface waters to **NC015** contains a headwater glacial depression. Within the glacially formed depression is an approximately one acre shrub fen community (**NC016**). Shrub fen communities are classified as globally imperiled/very rare. The primary source of hydrology for the shrub fen community is ground water seepages that create numerous drainage channels in the saturated/inundated wetland. **NC016** contains scattered trees, including white pine, red maple, aspen, and cherry (Prunus). The species dominating the shrub fen include **SP038**, skunk cabbage, clematis (Clematis sp.), cinnamon fern, sensitive fern, and cattail. One of the sedges observed in **NC016**, Carex interior, is an indicator of a high quality fen (J. Bissell, Cleveland Museum of Natural Hist., pers. commun.). As indicated above, the shrub fen provides habitat for a shrub (**SP038**) that is classified as imperiled/rare or uncommon in the state. **NC016** also provides habitat for an orchid that is an imperiled plant in Pennsylvania -- **SP039** (Isaac, 1992f). Although disturbed by past timber harvesting, the hydrology of **NC016** remains intact. With time, the shrub fen community can recover. Maintenance of groundwater quality and quantity is also necessary to protect **NC016.**

General recommendations regarding Landscape Conservation Area and Biological Diversity Area site protection and management are addressed on pages 52 and 53. The recommendations for the overall management and protection of the entire **French Creek Basin LCA** and the entire **French Creek BDA** are synonymous with the general recommendations for LCA's and BDA's. Refer to the recommendations on page 124 for guidance regarding the protection of the **BDA** on the Union City Quadrangle. (Note: The conditions by which the general recommendations for the protection and management of the **French Creek Basin LCA** and **French Creek BDA** can be modified are on page 124.)

Union Township BDA is a special species habitat. **Union Township BDA** contains a headwater swamp that provides habitat for special plant species **SP040**. The hydrology of the **BDA** has been altered by an impoundment. Disturbance has also promoted the occurrence of a weedy species, reed canary grass (Phalaris arundinacaea), that dominates part of the site. Both the impoundment and the extensive occurrence of the weedy species have adversely effected the site. However, the **BDA** does retain the habitat conditions necessary for **SP040**. **SP040** is a special plant species believed to be in danger of decline, however, insufficient data exists to provide these special plants another state classification status. General recommendations for the overall management and protection of Biological Diversity Areas are addressed on page 52. While these recommendations are offered as guidance for the protection of the special species

habitat area within the **Union Township BDA**, the quality of the biotic community within the **BDA** permits some leniency regarding the application of the recommendation on page 52.

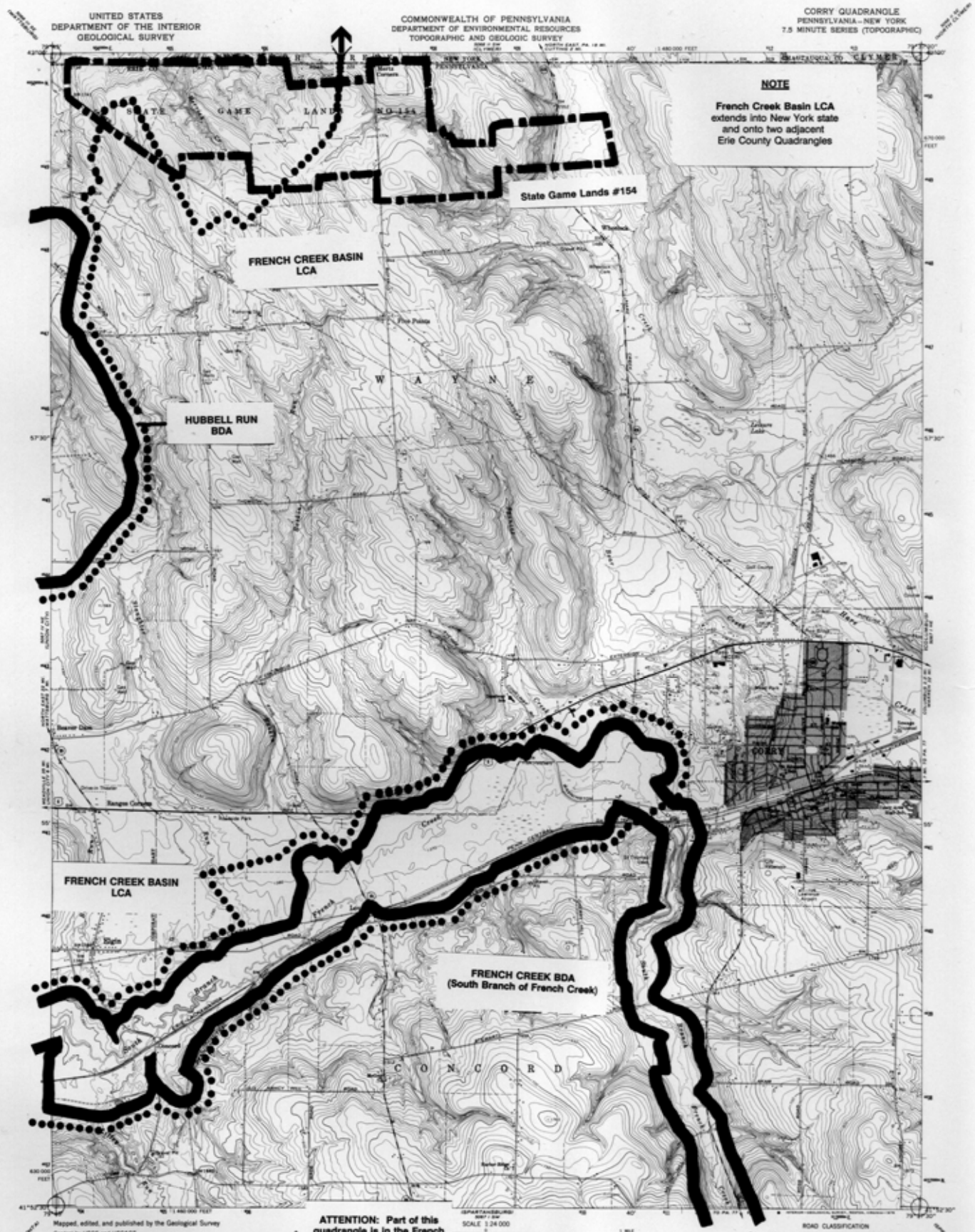
Inability to access a property prevented confirmation of a historic record indicating the location of a calcareous seep community, a globally very rare plant species population, and a state imperiled plant species population that may border Beaver Run. Calcareous seep communities are considered to be critically imperiled in the state. Aerial reconnaissance of the area indicated in the historic record revealed that an artificial impoundment occurs in the vicinity of the natural community and special plant species. As additional information is needed to verify the occurrence of the natural community and associated plant species of special concern, the suspected locations of the natural community and special plant species are not mapped or included on the quadrangle summary page.

CORRY QUADRANGLE

	PNDI Rank		Legal Status		Last
	Global	State	Fed.	State	Seen
FRENCH CREEK BASIN LCA *High Significance*					
FRENCH CREEK BDA *Exceptional Significance*					
NATURAL COMMUNITY: NC001	G?	S3	N	N	1992
NATURAL COMMUNITY: NC002	G?	S2S3	N	N	1992
SPECIAL PLANT: SP001	G5	S2S3	N	PT	1992
NATURAL COMMUNITY: NC003	G?	S3S4	N	N	1992
NATURAL COMMUNITY: NC004	G?	S2S3	N	N	1992

MANAGED LAND:

State Game Lands #154


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
TOPOGRAPHIC AND GEOLOGIC SURVEY
CORRY QUADRANGLE
PENNSYLVANIA—NEW YORK
7.5 MINUTE SERIES (TOPOGRAPHIC)
NOTE
French Creek Basin LCA
extends into New York state
and onto two adjacent
Erie County Quadrangles
State Game Lands #154
FRENCH CREEK BASIN
LCA
HUBBELL RUN
BDA
FRENCH CREEK BASIN
LCA
FRENCH CREEK BDA
(South Branch of French Creek)
WAYNE
CONCORD
CORRY
ATTENTION: Part of this
quadrangle is in the French
Creek watershed
SCALE 1:24 000
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
ROAD CLASSIFICATION
CORRY, PA.—N. Y.
1968
PHOTOREVISED 1973

CORRY QUADRANGLE

Portions of the **French Creek Basin LCA** are represented on the Corry Quadrangle, as well as a portion of the **French Creek BDA**. A description of these natural heritage areas follows. Refer to pages 119 and 120 for a holistic description of the biotic communities and the ecological significance of the natural resources within the **French Creek Basin LCA** and the **French Creek BDA**. The **French Creek Basin LCA** represented on this quadrangle includes a component of the **French Creek BDA**, part of the **Hubbell Run BDA**, and the part of **State Game Lands #154** located within the watershed of the main stem of French Creek.

The **French Creek BDA** component on this quadrangle is the medium gradient clearwater creek (**NC001**) known as the South Branch of French Creek. Per field surveys, aerial reconnaissance, and aerial imagery interpretation conducted for the inventory, the portion of **NC001** represented on the Corry Quadrangle retains natural community characteristics and qualities that warrant recognition. The quality of this biological resource is further augmented by the existence of a large naturally vegetated riparian corridor that includes high quality wildlife habitats, plus natural communities of state significance. (Since the South Branch of French Creek is also depicted on the Union City Quadrangle, refer to page 240 for additional information on this component of the **French Creek BDA**.)

An extensive section of the South Branch of French Creek floodplain contains a composite of terrestrial and aquatic habitats that includes natural ponds (**NC002** and **NC004**) and a broadleaf-conifer swamp community (**NC003**). Each of these natural communities exhibit exemplary qualities. The pond communities (**NC002** and **NC004**) are beaver impoundments of considerable size with high vegetation diversity. **NC002** is dominated by emergent and aquatic vegetation and snags with scattered shrub thickets and trees. Floating brownleaf (Potamogeton natans), duckweed (Lemna minor), coontail (Ceratophyllum sp.), and **SP001** are the aquatic plants that dominate the pond. Cinnamon fern (Osmunda cinamomea) is a local dominant within part of the pond. A bur-reed (Sparganium sp.) dominates the vegetation that borders the pond (**NC002**). Local dominants within this pond border include wool grass (Scirpus cyperinus), common cattail (Typha latifolia), and rice cutgrass (Leersia oryzoides). In the vicinity of **NC002** is a mixed mesic forest that occupies higher ground in the floodplain. Palustrine shrub-scrub wetlands and young miscellaneous forest are also part of the mosaic of habitats within the riparian corridor that borders the medium gradient clearwater creek (**NC001**).

NC003 is a broadleaf-conifer swamp community located in a fairly large floodplain depression. **NC003** is a very diverse natural community dominated by yellow birch (Betula lutea), red maple (Acer rubrum), eastern hemlock (Tsuga canadensis), sedges (Carex spp.), and sensitive fern (Onoclea sensibilis).

NC004 is another large natural pond community (i.e., beaver impoundment) located within this portion of the **French Creek BDA**. This pond contains an extensive area of open water with numerous scattered patches of vegetation. The natural pond community (**NC004**) is bordered by shrub thickets, graminoid marsh, and terrestrial woodlands of various ages. The vegetated portions of **NC004** varied in species composition, depending upon hydrologic conditions. Species dominating the saturated and shallow water areas within **NC004** include blue joint grass (Calamagrostis canadensis), needle rush (Eleocharis acicularis), a spikerush (Eleocharis sp.), and nodding bur-marigold (Bidens cernua forma. minima). The shrub thickets along **NC004** are locally dominated by speckled alder (Alnus rugosa) and narrow-leaved spirea (Spiraea alba).

Part of the **Hubbell Run BDA** is depicted on the Corry Quadrangle. As this natural heritage area is largely represented on the Union City Quadrangle, refer to page 231 for a description of the **BDA**.

State Game Lands #154 is located in Wayne Township and is about 1,416 acres in size. While **State Game Lands #154** is primarily woodlands, the game land also contains some shrub-scrub areas, food plots (R. Haibach, Pa. Game Comm., pers. commun.), palustrine shrub-scrub wetlands, streams, and beaver impoundments. Like other state game lands in Erie County, **State Game Lands #154** is managed for both game and nongame wildlife. Indicative of the wildlife value of this game land is the occurrence of breeding birds that utilize **State Game Lands #154** and adjacent habitats. Between 1984 and 1989, 63 species of birds were reported to breed within and in the vicinity of **State Game Lands #154** (Brauning, 1989). That portion of **State Game Lands #154** that is located within the watershed of the main stem of French Creek is included within the **French Creek Basin LCA**.

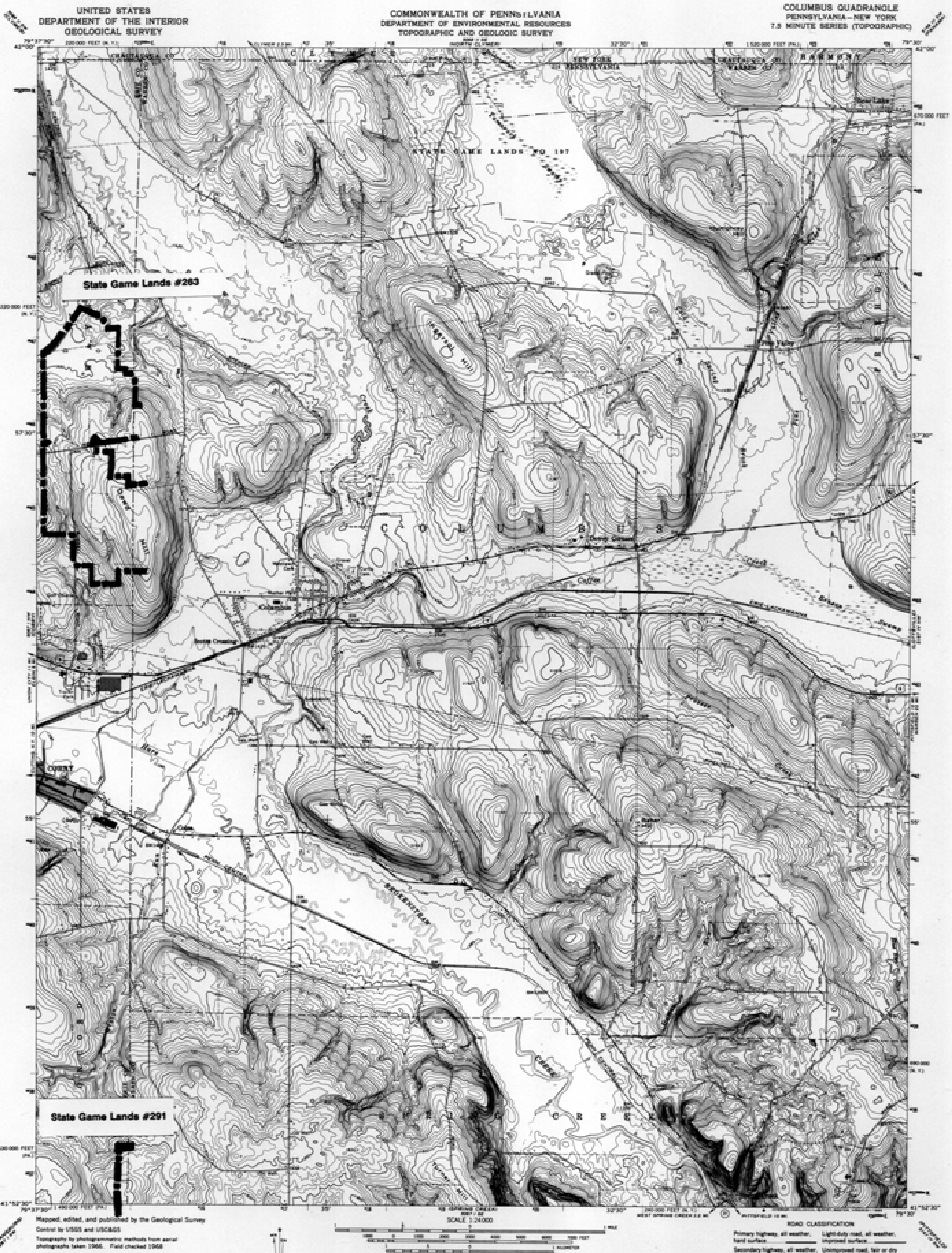
General recommendations regarding Landscape Conservation Area and Biological Diversity Area site protection and management are addressed on pages 52 and 53. The recommendations for the overall management and protection of the entire **French Creek Basin LCA** and the entire **French Creek BDA** are synonymous with the general recommendations for LCA's and BDA's. Refer to the recommendations on page 124 for guidance regarding the protection of the **BDA** on the Corry Quadrangle. (Note: The conditions by which the general recommendations for the protection and management of the **French Creek Basin LCA** and **French Creek BDA** can be modified are on page 124.)

COLUMBUS QUADRANGLE

	PNDI Rank		Legal Status		Last
	Global	State	Fed.	State	Seen

MANAGED LANDS:

State Game Lands #263
State Game Lands #291


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
TOPOGRAPHIC AND GEOLOGIC SURVEY
COLUMBUS QUADRANGLE
PENNSYLVANIA–NEW YORK
7.5 MINUTE SERIES (TOPOGRAPHIC)
NEW YORK
PENNSYLVANIA
HARMONY
STATE GAME LANDS NO 197
State Game Lands #263
C O L U M B U S
Columbus
State Game Lands #291
C R E E K
Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS
Topography by photogrammetric methods from aerial photographs taken 1966. Field checked 1968
Polyconic projection. 1927 North American datum
10,000-foot grids based on Pennsylvania coordinate system, north zone, and New York coordinate system, west zone
1000-meter Universal Transverse Mercator grid ticks, zone 17, shown in blue
Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked
Red tint indicates area in which only landmark buildings are shown
Revisions shown in purple compiled in cooperation with State of Pennsylvania agencies from aerial photographs taken 1973. This information not field checked
SCALE 1:24000
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST
QUADRANGLE LOCATION
Map photoinspected 1977
No major culture or drainage changes observed
ROAD CLASSIFICATION
Primary highway, all weather, hard surface
Light-duty road, all weather, improved surface
Secondary highway, all weather, hard surface
Unimproved road, fair or dry weather
U. S. Route
State Route
COLUMBUS, PA.–N. Y.
N4152.5—W7930/7.5
PHOTOINSPECTED 1977
1968
PHOTOREVISED 1973

COLUMBUS QUADRANGLE

State Game Lands #263 is a Managed Land located primarily in Wayne Township, although a portion of the game land extends into Warren County. **State Game Lands #263** is about 668 acres in size. Approximately 567 acres of the game land are located in Erie County. **State Game Lands #263** contains woodlands and reverting fields (R. Haibach, Pa. Game Comm., pers. commun.).

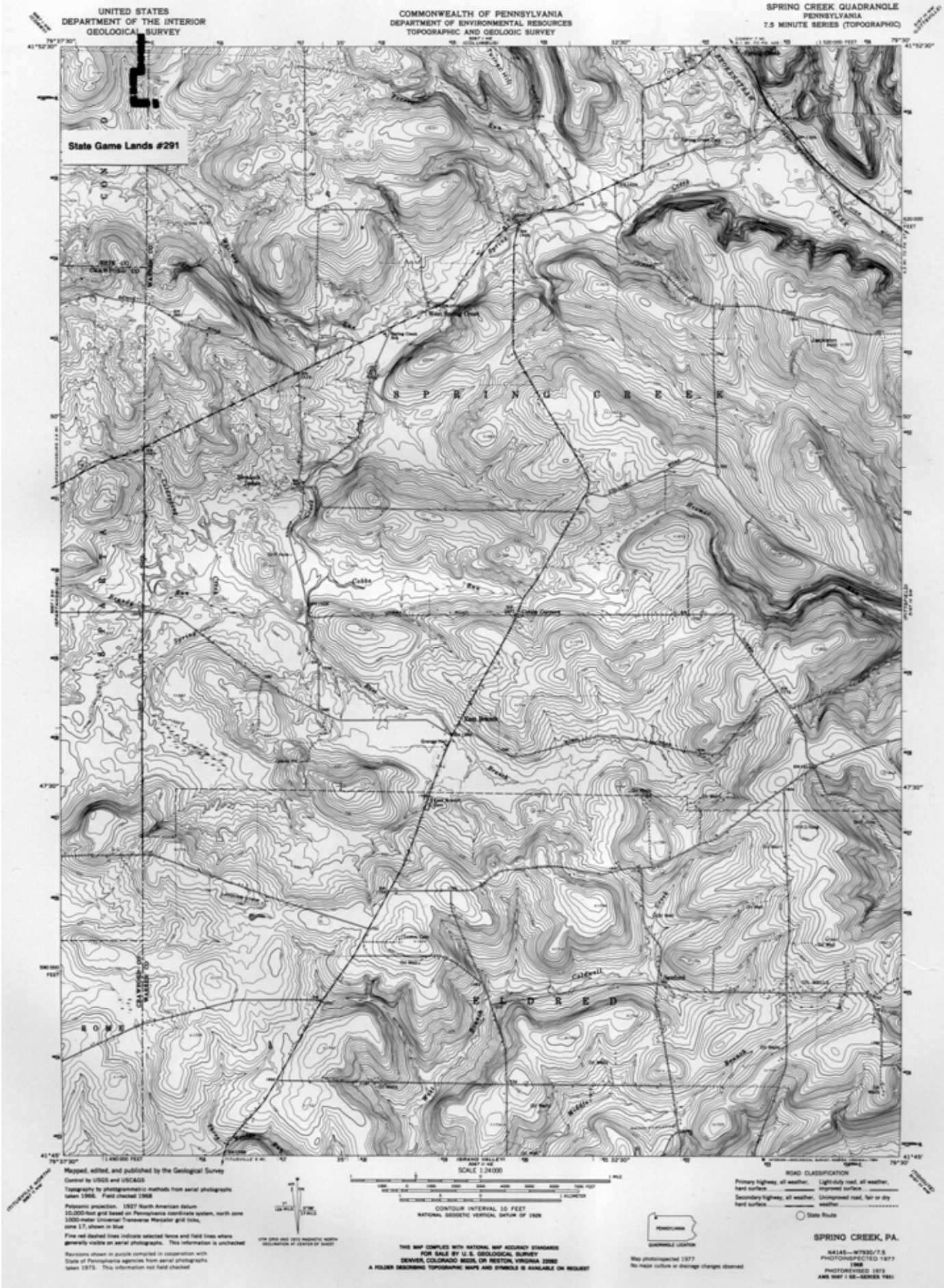
State Game Lands #291 is primarily located in Warren County, however, about 28 acres of this Managed Land are located in Concord Township. **State Game Lands #291** is represented on the Columbus and Spring Creek Quadrangles. Approximately 16 acres of **State Game Lands #291** are depicted on the Columbus Quadrangle. This portion of the Managed Land consists of steeply sloped, forested terrain (Erie County Department of Planning, 1991; U.S. Geological Survey, 1977b).

SPRING CREEK QUADRANGLE

	PNDI Rank		Legal Status		Last
	Global	State	Fed.	State	Seen

MANAGED LAND:

State Game Lands #291


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
TOPOGRAPHIC AND GEOLOGIC SURVEY
SPRING CREEK QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
State Game Lands #291
SPRING CREEK
ELDRED
ROME
SCALE 1:24000
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
ROAD CLASSIFICATION
SPRING CREEK, PA.

SPRING CREEK QUADRANGLE

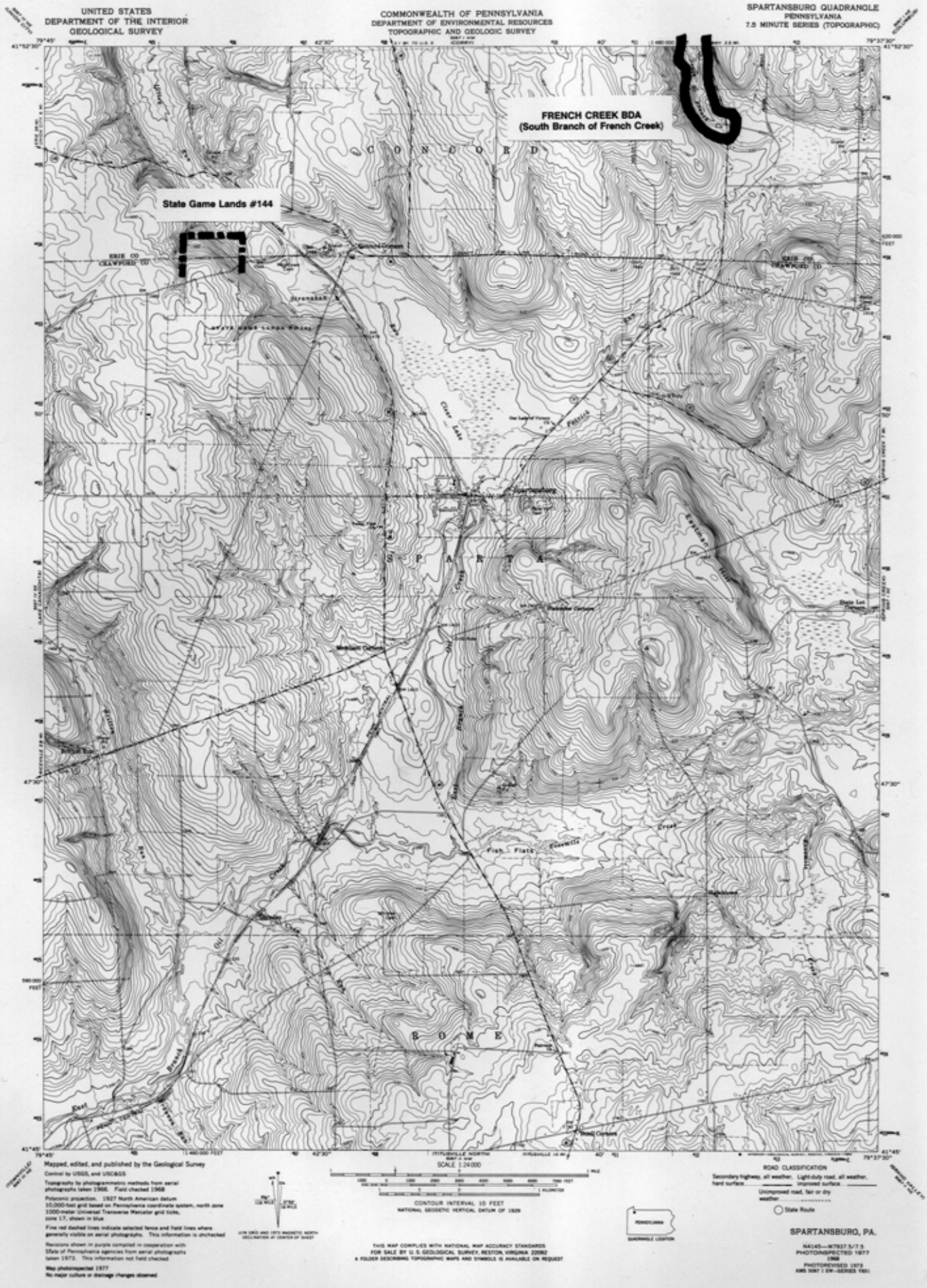
State Game Lands #291 is primarily located in Warren County, however about 28 acres of this Managed Land are located along the eastern border of Erie County in Concord Township. **State Game Lands #291** is represented on the Spring Creek and Columbus Quadrangles. Approximately 12 acres of **State Game Lands #291** are depicted on the Spring Creek Quadrangle. This portion of the Managed Land contains forested, hilly terrain and a stream, which is bordered by a narrow forested wetland (Erie County Department of Planning, 1991; National Wetland Inventory, 1977d; U.S. Geological Survey, 1977a).

SPARTANSBURG QUADRANGLE

	PNDI Rank		Legal Status		Last
	Global	State	Fed.	State	Seen
FRENCH CREEK BDA *Notable Significance*					
NATURAL COMMUNITY: NC001	G?	S3	N	N	1992

MANAGED LAND:

State Game Lands #144


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
TOPOGRAPHIC AND GEOLOGIC SURVEY
SPARTANSBURG QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
FRENCH CREEK BDA
(South Branch of French Creek)
State Game Lands #144
C O N N E A U T
S P A R T A
B O M E
Mapped, edited, and published by the Geological Survey
Control by USGS, and USC&GS
Topography by photogrammetric methods from aerial photographs taken 1966. Field checked 1968
Polyconic projection. 1927 North American datum
10,000-foot grid based on Pennsylvania coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 17, shown in blue
Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked
Revisions shown in purple compiled in cooperation with State of Pennsylvania agencies from aerial photographs taken 1973. This information not field checked
Map photoinspected 1977
No major culture or drainage changes observed
SCALE 1:24000
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST
ROAD CLASSIFICATION
Secondary highway, all weather. Light-duty road, all weather, hard surface
Improved surface
Unimproved road, fair or dry weather
State Route
SPARTANSBURG, PA.
N4145—W7937.5/7.5
PHOTOINSPECTED 1977
1968
PHOTOREVISED 1973
AMS 5967 I SW—SERIES V851

SPARTANSBURG QUADRANGLE

A portion of the **French Creek BDA** is represented on the Spartansburg Quadrangle. While a description of the **French Creek BDA** on the Spartansburg Quadrangle follows, refer to pages 119 and 120 for a holistic description of the biotic communities and the ecological significance of the natural resources within the **French Creek Basin LCA** and the **French Creek BDA**.

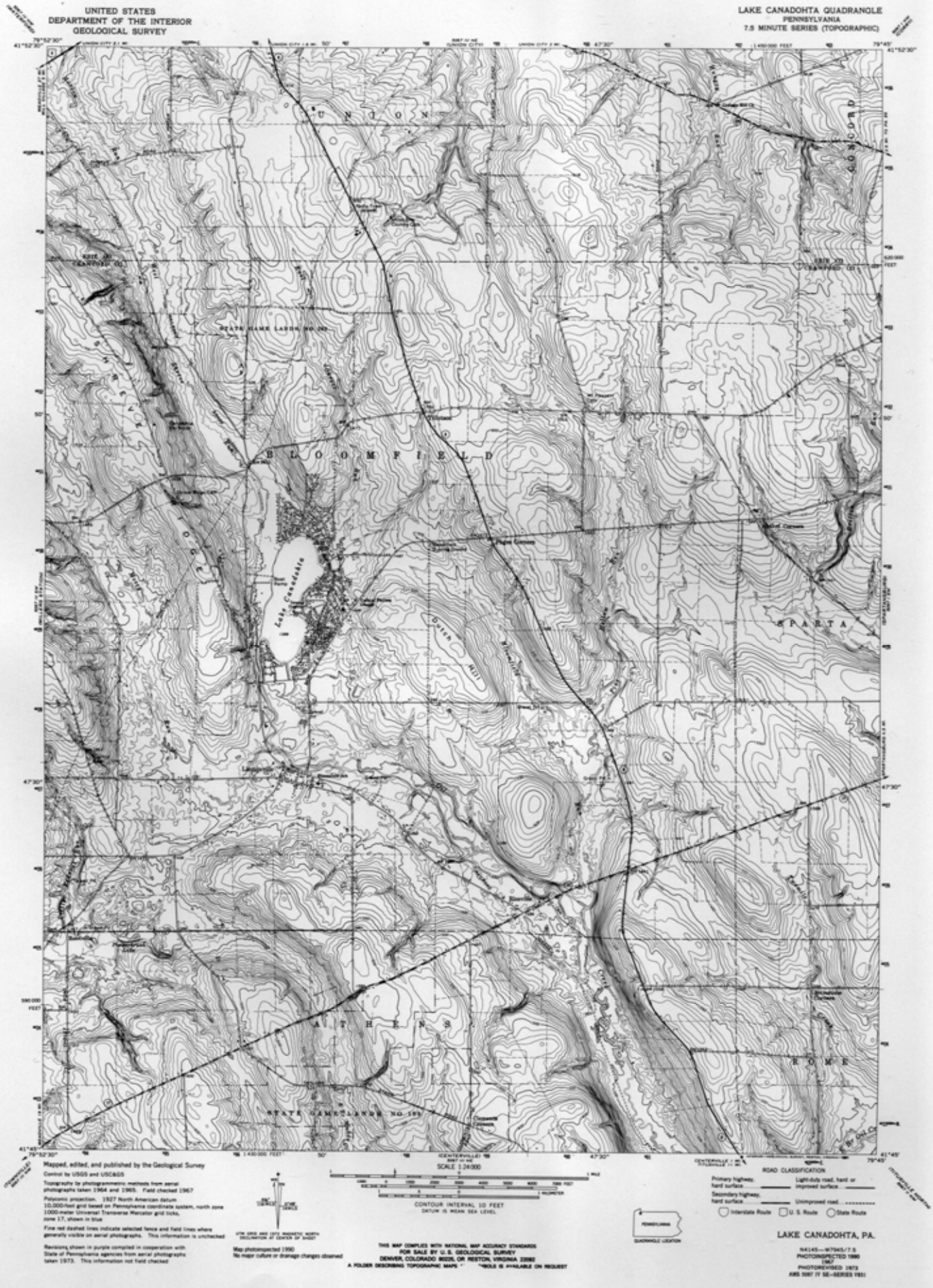
The South Branch of French Creek is a medium clearwater creek (**NC001**). The characteristics of this natural community and associated riparian habitats are described on pages 240 and 245. Maintenance of the ecological integrity of the portion of **NC001** represented on the Spartansburg Quadrangle contributes to the overall integrity of the **French Creek BDA**.

General recommendations regarding Biological Diversity Area site protection and management are addressed on page 52. The recommendations for the overall management and protection of the entire **French Creek BDA** are synonymous with the general recommendations for BDA's. Refer to the recommendations on page 124 for guidance regarding the protection of the **BDA** on the Spartansburg Quadrangle. (Note: The conditions by which the general recommendations for the protection and management of the **French Creek BDA** can be modified are on page 124.)

Approximately 51 acres of **State Game Lands #144** are located in Concord Township in southeast Erie County. However, most of this Managed Land is located in Crawford County. The portion of **State Game Lands #144** in Erie County contains forested hilly terrain (Erie County Department of Planning, 1991; U.S. Geological Survey, 1977).

LAKE CANADOHTA QUADRANGLE

	PNDI Rank		Legal Status		Last
	Global	State	Fed.	State	Seen

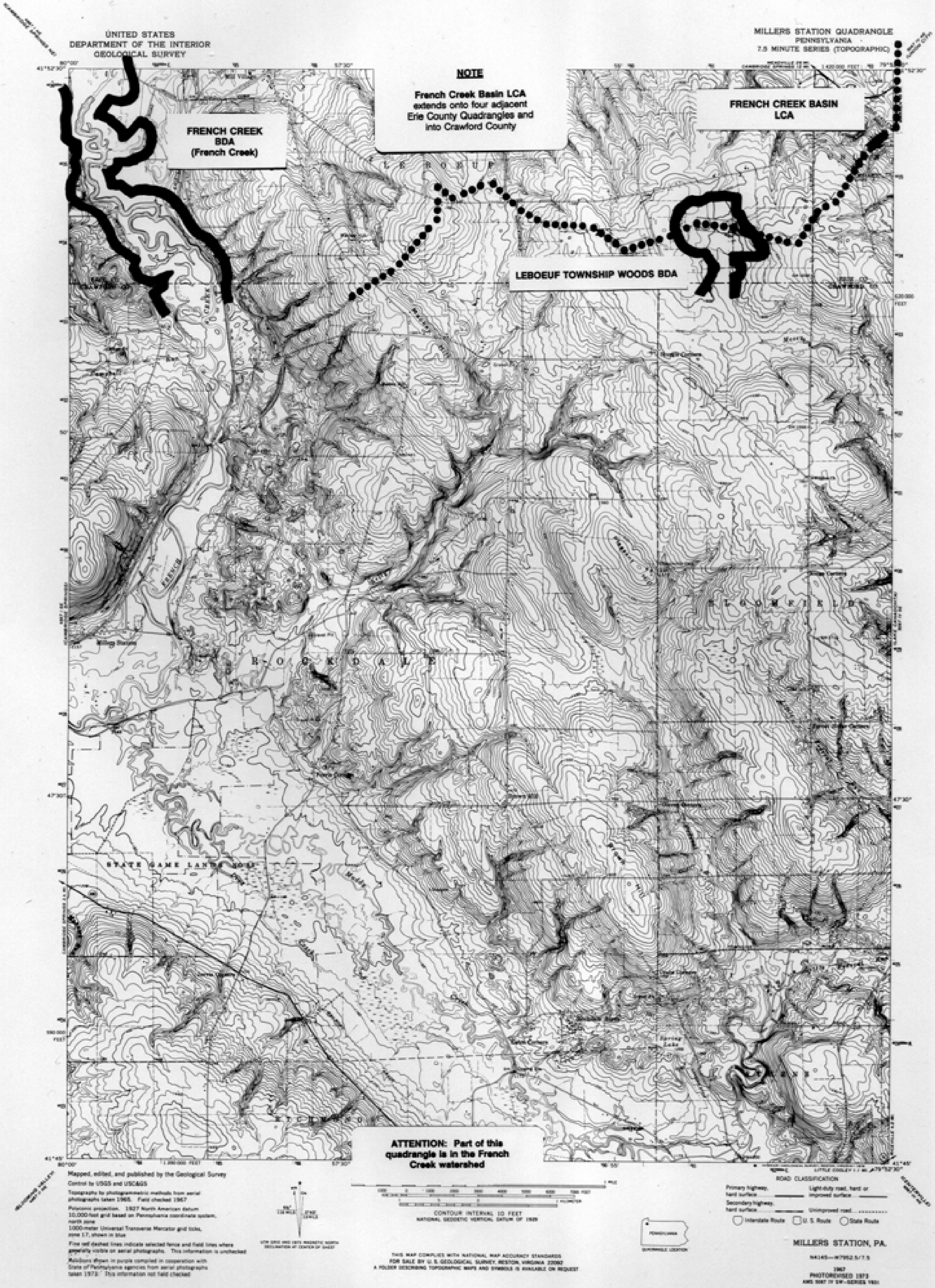

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
LAKE CANADOHTA QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
UNION
BLOOMFIELD
SPARTA
ATHENS
ROME
Lake Canadohta
STATE GAME LANDS NO. 199
SCALE 1:24000
CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
ROAD CLASSIFICATION
LAKE CANADOHTA, PA.
Mapped, edited, and published by the Geological Survey
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY
DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092

LAKE CANADOHTA QUADRANGLE

There are no known significant natural heritage areas in this quadrangle.

MILLERS STATION QUADRANGLE

	PNDI Rank		Legal Status		Last
	Global	State	Fed.	State	Seen
FRENCH CREEK BASIN LCA *Exceptional Significance*					
FRENCH CREEK BDA *Exceptional Significance*					
NATURAL COMMUNITY: NC001	G?	S1S2	N	N	1992
SPECIAL ANIMAL: SA001	G5	S2	N	PC	1992
SPECIAL ANIMAL: SA002	G3	S1	C2	PE	1992
SPECIAL ANIMAL: SA003	G2	S2	N	PE	1992
LEBOEUF TOWNSHIP WOODS BDA *Notable Significance*					
SPECIAL ANIMAL: SA004	G5	S3S4	N	N	1992


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MILLERS STATION QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
NOTE
French Creek Basin LCA extends onto four adjacent Erie County Quadrangles and into Crawford County
FRENCH CREEK BDA (French Creek)
FRENCH CREEK BASIN LCA
LEBOEUF TOWNSHIP WOODS BDA
LE BOEUF
BLOOMFIELD
ROCKDALE
STATE GAME LANDS
ATTENTION: Part of this quadrangle is in the French Creek watershed
Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS
Topography by photogrammetric methods from aerial photographs taken 1965. Field checked 1967
Polyconic projection. 1927 North American datum
10,000-foot grid based on Pennsylvania coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 17, shown in blue
Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked
Revisions shown in purple compiled in cooperation with State of Pennsylvania agencies from aerial photographs taken 1973. This information not field checked
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST
ROAD CLASSIFICATION
Primary highway, hard surface
Light-duty road, hard or improved surface
Secondary highway, hard surface
Unimproved road
Interstate Route
U. S. Route
State Route
PENNSYLVANIA
QUADRANGLE LOCATION
MILLERS STATION, PA.
N4145—W7952.5/7.5
1967
PHOTOREVISED 1973

MILLERS STATION QUADRANGLE

Portions of the **French Creek Basin LCA** and the **French Creek BDA** are represented on the Millers Station Quadrangle. While a description of the portions of the **LCA** and **BDA** on this quadrangle follows, refer to pages 119 and 120 for a holistic description of the biotic communities and the ecological significance of the natural resources within the **French Creek Basin LCA** and the **French Creek BDA**.

The **French Creek LCA** represented on the Millers Station Quadrangle includes a significant component of the **French Creek BDA** -- French Creek. French Creek is a medium gradient clearwater river community (**NC001**). **NC001** is an aquatic system that is considered to be critically imperiled/imperiled in Pennsylvania and of regional and global significance. The segment of **NC001** represented on the Millers Station Quadrangle is of particular importance. Three special animal species (**SA001**, **SA002**, and **SA003**) inhabit this section of French Creek (**NC001**) (Criswell, 1992). Each of these special animal species are fish species that are considered to be critically imperiled/imperiled in the state. **SA002** is also considered to be very rare on a global basis. Maintenance or improvement of water quality is essential for protecting these special animal species, as is the protection of stream bed habitats required for these species. Deep riffles over large rubble substrate is the habitat required by **SA003**. **SA002** requires sandy substrates. Habitat loss due to siltation is a threat to these special animal species, as is habitat loss resulting from such activities as channelization and dredging.

General recommendations regarding Landscape Conservation Area and Biological Diversity Area site protection and management are addressed on pages 52 and 53. The recommendations for the overall management and protection of the entire **French Creek Basin LCA** and the entire **French Creek BDA** are synonymous with the general recommendations for LCA's and BDA's. Refer to the recommendations on page 124 for guidance regarding the protection of the **BDA** on the Millers Station Quadrangle. (Note: The conditions by which the general recommendations for the protection and management of the **French Creek Basin LCA** and **French Creek BDA** can be modified are on page 124.)

LeBoeuf Township Woods BDA is a special species habitat area that provides breeding habitat for a bird (**SA004**) whose breeding colonies are tracked by the natural heritage program when the colonies consist of more than 15 nests. Per a local resident, the **SA004** colony has occupied the woodlands and/or an adjacent woodland for at least 26 years (D. Porter, pers. commun.). While **SA004** is classified as a rare or uncommon/apparently secure special animal species, the breeding colonies for **SA004** are classified as

rare/uncommon in the state. The Pennsylvania Biological Society considers special animal species **SA004** to be threatened in the state.

LeBoeuf Township Woods BDA is a forested tract greater than 92 acres in size in Erie County and is part of a large forested tract in northern Crawford County. In 1992, the **SA004** colony located within the **BDA** contained at least 17 nests. The **SA004** nesting colony observed is roughly five acres in size and is located in the area containing the oldest trees. The nesting colony is located near the edge of the woodland near a large pasture. Based on field observations, human activity would be limited within 820 feet of the **SA004** nesting colony, providing the necessary disturbance free buffer zone important for nesting habitat. The size of the **BDA**, vegetation structure, the presence of a 820 foot buffer zone nearly free of human disturbance, and the presence of water nearby provides a nesting habitat suitable for a **SA004** colony (Short and Cooper, 1985). The proximity of the nesting area to forage areas and other potential nests sites are also habitat variables of importance for **SA004**. However, assessing these variables is outside the scope of the inventory. Timber harvesting within the colony and reduction in the buffer zone would threaten the viability of the nesting colony for **SA004**.

Timber harvesting has occurred in the **LeBoeuf Township Woods BDA** in the past. The general recommendations regarding Biological Diversity Area site protection and management are addressed on page 52. Refer to these recommendations for guidance regarding the protection of the **LeBoeuf Township Woods BDA** on the Millers Station Quadrangle. More specific recommendations for this natural heritage area are:

(1) Timber harvesting within the nesting colony should be avoided;

(2) Property owners are encouraged to permit the expansion of the natural vegetation adjacent to the forest to provide a larger natural buffer for the **SA004** nesting colony; and

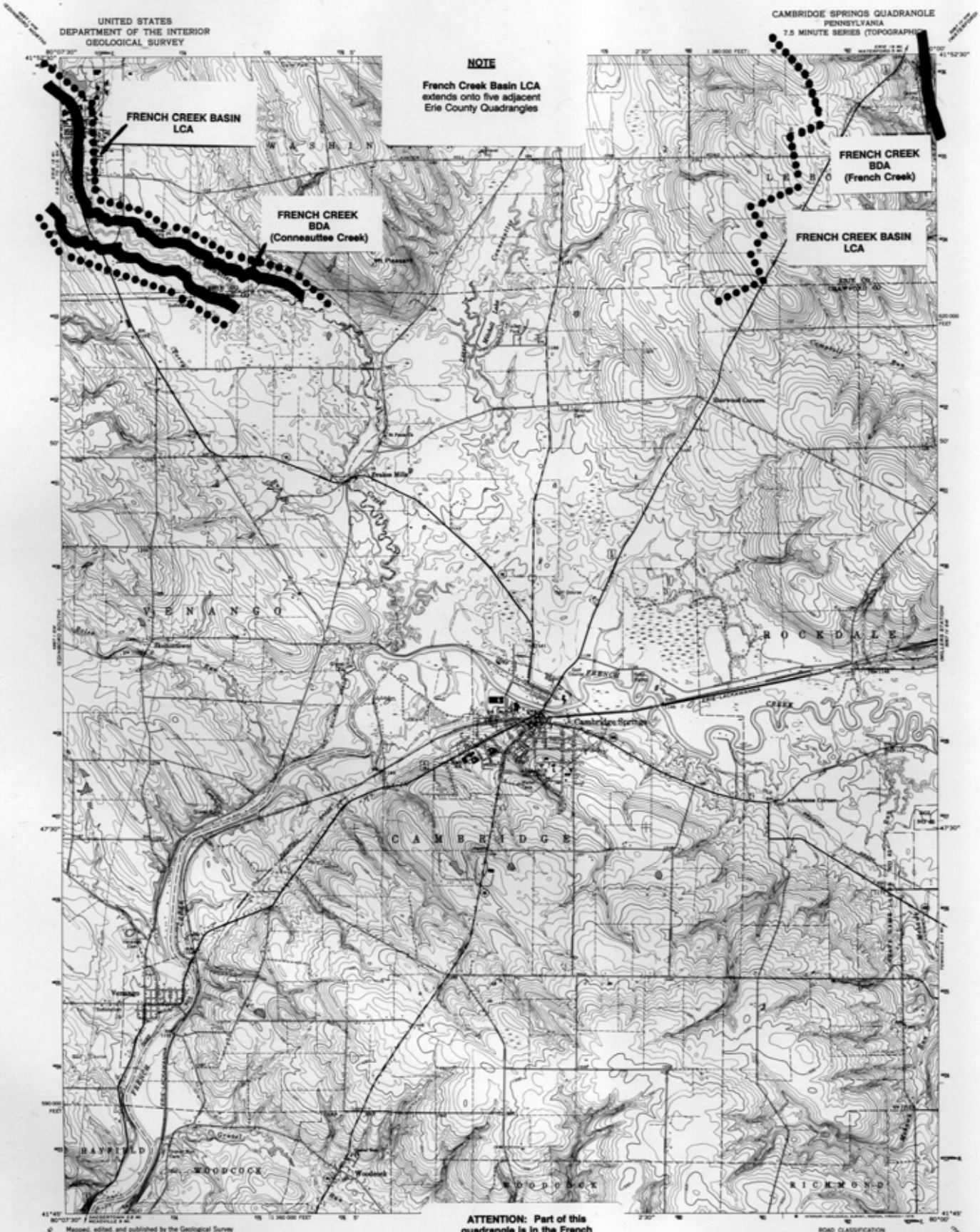
(3) Property owners are strongly encouraged to not enter the site during the **SA004** breeding/nesting season.

CAMBRIDGE SPRINGS QUADRANGLE

	PNDI Rank		Legal Status		Last
	Global	State	Fed.	State	Seen

FRENCH CREEK BASIN LCA *Notable Significance*

FRENCH CREEK BDA *Notable Significance*


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CAMBRIDGE SPRINGS QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
NOTE
French Creek Basin LCA
extends onto five adjacent
Erie County Quadrangles
FRENCH CREEK BASIN
LCA
FRENCH CREEK
BDA
(Conneauttee Creek)
FRENCH CREEK
BDA
(French Creek)
FRENCH CREEK BASIN
LCA
VENANGO
CAMBRIDGE
ROCKDALE
HAYFIELD
WOODCOCK
RICHMOND
Cambridge Springs
ATTENTION: Part of this
quadrangle is in the French
Creek watershed
Mapped, edited, and published by the Geological Survey
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
ROAD CLASSIFICATION
CAMBRIDGE SPRINGS, PA.
1968
PHOTOREVISED 1975

CAMBRIDGE SPRINGS QUADRANGLE

Portions of the **French Creek Basin Landscape LCA** and the **French Creek BDA** are represented on the Cambridge Springs Quadrangle. A description of the **LCA** and **BDA** depicted on this quadrangle follows. Refer to pages 119 and 120 for a holistic description of the biotic communities and the ecological significance of the natural resources within the **French Creek Basin LCA** and the **French Creek BDA**.

The portion of the **French Creek Basin LCA** represented on the Cambridge Springs Quadrangle includes part of the **French Creek BDA** -- Conneauttee Creek. In Crawford County, Conneauttee Creek is inhabited by a federally endangered species -- a freshwater mollusk that is known to inhabit only 12 streams in six states (Bartlett, 1993). Thus, maintenance of the ecological integrity of the portion of Conneauttee represented on the Cambridge Springs Quadrangle contributes to the overall integrity of the globally significant biodiversity of French Creek. Maintenance or improvement of water quality and stream bed habitat are critical to the protection of the overall integrity of French Creek, as well as the numerous animal species of special concern that inhabit the aquatic system.

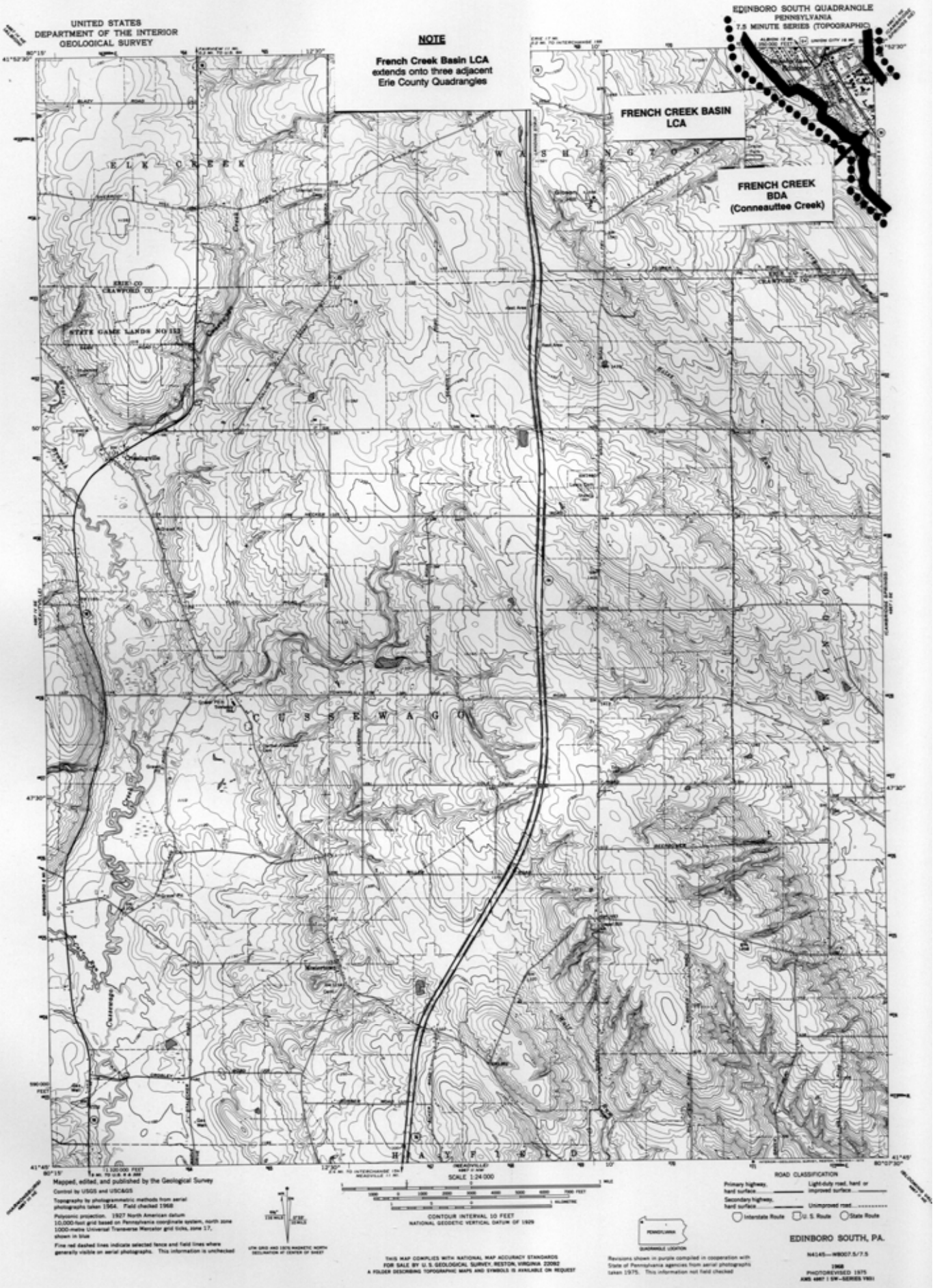
General recommendations regarding Landscape Conservation Area and Biological Diversity Area site protection and management are addressed on pages 52 and 53. The recommendations for the overall management and protection of the entire **French Creek Basin LCA** and the entire **French Creek BDA** are synonymous with the general recommendations for LCA's and BDA's. Refer to the recommendations on page 124 for guidance regarding the protection of the **BDA** on the Cambridge Springs Quadrangle. (Note: The conditions by which the general recommendations for the protection and management of the **French Creek Basin LCA** and **French Creek BDA** can be modified are on page 124.)

EDINBORO SOUTH QUADRANGLE

	PNDI Rank	Legal Status	Last
	Global State	Fed. State	Seen

FRENCH CREEK BASIN LCA *Notable Significance*

FRENCH CREEK BDA *Notable Significance*


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
NOTE
French Creek Basin LCA
extends onto three adjacent
Erie County Quadrangles
EDINBORO SOUTH QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
FRENCH CREEK BASIN
LCA
FRENCH CREEK
BDA
(Conneauttee Creek)
ELK CREEK
WASHINGTON
CUSSEWAGO
HAYFIELD
STATE GAME LANDS NO 132
Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS
Topography by photogrammetric methods from aerial photographs taken 1964. Field checked 1968
Polyconic projection. 1927 North American datum
10,000-foot grid based on Pennsylvania coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 17, shown in blue
Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked
SCALE 1:24 000
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
ROAD CLASSIFICATION
Primary highway, hard surface
Light-duty road, hard or improved surface
Secondary highway, hard surface
Unimproved road
Interstate Route
U. S. Route
State Route
EDINBORO SOUTH, PA.
N4145—W8007.5/7.5
1968
PHOTOREVISED 1975
AMS 4867 I SW—SERIES V851
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST
Revisions shown in purple compiled in cooperation with State of Pennsylvania agencies from aerial photographs taken 1975. This information not field checked

EDINBORO SOUTH QUADRANGLE

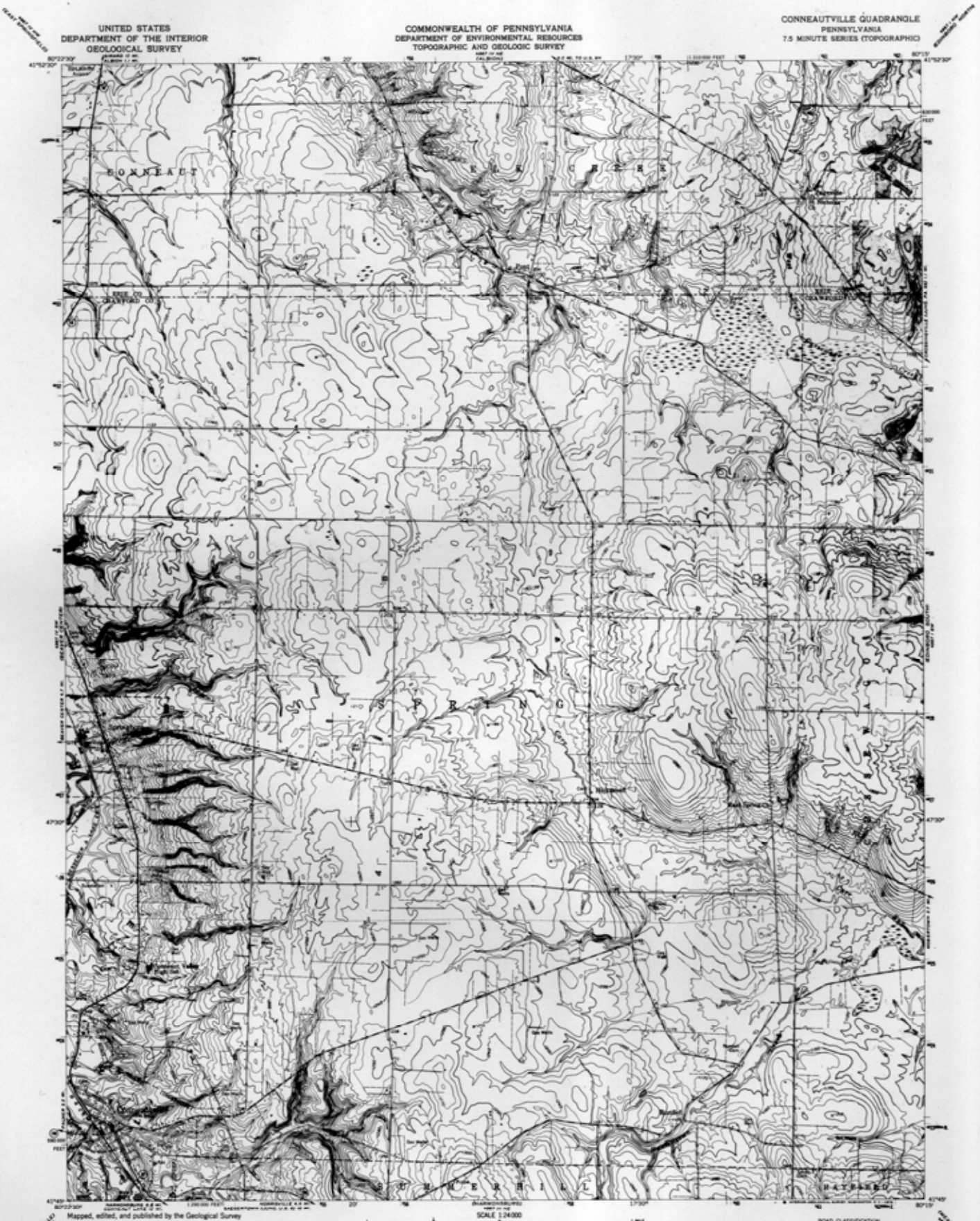
Portions of the **French Creek Basin Landscape LCA** and the **French Creek BDA** are represented on the Edinboro South Quadrangle. A description of the **LCA** and **BDA** depicted on this quadrangle follows. Refer to pages 119 and 120 for a holistic description of the biotic communities and the ecological significance of the natural resources within the **French Creek Basin LCA** and the **French Creek BDA**.

The portion of the **French Creek Basin LCA** represented on the Edinboro South Quadrangle includes part of the **French Creek BDA** -- Conneauttee Creek. In Crawford County, Conneauttee Creek is inhabited by a federally endangered species -- a freshwater mollusk that is known to inhabit only 12 streams in six states (Bartlett, 1993). Thus, maintenance of the ecological integrity of the portion of Conneauttee represented on this quadrangle contributes to the overall integrity of the globally significant biodiversity of French Creek. Maintenance or improvement of water quality and stream bed habitat are critical to the protection of the overall integrity of French Creek, as well as the numerous animal species of special concern that inhabit the aquatic system.

General recommendations regarding Landscape Conservation Area and Biological Diversity Area site protection and management are addressed on pages 52 and 53. The recommendations for the overall management and protection of the entire **French Creek Basin LCA** and the entire **French Creek BDA** are synonymous with the general recommendations for LCA's and BDA's. Refer to the recommendations on page 124 for guidance regarding the protection of the **BDA** on the Edinboro South Quadrangle. (Note: The conditions by which the general recommendations for the protection and management of the **French Creek Basin LCA** and **French Creek BDA** can be modified are on page 124.)

CONNEAUTVILLE QUADRANGLE

	PNDI Rank		Legal Status		Last
	Global	State	Fed.	State	Seen


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
TOPOGRAPHIC AND GEOLOGIC SURVEY
CONNEAUTVILLE QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
CONNEAUT
E L K C R E E K
S P R I N G
S U M M E R H I L L
HARTSTOWN
Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS
Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1957. Field check 1959
Polyconic projection. 1927 North American datum
10,000-foot grid based on Pennsylvania coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 17, shown in blue
Fine red dashed lines indicate selected fence and field lines visible on aerial photographs. This information is unchecked
Unchecked elevations are shown in brown
SCALE 1:24000
CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
ROAD CLASSIFICATION
Heavy-duty
Light-duty
Medium-duty
Unimproved dirt
State Route
CONNEAUTVILLE, PA.
N4145—W8015/7.5
PHOTOINSPECTED 1977
1959
PHOTOREVISED 1970
AMS 4867 IV SE—SERIES V851
Map photoinspected 1977
No major culture or drainage changes observed
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, WASHINGTON, D. C. 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST
Revisions shown in purple compiled in cooperation with State of Pennsylvania agencies from aerial photographs taken 1970. This information not field checked

CONNEAUTVILLE QUADRANGLE

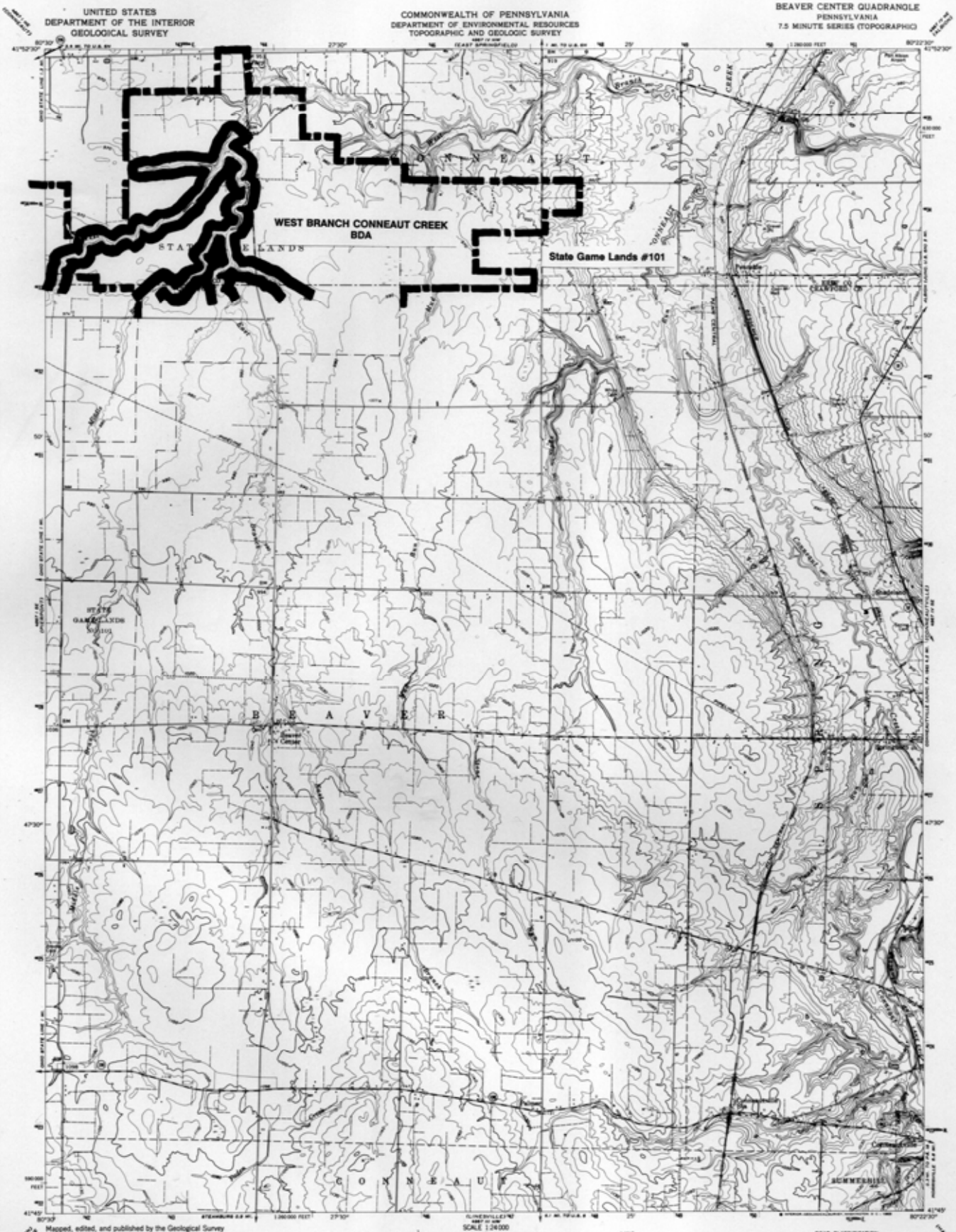
There are no known significant natural heritage areas in this quadrangle.

BEAVER CENTER QUADRANGLE

	PNDI Rank		Legal Status		Last
	Global	State	Fed.	State	Seen
WEST BRANCH CONNEAUT CREEK BDA	*Notable Significance*				
SPECIAL ANIMAL: SA001	G5	S2	N	?	1985/86

MANAGED LAND:

State Game Lands #101


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
TOPOGRAPHIC AND GEOLOGIC SURVEY
BEAVER CENTER QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
WEST BRANCH CONNEAUT CREEK
BDA
State Game Lands #101
CONNEAUT
BEAVER
CONNEAUT
SCALE 1:24000
CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
ROAD CLASSIFICATION
Heavy-duty
Medium-duty
Light-duty
Unimproved dirt
State Route
BEAVER CENTER, PA.
N4145—W8022.5/7.5
PHOTOINSPECTED 1977
1959
PHOTOREVISED 1970
AMS 4667 IV SW—SERIES V851
Mapped, edited, and published by the Geological Survey
Control by USGS, USC&GS, and USCE
Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1959 and 1957. Field check 1959
Polyconic projection. 1927 North American datum
10,000-foot grid based on Pennsylvania coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 17, shown in blue
Fine red dashed lines indicate selected fence and field lines visible on aerial photographs. This information is unchecked
Revisions shown in purple compiled in cooperation with State of Pennsylvania agencies from aerial photographs taken 1970. This information not field checked
Map photoinspected 1977
No major culture or drainage changes observed
UTM GRID AND 1970 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, WASHINGTON, D. C. 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST
PENNSYLVANIA
QUADRANGLE LOCATION

BEAVER CENTER QUADRANGLE

A Managed Land, **State Game Lands #101**, is located in Conneaut Township, Erie County and extends into Crawford County. In Erie County, **State Game Lands #101** is about 799 acres in size. State Game Lands #101 is located on the northwest quadrant of the Beaver Center Quadrangle and extends onto the Pierpont Quadrangle. The portion of **State Game Lands #101** on the Beaver Center Quadrangle is approximately 689 acres in size. About 110 acres of **State Game Lands #101** are represented on the Pierpont Quadrangle. A separate portion of **State Game Lands #101** is located on the East Springfield Quadrangle and described on page 193. **State Game Lands #101** contains extensive areas of terrestrial and wetland forest, forested/shrub-scrub wetlands, streams, and fields. In 1985 a tornado created extensive openings in the forest. The tornado damaged areas are recovering and exhibit very good plant species diversity. Within **State Game Lands #101** is a special species habitat -- **West Branch Conneaut Creek BDA**.

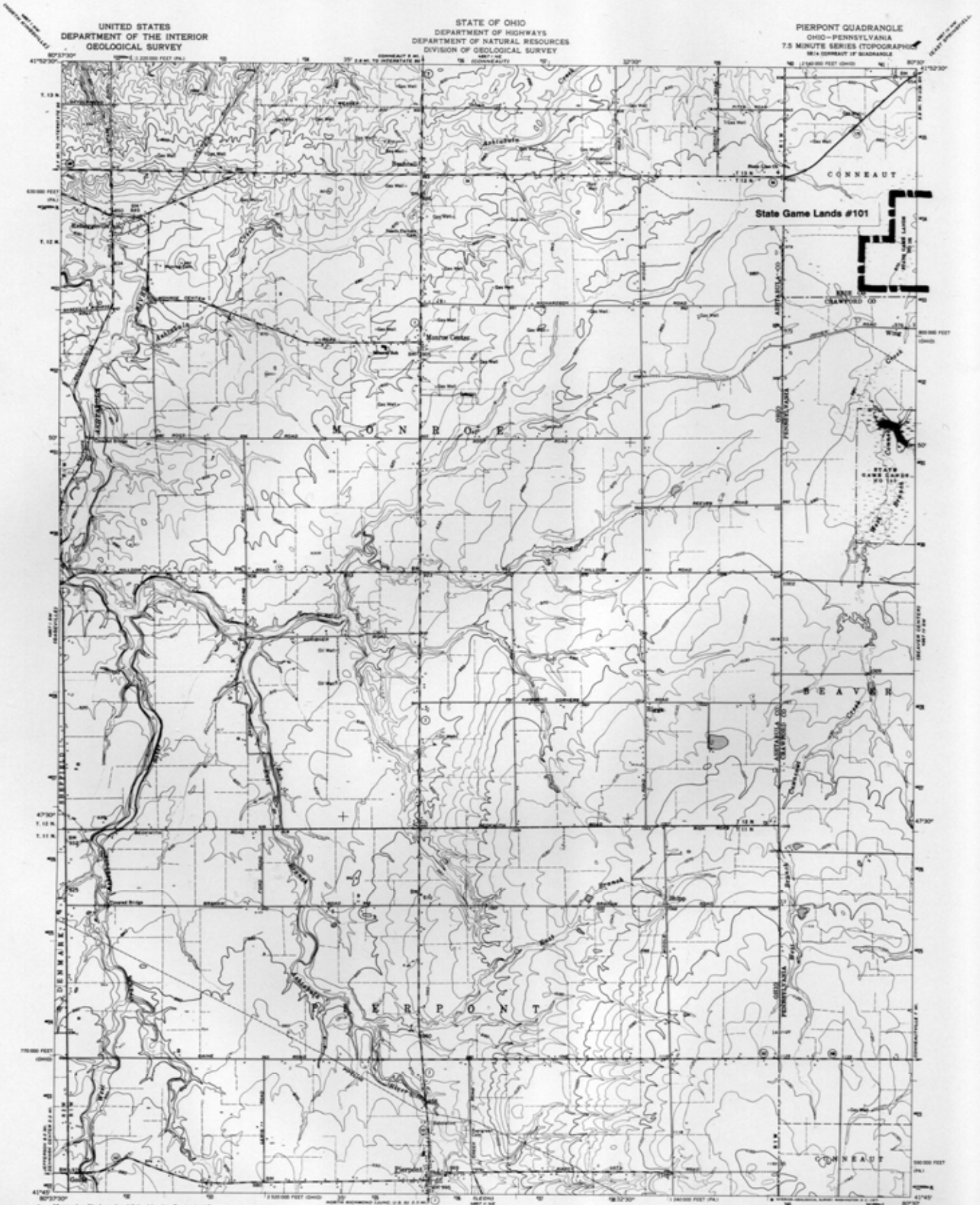
West Branch Conneaut Creek BDA is a special species habitat. The West Branch of Conneaut Creek provides habitat for a special animal species (**SA001**). **SA001** represents a fish species population that is classified as imperiled in the state and is a Pennsylvania candidate species (i.e., a species that could become threatened or endangered in the future). The Pennsylvania Biological Society considers the species to be rare in the state. A small population of **SA001** inhabits the **West Branch Conneaut Creek BDA**. **SA001** requires a gravel stream bed in shallow, swift water for breeding (Palmer, 1949). Stream modification via channelization, dredging, or impoundment would adversely effect **SA001**. Although **SA001** can tolerate some disturbance, protection of the **SA001** population requires that stream water quality, water quantity, and critical habitats be maintained. Based on the erodibility of soils bordering the stream and the corresponding extent of vegetative cover, the recommended buffer along either side of the stream is 84 feet wide. This buffer is too small to accurately depict given the scale of the quadrangle map. Therefore, the **BDA** boundary depicted on the quadrangle only represents the limits of this particular natural heritage area. General recommendations for the protection and management of Biological Diversity Area are addressed on page 52 and are applicable to the **West Branch Conneaut Creek BDA**.

PIERPONT QUADRANGLE

	PNDI Rank		Legal Status		Last
	Global	State	Fed.	State	Seen

MANAGED LAND:

State Game Land #101


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
STATE OF OHIO
DEPARTMENT OF HIGHWAYS
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL SURVEY
PIERPONT QUADRANGLE
OHIO—PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
CONNEAUT
State Game Lands #101
MONROE
BEAVER
DENMARK
PIERPONT
Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS
Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1958. Field check 1960
Polyconic projection. 1927 North American datum
10,000-foot grids based on Ohio coordinate system, north zone,
and Pennsylvania coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks,
zone 17, shown in blue
Fine red dashed lines indicate selected fence and field lines where
generally visible on aerial photographs. This information is unchecked
Ohio area lies within the Connecticut Western Reserve
Land lines established by private subdivision of the
Connecticut Western Reserve
SCALE 1:24 000
CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
ROAD CLASSIFICATION
Heavy-duty
Light-duty
Medium-duty
Unimproved dirt
State Route
PIERPONT, OHIO—PA.
N4045—W8030/7.5
1960
PHOTOREVISED 1970
AMS 6867 I SE—SERIES V852
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, WASHINGTON, D. C. 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST
Revisions shown in purple compiled in cooperation with
State of Ohio agencies from aerial photographs taken 1970
This information not field checked

PIERPONT QUADRANGLE

A Managed Land, **State Game Lands #101**, is located in Conneaut Township. **State Game Lands #101** is located in the northeast corner of the quadrangle and extends onto the Beaver Center Quadrangle. In Erie County, **State Game Lands #101** is about 799 acres in size. The portion of **State Game Lands #101** on the Beaver Center Quadrangle is approximately 689 acres in size. About 110 acres of **State Game Lands #101** are represented on the Pierpont Quadrangle. A separate portion of **State Game Lands #101** is located on the East Springfield Quadrangle and is described on page 193. Aerial imagery (USDA, 1981) indicates that this section of the game land is primarily forested. Forested and forested/shrub-scrub wetlands are located throughout this portion of **State Game Lands #101** (National Wetland Inventory, 1977a).

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APPENDICES

APPENDIX I

FEDERAL AND STATE ENDANGERED SPECIES CATEGORIES,
GLOBAL AND STATE ELEMENT RANKS

Several federal and state legislative acts have provided the authority and means for the designation of endangered, threatened, rare, etc. species lists. Those acts and status summaries follow. However, not all of the species or natural communities considered by conservation biologists (e.g., Pennsylvania Biological Survey) as "special concern resources" are included on the state or federal lists. In this county inventory report, "N" denotes those special concern species that are not officially recognized by state or federal agencies. Therefore: N = No current legal status, but is considered to be of special concern in Pennsylvania, or is under review for such consideration, by conservation biologists. Contact the Pennsylvania Natural Diversity Inventory for more information.

FEDERAL STATUS

All Plants and Animals: Legislative Authority: U.S. Endangered Species Act (1973), U.S. Fish and Wildlife Service, February 21, 1990, 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 throughout all or a significant portion of their ranges.

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

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

C1 = Candidate 1 - Taxa for which the Service has on file enough substantial information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species. Taxa of known vulnerable status in the recent past that may already have become extinct.

C2 = Candidate 2 - Taxa for which there is some evidence of vulnerability but for which there are not enough data to support listing proposals at this time.

APPENDIX I (Cont.)

C3 = Candidate 3 (See 3A, 3B, 3C below) - Taxa that once were considered for listing as threatened or endangered but are no longer under such consideration. Such taxa are further divided into three subcategories, to indicate the reason(s) for their 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 distinct 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 = No current legal status, but is considered to be of special concern in Pennsylvania, or is under review for such consideration, by conservation biologists. Contact the Pennsylvania Natural Diversity Inventory for more information.}

APPENDIX I (Cont.)

PENNSYLVANIA STATUS

Native Plant Species: Legislative Authority: Title 25 Chapter 82, Conservation of Native Wild Plants, January 1, 1988; 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 are 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.

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 their future decline, or if the species are greatly exploited by man.

PR = Pennsylvania Rare - Plant species which are uncommon within this Commonwealth because they may be found in restricted geographic areas or in low numbers throughout this Commonwealth.

PX = Pennsylvania Extirpated - Plant species believed by the Department to be extinct within this Commonwealth. These plants may or may not be in existence outside the Commonwealth.

PV = Pennsylvania Vulnerable - Plant species which are in danger of population decline within this Commonwealth 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 - A classification of 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 = No current legal status, but is considered to be of special concern in Pennsylvania, or is under review for such consideration, by conservation biologists. Contact the Pennsylvania Natural Diversity Inventory for more information.}

APPENDIX I (Cont.)

Wild Birds and Mammals - Legislative Authority: Title 34 Chapter 133, Game and Wildlife Code, revised Dec. 1, 1990 Pennsylvania Game Commission.

PE = Pennsylvania Endangered - Species in imminent danger of extinction or extirpation throughout their range in Pennsylvania if the deleterious factors affecting them continue. These are: 1) species whose numbers have already been reduced to a critically low level or whose habitat have 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.

PT = Pennsylvania Threatened - 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 population within the Commonwealth are decreasing or have been heavily depleted by adverse factors and while not actually endangered, are still in critical condition; 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".

{N = No current legal status, but is considered to be of special concern in Pennsylvania, or is under review for such consideration, by conservation biologists. Contact the Pennsylvania Natural Diversity Inventory for more information.}

APPENDIX I (Cont.)

Fish, Amphibians, Reptiles, and Aquatic Organisms - Legislative Authority: Title 30 Chapter 75, Fish and Boat Code, revised February 9, 1991; Pennsylvania Fish and Boat Commission

PE = Pennsylvania Endangered - All species declared by: 1) 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) have been declared by the Pennsylvania Fish and Boat Commission's Executive Director to be threatened with extinction and appear on the Pennsylvania Endangered Species List published by the Pennsylvania Bulletin.

PT = Pennsylvania Threatened - All species declared by: 1) 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 deteriorates, and appear on a Threatened Species List published in the Federal Register; or 2) have been declared by the Pennsylvania Fish and Boat Commission Executive Director to be in such small numbers throughout their range that they may become endangered if their environment deteriorates and appear on the Pennsylvania Threatened Species List published in the Pennsylvania Bulletin.

Internal Fish and Boat Commission Status Category:

PC = Pennsylvania Candidate - Species that exhibit the potential to become Endangered or Threatened in the future. Pennsylvania populations of these taxa are: 1) "rare" due to their decline, distribution, restricted habitat, etc.; 2) are "at risk" due to aspects of their biology, certain types of human exploitation, or environmental modification; or, 3) are considered "undetermined" because adequate data is not available to assign an accurate status.

This category is unofficial and has no basis in any law (i. e., Chapter 75, Fish and Boat Code), as do the Endangered and Threatened categories.

{N = No current legal status, but is considered to be of special concern in Pennsylvania, or is under review for such consideration, by conservation biologists. Contact the Pennsylvania Natural Diversity Inventory for more information.}

APPENDIX I (Cont.)

Invertebrates - Pennsylvania Status: No state agency has been assigned to develop regulations to protect terrestrial invertebrates, although a federal status may exist for some species. Aquatic invertebrates are regulated by the Pennsylvania Fish and Boat Commission, but have not been listed to date.

Although no invertebrate species are presently state listed, numerous state status and/or state rank designations have been unofficially assigned by conservation biologists. NOTE: Invertebrate species are regularly considered under the U.S. Endangered Species Act for federal status assignments.

{N = No current legal status, but is considered to be of special concern in Pennsylvania, or is under review for such consideration, by conservation biologists. Contact the Pennsylvania Natural Diversity Inventory for more information.}

APPENDIX I (Cont.)

GLOBAL AND STATE RANKING

Global and State Ranking is a system utilized by the network of 50 state natural heritage programs in the United States. Although similar to the federal and state status designations, the ranking scheme allows the use of one comparative system to "rank" all species in a relative format. Unlike state or federal status designation guidelines, the heritage ranking procedures are also applied to natural community resources. Global ranks consider the imperilment of a species or community throughout its range, while state ranks provide the same assessment within each state. Although there is only one global rank used by the heritage network, state ranks are developed independently and allow a comparison state by state. For more information, contact the Pennsylvania Natural Diversity Inventory.

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.

APPENDIX I (Cont.)

G? = Not ranked to date.

NOTE: The study of naturally occurring biological communities is complex and natural community classification is unresolved both regionally and within Pennsylvania. The Global and State Ranking of natural communities also remains difficult and incomplete. Although many natural community types are clearly identifiable and have been ranked, others are still under review and appear as G? and/or S?.

APPENDIX I (Cont.)

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 (occurring only once or a few times) or casual (occurring more regularly although not every year) 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 or catalpa in eastern states).

SH = Of historical occurrence in the state, perhaps having not been verified in the past 20 years, and suspected to be still extant.

SN = Regularly occurring, usually migratory and typically nonbreeding 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.

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

SX = Apparently extirpated from the state.

SZ = Not of significant conservation concern in the state, invariably because there are no (zero) definable occurrences in the state, although the taxon is native and appears regularly in the state.

S? = Not ranked to date.

APPENDIX I (Cont.)

NOTE: The study of naturally occurring biological communities is complex and natural community classification is unresolved both regionally and within Pennsylvania. The Global and State Ranking of natural communities also remains difficult and incomplete. Although many natural community types are clearly identifiable and have been ranked, others are still under review and appear as G? and/or S?

APPENDIX II

COUNTY SIGNIFICANCE RANKS

The natural heritage sites that have qualified for inclusion in this report have been classified regarding their significance as areas of importance to the biological diversity and ecological integrity of the county. Included in this evaluation is also the level of state and/or national significance. These ranks have been used to prioritize the significance of all identified sites and suggest the relative attention that sites should receive for the amount, degree and rate of protection.

Significance Rank	Explanation
EXCEPTIONAL	Outstanding county significance. Sites that represent areas of great importance for the biological diversity and ecological integrity of the county, state and/or region. One or more occurrences of state or national species of special concern, a rare natural community type, a relatively undisturbed natural area, or high quality biological diversity area, is present at the site. Sites of exceptional county significance merit quick, strong and complete protection.
HIGH	Important county significance. Sites that represent vital areas of the county's biological and ecosystem resources and have not been overly disturbed by human activities. Also occasionally included are sites that have less important occurrences of state or nationally imperiled species and/or natural communities. These sites represent areas harboring important natural resources that merit complete protection in the near future.
NOTABLE	General county significance. Sites that harbor many of the flora, fauna and natural community resources in the county, and although somewhat disturbed by human activities, still represent areas that provide habitat, open space, educational lands and general landscape and/or watershed protection. These sites will be increasingly important to the future quality of the county's overall environment, and merit the attention of planners and conservationists so that their present condition can be maintained.

APPENDIX III
ERIE COUNTY NATURAL HERITAGE INVENTORY
SITE SURVEY FORM

Site Name:_____

County: Erie Municipality:_____

Quad Name:_____ Quad Code:_____ 10,10:_____

Reference:_____

Land Owners (include best method of contact, date contacted, and method of permission):

Directions to Site:_____

_____

Site Elevation:_____ Site Size:_____ Aspect:_____

Aerial Photo Int. Air Photo #:_____ Photo Type:_____

Comments from Aerial Photo Interpretation:_____

_____

_____

Aerial Reconnaissance Date:_____ Team:_____

Comments from Aerial Survey:_____

_____

_____

Ground Survey Date:_____ Team:_____

Community(s) Type:_____

Setting of Community(s):_____

Conditions:_____

Description of site (quality, vegetation, significant species, aquatic features, notable landforms, natural hazards, age, etc.):

Evidence of Disturbance (logging, grazing, mining, past agriculture, erosion, sedimentation, filling, draining, exotic flora, etc.):

APPENDIX III (CONT.)
ERIE COUNTY NATURAL HERITAGE INVENTORY
SITE SURVEY FORM (CONT.)

Recovery Potential:
Surrounding Land Use:
Threats to Site and Management/Protection:

Previously Identified Element Occurrences*:

Species:

****

Accepted for inclusion in report: _____ Rejected: _____ Date:
Reason:

*Element Occurrences can be a plant, animal, or natural community tracked by PNDI that can be mapped to a precise location on a U.S.G.S. Topographic Quadrangle based on a recent and/or historical record.

APPENDIX VI

NATURAL HERITAGE SITE RECOMMENDATION FORM

Your Name:_____ Phone:_____
Address:_____
Site Name:_____ Date of Observation:_____
Quadrangle Name:_____ Owner:_____
Owners Attitude Toward Conservation (if known):_____
Exact Location of Site (please be specific and include a map or sketch):_____
_____
Size of Site (approx. acres):_____

Site Description: __ Mature or Old Growth Forest
__ Forested Wetland
__ Shrub Wetland
__ Marsh//Wet Meadow/Bog/ Fen
__ Natural Pond or Lake
__ High Quality Stream
__ Habitat for Federal/State Species of Special Concern
__ Other

Written Description of Site: Try to convey a mental image of the sites features by including vegetation, significant plants and animals, aquatic features, land forms, geologic features, etc.:_____
_____
_____
_____
_____
_____
_____
_____
Evidence of Disturbance (logging, mining, erosion, sedimentation, filling, draining, grazing, etc.):_____
_____
_____
Attach any additional information, species list, maps, etc. Send completed report forms to Norma Kline, Western PA Conservancy, 316 Fourth Ave., Pitts., PA, 15222, (412)288-2777. Additional forms may be obtained from this office. Thank you for your contribution to the Erie County Natural Heritage Inventory.

APPENDIX V

CLASSIFICATION OF NATURAL COMMUNITIES
IN PENNSYLVANIA
(DRAFT)

COMMUNITY NAME	GLOBAL RANK	STATE RANK
ESTUARINE COMMUNITIES		
Deepwater Subtidal Community	G?	S1
Shallow-Water Subtidal Community	G?	S1
Freshwater Intertidal Mudflat	G3G4	S1
Freshwater Intertidal Marsh	G3G4	S1
RIVERINE COMMUNITIES		
Low-Gradient Ephemeral/Intermittent Creek	G?	S5
Low-Gradient Clearwater Creek	G?	S3S4
Low-Gradient Clearwater River	G?	S2S3
Low-Gradient Brownwater Creek	G?	S2S3
Medium-Gradient Ephemeral/Intermittent Creek	G?	S5
Medium-Gradient Clearwater Creek	G?	S3
Medium-Gradient Clearwater River	G?	S?
Medium-Gradient Brownwater Creek	G?	S3
High-Gradient Ephemeral /Intermittent Creek	G?	S5
High-Gradient Clearwater Creek	G?	S3
High-Gradient Clearwater River	G?	S?
High-Gradient Brownwater Creek	G?	S?
Waterfall and Plungepool	G?	S3S4
Spring Community	G?	S1S2
Spring Run Community	G?	S1S2
LACUSTRINE		
Calcareous Glacial Lake	G?	S1
Acidic Glacial Lake	G?	S2
Nonglacial Lake	G?	S2
Artificial Lake		
Natural Pond	G?	S2S3
Artificial Pond		
Stable Natural Pool	G?	S?
Ephemeral/Fluctuating Natural Pool	G?	S1

Appendix V (Cont.)

COMMUNITY NAME	GLOBAL RANK	STATE RANK
LACUSTRINE		
Artificial Pool		
Ephemeral/Fluctuating Limestone Sinkhole	G?	S1
PALUSTRINE COMMUNITIES		
Acidic Broadleaf Swamp	G5	S1S2
Circumneutral Broadleaf Swamp	G?	S2S3
Northern Circumneutral Broadleaf Swamp	G?	S1S2
Boreal Conifer Swamp	G?	S2
Northern Conifer Swamp	G?	S3S4
Broadleaf-Conifer Swamp	G?	S3S4
Floodplain Swamp	G?	S1
Calcareous Seepage Swamp	G?	S1
Acidic Shrub Swamp	G5	S3
Circumneutral Shrub Swamp	G?	S3
Graminoid Marsh	G?	S3
Robust Emergent Marsh	G?	S2
Mixed Graminoid-Robust Emergent Marsh	G?	S2S3
Calcareous Marsh	G?	S1
Glacial Bog	G?	S2S3
Nonglacial Bog	G?	S3
Reconstituted Bog		
Shrub Fen	G2G3	S1
Basin Graminoid-Forb Fen	G?	S1
Hillside Graminoid-Forb Fen	G?	S1
Circumneutral Seep Community	G?	S3?
Calcareous Seep Community	G?	S1
Acidic Seep Community	G?	S3?
Riverside Seep Community	G?	S2?
TERRESTRIAL COMMUNITIES		
Boreal Forest	G?	S?
Northern Conifer Forest	G5	S3S4
Northern Hardwood Forest	G?	S3S4
Northern Hardwood-Conifer Forest	G?	S3
Xeric Central Hardwood Forest	G?	S5

Appendix V (Cont.)

COMMUNITY NAME	GLOBAL RANK	STATE RANK	
Xeric Central Conifer Forest	G?	S3S4	
Xeric Central Hardwood-Conifer Forest	G?	S3	
Pitch Pine-Scrub Oak Barrens	G2G3	S1S2	
Dry-Mesic Acidic Central Forest	G?	S5	
Dry-Mesic Calcareous Central Forest	G?	S2S3	
Mesic Central Forest	G?	S2	Talus
Slope Forest	G?	S2?	
Coastal Plain Forest	G?	S1	
Floodplain Forest	G?	S2	
River Gravel Community	G?	S4S5	
Eastern Serpentine Barrens	G2	S1	
Appalachian Shale Barren	G?	S1	
Appalachian Sand Barren	G?	S?	
Boulder Field	G?	S5	
Calcareous Cliff Community	G?	S2	
Acidic Cliff Community	G?	S5	
Shale Cliff Community	G?	S2	
Riverside Outcrop Community	G?	S2S3	
Calcareous Riverside Outcrop Community	G?	S1	
Acidic Rocky Summit Community	G?	S1S2	
Calcareous Rocky Summit Community	G?	S1	
Lake Bluff Habitat	G?	S2	
Lake Sediment Slump	G?	S1	
Dune Habitat	G?	S1	
Upper Beach Habitat	G?	S1	
SUBTERRANEAN COMMUNITIES			
Solution Cave Terrestrial Community	G?	S3	
Solution Cave Aquatic Community	G?	S3	
Tectonic Cave Community	G?	S3S4	
Talus Cave Community	G?	S2S4	
DISTURBED COMMUNITIES			
Bare Soil			
Meadow/Pastureland			
Cultivated Land			
Successional Field			
Young Miscellaneous Forest			
Conifer Plantation			

APPENDIX VI

SITES REJECTED DURING INVENTORY

This table provides information concerning sites that were rejected during the course of the Erie County Natural Heritage Inventory. The rejected sites are listed alphabetically. The U.S.G.S. quadrangle on which the site is located is provided. Also provided is the "10/10" code for each site. The "10/10" code provides the general location of each site on the U.S.G.S. quadrangle by using the simple system of counting (approximately) from the top left hand corner of the map: 10 blocks over and 10 blocks down (x and y coordinates).

Sites	U.S.G.S. Quadrangle	10/10	Comments
Asbury Recreation Area	Swanville	06,05	Significant qualities absent.
Bear Run Gorge	Swanville	03,05	Too small; no buffer.
Beaver Run	Union City	10,05	Highly disturbed; too little buffer.
Beaver Run Headwater Wetland	Union City	08,05	Natural community common in state and county.
Black Cherry Tree Site	Wattsburg	unknown	Single tree does not correspond to site criteria.
Branchville Special Species Habitat	Edinboro North	10,03	PNDI data not current.
Brandy Run	Albion Fairview	09,01 09,10	Highly disturbed.
Brokenstraw Creek	Columbus	01,01	Highly disturbed; significant qualities absent.
Cemetery Road Bluff	Harborcreek	08,04	Bluff largely unvegetated.
City Limits Open Space	Erie North Erie South	09,10 09,01	Highly disturbed.
College Woods	Cambridge Springs NE	unknown	Too small.
Conneauttee Creek & Wetlands	Edinboro North	09,06	Significant qualities absent.
Corry Wetlands	Corry	08,05	Highly disturbed.
Cradle Knolls	Hammett	08,06	Highly disturbed.

Sites	U.S.G.S. Quadrangle	10/10	Comments
East Br. LeBoeuf Creek & Headwater Confluences	Hammett	08,06	Highly disturbed.
East City Line Forest	Erie North	08,06	Highly disturbed.
Four Mile Creek Headwaters	Hammett	02,03	Highly disturbed.
French Creek Dam Site	Union City	03,03	Significantly modified by presence of dam.
Glenwood Park Woods	Erie South	05,03	Insufficient buffer.
Grahamville Reservoir	North East	07,05	Man-made.
Greenfield Forested Ridge/State Game Lands #163	North East Wattsburg	02,09 03,01	Significant qualities absent.
Harborcreek Forested Lake Bluff Crest	Erie North	10,05	Highly disturbed.
Harborcreek Woods	Harborcreek	02,05	Highly disturbed.
Hare Creek Wetlands	Corry	09,03	Disturbed; significant qualities absent.
Hatch Hollow Wetland	Union City	05,04	Does not fit site criteria.
Headwaters of Cussewago Creek	Edinboro South	unknown	Woodland cut.
Hemlock Woods Edinboro	Edinboro South	10,03	Disturbed; significant qualities absent.
Howard Eaton Resevoir	North East	09,08	Man-made.
Iroquois Forested Wetland/Stream Site	Harborcreek	10,06	Highly disturbed.
Juva Road Heron Rookery	Waterford	unknown	Rookery abandoned & too small.

Sites	U.S.G.S. Quadrangle	10/10	Comments
Lawrence Park Township Park	Erie North	10,07	Too small.
LeBoeuf Creek Headwater Wetland	Waterford	04,05	Highly disturbed.
Lowville NW Depression	Wattsburg	01,06	Significant qualities absent.
Lowville SW Wetland	Wattsburg	03,08	Highly disturbed.
Jumbo Woods	Beaver Center	02,03	Significant qualities absent.
Laura Olsen Sanctuary	unknown	unknown	Located in Crawford County.
Erdman's Woods	unknown	unknown	Located in Crawford County.
Mallick Park	North East	09,05	Forest fragmented.
Mill Village Fossil Site	Waterford	unknown	Nor referenced in Geyer & Bolles (1987; 1979) or Hoskins et al. (1983).
Mill Village Special Species Habitat	Waterford	03,10	Not special species habitat.
Mt. St. Benedict Forest	Harborcreek	03,05	Disturbed.
Mitchell Lake NW Wetlands	Cambridge Springs	05,02	Disturbed; Man-made lake(?).
Mouth of Twenty Mile Creek	North East	08,01	Disturbed.
New Road Forest	Erie South	05,09	Forest fragmented.
Ravine Forest	unknown	unknown	Unable to locate.
(Rt.) 6N Forest	Albion	06,10	Too small.
Six Mile & Seven Mile Creeks Forested Headwaters	Hammett Harborcreek	08,01 09,10	Forest too young & fragmented.
Smith Resevoir	North East	05,06	Man-made.

Sites	U.S.G.S. Quadrangle	10/10	Comments
Special Species Habitat	Erie South	05,02	Developed.
Summit Township Conifer Stand	Erie South	10,04	Significant qualities absent.
Turk's-cap Lily Site	Swanville	09,06	Not species of special concern.
Twelve Mile Creek Gorge	North East	02,08	Significant qualities absent.
Union-LeBoeuf Road Heron Rookery	Millers Station	09,02	Rookery too small.
Wattsburg Fairgrounds Wetland/Stream Site	Wattsburg	05,09	Highly disturbed.
West Branch Conneaut Creek	Beaver Center	03,01	Insufficient buffer.
West Branch French Creek #2	Wattsburg	03,03	Highly disturbed.
Wheeler Town Road Swamp	Waterford	05,07	Highly disturbed.
Whitney Run Fen #1	Spartansburg	09,02	Highly disturbed.
Whitney Run Fen #2	Spartansburg Spring Creek	10,02 01,01	Significant qualities absent.

APPPENDIX VII

POTENTIAL SITES IDENTIFIED DURING INVENTORY

This table provides information concerning sites that were identified as potential natural heritage sites during the inventory, however, time constraints or inability to access these areas, in whole or in park, prevented their evaluation. The potential sites are listed alphabetically with the U.S.G.S. quadrangles on which they are located. The "10/10" code provides the general location of each site on the U.S.G.S. quadrangle by using the simple system of counting (approximately) from the top left hand corner of the map: 10 blocks over and 10 blocks down (x and y coordinates). The comments indicate features of interest regarding the site.

Sites	U.S.G.S. Quadrangle	10/10	Comments
Concord Corners NW Forest	Spartansburg	02,01	May contain area of mature forest.
Conneaut Creek Heron Rookery	Albion East Springfield	01,08 02,08	Reported rookery for species of special concern.
Cussewago Creek Headwaters	Edinboro North	03,06	May contain high diversity of habitats.
Cussewago Creek Wetland	Edinboro North	02,10	May contain high diversity of habitats.
Depot Road Forested Knoll	Harborcreek	06,10	Photo signature suggests unusual forest characteristics.
Dunn Valley North Forest	Erie South	03,08	May contain area of mature forest.
Dutchtown Fen	Waterford	02,09	May contain natural community of significance.
Edinboro Bog	Cambridge Springs NE	unknown	May contain natural community of significance.
Elk Creek Road Forest	Erie South	09,08	May contain mature forest.
French Creek Tributary Beaver Pond	Waterford	07,04	Unusual photo signature.
French Creek Tributary Headwater Swamp	Waterford	08,03	May contain natural community of significance.
Fringed Gentian Site	Swanville	05,03	May contain natural community of significance.

Sites	U.S.G.S. Quadrangle	10/10	Comments
Hatch Hollow Road Swamp/Woods	Union City	03,03	May contain high diversity area.
Hemlock Woods - State Game Lands #190	Waterford	09,04	Needs further investigation.
Hill Road SE - Forested Valley	Wattsburg	01,08	May contain high diversity of habitats.
Horton Run Wetlands	Lake Canadohta	01,01	May contain natural community of significance and/or high diversity of habitats.
I-90 Mature Second Growth Forest	Conneaut	10,04	Recommended as good example of mixed mesophytic hardwood forest.
Jamolowicz Field	Hammett	01,02	May be used as educational area/scientific area.
Kimble Hill Road Forest	Waterford	10,05	May contain area of mature forest.
Kuhn's Fen	Waterford	01,03	May contain globally rare natural community.
Langdon SW Forest	Erie South	09,04	May contain mature forest.
Marsh Creek Headwater Wetland	East Springfield	03,08	Ground survey needed.
Marsh Creek Lake	East Springfield	05,08	Ground survey needed.
McLaughlin Road Pond Wetlands 1 & 2	Cambridge Springs NE	03,04	Ground survey needed.
North East Spring	North East	unknown	Needs further investigation.
Pine Run Headwater Wetland	Union City	08,05	May contain natural community of significance; additional investigation needed.
Pine Run Wetland	Union City	08,08	May contain natural community of significance.
Prindle Road Forest	North East	01,09	May contain mature forest.

Sites	U.S.G.S. Quadrangle	10/10	Comments
Steadman's Fields	Cambridge Springs NE	01,02	Need additional investigation.
Summit Township Forest #1	Erie South	06,07	May contain mature forest.
Summit Township #2	Erie South	07,08	May contain mature forest; part of Forest Lee Road Woods BDA.
Thomas Run Ravine & Woods	Swanville	08,06	May contain natural community of significance.
Township Boundary Forested Plateau/Ravines	Harborcreek	09,07	May contain large, mature forest.
Tributary to Twelve Mile Creek Gorge	Harborcreek North East	10,06 01,06	Unusual photo signature.
Washington Township Forest	Cambridge Springs NE	02,05	May contain mature forest.
Weeks Valley Road Forest	Wattsburg	10,06	May contain highly diverse forest.
Weeks Valley Forest	Wattsburg	08,06	May contain mature forest.
West Alder Brook & Wetlands	Hammett Wattsburg	10,05 01,05	May contain high diversity of habitats.
West Branch Darrows Creek	Cambridge Springs NE	01,08	May contain high diversity area.
Wheeler Road Forest	Corry	05,03	May contain mature forest.
Winton Run Forested Wetland	Columbus	01,09	Unusual photo signature; may contain high diversity of habitats.

APPENDIX VIII

NATURAL HERITAGE PROGRAM & CONSERVATION DATA CENTER NETWORK

Natural Heritage Programs (NHPs) and Conservation Data Centers (CDCs) are continually updated, computer assisted inventories of the biological and ecological features and biodiversity preservation of the country or region in which they are located. These data centers are designed to assist in conservation planning, natural resource management, environmental impact assessment and planning for sustainable development.

The Network: Where are the NHPs and CDCs

There are now 85 data centers operating in the western hemisphere including all 50 U.S. states (most are called Natural Heritage Programs), several U.S. Bioreserves and National Parks, Puerto Rico, three Canadian provinces, and 13 countries in Latin America (CDCs) and the Caribbean. Regional centers provide administrative and technical support to the individual programs.

Each data center is established within a local institution, most frequently as part of a government agency responsible for natural resource management and protection. While individual centers are under local control and are staffed by local scientists and conservationists, they also operate within a network. Tasks that only need be done once for all the CDCs and Heritage Programs, are apportioned to one unit with the results shared throughout the network.

Methodology: How the NHPs and CDCs Work

Each data center uses the Biological and Conservation Data System as the basis for its operation, a system developed and refined by The Natural Conservancy since 1974. The information is managed in more than 30 interrelated computer files, supported by extensive map and manual files, and a library. A trained staff of biologists, natural resource specialists and data managers interprets the data for use in local conservation and development planning, natural resource management and environmental impact assessment.

Information assembled and managed by data centers focusses on: ecosystems and species, their biology, habitats, locations, conservation status and management needs, managed areas such as National Parks, Forest Reserves, and watersheds, and on data sources.

Each center compiles information from existing sources such as scientific literature, knowledgeable people, and museum collections. The local staff also directs and conducts field inventories of species and natural communities of special concern, or may be contracted for biological assessments of specific sites. Each study and report benefits from earlier work in the same area and, through the network, related information gathered at other times and places multiplies the local effort. Central network databases are supported through cooperative agreements with academic and scientific institutions.