ENVIRONMENTAL RESOURCE INVENTORY

for the TOWNSHIP of

MANNINGTON

SALEM COUNTY, NEW JERSEY

prepared by:

Delaware Valley Regional Planning Commission

with:

The Environmental Commission of Mannington Township

2007

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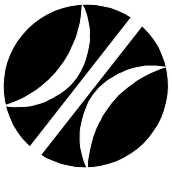
2007

Created in 1965, the Delaware Valley Regional Planning Commission (DVRPC) is an interstate, intercounty, and intercity agency that provides continuing, comprehensive, and coordinated planning to shape a vision for the future growth of the Delaware Valley region. The region includes Bucks, Chester, Delaware, and Montgomery counties, as well as the City of Philadelphia in Pennsylvania; and Burlington, Camden, Gloucester, and Mercer counties in New Jersey. DVRPC provides technical assistance and services; conducts high priority studies that respond to the requests and demands of member state and local governments; fosters cooperation among various constituents to forge a consensus on diverse regional issues; determines and meets the needs of the private sector; and practices public outreach efforts to promote two-way communication and public awareness of regional issues and the Commission.



The DVRPC logo is adapted from the official seal of the Commission and is designed as a stylized image of the Delaware Valley. The outer ring symbolizes the region as a whole while the diagonal bar signifies the Delaware River flowing through it. The two adjoining crescents represent the Commonwealth of Pennsylvania and the State of New Jersey. The logo combines these elements to depict the areas served by DVRPC.

DVRPC is funded by a variety of funding sources including federal grants from the U.S. Department of Transportation's Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) The Pennsylvania and New Jersey departments of transportation, as well as by DVRPC's state and local member governments. The authors, however, are solely responsible for this report's findings and conclusions, which may not represent the official views of policies of the funding agencies.

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This report was funded by the Association of New Jersey Environmental Commissions (ANJEC) Smart Growth Assistance Grant Program, funded by the Geraldine R. Dodge Foundation, and by the Township of Mannington. The authors are solely responsible for the report's findings and conclusions, which may not represent the official views or policies of the non-township funding agency.

Cover Photos: *Waldac Farm* by Ted Krohn; *Combine with Cornhead Reel* by Nicholas Culver; *Heron* by Nathaniel Culver; *Mannington Marsh* by S. McCarthy

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ACKNOWLEDGEMENTS

Many thanks are due to the organizations that provided funding for this *Environmental Resource Inventory for Mannington Township*. They are:

- The Association of New Jersey Environmental Commissions (ANJEC) Smart Growth Assistance Grant Program, funded by the Geraldine R. Dodge Foundation.

- The Township of Mannington

Township Committee, Township of Mannington

Mayor Donald C. Asay
Ernest F. Tark, Jr., Committeeperson
George B. Wright, Committeeperson

The impetus for the creation of this document, and its guidance and review, came from the Mannington Township Environmental Commission.

The Mannington Township Environmental Commission

Suzanne Culver, Chairperson
John Cameron
William Dolbow
Timothy Mangold
Russell Oakes, Secretary
William Wilson

Members of the Mannington Township Environmental Commission, Mayor Donald Asay, and Planning Consultant Linda Weber of Clarke Caton Hintz provided information and reviewed the Inventory in detail. Elizabeth Ciuzio of the New Jersey Audubon Society gave detailed information on the Mannington Meadows Important Bird Area. Both Clarke Caton Hintz and NJ Audubon Society provided maps that are included in the Inventory. Mary Hancock, Clerk of Mannington Township, was very helpful to the project at all times, as was Dominick J. Sassi of the Association of New Jersey Environmental Commissions (ANJEC).

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Much appreciation goes to Laura Ottoson, DVRPC intern and graduate student at the University of Pennsylvania, for outstanding work researching and preparing the basic draft document during her three-month internship with DVRPC.

The following DVRPC staff members made significant contributions to this report:

Suzanne McCarthy –Manager, Office of Environmental Planning – Writer and editor
Laura Ottoson, DVRPC Regional Planning Intern.
Kenneth Thompson – GIS Analyst
Becky Maule – Cover Design
Carl Barbee – Printing & Production

INTRODUCTION

The purpose of an Environmental Resource Inventory is to identify and describe the natural resources of a community. A community's natural resources – its soil, water, air, forests, fields, and waterways – are fundamental to its character. They are the foundation for its economic success and its quality of life. The protection and wise use of those resources is essential to the public health, safety, and welfare of current and future residents. The Environmental Resource Inventory provides the basis for the development of methods and steps to preserve, conserve, and utilize those resources.

Natural resources have influenced the lives of Mannington's inhabitants since early times. Long before European settlement, the area's streams and upland forests provided fishing and hunting grounds for the Native Americans that lived in Salem County. Native American villages also made good use of the region's rich agricultural soils, farming indigenous corn, tomatoes and peaches. European settlers took advantage of the area's high-quality agricultural soils, clearing the forest and cultivating grain, fruits and vegetables.

As development increases in and around Mannington, documentation of its natural resources has become a necessity, especially if it is to support future residents. Resources such as surface and ground water will become increasingly important to the residents of Mannington and neighboring communities. Mannington's water, wetlands, forests, and grasslands provide significant habitat for a wide variety of plants and animals. The quality of these areas is important in maintaining the health and vitality of the township. With a detailed knowledge of these resources, Mannington's citizens will be able to balance the pressures of growth with conservation, maintaining and shaping their community's identity and the sense of place it provides.

Preparing an Environmental Resource Inventory requires gathering all the existing information that can be found about a township's resources, and presenting it in a form that is useful to a broad audience. The inventory reflects a particular moment in time, and it is assumed that it will be updated as new data becomes available.

Several documents and reports were utilized in preparing the *Environmental Resource Inventory for Mannington Township*. These reports and a number of reference works are listed at the end of this document.

The maps and data relating to natural resources are derived from the New Jersey Department of Environmental Protection's (NJDEP's) Geographic Information System mapping, from *The Landscape Project* produced by the Endangered and Nongame Species Program of the New Jersey Fish and Wildlife Division, from New Jersey Audubon Society data, and from mapping data compiled and prepared by the Delaware Valley Regional Planning Commission (DVRPC).

Source: DVRPC

Mannington Township's Municipal Building
with the Elementary School in the background

BRIEF HISTORY

Humans have been present in the Mannington area for about ten thousand years. The Ware archeological site on the banks of the Salem River in Mannington, which was occupied by early people even in late prehistoric times, has produced thousands of artifacts. Some of the artifacts found at this location also indicate that Native Americans still inhabited the site when Europeans arrived in the area.

At the time of European arrival, the American Indian name for the region extending from southeastern New York and western Long Island to southeastern Pennsylvania and northern Delaware was Lenapehoking. Those who inhabited that land are today referred to as the Lenape. The native residents formed not one, but many tribes in the land that would become the state of New Jersey.

American Indians were hunting, fishing, and growing crops in southern New Jersey when Swedish and Finnish settlers arrived in the Delaware Valley. (Finland was at that time part of Sweden.) In 1638 the Swedes established a colony at the confluence of the Delaware River and Raccoon Creek and then settled throughout the region.

English Quakers, led by John Fenwick, arrived in the Mannington area in November of 1675. Fenwick founded Fenwick Colony, which today is known as Salem and Cumberland counties. He intended it to be a democratic colony based on Quaker beliefs, and actually planned several towns. Mannington was originally called East Fenwick, a name that appears on a 1679 deed. East Fenwick was renamed Maneton by 1701. In 1798 the township was formally incorporated. Mannington borders changed in 1873 when a portion of the township was transferred to Quinton.

Less than a quarter century after Fenwick's arrival, various infrastructure projects were ongoing in the colony. King's Highway, running from Salem to Burlington, was under construction in 1682. The road originally followed ridges and other high ground in order to avoid swamps and marshes. Later the road was rebuilt and straightened. Salem's first water-powered gristmill was built in 1692, and other such mills were built in the township over the next two centuries. In 1697 legislation authorized the construction of tide banks. Residents spent much time repairing ditches and banks that were damaged by tides and muskrats. Another water project in the township's early history was the construction of Denn's Canal in 1820, which shortened travel on the Salem River by two miles. By the 1890s, Denn's Canal was no longer in use due to silting problems. An alternative to water transportation arrived in 1863 when the railroad came through Mannington, providing service from Salem City to Camden. With the twentieth century expansion of automotive travel, the need for passenger rail service declined. Consequently, the Salem passenger depot was torn down in 1944. Today, trains in Mannington move only freight.

Before the arrival of European settlers, Mannington was almost entirely an oak-hickory forest. By 1880, 207 farms covered the landscape. Crops were often transported by water, loaded onto boats from river landings at each farm. According to the 1820 census, farms in the township produced wheat, corn, oats, potatoes, and flax. In the middle of the nineteenth century, three nurseries also operated in Mannington, supplying fruit and shade trees as well as plants.

Other industries also operated in the township. Marl, a valuable fertilizer rich in calcium and carbonated lime, was discovered in Mannington in 1836. One marl pit produced an exciting find when a marl worker unearthed a mastodon skeleton near Swedes' Bridge in 1869. This skeleton is now housed in Rutgers University's Geology Hall. In addition, phosphate was manufactured in Quaker Neck in the 1880s, and limekilns operated at the back of Hedgefield, on Fenwick Creek in Claysville, and in other locations. Mannington was also home to several distilleries that manufactured liquors from apple cider. After a fire destroyed the Mannington Mills plant in Salem City, the company opened a new facility in Mannington in the 1920s. By 1964 the company employed about 600 people. Currently Mannington Mills operates plants in three other states, in addition to New Jersey. Workers manufacture resilient flooring at the Mannington facility.

Twentieth century developments brought county services and new transportation options to Mannington as the township continued agricultural traditions. Salem County opened several facilities in the township, including the Memorial Hospital of Salem County and the Salem County Nursing Home. In 1951, the completion of the New Jersey Turnpike and the Delaware Memorial Bridge increased access to and from the township.

Today Mannington remains a rural community. Modern highways provide residents and visitors with routes to and from the township. Mannington Mills still manufactures flooring products and transports freight via rail through the township. Residents can access county health and education services located in the municipality. While educational, health and social services industries employ the greatest number of Mannington residents (25%), agriculture continues to dominate the township's landscape and remains the primary land use in the township.

Photo by David Culver

Mount Zion African Methodist Episcopal Church.
The congregation was founded in 1807 and became part of the African Methodist Espiscopal (AME) movement around 1815. This is the third church building used by the congregation and dates from approximately 1921.

MANNINGTON TOWNSHIP: LOCATION, SIZE, & LAND USE

Mannington, an incorporated township, is located in the middle of Salem County, New Jersey. The township is bounded by six Salem County municipalities: Pilesgrove and Carneys Point townships to the north, Pennsville Township to the west, Salem City to the south, Quinton Township to the southeast, and Alloway Township to the east. The Salem River forms a large portion of Mannington's northern and western borders. See **Map 1A: Base Map** and **Map 1B: Aerial (2002).**

The 1990 U.S. Census lists a population of 1,693 residents for Mannington Township. By the 2000 Census, Mannington's population had decreased by 7.9 percent to 1,559 residents. The largest population drop between 1990 and 2000 was in the group-quarters population,[1] which decreased from 258 to 140 persons within the decade. The household population of the township declined by only 16 persons, or 1.1 percent of the 1990 population.

Mannington Township occupies 24,427 acres or 38 square miles. It lies on the coastal plain of New Jersey. Mannington's land use reflects its natural setting and its long agricultural past. Most of the township remains rural today. Residential development is scattered throughout Mannington, with a concentration of residences along State Route 45 near Salem City.

Before European settlement, an oak-hickory forest covered most of Mannington. Although large portions of that forest are now gone, 7.1 percent of Mannington Township remains forested. Given the good soils in Mannington, it is not surprising that as of 2002, 55.5 percent of the township's land area was dedicated to agricultural uses. Water and wetlands constitute 30.2 percent of the township land.

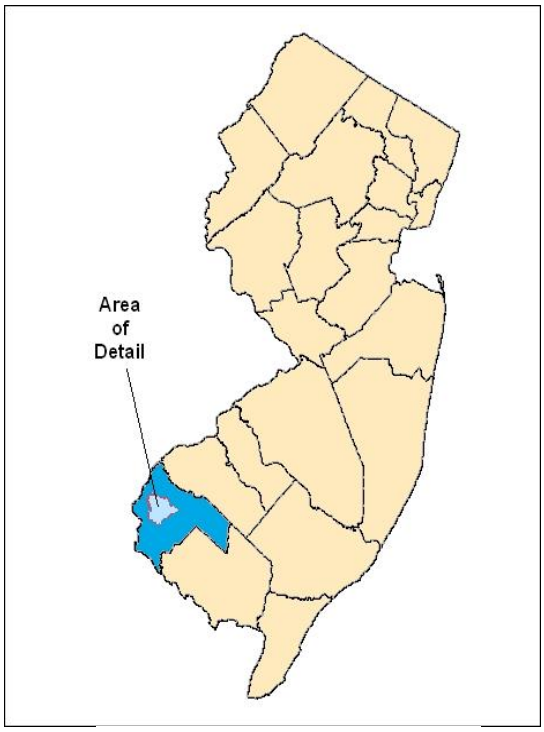
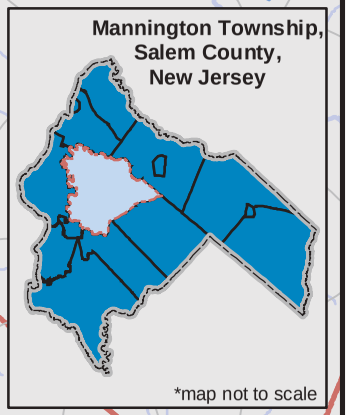


Figure 1. Location of Mannington Township

Table 1. shows Mannington's land use/land cover grouped into general categories. The categories are based on data collected from the New Jersey Department of Environmental Protection's (NJDEP's) 2002 color infrared digital imagery.

[1] The U.S. Census Bureau defines the group-quarters population as those people not living in housing units. The bureau further categorizes those living in group quarters as institutionalized and noninstitutionalized. The institutionalized population includes people classified as patients or inmates who are generally under the supervision of trained staff and have restricted interaction with the surrounding community. Hospitals and prisons are examples of facilities that house institutionalized group-quarters populations. The noninstitutionalized group-quarters population includes people living in group homes, convents, college dormitories, and military barracks, as well as the staff residents of institutions.

Mannington Township



Stream
Lake
Municipality

Source : NJDEP,NJDOT,DVRPC.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

Map 1A: Base Map

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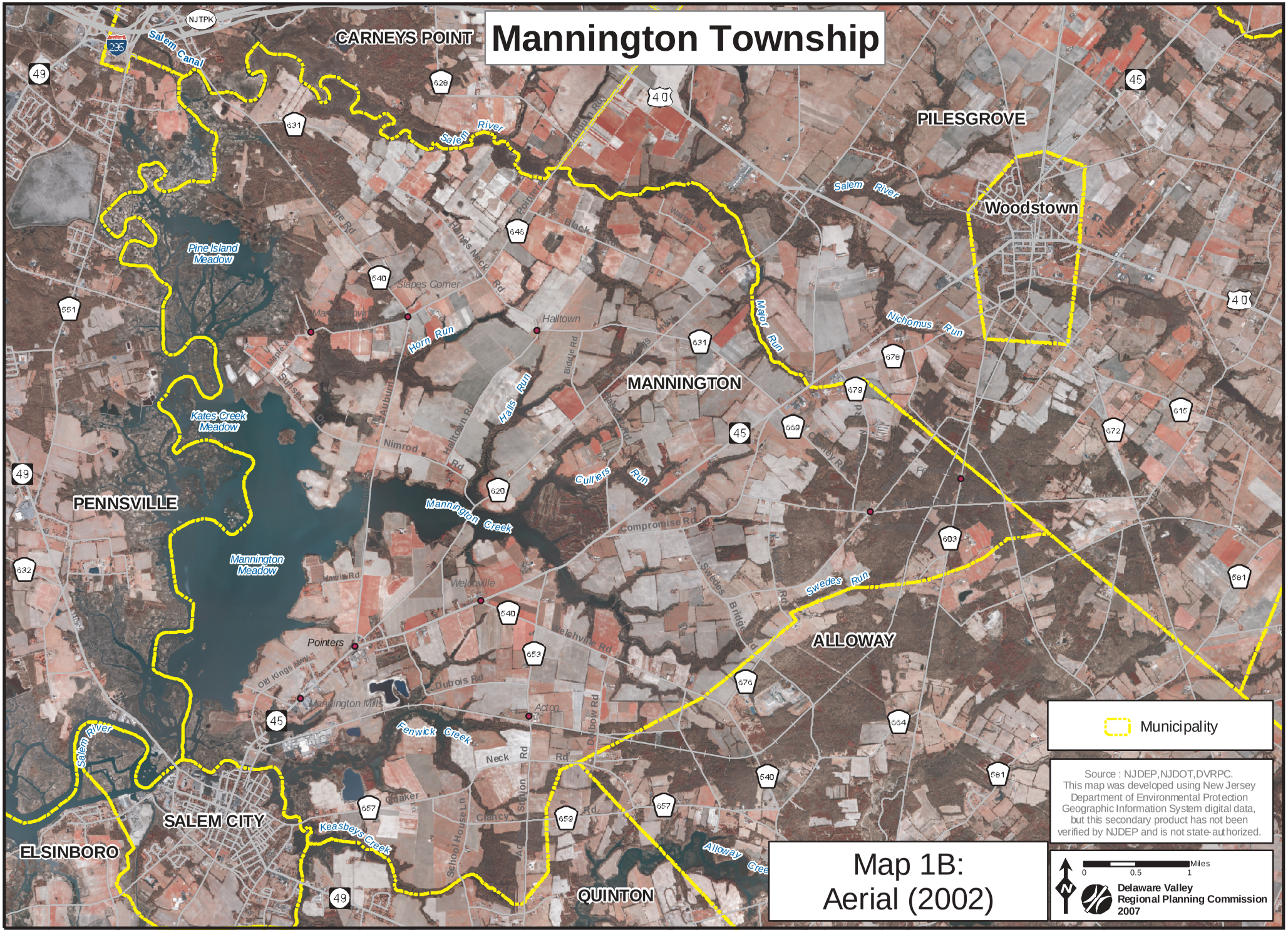
Mannington Township
CARNEYS POINT
PILESGROVE
Woodstown
MANNINGTON
PENNSVILLE
ALLOWAY
SALEM CITY
ELSINBORO
QUINTON
Salem Canal
Salem River
Pine Island Meadow
Kates Creek Meadow
Mannington Meadow
Mannington Creek
Fenwick Creek
Keasbeys Creek
Alloway Creek
Horn Run
Halls Run
Culliers Run
Major Run
Nichomus Run
Swedes Run
Halltown
Slapes Corner
Welchville
Pointers
Mannington Mills
Acton
Municipality
Source : NJDEP,NJDOT,DVRPC.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
Map 1B:
Aerial (2002)
Miles
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Delaware Valley Regional Planning Commission
2007

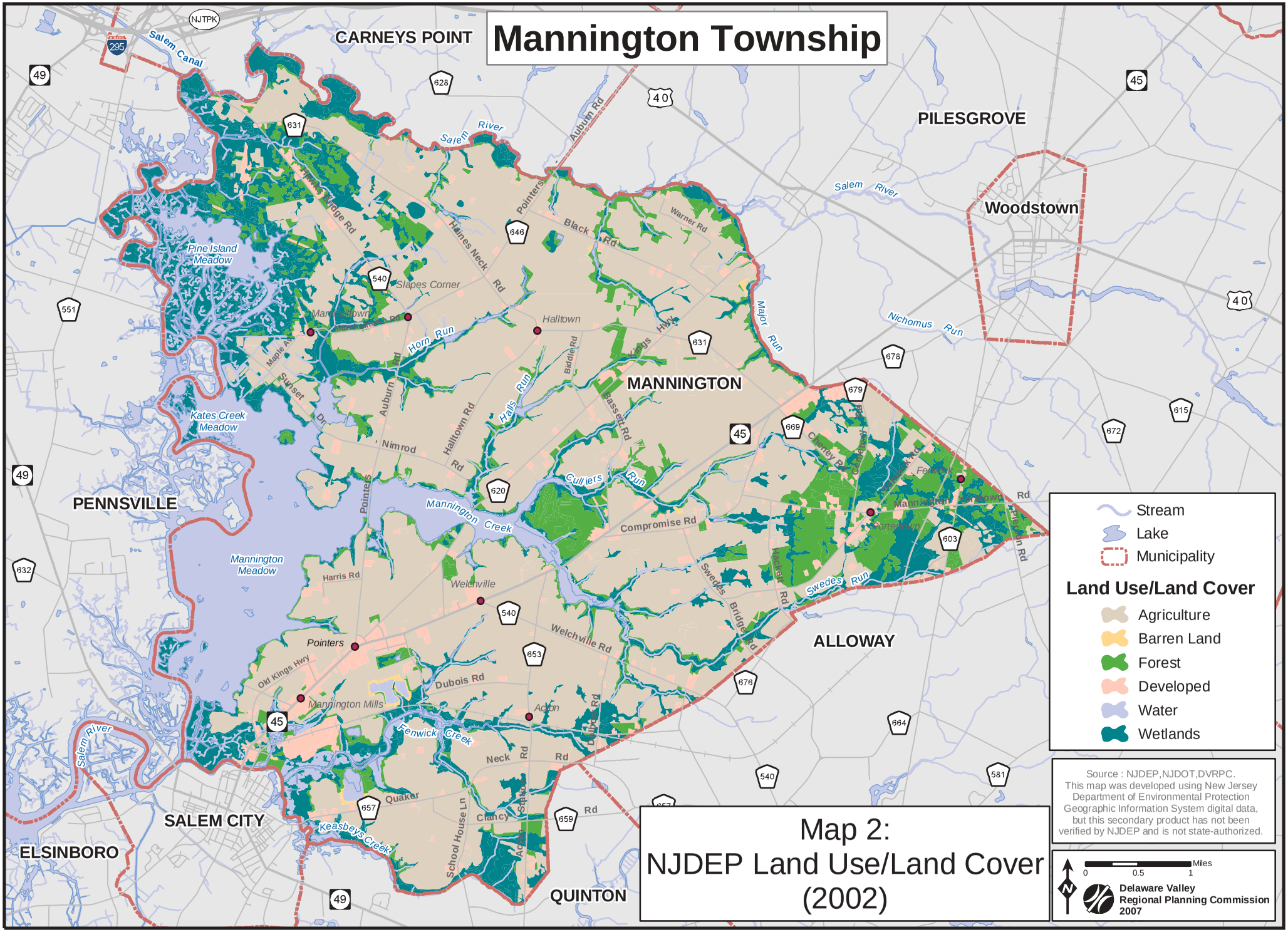

Mannington Township
CARNEYS POINT
PILESGROVE
Woodstown
MANNINGTON
PENNSVILLE
ALLOWAY
SALEM CITY
ELSINBORO
QUINTON
Salem River
Salem Canal
Mannington Creek
Nimrod Rd
Halltown Rd
Compromise Rd
Welchville Rd
Dubois Rd
Neck Rd
Fenwick Creek
Keasbey Creek
Swedes Run
Culliers Run
Halls Run
Horn Run
Major Run
Nichomus Run
Pine Island Meadow
Kates Creek Meadow
Mannington Meadow
Slapes Corner
Halltown
Welchville
Pointers
Mannington Mills
Acton
Fenwick
Stream
Lake
Municipality
Land Use/Land Cover
Agriculture
Barren Land
Forest
Developed
Water
Wetlands
Source : NJDEP,NJDOT,DVRPC.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
Map 2:
NJDEP Land Use/Land Cover
(2002)
Miles
0
0.5
1
Delaware Valley
Regional Planning Commission
2007

Table 2. breaks down the 2002 general land use/land cover categories into detailed land cover categories. See also **Map 2: Mannington NJDEP Land Use/Land Cover (2002)**

Table 1: Mannington General Land Use/Land Cover Classes (2002)

General Land Use/ Land Cover Class	Acres	Percent
Agriculture	13,557.7	55.50%
Wetlands	4,012.6	16.43%
Water	3,362.8	13.77%
Forest & brushland	2,334.9	9.56%
Urban	1,132.7	4.64%
Barren Land	26.6	0.11%
TOTAL	**24,427.3**	**100.00%**

Source: NJDEP, Bureau of Geographic Information System

Table 2: Mannington Township Detailed Land Use/Land Cover (2002)

Land Use Categories	Acres	Percent (%) of Total Land Area
Agriculture - Confined feeding operations	27.84	0.11
Agriculture - Cropland and pastureland	12,684.98	51.93
Agriculture - Other	301.49	1.23
Agriculture Wetlands (modified/drained wetlands)	465.41	1.91
Altered Lands	1.32	0.01
Artificial Lakes	163.16	0.01
Athletic Fields (schools)	6.46	0.03
Brush/Shrubland - Coniferous	33.60	0.14
Brush/Shrubland - Deciduous	85.20	0.35
Brush/Shrubland - Mixed	325.20	1.33
Commercial/Services	101.02	0.41
Extractive Mining	26.64	0.11
Forest - Coniferous	27.98	0.11
Forest - Deciduous	1,620.68	6.63
Forest - Mixed (> 50% deciduous)	31.03	0.13
Forest - Mixed (> 50% coniferous)	55.34	0.23
Industrial	65.72	0.27
Modified Wetlands (disturbed wetlands)	15.00	0.06
Modified Wetlands (former agricultural)	12.67	0.05
Modified Wetlands (right-of-way)	42.70	0.17
Modified Wetlands (managed in maintained lawn)	14.06	0.06
Old Field (< 25% brush covered)	155.85	0.64
Orchards/vineyards/nurseries/horticultural areas	62.59	0.26
Plantation	15.38	0.06
Recreational Land	32.34	0.13

Land Use Categories	Acres	Percent (%) of Total Land Area
Residential (rural, single unit)	594.90	2.44
Residential (single unit, low density)	141.21	0.58
Residential (single unit, medium density)	20.75	0.08
Streams and Canals	2.64	0.01
Tidal Waters	3,196.96	13.09
Transport/Communication/Utilities	66.13	0.27
Urban	87.83	0.36
Urban or Built-Up Land - Other	14.91	0.06
Wetlands - Herbaceous	1,055.59	4.32
Wetlands (coniferous wooded)	0.62	0.00
Wetlands (deciduous wooded)	1,886.63	7.72
Wetlands (freshwater tidal marsh)	589.99	2.42
Wetlands (mixed scrub/shrub, coniferous dominated)	3.83	0.02
Wetlands (mixed scrub/shrub, deciduous dominated)	32.21	0.13
Wetlands (scrub/shrub, coniferous dominated)	2.77	0.01
Wetlands (scrub/shrub, deciduous dominated)	356.57	1.46
Totals	**24,427.21**	**100.00**

Source: NJDEP, Bureau of Geographic Information System

Source: Brian Marsh

Land in Mannington Township along Mannington Meadows

NATURAL RESOURCES

PHYSIOGRAPHY

Physiography is the study of a location in relation to its underlying geology. New Jersey is characterized by four physiographic provinces. The rocky terrain of the Appalachian Province is at one extreme and the sands of the coast are at the other. Mannington is located in the Coastal Plain, the southernmost of these four provinces in New Jersey.

Figure 2. The Physiographic Regions of New Jersey

The Atlantic Coastal Plain landscape extends from Massachusetts to Texas and is divided into Inner and Outer sections. In New Jersey, the Inner Coastal Plain is made up of interbedded sand and clay. Deposits originating in the breakdown of Appalachian and Catskill sedimentary, metamorphic, and igneous rocks are interbedded with layers formed by oceanic (marine) deposition, which occurred as the ocean shoreline advanced and receded over geologic time. The Inner Plain layers date from the Cretaceous Period, 135 to 65 million years ago. Generally, soils of the Inner Coastal Plain are quite fertile.

The Outer Coastal Plain was formed more recently than the Inner Coastal Plain. It was laid down by the ocean and developed during the mid-to-late part of the Cenozoic Period, 65 million years ago to the present. Outer Coastal Plain soils are sandier and less fertile than those of the Inner Plain and do not hold water as well.

In the general vicinity of the dividing line between the two segments of the Coastal Plain is a belt of low hills, which runs northeast and southwest through the southern half of New Jersey. These hills are the youngest of the Cretaceous formations and are largely made up of sand and marl formations. The hills taper to fairly low elevations in Gloucester County but are visible in the Mullica Hill area. They are less visible in Salem County but do contribute to the slightly rolling landscape. The Inner Coastal Plain lies to the west of this band of hilly formations and the Outer Coastal Plain lies to the east.

Mannington straddles the divide of the Inner and Outer coastal plains. Although portions of Mannington are in the Outer Coastal Plain, most of the township's soils are generally regarded as highly productive agriculturally. This is because the drop in soil fertility between the Inner and Outer coastal plains is not immediate, but changes gradually moving from west to east across the Outer Coastal Plain.

TOPOGRAPHY AND SURFACE LANDSCAPES

Mannington Township is dominated by wetlands, water, and quality agricultural soils. Most wetlands occur adjacent to the Salem River and its tributaries that flow across the township. Deciduous wooded wetlands flank streams throughout Mannington, and freshwater tidal marshes border meadows and streams in the western portion of the township. Mannington's upland areas are characterized by rich soils that once supported extensive oak forests. Today, deciduous upland forests grow mainly in the eastern corner of the township, and agriculture dominates the landscape.

A few steep slopes are found along streams and rivers, particularly around the Salem River and a few of its tributaries in the north. Steep slopes are also associated with streams such as Mannington Creek and an unnamed tributary of Culliers Run, as well as rises like Big Mannington Hill. River channels are, in general, relatively flat (as in all of southern New Jersey). The valleys of some of these creeks are as low as sea level as they enter Mannington Meadows.

The western half of Mannington Township is fairly flat and low in altitude. Elevations range from zero to about 35 feet above sea level. Moving east, Mannington's topography increases in elevation. Land is generally between 50 and 75 feet in elevation in the northeast, with hilltops over 100 feet above sea level; Big Mannington Hill reaches over 120 feet above sea level. The southeastern section of Mannington, generally below Compromise Road, is lower in elevation than the northeastern portion and only occasionally does land reach elevations above 50 feet.

SOILS

Soil is the foundation for all land uses. A region's soil defines what vegetation is possible, influencing agricultural uses. It also determines how land can be developed for other purposes. Soil is also a natural resource that cannot be replenished on the human time scale.

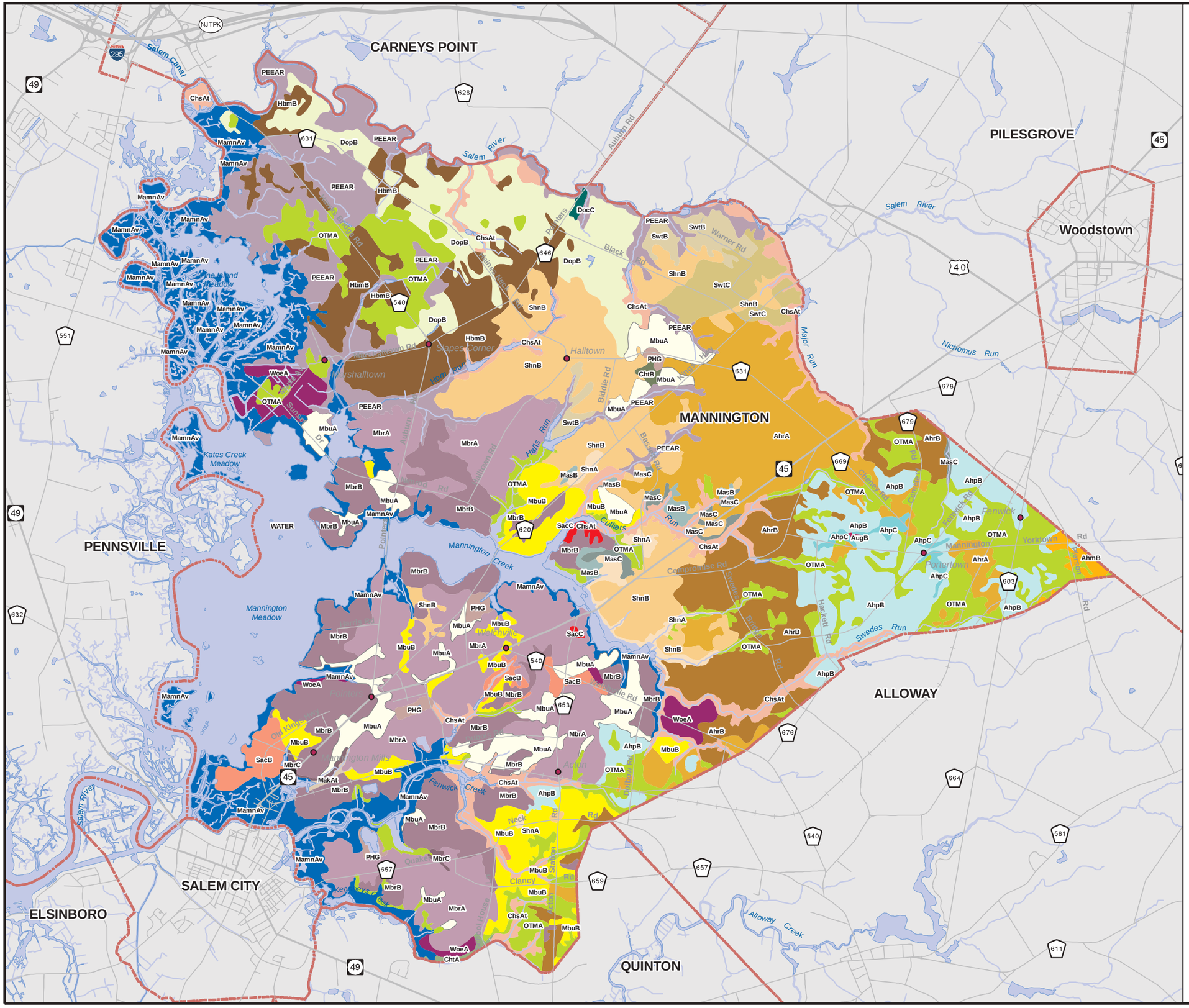
Mannington Township soils consist of 18 series types and 30 variations within those series as identified by the U.S. Department of Agriculture's Natural Resources Conservation Service. These are listed in **Table 4: Mannington Township Soils** (page 21and shown on **Map 3: Mannington Soils**.

Soil Quality Classification

State and national agricultural agencies classify farmland soils into several categories. Mannington contains Prime Farmland soils, Soils of Statewide Importance, and Unique Farmland soils. The majority of Mannington's land, 62.9 percent, is rich, arable, and valuable soil. Each category of farmland is explained on the following pages. See **Table 3: Mannington Soils** for the acreage in each category and **Map 4**: **Agricultural Quality of Soils.**

Mannington Township

Map 3:
Mannington Soils



Soil Type

- AhmB, Alloway sandy loam, 2 to 5 percent slopes
- AhpB, Alloway loam, 2 to 5 percent slopes
- AhpC, Alloway loam, 5 to 10 percent slopes
- AhrA, Alloway silt loam, 0 to 2 percent slopes
- AhrB, Alloway silt loam, 2 to 5 percent slopes
- AugB, Aura sandy loam, 2 to 5 percent slopes
- ChsAt, Chicone silt loam, 0 to 1 percent slopes, frequently flooded
- ChtA, Chillum silt loam, 0 to 2 percent slopes
- ChtB, Chillum silt loam, 2 to 5 percent slopes
- DocC, Downer loamy sand, 5 to 10 percent slopes
- DopB, Downer-Galestown complex, 0 to 5 percent slopes
- HbmB, Hammonton loamy sand, 0 to 5 percent slopes
- MakAt, Manahawkin muck, 0 to 1 percent slopes, frequently flooded
- MamnAv, Mannington-Nanticoke complex, 0 to 1 percent slopes, very frequently flooded
- MasB, Marlton silt loam, 2 to 5 percent slopes
- MasC, Marlton silt loam, 5 to 10 percent slopes
- MbrA, Matapeake silt loam, 0 to 2 percent slopes
- MbrB, Matapeake silt loam, 2 to 5 percent slopes
- MbrC, Matapeake silt loam, 5 to 10 percent slopes
- MbuA, Mattapex silt loam, 0 to 2 percent slopes
- MbuB, Mattapex silt loam, 2 to 5 percent slopes
- OTMA, Othello, Fallsington, and Trussum soils, 0 to 2 percent slopes
- PEEAR, Pedricktown, Askecksy, and Mullica soils, 0 to 2 percent slopes, rarely flooded
- PHG, Pits, sand and gravel, ; PHG, Pits, sand and gravel
- SacB, Sassafras sandy loam, 2 to 5 percent slopes
- SacC, Sassafras sandy loam, 5 to 10 percent slopes
- ShnA, Sharptown silt loam, 0 to 2 percent slopes
- ShnB, Sharptown silt loam, 2 to 5 percent slopes
- SwtB, Swedesboro loamy sand, 0 to 5 percent slopes
- SwtC, Swedesboro loamy sand, 5 to 10 percent slopes
- WATER, Water
- WoeA, Woodstown sandy loam, 0 to 2 percent slopes

Source : NJDEP, NJDOT, DVRPC, NRCS.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

0 0.5 1 Miles

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2007

Mannington Township

Map 4: Agricultural Quality of Soils

Soil Designation

- P-1 -Prime Farmland
- S-1 -Farmland of Statewide Importance
- U-1 -Farmland of Unique Importance
- NA -Not Rated for Agricultural Use
- WATER

Source : NJDEP, NJDOT, DVRPC, NRCS.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

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Delaware Valley Regional Planning Commission 2007

Prime Farmland Soils

The most abundant of all soils in Mannington are those classified as Prime Farmland soils. About 50 percent (12,245 acres) of Mannington's soils are considered Prime Farmland (P-1) soils. Prime Farmlands are lands that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. They can sustain high yields of crops when managed with correct farming methods. Prime Farmlands are not excessively erodible or saturated with water for long periods of time and do not flood frequently.

The USDA outlines specific criteria for Prime Farmland classification. For example, according to Prime and Unique Farmlands federal regulations (7 CFR Part 657), soil horizons within a depth of 40 inches (or within the root zone if the root zone is less than 40 inches) must have a pH between 4.5 and 8.4. The soils must have a mean average temperature above 32 degrees Fahrenheit at a depth of 20 inches. The USDA outlines additional Prime Farmland requirements for mean summer soil-temperature, erodibility factor, water table depth, permeability rate, and more. When identifying qualifying prime soil mapping units within a state, state conservationists are allowed to deviate from the permeability standard or to adopt more stringent criteria for the other requirements.

Land classified as Prime Farmland does not have to be farmed but does have to be available for such use. Thus, water or urban or built-up land does not qualify as Prime Farmland.

Soils of Statewide Importance

Almost 13 percent (3,118 acres) of Mannington's soils are classified as Soils of Statewide Importance (S-1). These soils are close in quality to Prime Farmland and can sustain high yields of crops when correctly managed under favorable conditions. Under such favorable conditions, these yields may be as high as Prime Farmland yields.

Criteria for establishing Soils of Statewide Importance are determined by state agencies. In New Jersey, soils with a capacity class of II or III that do not meet prime farmland criteria are rated as Soils of Statewide Importance.

Unique Farmland Soils

Eight percent (1,954 acres) of Mannington's soils are ranked as Unique Farmland (U-1) soils. Certain soil qualities, locations, growing seasons, and moisture supplies allow Unique Farmland to support specific specialized crops when properly managed. The USDA outlines specific Unique Farmland criteria: Unique Farmland exhibits specific conditions, including temperature, humidity, air drainage, elevation, aspect, or nearness to market, that support a particular food or fiber crop. In order for lands to be classified as Unique Farmland, the land must also be used for a specific high-value food or fiber crop and have an adequate moisture supply for that crop.

Soils Not Rated

Several of the soils that are present in Mannington have not been rated for agricultural use by the Natural Resource Conservation Service (NRCS) and are labeled "NR." These soils may be best suited for uses other than agricultural crops or they may simply not yet have been assessed for quality by NRCS. NRCS created all the Soil Quality Classifications in 1990 but in 2005 the agency created several new subtypes of soils, which are not yet rated for agricultural use. Soils

that are not rated are not necessarily limited. Each soil's land capability class and subclass describe how the soil is limited with respect to different uses, and for what reasons the soil is limited. (See inset box on page 17.)

Table 3: Agricultural Values for Mannington Soils

Designation	Type	Acres	Percent
P-1	Prime Farmland	12,244.6	50.1%
S-1	Statewide Importance	3,118.4	12.8%
U-1	Unique Farmland	1,954.1	8.0%
NR	Soils not classified for farmland use: wet soils, pits, steep slopes, made land, etc.	3,987.2	16.3%
Water	Water	3,123.0	12.8%
Totals		**24,427.2**	**100.0%**

Source: NJ Important Farmlands Inventory, USDA Natural Resources Conservation Service

Photo by Nicholas Culver

Mannington Township has some of the richest soils in New Jersey

Hydric Soils

More than 25 percent of Mannington's soils are considered hydric soils. Hydric soils, as defined by the National Technical Committee of Hydric Soils, are soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in their subsurface, and they support the development of hydrophytic vegetation only. Hydric soils have unique soil properties, and they are an important element to wetland areas. If a soil is classified as "hydric," land use may be restricted due to the relationship of hydric soils to the definition of wetlands and laws regarding wetland preservation. More detailed descriptions of Mannington's wetland areas are found in the *Natural Resources* section, under "Wetlands" and "Agricultural Wetlands," page 31-33, and the *Biological Resources* section, under "Wetlands," pages 60-62.

Soil Series

Several soil series appear more frequently in Mannington than others, and are briefly described as follows according to the Salem County Soil Survey and NCRS soil database.

Alloway Series

The Alloway soil series, previously mapped in Salem County as the Keyport series, accounts for about 17 percent of all soils in Mannington (4,100 acres). The soil series consists of very deep, moderately well drained soils on uplands. These soils formed in Coastal Plain sediments. Typically, Alloway soils can be found in the form of cultivated silt loams. The permeability of Alloway soils is slow. Depth to the seasonal high water table for the Alloway series is between 1.5 and 3.5 feet. Most Alloway soils have been cleared for farming or general crops, hay, and pasture. However, the natural vegetation that still exists consists mostly of oaks, beech, hickory, sweet gum, and yellow poplar.

Alloway soils in Salem County are classified as Prime Farmland depending on slope. (Capability Class II or III depending on slope and other variables)

Matapeake Series

The Matapeake soil series accounts for about 16 percent of all soils in Mannington (3,990 acres). The series consists of very deep, well-drained soils on upland interfluves and side slopes. The permeability of Matapeake soils ranges from moderate to moderately slow. Depth to the seasonal water table is usually greater than 6 feet, although in soils below 25 feet of elevation the water table depth may be between 4 and 6 feet. Typically, Matapeake soils are cultivated with such crops as corn, soybeans and small grains. Occasionally the soils are irrigated. Native vegetation includes oaks. Loblolly, Virginia, or shortleaf pine may also grow in cutover areas.

Matapeake silt loam in Salem County is classified as Prime Farmland or Soil of Statewide Importance depending on slope. (Capability Class I, II, or III depending on slope)

Mannington-Nanicoke Complex Series

The Mannington-Nanicoke Complex soil series accounts for about 8 percent of all soils in Mannington (1,939 acres). Mannington soils are very deep, very poorly drained, hydric soils. Typically, Mannington soils can be found in freshwater tidal marshes by rivers and streams

Capability Class

I – Soils have few limitations that restrict their use.

II – Soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

III – Soils have severe limitations that reduce the choice of plants, require very careful management, or both.

IV – Soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

V – Soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, woodland, or wildlife habitat.

VI – Soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, woodland, or wildlife habitat.

VII – Soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture, woodland, or wildlife habitat.

VIII – Soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or to aesthetic purposes.

affected by the tide. The permeability of the Mannington series is classified as moderately slow or moderately rapid to rapid depending on the soil layer. Depth to the seasonal high water table is half a foot or less. The soil is primarily used as wetland wildlife habitat. Native vegetation includes sweet flag, arrow arum, splatterdock, and pickerelweed. If farmed, the soil is Unique Farmland. (Capability Class VIII)

Nanicoke soils consist of very deep, very poorly drained, hydric soils on tidal marshes and floodplains. The permeability of Nanicoke soils is moderately slow. Depth to the seasonal high water table is 0 to 6 inches. Nanicoke soils, like the Mannington series, are used as wetland wildlife habitat. Natural vegetation includes splatterdock, arrow arum, arrowhead, and pickerelweed. The soil is classed as Unique Farmland, if farmed. (Capability Class VIII)

Othello, Fallsington, and Trussum Series

The Othello, Fallsington, and Trussum series soils comprise about 8 percent of all soils found in Mannington (1,899 acres). The complex is considered Soil of Statewide Importance, and the soils have a capability class of III.

Othello soils, located extensively along the western side of Salem County, are very deep, poorly drained hydric soils. Typically, Othello soils can be found in the form of cultivated silt loams. The permeability of the Othello series can be classified as moderately slow and, consequently, these soils have a high water-holding capacity. The seasonal high water table is less than one foot deep. Much of Othello acreage is idle or woodland, supporting natural vegetation consisting mostly of wetland oak, red maple, and sweetgum. Othello soils are wet in the springtime when crops are planted and are also usually wet in the fall when harvesting occurs. However, with adequate drainage, some is used to grow hay, corn, and soybeans or used for pasture. Othello soils are very suitable for ponds – irrigation, recreation, or wildlife habitat.

Fallsington soils are also very deep, poorly drained hydric soils. These soils were formed from loamy marine and old alluvial sediments. The permeability of Fallsington soils ranges from moderate to moderately slow. The depth to the seasonal high water table is 0 to 12 inches. Fallsington soils are mainly used for cultivation of crops such as corn, soybeans, or small grains, as well as for pasture. White oak, water oak, willow oak, swamp or red maple, sweet gum, holly, greenbriar, and pond pine dominate in wooded areas, and loblolly pine does grow in areas no longer in cultivation.

Trussum soils are very deep, poorly drained, hydric soils. These soils were formed from clayey marine sediments and are found in low-lying uplands, interfluves, terraces, and shallow depressions. Trussum soils have slow permeability. Like Othello and Fallsington soils, depth to the seasonal high water table is less than a foot. Trussum soils are mainly woodlands: red maple, sweetgum, blackgum, and willow oak dominate the upperstory, while American holly, sweetbay, greenbriar and highbush blueberry occupy the understory. Crops such as corn and soybeans are grown on a few artificially drained locales.

Sharptown Series

The Sharptown soil series makes up almost 8 percent of all soils in Mannington (1,858 acres). Sharptown soils are very deep, moderately well drained soils. These soils were formed from silty eolian deposits that were underlain by loamy marine sediments containing glauconite.

Typically, Sharptown soils can be found on marine terraces. The permeability of Sharptown soils ranges from moderate in the subsoil to moderately slow in the underlying material. Depth to the seasonal high water table is 1.5 to 3.5 feet. Most Sharptown soils have been used for cultivating corn, soybeans, or small grains, and for pasture. The Sharptown series supports natural vegetation consisting of mixed hardwoods such as oaks, sweet gum, red maple, and holly. These soils are classified as Prime Farmland. (Capability Class II)

Mattapex Series

Mattapex soils comprise over 6 percent of all soils in Mannington (1,596 acres). The soils are very deep and moderately well-drained with a moderate to moderately slow rate of permeability. The seasonal high water table is 1.5 to 3 feet deep. Mattapex soils were formed from silty eolian deposits that were underlain by coarser fluvial or marine sediments, and are found on marine terraces and uplands. While most Mattapex soils are used for growing crops such as corn, soybeans and small grains, some sections are in urban areas or are used to grow vegetables or hay, or used as pasture. When wooded, the soils support mixed hardwoods, including oaks, sweetgum, red maple, and holly. Second growth areas sometimes sustain loblolly pines. Mattapex soils are classified as Prime Farmland. (Capability Class II)

Pedricktown, Askecksy, and Mullica Series

Pedricktown, Askecksy, and Mullica soils comprise about 6 percent of all soils in Mannington (1,462 acres). Pedricktown soils are very deep, very poorly drained, hydric soils. These soils were formed from loamy and sandy alluvial sediments. Typically, Pedricktown soils can be found on broad flats and depressions along major streams and floodplains. They can also be found in backswamp areas of small rivers and streams. The permeability of Pedricktown soils ranges from moderately slow to slow. Depth to the seasonal high water table is half a foot or less. Most Pedricktown soils have been used for woodland, and the series supports natural vegetation dominated by red maple, American holly, and sweet gum. (Capability Class IV)

Askecksy soils are very deep, poorly drained, hydric soils. These soils were formed from sandy alluvial and marine sediments, and can be found on low-lying uplands, broad depressions, floodplains, and stream terraces. The permeability of Askecksy soils is rapid, and depth to the seasonal high water table is 0 to 6 inches. Cleared areas were mostly drained by open ditches in the first half of the twentieth century and are used to grow crops such as corn, soybeans and small grains. In wooded areas, red maple, sweet gum, white oak, willow oak, and loblolly pine dominate the upperstory, and greenbriar, American holly, sweetbay, and lowbush blueberry dominate the understory. (Capability Class IV)

Mullica soils are very deep, very poorly drained, hydric soils formed from loamy siliceous marine sediments. Mullica soils can be found on broad flats along streams in low headwater areas as well as in dispersed, small, low-lying places. The permeability of Mullica soils is moderate in the solum and rapid in the substrata, and the seasonal high water table is less than a foot from

Source: DVRPC

Mute Swans in marshland that is underlain by the Pedricktown-Askecksy-Mullica soil complex

the surface. Most Mullica soils have been used for woodland, and natural vegetation includes pin oak, white oak, willow oak, red maple, bay magnolia, sweet gum, black gum, and black birch. Drained soils are used to grow truck crops and blueberries, as well as for pastureland. (Capability Class IV)

Downer-Galestown Series

The Downer-Galestown complex soil series makes up over 4 percent of all Mannington soils (1,141 acres). Downer soils are very deep, well drained soils with a moderate to moderately rapid rate of permeability. Depth to the seasonal high water table is greater than six feet. Formed from fluviomarine deposits, Downer soils are found on broad influves, hills, and ridges. Field crops, vegetables, flowers, and fruit trees grow on much of the soil area. The soil supports native vegetation including various oaks, Virginia pine, pitch pine, hickory, sassafras, dogwood, greenbriar, American holly, low bush blueberry, and mountain laurel. Downer sandy loam is classified as Prime Farmland while Downer loamy sand is classified as a Soil of Statewide Importance, meaning these soils are moderately to highly suitable for cultivated crops. (Capability Class II)

The Galestown soils are very deep and somewhat excessively drained with rapid permeability. The soils formed from deposits of sandy marine sediments and glacial outwash on glacial terminal moraine, and they are found on marine terraces, uplands, and end moraines. The seasonal high water table is usually greater than six feet below the surface. Galestown soils are often irrigated and are used to grow corn, soybeans, and truck crops. Wooded soils in the Coastal Plain feature black oak and white oak, as well as shortleaf, Virginia and loblolly pines, while on the glacial terminal moraine, eastern white pine, black oak and northern red oak are the native vegetation. Galestown sand is classified as Unique Farmland. (Capability Class III)

Hammonton Series

Hammonton soils comprise about 4 percent of all soils in Mannington (1,073 acres). Hammonton soils are very deep, moderately well drained soils. These soils formed from fluviomarine deposits. Typically, Hammonton soils can be found on low hills, on flats, and in depressions. The permeability of Hammonton soils ranges from moderate to moderately rapid, and the depth to the seasonal high water table is 1.5 to 3.5 feet. Hammonton soils support a native mixed hardwood forest with pitch pine, shortleaf pine, and Virginia pine. When cleared, the soils may be used to grow fruit, vegetables, row crops, and nursery crops. Hammonton loamy sand is a Soil of Statewide Importance. (Capability Class II)

An irrigation hose reel

Photo by Nicholas Culver

Table 4: Mannington Township Soils

Soil Code	Soil Description	Acres	Percentage of all Acres	Designation	Hydric Soil
AhpB	Alloway loam, 2 to 5 percent slopes	1,141.1	4.7%	P-1	No
AhpC	Alloway loam, 5 to 10 percent slopes	73.1	0.3%	NR	No
AhmB	Alloway sandy loam, 2 to 5 percent slopes	57.2	0.2%	P-1	No
AhrA	Alloway silt loam, 0 to 2 percent slopes	1,617.4	6.6%	P-1	No
AhrB	Alloway silt loam, 2 to 5 percent slopes	1,211.3	5.0%	P-1	No
AugB	Aura sandy loam, 2 to 5 percent slopes	2.5	0.0%	P-1	No
ChsAt	Chicone silt loam, 0 to 1 percent slopes, frequently flooded	919.2	3.8%	NR	Yes
ChtA	Chillum silt loam, 0 to 2 percent slopes	19.5	0.1%	P-1	No
ChtB	Chillum silt loam, 2 to 5 percent slopes	17.9	0.1%	P-1	No
DocC	Downer loamy sand, 5 to 10 percent slopes	13.0	0.1%	S-1	No
DopB	Downer-Galestown complex, 0 to 5 percent slopes	1,141.2	4.7%	NR	No
HbmB	Hammonton loamy sand, 0 to 5 percent slopes	1,073.4	4.4%	S-1	No
MakAt	Manahawkin muck, 0 to 1 percent slopes, frequently flooded	15.1	0.1%	U-1	Yes
MamnAv	Mannington-Nanticoke complex, 0 to 1 percent slopes, very frequently flooded	1,938.9	7.9%	U-1	Yes
MasB	Marlton silt loam, 2 to 5 percent slopes	74.6	0.3%	P-1	No
MasC	Marlton silt loam, 5 to 10 percent slopes	83.2	0.3%	S-1	No
MbrA	Matapeake silt loam, 0 to 2 percent slopes	2,279.0	9.3%	P-1	No
MbrB	Matapeake silt loam, 2 to 5 percent slopes	1,686.1	6.9%	P-1	No
MbrC	Matapeake silt loam, 5 to 10 percent slopes	24.5	0.1%	S-1	No
MbuA	Mattapex silt loam, 0 to 2 percent slopes	806.2	3.3%	P-1	No
MbuB	Mattapex silt loam, 2 to 5 percent slopes	790.2	3.2%	P-1	No
OTMA	Othello, Fallsington, and Trussum soils, 0 to 2 percent slopes	1,899.3	7.8%	S-1	Yes
PEEAR	Pedricktown, Askecksy, and Mullica soils, 0 to 2 percent slopes, rarely flooded	1,462.2	6.0%	NR	Yes
PHG	Pits, sand and gravel	79.4	0.3%	NR	--
SacB	Sassafras sandy loam, 2 to 5 percent slopes	201.2	0.8%	P-1	No
SacC	Sassafras sandy loam, 5 to 10 percent slopes	25.0	0.1%	S-1	No
ShnA	Sharptown silt loam, 0 to 2 percent slopes	147.6	0.6%	P-1	No
ShnB	Sharptown silt loam, 2 to 5 percent slopes	1,710.7	7.0%	P-1	No
SwtB	Swedesboro loamy sand, 0 to 5 percent slopes	208.3	0.9%	P-1	No
SwtC	Swedesboro loamy sand, 5 to 10 percent slopes	312.0	1.3%	NR	No
WATER	Water	3,123.0	12.8%	WATER	--
WoeA	Woodstown sandy loam, 0 to 2 percent slopes	274.0	1.1%	P-1	No
Total		**24,427.2**	**100.0%**		
Total Farmland Acreage		**15,362.9**	**62.9%**		
Total Non-Farmland Acreage		**9,064.3**	**37.1%**		

Source: USDA-Natural Resources Conservation Service (2002)

***Explanation of Designations**

P–1	Prime Farmland
S–1	Statewide Importance
U–1	Unique Farmland
NR	Soils not classified for farmland use: wet soils, pits, steep slopes, made land, etc.

Soil characteristics can severely restrict the use of sites for construction and development. **Table 5: Soil Limitations for Development** records the soils and their possible limitations for building foundations and septic systems. As indicated in the table, the township has some soils that are severely limited for onsite disposal fields for septic systems. Septic system disposal fields require soils that have a low water table (over five feet below the surface) and high permeability to allow for proper drainage of wastewater. Soils with high water tables (five feet or less from the surface) create a potential for erosion, wet basements, and low permeability, often allowing wastewater to collect near the surface. This table is a summary of a report on building suitability available from the NRCS 2006 database for Salem County soils. It is included here as a general guide and is not intended to eliminate the need for site analysis.

Table 5: Soil Limitations for Development

Soil Description	Soil Code	Acres	Building without Basement	Building with Basement	Disposal Field
Alloway loam, 2 to 5 percent slopes	AhpB	1,141.1	B	C	C
Alloway loam, 5 to 10 percent slopes	AhpC	73.1	B	C	C
Alloway sandy loam, 2 to 5 percent slopes	AhmB	57.2	B	C	C
Alloway silt loam, 0 to 2 percent slopes	AhrA	1,617.4	B	C	C
Alloway silt loam, 2 to 5 percent slopes	AhrB	1,211.3	B	C	C
Aura sandy loam, 2 to 5 percent slopes	AugB	2.5	A	A	C
Chicone silt loam, 0 to 1 percent slopes, frequently flooded	ChsAt	919.2	C	C	C
Chillum silt loam, 0 to 2 percent slopes	ChtA	19.5	A	A	A
Chillum silt loam, 2 to 5 percent slopes	ChtB	17.9	A	A	A
Downer loamy sand, 5 to 10 percent slopes	DocC	13.0	B	B	A
Downer-Galestown complex, 0 to 5 percent slopes	DopB	1,141.2	A	A	A
Hammonton loamy sand, 0 to 5 percent slopes	HbmB	1,073.4	B	C	C
Manahawkin muck, 0 to 1 percent slopes, frequently flooded	MakAt	15.1	C	C	C
Mannington-Nanticoke complex, 0 to 1 percent slopes, very frequently flooded	MamnAv	1,938.9	C	C	C
Marlton silt loam, 2 to 5 percent slopes	MasB	74.6	B	B	C
Marlton silt loam, 5 to 10 percent slopes	MasC	83.2	B	B	C
Matapeake silt loam, 0 to 2 percent slopes	MbrA	2,279.0	A	A	A
Matapeake silt loam, 2 to 5 percent slopes	MbrB	1,686.1	A	A	A
Matapeake silt loam, 5 to 10 percent slopes	MbrC	24.5	B	B	A
Mattapex silt loam, 0 to 2 percent slopes	MbuA	806.2	B	C	C
Mattapex silt loam, 2 to 5 percent slopes	MbuB	790.2	B	C	C
Othello, Fallsington, and Trussum soils, 0 to 2 percent slopes	OTMA	1,899.3	C	C	C
Pedricktown, Askecksy, and Mullica soils, 0 to 2 percent slopes, rarely flooded	PEEAR	1,462.2	C	C	C
Pits, sand and gravel	PHG	79.4	N/R	N/R	N/R
Sassafras sandy loam, 2 to 5 percent slopes	SacB	201.2	A	A	A
Sassafras sandy loam, 5 to 10 percent slopes	SacC	25.0	A	A	A
Sharptown silt loam, 0 to 2 percent slopes	ShnA	147.6	B	C	C
Sharptown silt loam, 2 to 5 percent slopes	ShnB	1,710.7	B	C	C
Swedesboro loamy sand, 0 to 5 percent slopes	SwtB	208.3	A	A	A

Soil Description	Soil Code	Acres	Building without Basement	Building with Basement	Disposal Field
Swedesboro loamy sand, 5 to 10 percent slopes	SwtC	312.0	B	B	A
Water	WATER	3,123.0	N/R	N/R	N/R
Woodstown sandy loam, 0 to 2 percent slopes	WoeA	274.0	A	C	B
Total Acres		**24,427.2**			

Key to Land Use Implications	
A = Not Limited	Little or no limitation(s) or easily corrected by use of normal equipment and design techniques.
B = Somewhat Limited	Presence of some limitation, which normally can be overcome by careful design and management at somewhat greater cost.
C = Very Limited	Limitations that, normally, cannot be overcome without exceptional, complex, or costly measures.
N/R = Not Rated	Limations are not rated.

Source: US Department of Agriculture, Natural Resource Conservation Service

Photo by Nicholas Culver

Farmland with Mannington Meadows in the distance

CLIMATE

Situated midway between the North Pole and Equator, New Jersey is influenced by hot, cold, dry and humid airstreams that create highly changeable local weather. From May through September, New Jersey is dominated by moist, tropical air, originating in the Gulf of Mexico and carried by prevailing winds from the southwest. In winter, winds generally prevail from the west and northwest bringing cold, polar air masses from subarctic Canada. In March and April, the Mannington area experiences the highest average wind speeds of the year, about 11 miles per hour.

The climate in New Jersey varies within five regions: North, Central, Southwest, Pine Barrens, and Coastal. Mannington is in the Southwest zone, a region that registers some of the highest average daily and evening temperatures. The moderating effect of the nearby Delaware Bay is responsible in part for these higher temperatures. In addition, the area's soils retain the day's warmth into the night while Pine Barrens soils are sandy and exhibit a strong radiational cooling after sunset. Evening temperatures can be as much as 20 degrees lower in the Pine Barrens than in neighboring climate zones. In contrast, the Coastal Zone is generally warmer in the autumn and winter, and cooler in the spring and summer (coinciding with ocean water temperatures) than Mannington.

Detailed weather data from stations in nearby Woodstown is available from the Office of the New Jersey State Climatologist. The Mannington area experiences a normal maximum temperature of 88.1°F in July and a normal minimum temperature in January of 24.3°F. The extreme temperatures recorded at the nearby Woodstown station are a low of -13°F on January 22, 1984 and a high of 103°F on July 3, 1966.

The region's annual mean temperature is 55.2°F. This compares with a statewide mean temperature of 52.3°F. Of 36 stations located throughout the state, only one – the Atlantic City Marina (55.3°F) – has a higher annual average mean temperature. The mean temperature in the Mannington area for July is 76.9°F, surpassed only by Newark (77.2°F), an area which experiences the urban heat island effect. The monthly mean temperature for January is 32.9°F, exceeded only by three southern, coastal stations – Atlantic City Marina (35.2°F), Cape May Point (34.3°F), and Belleplain (33.2°F).

Precipitation and Storm Events

The Southwest climate zone, where Mannington is located, receives less precipitation than the North, Central and Coastal regions. The normal average annual precipitation for the area (1971 through 2000) was 45.76 inches compared to a statewide normal annual precipitation of 47.87 inches. The region's lack of orthographic features and greater distance from the Great Lakes-St. Lawrence storm track may explain lower precipitation. Mannington's location, approximately 60 miles inland, is also less susceptible to heavy rains associated with coastal storms. The Mannington area receives the most precipitation in July, normally 4.41 inches, and the least precipitation in February, normally 2.89 inches.

Snowfall typically occurs in New Jersey when moist air from the south converges with cold air from the north. In Mannington snowfall may occur from mid-October to mid-April, but is most likely to occur from December to March. Snow is on the ground an average of 17 days each year.

Severe storm events, including thunderstorms, tropical storms, blizzards, ice storms, hail storms and tornadoes, occur in Salem County. Tornadoes are infrequent; about five, generally weak, occur in New Jersey each year. Thunderstorms occur in the Mannington area about 30 days each year, mainly in June, July, and August. In modern history, only hurricanes passing offshore of New Jersey or the remnants of hurricanes have impacted the state. Nevertheless, some of these have been severe. For example, on September 16, 1999, Hurricane Floyd was downgraded to a tropical storm as it passed east of Atlantic City. Floyd caused torrential rains, high winds, and flooding across New Jersey.

While not climate-related, earthquakes are another natural hazard that warrants a brief discussion. Five earthquakes have occurred with epicenters located in Salem County and are listed below:

- November 15, 1939 – 3.4 magnitude centered east of Elmer on the Upper Pittsgrove/Franklin border
- February 28, 1973 – 3.5 magnitude centered east of Deepwater, Carneys Point Township
- July 10, 1973 – 2.6 magnitude centered south of Auburn, Oldmans Township
- October 23, 1990 – 2.9 magnitude centered north of Hancocks Bridge in Elsinboro Township, and
- March 25, 1998 – 1.9 magnitude centered at Artificial Island, Lower Alloways Creek Township.

Growing Seasons

Mannington is within U.S. Department of Agriculture (USDA) Plant Hardiness Zone 7, where annual minimum temperatures are typically between 0°F and 5°F. In New Jersey, all of Salem County, adjacent portions of Cumberland and Gloucester counties, and areas along the Atlantic coastline are designated as Zone 7, the warmest USDA Plant Hardiness Zone in New Jersey.

Mannington's agricultural growing season is approximately six months, or 180 days, from mid-April to mid-October. This is the period between the last spring frost and first autumn frost. However, harvesting of grain crops typically continues throughout November, and winter crops such as broccoli, cauliflower, and cabbage are grown until the first hard freeze, usually in early January. The frost-free growing season in Mannington is about 60 days longer than in northern New Jersey, where frosts generally end in May and begin in October.

Photo by Nicholas Culver

Preparing a field for planting in early spring

SURFACE WATER RESOURCES

All of Mannington's land drains to the Delaware River by way of the Salem River. Five subwatersheds within the Salem watershed drain Mannington land. In the north and west, three of the subwatersheds drain directly to the Salem River. One subwatershed drains to the Salem River between County Home Road and Courses Landing, another drains to the Salem River between Courses Landing and the dam south of the Salem Canal, and the third drains to the Salem River between the dam and the Fenwick Creek outlet. Water in a fourth subwatershed flows to Mannington Creek. Finally, land in the southernmost subwatershed of Mannington drains to the Fenwick and Keasbey creeks.

Watersheds

A watershed is all the land that drains to a particular waterway such as a river, stream, lake, or wetland. A watershed's boundaries are defined by the high points in the terrain, such as hills and ridges. Large watersheds are made up of smaller ones, down to the catchment level of a local site. So, for example, the Delaware River watershed is made up of many smaller watersheds, such as the Salem River watershed. The Salem River watershed, in turn, is formed of several subwatersheds, consisting of the land that drains to a major tributary or branch of the river, such as the Mannington Creek subwatershed. These subwatersheds can be further subdivided into smaller ones, each surrounding the smaller tributaries that flow to the larger channel, and so on down to the catchment level. Watersheds are natural ecological units, where soil, water, air, plants, and animals interact in a complex relationship. Mannington contains two HUC -11[2] watersheds – the Salem River above Route 540 and Salem River below Route 540. NJDEP has separated the watershed into these two areas and given them separate HUC-11 numbers because the Salem River watershed is so large.

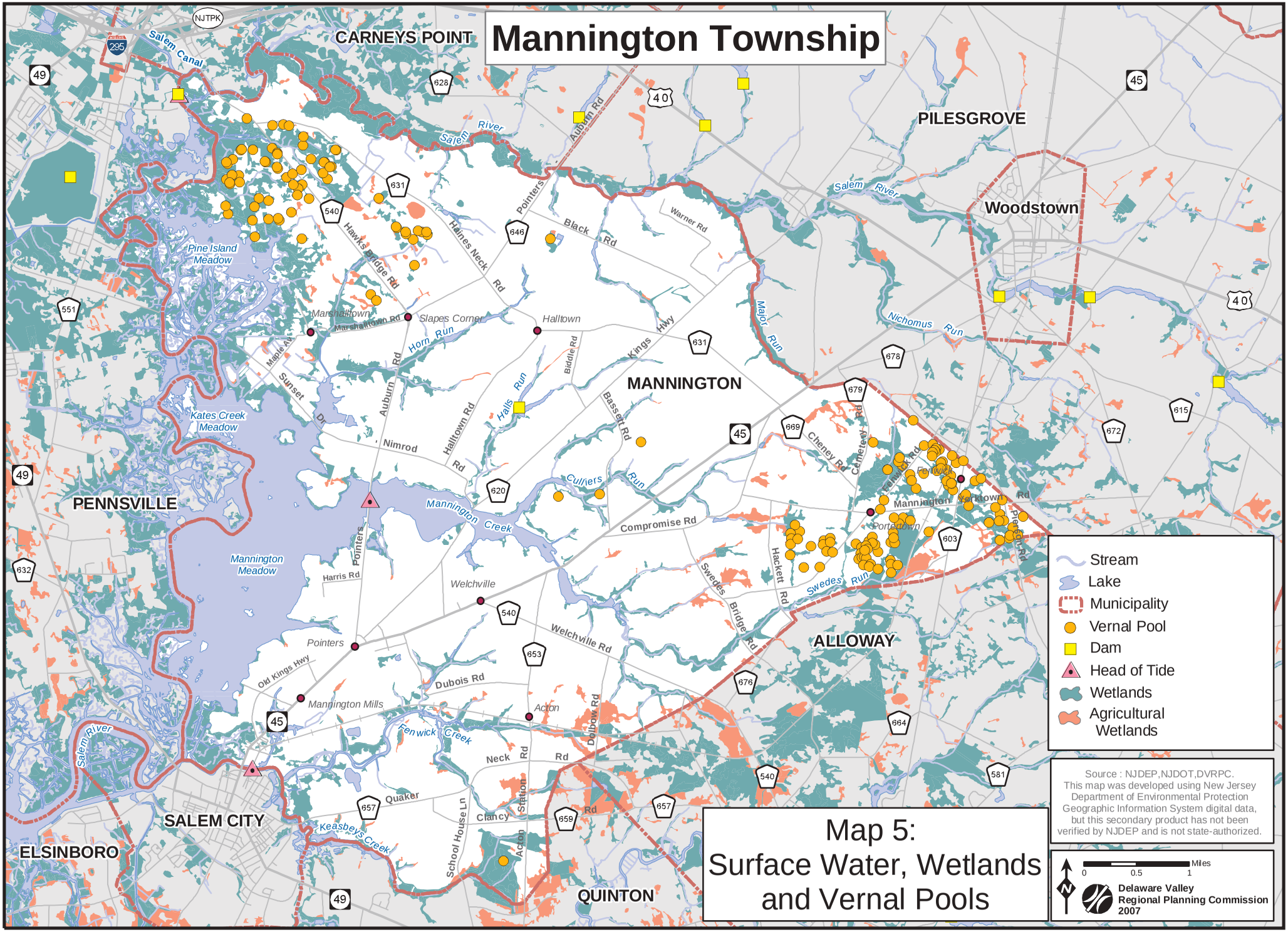
The percentage of land that is within the Salem River watershed in Mannington is listed in the following table. See also **Map 6: Watersheds**, and **Map 5: Surface Water, Wetlands, and Vernal Pools**,

Table 6: Watersheds and Subwatersheds in Mannington

Watershed	USGS Watershed Code (HUC-11 Number)	Stream Classification	Acreage within Municipality	% of Municipal Land	Subwatersheds (HUC-14 Numbers) within Mannington
Salem River	02040206030 02040206040	FW2-NT/SE1	24,446	100%	02040206030040 02040206030060 02040206040010 02040206040020 02040206040030

Source: NJDEP, Bureau of Geographic Information Systems

[2] "HUC" stands for Hydrological Unit Code, which is a numerical identification number given to every drainage system in the United States by the US Geological Survey. HUC-11 codes are the 11-digit numbers applied to a part of a drainage area that is approximately 40 square miles in size. HUC-11 areas are further subdivided into HUC-14 subwatersheds, with the identification number for each one having 14 digits.


Mannington Township
CARNEYS POINT
PILESGROVE
Woodstown
MANNINGTON
PENNSVILLE
ALLOWAY
SALEM CITY
ELSINBORO
QUINTON
Salem River
Salem Canal
Pine Island Meadow
Kates Creek Meadow
Mannington Meadow
Mannington Creek
Fenwick Creek
Keasbeys Creek
Swedes Run
Culvers Run
Halls Run
Horn Run
Major Run
Nichomus Run
Marshalltown
Slapes Corner
Halltown
Nimrod
Welchville
Mannington Mills
Acton
Porterstown
Yorktown
Fenwick
Stream
Lake
Municipality
Vernal Pool
Dam
Head of Tide
Wetlands
Agricultural Wetlands
Source : NJDEP,NJDOT,DVRPC.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
Map 5:
Surface Water, Wetlands and Vernal Pools
Miles
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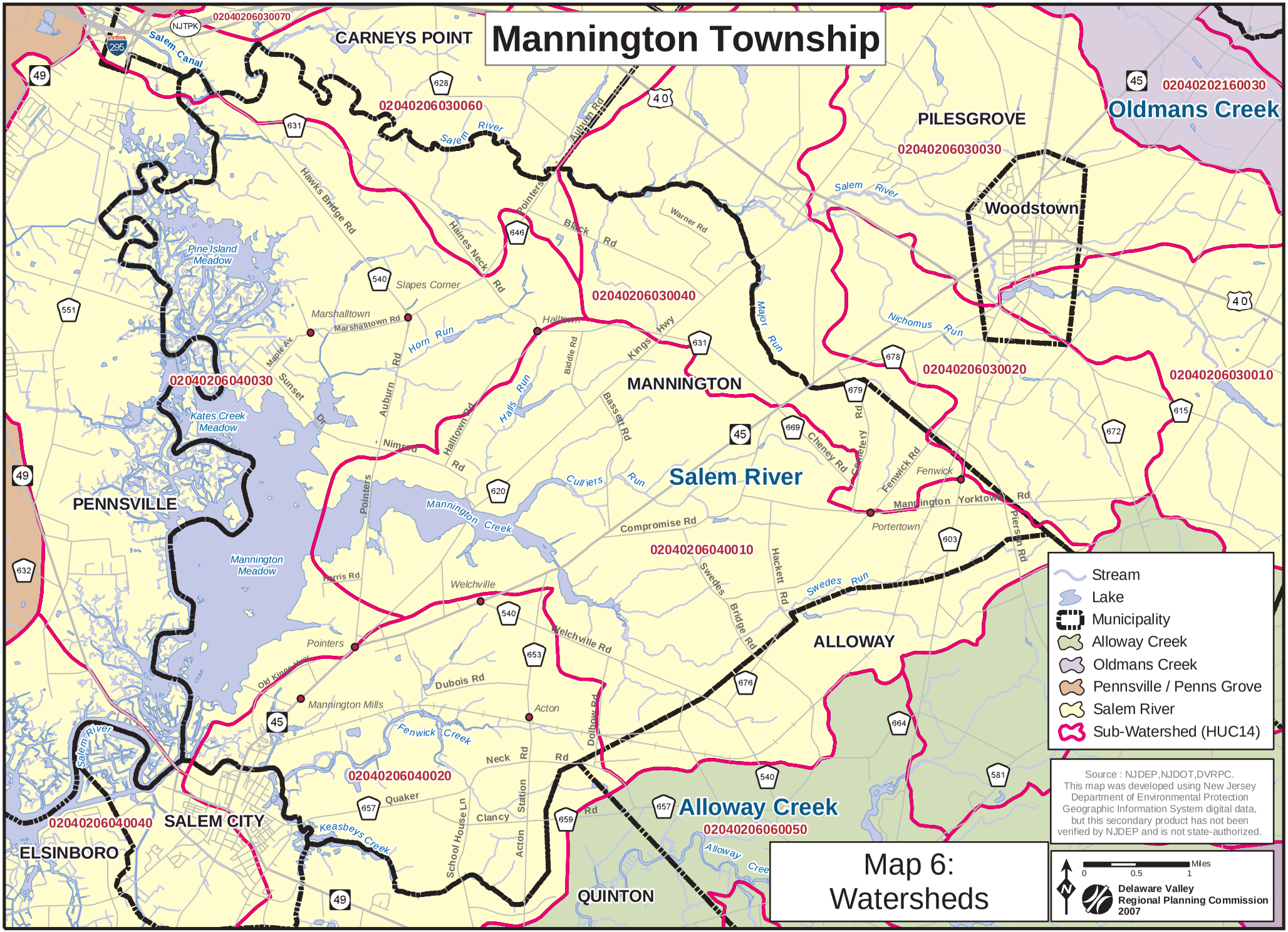
0.5
1
Delaware Valley Regional Planning Commission
2007


Mannington Township
CARNEYS POINT
PILESGROVE
Woodstown
Oldmans Creek
MANNINGTON
PENNSVILLE
SALEM CITY
ELSINBORO
ALLOWAY
QUINTON
Salem River
Alloway Creek
02040206030070
02040206030060
02040206030040
02040206030030
02040206030020
02040206030010
02040206040030
02040206040010
02040206040020
02040206040040
02040206060050
02040202160030
Salem Canal
Salem River
Pine Island Meadow
Kates Creek Meadow
Mannington Meadow
Mannington Creek
Fenwick Creek
Keasbeys Creek
Alloway Creek
Nichomus Run
Major Run
Halls Run
Horn Run
Culliers Run
Swedes Run
Marshalltown
Slapes Corner
Halltown
Welchville
Mannington Mills
Acton
Portertown
Fenwick
Stream
Lake
Municipality
Alloway Creek
Oldmans Creek
Pennsville / Penns Grove
Salem River
Sub-Watershed (HUC14)
Source : NJDEP,NJDOT,DVRPC.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
Map 6:
Watersheds
Miles
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Delaware Valley Regional Planning Commission
2007

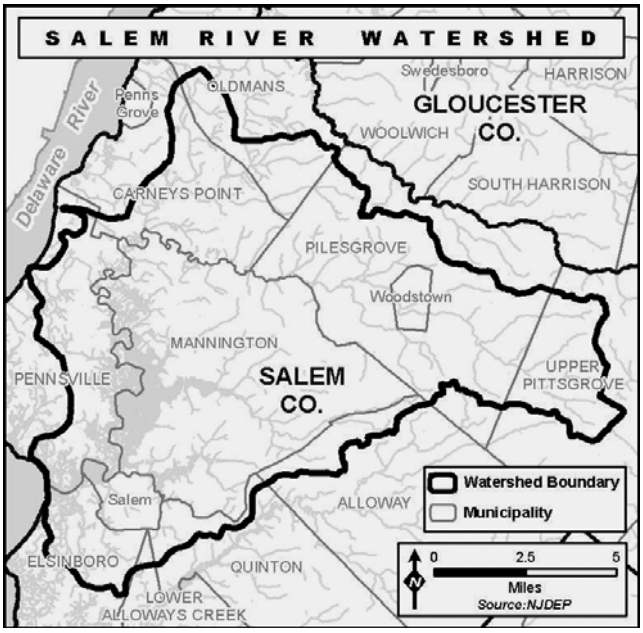
Salem River Watershed

The Salem River watershed drains an area of 117 square miles, covering about one-third of Salem County, making it the largest watershed within the county. One hundred percent of the land in Mannington drains to the Salem River.

The Salem River flows 32 miles west from the area of Pole Tavern in Upper Pittsgrove Township, through Pilesgrove, to an extensive marshland in Carneys Point Township. From there a cut channel runs to the Delaware River just below Deepwater. This channel conveys water to the DuPont facility located on the Delaware River where the river water is used in industrial processing. DuPont holds the water rights to the Salem River through this channel. The river's flow originally turned south to become part of the large Mannington Meadow body of shallow water, which is also fed by smaller streams coming in from the east. A dam with no spillway now blocks movement of water between the channel and the meadow. From the meadow, which is tidal throughout its extent, water moves southward. Just above the City of Salem, it turns west and flows into the Delaware River just below the Supawna Meadows National Wildlife Refuge.

Major tributaries of the Salem River (considered as a whole) within Mannington include Mannington Creek, Major Run, and Fenwick Creek. Major Run starts in Mannington Township and forms part of the border between Pilesgrove and Mannington. Mannington Creek flows from the middle of the township into Mannington Meadow. Fenwick Creek is joined by Keasbeys Creek and then flows into the Salem River near Salem City. Keasbeys Creek forms part of Mannington's border with Salem City and Quinton. Other streams in the Salem River watershed in Mannington are Swedes Run, Culliers Run, Halls Run, and Horn Run.

The Salem River watershed provides critical habitat for many rare, threatened, and endangered species, due to its extensive freshwater and tidal wetlands and marshes. Several wildlife management areas have been established by the state along the river and around the Mannington meadow, in addition to the very large federal Supawna Meadows National Wildlife Refuge near its mouth. Four of these state wildlife management areas are located in Mannington Township. The Mannington Marsh and surrounding lands are also designated as an Internationally Important Bird Area (see **Appendix E: Mannington Meadows Important Bird Area**).



Source: NJDEP, Bureau of Geographic Information Systems

Fig. 3: Map of the Salem River Watershed

Additionally, the National Park Service has designated 17 miles of the Salem River, from its mouth to its junction with Major Run, as part of the Nationwide Rivers Inventory (NRI),[3] based on its remarkable scenic and recreational opportunities as well as outstanding habitat for fish and wildlife. The NRI is a register of river segments that potentially qualify as national wild, scenic or recreational river areas. See ***Sources of Information***, p. 97, for the National Park Service/NRI website for more details.

Streams

About 110 stream miles cross Mannington Township. Of these, 81 miles are first order or second order (headwater) streams. That is, they are the initial sections of stream channels with no contributing tributaries (first order streams), or they are stream channels formed from only one branching section of tributaries above them (second order streams). The headwaters are where a stream is "born," and actually begins to flow.

Table 7: Mannington Township Streams

Stream Order	Miles
First Order Streams (smallest)	58.5
Second Order Streams	22.6
Third Order Streams	16.0
Fourth Order Streams	3.6
Fifth Order Streams	9.7
Total Stream Miles	**110.3**

Source: NJDEP, Bureau of Geographic Information Systems

Headwaters are of particular importance because they tend to contain a diversity of aquatic species and their condition affects downstream water quality. Because of their small size, they are highly susceptible to impairment by human activities on the land. First and second order streams are narrow and often shallow, and are characterized by relatively small base flows. This makes them subject to greater temperature fluctuations, especially when forested buffers on their banks are removed. They are also easily over-silted by sediment-laden runoff and their water quality can be rapidly degraded. In addition, first order streams are greatly affected by changes in the local water table because they are fed by groundwater sources. Headwaters are important sites for the aquatic life that is at the base of the food chain, and often serve as spawning or nursery areas for fish.

Tidal flows bring Delaware River water into the streams twice a day. Tidal flows both help and hinder maintenance of good water quality in affected streams. The flood

Source: DVRPC

A tidal stream

[3] It is a requirement that each federal agency, as part of its normal planning and environmental review processes, take care to avoid or mitigate adverse effects on rivers identified in the Nationwide Rivers Inventory. Further, all agencies are required to consult with the National Park Service prior to taking actions that could effectively foreclose wild, scenic or recreational status for rivers on the inventory.

(incoming) tide carries leaves and nutrients that are beneficial to aquatic organisms, but it also limits the regular flushing out of silt and pollutant-laden waters coming from upstream. Silt deposition within a stream tends to increase during flood tides, although deposition is also a function of stream shape, the presence of specific flow barriers, and the quantity of silt (the load) being carried by the stream. See **Map 5: Surface Water, Wetlands, and Vernal Pools**.

Lakes and Ponds

There are 139 acres of artificial ponds and small lakes in Mannington and no large lakes. All lakes in Mannington are classified as artificial waterbodies by NJDEP. Naturally occurring lakes and ponds do not exist in southern New Jersey. Artificial lakes and ponds are man-made impoundments of water that are one acre or larger, formed by damming. They are often used for irrigation and flood control. Artificial ponds and lakes may also be the result of an active extractive operation. See **Map 5: Surface Water, Wetlands, and Vernal Pools**.

Wetlands

Wetlands support unique communities that serve as natural water filters and as incubators for many beneficial species. The term "wetland" is applied to areas where water meets the soil surface and supports a particular biological community. The source of water for a wetland can be an estuary, river, stream, lake edge, or groundwater that rises close to the land surface. Under normal circumstances, wetlands are those areas that support a prevalence of defined wetland plants on a wetland soil. The US Fish & Wildlife Service designates all large vascular plants as wetland (hydric), non-wetland (non-hydric) or in-between (facultative). Wetland soils, also known as hydric soils, are areas where the land is saturated for at least seven consecutive days during the growing season.

Source: DVRPC

The American egret is a wading bird that feeds in both fresh and tidal wetlands

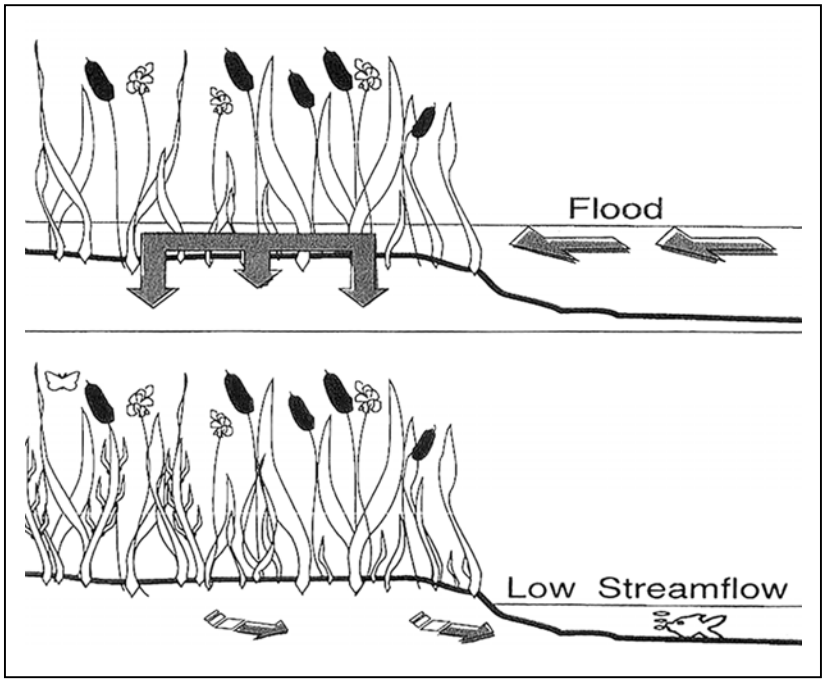
Wetlands are classified as either tidal or nontidal. Tidal wetlands can be either saline or freshwater. There are also special wetland categories to denote saturated areas that have been altered by human activities. For legal definitions of wetlands, ANJEC's publication *Freshwater Wetlands Protection in New Jersey*, listed in the **Sources of Information** section, is recommended.

New Jersey protects freshwater (interior) wetlands under the New Jersey Freshwater Wetlands Protection Act Rules: N.J.A.C. A 7:7A. The law also protects transition areas or "buffers" around freshwater wetlands. The New Jersey freshwater wetlands maps provide guidance on where wetlands are found in New Jersey, but they are not the final word. Only an official determination from DEP, called a "letter of interpretation," can determine for sure if there are freshwater wetlands on a property. An LOI verifies the presence, absence, or boundaries of freshwater wetlands and transition areas on a site. Activities permitted to occur within wetlands are very limited and permits are required for most of them. Additional information on wetlands

rules and permits is available through NJDEP and on its website under "land use." See ***Sources of Information***, page 97.

Natural wetlands of all types in Mannington total 4,013 acres, of which 1,887 acres are forested wetlands, 1,451 acres are low-growing scrub/shrub or herbaceous wetlands, and 590 acres are tidal wetlands. The tidal wetlands are primarily located along Fenwick Creek and in Pine Island and Kate's Creek Meadows. See **Map 5: Surface Water, Wetlands, and Vernal Pools**.

Mannington also includes 84 acres of wetland areas that have been altered by human activities and no longer support typical wetland vegetation, or are not vegetated at all. These modified wetland areas do, however, show obvious signs of soil saturation and exist in areas shown to have hydric soils on US Soil Conservation Service soil surveys. Modified wetlands fall into categories defined by the *Anderson Land Use Classification* system, as follows: there are 13 acres of former agricultural wetlands, 15 acres of disturbed wetlands, 43 acres of wetland right-of-ways, and 14 acres of wetlands found in maintained greenspace or lawn. A more detailed description of all Mannington's wetland areas is found in the ***Biological Resources*** section, under "Wetlands," page 60.



Source: The Streams of Washington Township, with permission.

Figure 4. Wetlands.
Wetlands vegetation traps and holds flood waters, allowing it to percolate into the ground

Agricultural Wetlands

Agricultural wetlands occupy 465 acres of Mannington Township. These "quasi-wetlands" are found scattered as small sites primarily in the northwest and southeast portions of the township. These wetlands tend to border natural wetlands or streams. Agricultural wetlands are modified, former wetland areas that are under cultivation. These areas still exhibit evidence of soil

saturation in aerial infrared photo surveys, but they do not support natural wetland vegetation. See **Map 5: Surface Water, Wetlands, and Vernal Pools**.

As long as agricultural wetland areas remain in agricultural use, they are exempt from New Jersey's Freshwater Wetlands Rules *N.J.A.C. 7:7A.* However, if an agricultural area is removed from agricultural production for more than five years, any wetlands located within that area lose their exempt status. Also, according to *N.J.A.C. 7:7A-2.8(b)2*, "the exemptions apply only as long as the area is used for the exempted activity." Therefore, if the area is used for anything other than farming, the exemption no longer applies.

In addition, if hydric soils are present, certain activities on drained farmland may be regulated by the state of New Jersey. While the Freshwater Wetlands Protection Rules set forth several specific farming, ranching, and silviculture exemptions, those exemptions are subject to another limitation:

> If an area with hydric soils has been drained for farming purposes through the use of drainage structures such as tiles or ditches, the Department shall presume that the area has wetlands hydrology for the purpose of identifying a freshwater wetland under N.J.A.C. 7:7A-2.3. To rebut this presumption of wetlands hydrology, all drainage structures shall be removed or completely disabled and the area shall be left undisturbed for at least one normal rainfall year, after which the presence or absence of wetlands hydrology shall be determined through use of technical criteria, field indicators, and other information, in accordance with the 1989 Federal manual. [7:7A-2.8(b)5]

Historically, Salem County farmers employed several methods to drain land, including the use of tile drains. Tile drains still exist, and function, in the area.

The Natural Resources Conservation Service sponsors the Wetlands Reserve Program (www.nrcs.usda.gov/programs/wrp), a voluntary program that offers landowners an opportunity to receive payments for restoring and protecting wetlands on their property, including agricultural wetlands. Restoring agricultural wetlands requires removing them from agricultural use and restoring them to their natural state. This program provides technical and financial assistance to eligible landowners who can enroll eligible lands through permanent easements, 30-year easements, or restoration cost-share agreements. See **Appendix D: Federal and State Conservation Programs for Farmers**, for additional information.

Vernal Pools

Vernal pools are bodies of water that appear following snowmelt and during spring rains, but that disappear or are dry during the rest of the year. They are highly important sites for certain rare species of frogs and salamanders, called obligate breeders. Obligate breeders will only breed in vernal pools, because the pool's impermanence prevents residence by predators who would consume the eggs and young. Vernal pools also provide habitat for amphibians and reptiles that may breed in them but not exclusively (facultative breeders), or may use the pools at some point in their life cycles.

Vernal pools are so intermittent that their existence as wetlands has frequently not been recognized. Consequently, many of them have disappeared from the landscape, or have been substantially damaged. This, in turn, is a principal cause of the decline of their obligate amphibian species.

The New Jersey Division of Fish and Wildlife has been conducting a Vernal Pool Survey project since 2001, to identify, map, and certify vernal ponds throughout the state. Once a vernal pond is certified, regulations require that a 75-foot buffer be maintained around the pond. NJDEP's Division of Land Use Regulation oversees this designation and restricts development around vernal ponds by denying construction permits. Local municipalities can provide additional protection by instituting restrictive zoning or negotiating conservation easements on the land surrounding the pond.

The state has identified an outstanding number of possible vernal pools within Mannington – 164 in all. These pools are concentrated mainly in the northwest and eastern corners of the township. Surveys of each pool are planned in order to determine what species are present and, indeed, if the pool is still in existence as a natural habitat. A certified vernal pool is defined as one that occurs in a confined basin without a permanently flowing outlet, has habitat documented for one obligate or two facultative herptile species, maintains ponded water for at least two continuous months between March and September, and is free of fish populations throughout the year. Of the 164 listed pools, 21 have been visited and confirmed as vernal, although they have not been surveyed to determine if they qualify for certification. See **Map 5: Surface Water, Wetlands, and Vernal Pools** and **Appendix A: Possible Vernal Pools in Mannington Township, Salem County** where the pools are listed, along with their Geographic Positioning System coordinates.

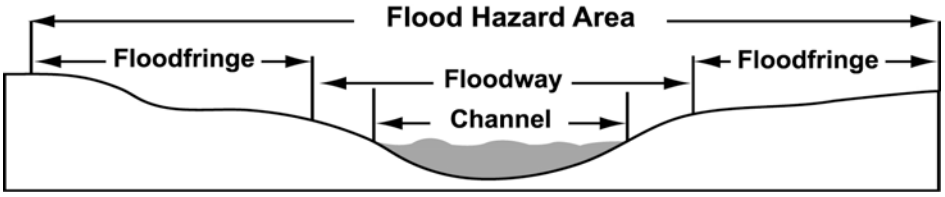
Photo by Nathaniel Culver

A green frog

Floodplains

Areas naturally subject to flooding are called floodplains, or flood hazard areas. Floodplains encompass a floodway, which is the portion of a floodplain subject to high velocities of moving water, and the adjacent flood fringe, which helps to hold and carry excess water during overflow of the normal stream channel. The 100-year floodplain is defined as the land area that will be inundated by the overflow of water resulting from a 100-year flood (a flood that has a 1 percent chance of occurring in any given year).

Although the terms "flood hazard area" and "100-year floodplain" denote similar concepts, NJDEP defines them in slightly different ways. New Jersey's regulations define the flood hazard area as the area inundated by a flood resulting from the 100-year discharge increased by 25 percent. This type of flood is called the "flood hazard area design flood" and it is the flood regulated by NJDEP.



Source: The Streams of Washington Township, with permission

Figure 5: Parts of a Flood Hazard Area

Floodplains require protection in order to prevent loss to residents, especially within the boundaries of the floodway. Equally important is the preservation of the environmentally sensitive aquatic communities that exist in floodplains. These communities are often the first link in the food chain of the aquatic ecosystem. In addition, floodplains serve the function of removing and mitigating various pollutants, through the uptake by their vegetation of excess chemical loads in the water and by the filtering of sediments generally. All efforts to keep development out of floodplains will help to preserve the flood-carrying capacity of streams and their water quality.

In New Jersey and throughout the country, building in areas subject to flooding is regulated to protect lives, property, and the environment. New Jersey regulates construction in the flood hazard area under the Flood Hazard Area Control Act, N.J.S.A. 58:16A-50 et seq., and its implementing rules at N.J.A.C. 7:13. Activities that are proposed to occur in a flood hazard area will require issuance of a stream encroachment permit or a letter of non-applicability from the NJDEP. Additional information on floodplain activities is available from NJDEP and from its website under "Land use." See ***Sources of Information***, page 97.

New Jersey's flood hazard area maps are not available in digital form. Consequently, it is only possible to approximate the spatial extent of the flood hazard area in Mannington by using the Federal Emergency Management Agency's (FEMA's) 100-year floodplain maps. FEMA's maps show that 8,083 acres or 33 percent of the township's land area falls within the 100-year

floodplain. Presumably, the flood hazard area would be slightly larger.[4] Mannington's floodplain areas are located along most water bodies, particularly along Fenwick Creek and in the northwestern section of the township by the Salem River. Smaller streams may periodically flood, but the Federal Emergency Management Agency and NJDEP have not delineated these floodplains because the risk to property and human health is usually minor. See **Map 7: Flood Hazard Areas and Steep Slopes**.

Table 8: Flood Hazard Area Acreage

Category	Acres
100-year floodplain	8,083

Source: Federal Emergency Management Agency (FEMA)

Tidelands

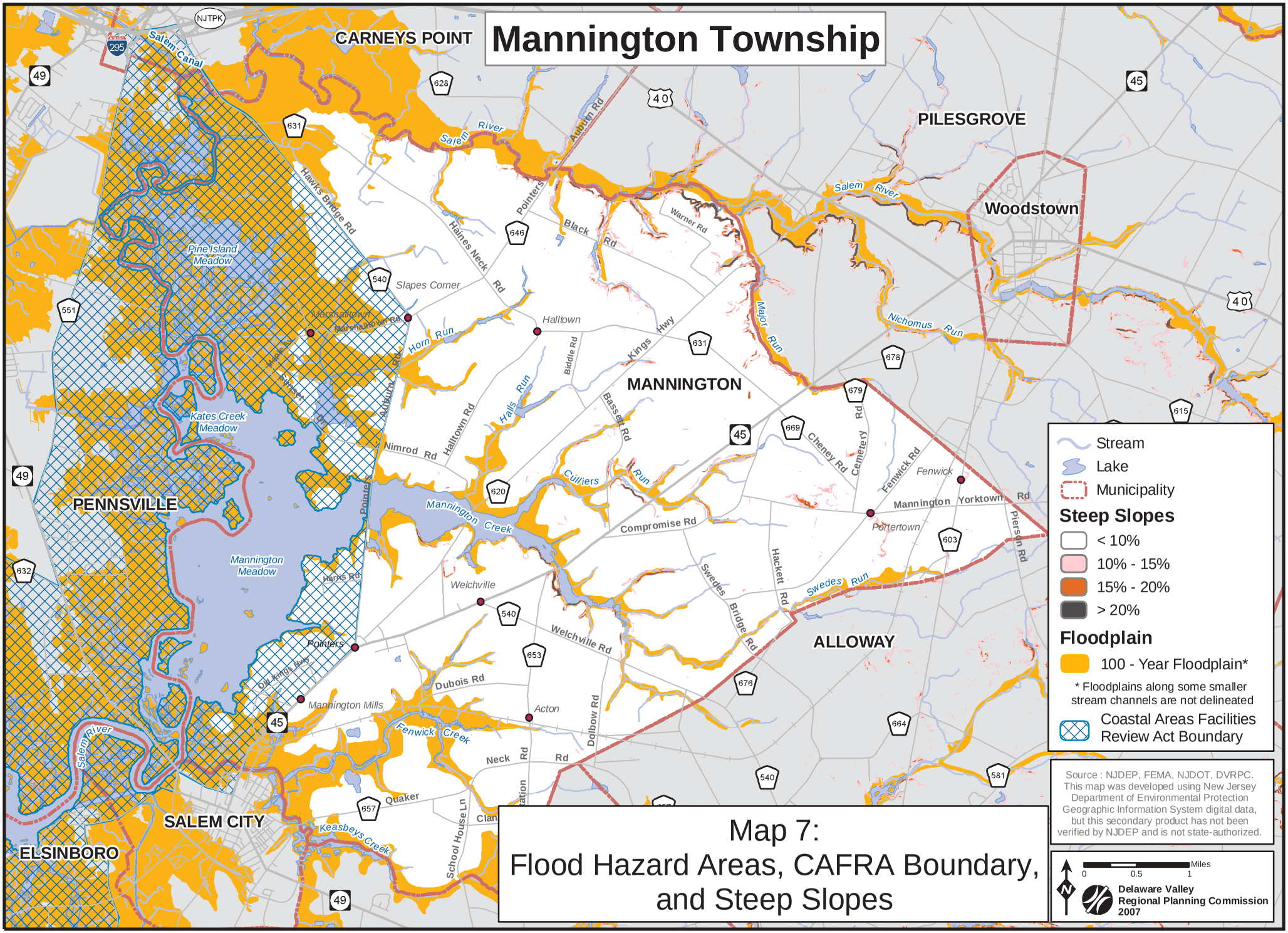
Part of Mannington Township falls within the boundaries of the Coastal Areas Facilities Review Act (CAFRA), which is one of the legislative acts (NJSA 13:19-1 *et seq*.), along with the Wetlands Act of 1970, the Waterfront Development Law of 1914, and the common law Public Trust Doctrine concerning riparian lands, that authorize New Jersey's coastal management program. The program guides development along New Jersey's tidal coastline, including oceanfront, bayshore, and the tidal Delaware River. Most construction in the coastal zone requires a permit under one or more of the laws listed above. See **Map 7: Flood hazard Areas, CAFRA Boundary, and Steep Slopes** for a depiction of the CAFRA area.

CAFRA gives the NJDEP review power over the placement and construction of coastal area facilities including manufacturing plants, power stations, landfills, highways, housing developments over 24 units, and other large projects. The Wetlands Act of 1970 regulates activities on coastal lands that are located at or below high water that would alter or pollute those areas and applies to virtually any coastal wetlands project, including all dredging, filling or excavation, maintenance or construction of structures, harvesting natural products, diversion/use of water, application of pesticides, and alteration of marsh contours. The Waterfront Development Law applies to tidal waterways and adjacent upland outside the CAFRA area but does not apply in Mannington Township because all its tidal waters are within the CAFRA area. Any application for a Waterfront Development Permit requires legal proof of the right to use the riparian land, under the "Public Trust Doctrine." Any construction must also meet municipal requirements.

Surface Water Quality

Water quality standards are established by federal and state governments to ensure that water is suitable for its intended use. The federal Clean Water Act (P.L. 95-217) requires that wherever possible water-quality standards provide water suitable for fish, shellfish, and wildlife to thrive and reproduce and for people to swim and boat.

[4] Site plan and subdivision applications require detailed engineering studies that depict the boundaries of the flood hazard area at a large scale.


Mannington Township
CARNEYS POINT
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Swedes Run
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Slapes Corner
Halltown
Welchville
Mannington Mills
Acton
Fenwick
Portertown
Hawks Bridge Rd
Haines Neck Rd
Pointers
Auburn Rd
Black Rd
Warner Rd
Kings Hwy
Biddle Rd
Bassett Rd
Halltown Rd
Nimrod Rd
Cheney Rd
Cemetery Rd
Fenwick Rd
Mannington Yorktown Rd
Compromise Rd
Hackett Rd
Swedes Bridge Rd
Pierson Rd
Welchville Rd
Dubois Rd
Dolbow Rd
Neck Rd
Quaker
School House Ln
Harris Rd
Old Kings Hwy
Stream
Lake
Municipality
Steep Slopes
< 10%
10% - 15%
15% - 20%
> 20%
Floodplain
100 - Year Floodplain*
* Floodplains along some smaller stream channels are not delineated
Coastal Areas Facilities Review Act Boundary
Source : NJDEP, FEMA, NJDOT, DVRPC. This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
Map 7:
Flood Hazard Areas, CAFRA Boundary, and Steep Slopes
Miles
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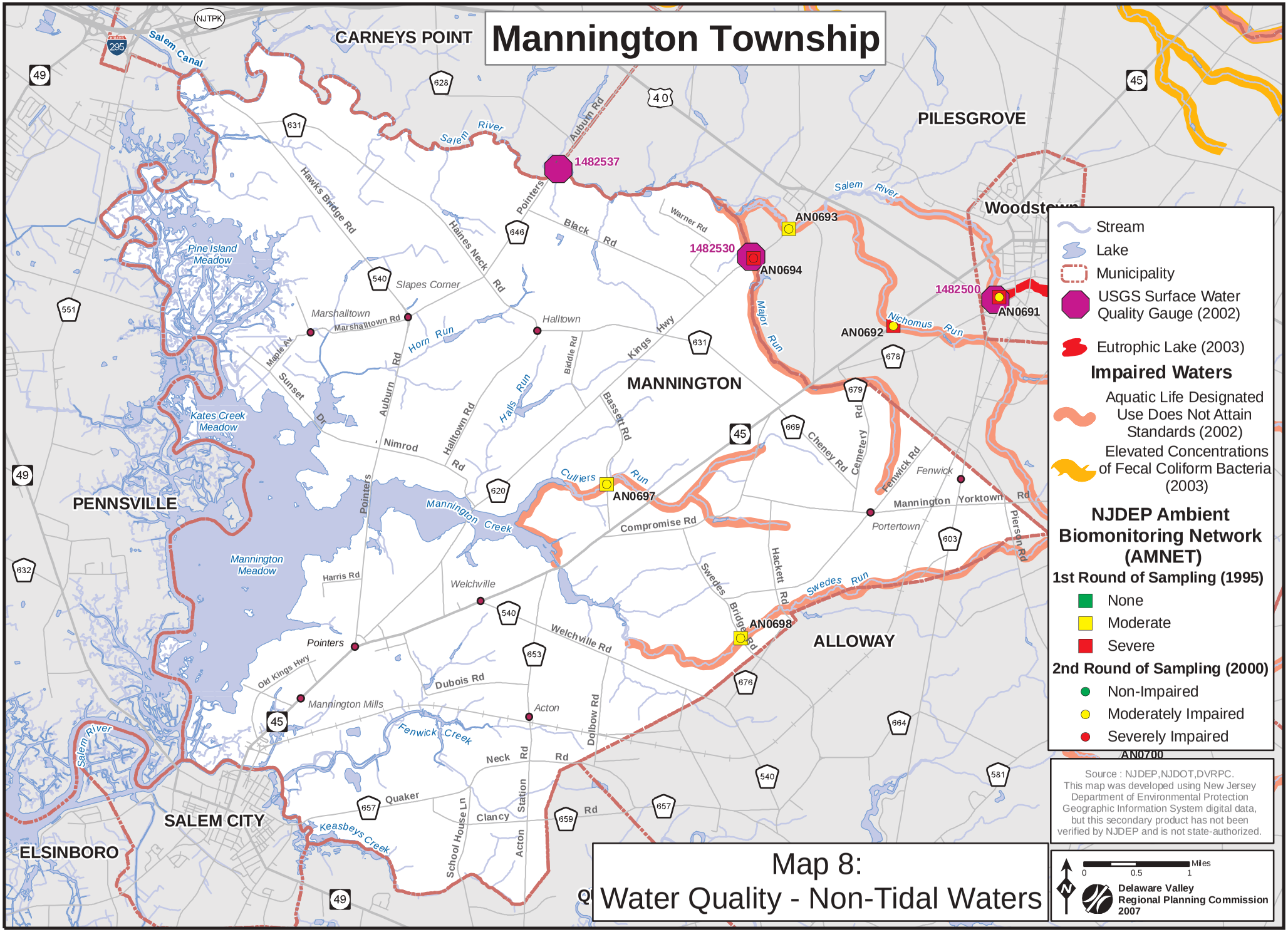
Mannington Township
CARNEYS POINT
PILESGROVE
MANNINGTON
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Marshalltown Rd
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Major Run
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Maple Av
Sunset Dr
Auburn Rd
Halltown Rd
Halls Run
Biddle Rd
Bassett Rd
Kates Creek Meadow
Nimrod
Culliers Run
Cheney Rd
Cemetery Rd
Fenwick Rd
Fenwick
Mannington Yorktown Rd
Portertown
Mannington Creek
Compromise Rd
Pierson Rd
Mannington Meadow
Harris Rd
Welchville
Swedes Bridge Rd
Hackett Rd
Swedes Run
Welchville Rd
Old Kings Hwy
Dubois Rd
Mannington Mills
Acton
Dolbow Rd
Fenwick Creek
Neck Rd
Quaker
Clancy
Station Rd
School House Ln
Keasbeys Creek
Salem River
1482537
1482530
1482500
AN0693
AN0694
AN0691
AN0692
AN0697
AN0698
AN0700
NJTPK
295
49
45
40
631
628
646
540
551
678
679
669
620
632
653
676
664
603
657
659
581
Stream
Lake
Municipality
USGS Surface Water Quality Gauge (2002)
Eutrophic Lake (2003)
Impaired Waters
Aquatic Life Designated Use Does Not Attain Standards (2002)
Elevated Concentrations of Fecal Coliform Bacteria (2003)
NJDEP Ambient Biomonitoring Network (AMNET)
1st Round of Sampling (1995)
None
Moderate
Severe
2nd Round of Sampling (2000)
Non-Impaired
Moderately Impaired
Severely Impaired
Source : NJDEP,NJDOT,DVRPC.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
Map 8:
Water Quality - Non-Tidal Waters
N
Miles
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Delaware Valley Regional Planning Commission
2007

All waterbodies in New Jersey are classified by NJDEP as either freshwater (FW), pinelands water (PL), saline estuarine water (SE) or saline coastal water (SC). Freshwater is further broken down into freshwater that originates and is wholly within federal or state parks, forests, or fish and wildlife lands (FW1) and all other freshwater (FW2). The water quality for each of these groups must be able to support designated uses that are assigned to each waterbody classification (see *Surface Water Quality Standards N.J.A.C. 7:9B-1.12*). In addition to being classified as FW1 and FW2, fresh waterbodies are classified as trout-producing (TP), trout-maintaining (TM) or nontrout waters (NT). Each of these classifications may also be subject to different water quality standards.

The one major river in Mannington, the Salem River, is classified as FW2–NT/SE, which means that it is both a freshwater and an estuarine stream that is not trout producing or trout maintaining. The Salem River is freshwater from its headwaters to a location downstream past the head of tide. From these points seaward, the river is estuarine water.

Tributary streams that are not explicitly classified by the NJDEP take the classification of the river into which they flow. All streams in Mannington are tributaries of the Salem River and are not classified by the NJDEP. Therefore, tributary streams in Mannington are either FW2-NT or FW2-NT/SE1 waters, depending on whether or not the section they meet is estuarine.

Table 9: Water Quality Classifications of Streams in Mannington

Streams	Classification
Salem River	FW 2 – NT/SE1

Source: NJDEP, Surface Water Quality Standards, N.J.A.C. 7:9b;

According to NJDEP rules, FW2-NT waters must provide for (1) the maintenance, migration and propagation of the natural and established biota; (2) primary and secondary contact recreation (i.e., swimming and fishing/boating); (3) industrial and agricultural water supply; (4) public potable water supply after conventional filtration and disinfection; and (5) any other reasonable uses.
The determination of whether or not water quality is sufficient to meet a waterbody's designated use(s) is based on numerous surface water quality parameters. Some examples of surface water quality parameters include fecal coliform, dissolved oxygen, pH, phosphorous, and toxic substances. NJDEP also evaluates water quality by examining the health of aquatic life in a stream.

NJDEP operates two water-quality monitoring networks. In cooperation with US Geological Survey (USGS), it runs the ***Ambient Surface Water Monitoring Network (ASWM)***. This network contains 115 stations that monitor for nutrients (i.e., phosphorous and nitrogen), bacteria, dissolved oxygen, metals, sediments, chemicals, and other parameters.

The second water quality monitoring system is the ***Ambient Biomonitoring Network (AMNET)***, which is administered solely by NJDEP. It evaluates the health of aquatic life as a biological indicator of water quality.[5] This network includes 820 monitoring stations located throughout the state. Each station is sampled once every five years. The first round of sampling for all stations took place between 1992 and 1996 and a second round occurred between 1997 and 2001.

[5] More specifically, AMNET monitors the diversity of communities of small bottom-dwelling aquatic organisms.

Ambient Surface Water Monitoring (ASWM) network

The USGS/NJDEP Ambient Surface Water Monitoring (ASWM) network operates sites near Mannington on the Salem River and Major Run. Across the Mannington border in Pilesgrove, water quality in Major Run is monitored at Sharptown. Salem River water quality is monitored at Woodstown and at Courses Landing in Carneys Point. These sites are tested for a range of elements, including dissolved oxygen, pH, ammonia, nitrogen, and phosphorous. The results of these samples are summarized in **Table 10: New Jersey ASWM Sampling Locations for Mannington Waterways**, and the station locations are depicted on **Map 8: Water Quality – Nontidal Waters.** This map reflects conditions on freshwater, nontidal streams and the reporting methodology used through 2005. See the section below on *New Jersey's Integrated Water Quality Monitoring and Assessment Report* for information on 2006 reporting.

Ambient Biomonitoring Network (AMNET)

There are three AMNET sites that assess aquatic life within Mannington and an additional two sites that are upstream of the township on the Salem River. These five AMNET sites are listed in ***Table 11: New Jersey AMNET Sampling Locations for Mannington Waterways*** and are also depicted on **Map 8: Water Quality – Nontidal Waters**.

NJDEP first sampled the Major Run AMNET site in August of 1995 and the Culliers Run tributary and Swedes Run sites in September of 1995. The Mill Street and Kings Highway sites outside of Mannington on the Salem River were sampled in August of 1995. Five years later the five sites were sampled again. Each AMNET site was tested for one water quality parameter ─ the diversity of the aquatic communities at that site. Specifically, the benthic (bottom-dwelling) macroinvertebrates (insects, worms, mollusks, and crustaceans that are large enough to be seen by the naked eye) are collected. The numbers and types of species present are directly related to water quality. More sensitive species disappear first, as the pollution level increases, followed by moderately sensitive species. As these species "drop out," the diversity of the community drops as well.

In the 1995 (first round) sampling:
One of the three sites in Mannington had impairment scores that put it into the range of "severely impaired" for aquatic life support. The other two sites were ranked as "moderately impaired." One of the two Salem River sites was severely impaired, the other was only moderately impaired.

In the 2000 (second round) sampling:
The severely impaired site in Mannington scored even lower in 2000 and thus maintained a severely impaired status. The two previously moderately impaired sites scored at the same level of moderate impairment as in 1995. The moderately impaired Salem River site remained at the same level of impairment, while the severely impaired site improved in water quality and moved up to a moderately impaired ranking.

No further sampling since the 2000 – 2001 round has occurred in the Mannington Township area.

Other Monitoring

Certain fish may contain toxic chemicals, such as PCBs, dioxins, or mercury, which accumulate in water and aquatic life. Chemical contaminants such as dioxin and PCBs are classified by the U.S. Environmental Protection Agency as probably cancer-causing substances in humans. Elevated levels of mercury can pose health risks to the human nervous system. Infants, children, pregnant women, nursing mothers, and women of childbearing age are considered to be at higher risk from contaminants in fish than other members of the general public.

Since 1982, NJDEP has been catching fish at numerous sampling stations throughout the state and testing for contaminant levels, adopting advisories to guide residents on safe consumption practices. For example, for all tributaries of the Delaware River between the Pennsylvania – Delaware border and the C and D Canal in Delaware, there is an advisory to eat American eel only once a year. This would apply to Mannington Meadows and its tributary streams.

Some special monitoring by NJDEP includes the 303(d) Evaluation Monitoring, also called 303(d) Reconnaissance Monitoring, which was initiated in 1998 to provide high quality, current data regarding concentrations of total recoverable and dissolved metals in waterbodies included on the 1998 303(d) List for metals. This monitoring effort is also conducted cooperatively by the NJDEP and USGS.

Table 10: New Jersey ASWM Sampling Locations for Mannington Waterways

Site ID	Station Name/Waterbody	Municipality	Parameters Tested	Data Source	2004 Impairment Status	2006 Impairment Status
1482530	Major Run at Sharptown	Pilesgrove	Phosphorus , Fecal Coliform	NJDEP/USGS Data	Impaired	Delisted– Fecal Coliform TMDL approved; Impaired for Phosphorus
01482530	Major Run at Sharptown	Pilesgrove	Temperature, Dissolved Oxygen, pH, Nitrate, Dissolved Solids, Total Suspended Solids, Unionized Ammonia	NJDEP/USGS Data	Attaining	Impaired for Temperature & Total Suspended Solids
01482537	Salem River at Courses Landing [Rte 646]	Carneys Point	Fecal Coliform	NJDEP/USGS Data	Impaired	Delisted - TMDL
01482537	Salem River at Courses Landing [Rte 646]	Carneys Point	Phosphorus, Temperature, Dissolved Oxygen	NJDEP/USGS Data	Impaired	Delisted
01482500	Salem River at Woodstown	Woodstown	Fecal Coliform	NJDEP/USGS Data	Impaired	Delisted - TMDL
01482500	Salem River at Woodstown	Woodstown	Phosphorus	NJDEP/USGS Data	Impaired	Impaired - Phosphorus
01482500	Salem River at Woodstown	Woodstown	Temperature, pH, Dissolved Oxygen, Nitrate, Dissolved Solids, Total Suspended Solids, Unionized Ammonia	NJDEP/USGS Data	Attaining	Impaired – pH

Source: NJDEP, Bureau of Freshwater and Biological Monitoring

Table 11: New Jersey AMNET Sampling Locations Mannington Waterways

Site ID	Station Name/Waterbody	Municipality	Parameters Tested	1995 NJ Impairment Score	2000 NJ Impairment Score	2004 Impairment Status	2006 Impairment Status
AN0691	Salem River at Mill Street	Pilesgrove	Benthic Macroinvertebrates	6	15	Insufficient Data	Insufficient Data
AN0693	Salem River at Kings Highway	Pilesgrove	Benthic Macroinvertebrates	12	12	Impaired	Delisted
AN0694	Major Run at Pointers-Sharptown Road	Mannington	Benthic Macroinvertebrates	6	0	Impaired	Delisted
AN0697	Unnamed Tributary to Culliers Run at Basset Road	Mannington	Benthic Macroinvertebrates	12	12	Insufficient Data	Insufficient Data
AN0698	Swedes Run at Swedes Bridge Road	Mannington	Benthic Macroinvertebrates	15	15	Insufficient Data	Insufficient Data

Source: NJDEP, Bureau of Freshwater and Biological Monitoring

NJ Impairment Score	Biological Assessment
0-6	Severely Impaired
9-21	Moderately Impaired
24-30	Non-impaired

New Jersey's Integrated Water Quality Monitoring and Assessment Report

The Federal Clean Water Act under Section 303(d) requires states to identify "Impaired Waters" where specific designated uses are not fully supported. Accordingly, in 2002, 2004, and again in 2006, NJDEP compiled the *Integrated Water Quality Monitoring and Assessment Report* (www.state.nj.us/dep/wmm/sgwqt), which included as Sublist "4" and Sublist "5" those waters that are determined to be impaired. Other lists in the report included waterways that are attaining standards (Sublist "1") or where additional data is needed to determine their status (Sublists "2" and "3").

In the *2002* and *2004 Integrated List of Waterbodies*, the ASWM station on Salem River in Woodstown was listed on sublists 4 and 5 as impaired for two parameters: fecal coliform and phosphorous, respectively. The ASWM station on Major Run in Pilesgrove was listed on Sublist 5 for both phosphorous and fecal coliform. Both stations were on Sublist 1 (fully attaining or nonimpaired) for temperature, dissolved oxygen, pH, nitrate, dissolved solids, total suspended solids and ammonia. The Salem River station at Courses Landing was listed on Sublist 4 for fecal coliform and Sublist 5 for phosphorus, temperature, and dissolved oxygen.

Also in the *2002* and *2004 Integrated List of Waterbodies*, all three AMNET stations in Mannington were severely or moderately impaired for aquatic life, but only one of these stations—Major Run at Sharptown Road – was placed on Sublist 5 in the *2004 Integrated List*. The other two stations were placed on Sublist 3 because there was "insufficient data" to list them as either impaired or nonimpaired with any certainty. These were the Swedes Run site and the site on the unnamed tributary of Culliers Run. The two AMNET sites on the Salem River in

Pilesgrove were moderately impaired for aquatic life in the 2000 round of testing and the *2004 Integrated List of Waterbodies* listed one of these – Salem River Mill Street station – as impaired on Sublist 5. The other station – Kings Highway – was listed on Sublist 3 because of insufficient data.

In 2006, NJDEP rearranged its listings of waterbodies so as to report, on a subwatershed basis, the attainment of water quality standards required for achieving designated uses, rather than reporting stream segment impairments connected to particular sampling sites. Many HUC-14 subwatersheds have more than one monitoring station within them. Assessment of each subwatershed for attainment will be based on a suite of parameters rather than listing by individual parameter. Subwatershed evaluation will, therefore, be more comprehensive and consistent over time. It also allows for changes in the location of sampling stations. The *2006 Integrated List* was issued in early 2007. A revised map has not yet been issued.

Table 12: 2006 Integrated List of Waterbodies by Subwatershed, Mannington Township

Assessment Unit ID (Subwatershed)	Assessment Unit Name	Aquatic Life (general)	Primary Contact Recreation	Secondary Contact Recreation	Drinking Water Supply	Agricul. Water Supply	Industr. Water Supply	Fish Consumption
02040206 030040-01	Salem R (from Courses Landing [Rte 646] to County Home Rd)	Sublist 5	Sublist 4A	Sublist 4A	Sublist 2	Sublist 2	Sublist 2	Sublist 3
02040206 030060-01	Salem R (from the Canal dam to Courses Lndg [Rte 646])	Sublist 5	Sublist 4A	Sublist 3	Sublist 3	Sublist 3	Sublist 3	Sublist 3
020402060 40010-01	Mannington Creek	Sublist 3	Sublist 3	Sublist 3	Sublist 3	Sublist 3	Sublist 3	Sublist 3
02040206 040020-01	Fenwick Creek / Keasbeys Creek	Sublist 3	Sublist 3	Sublist 3	Sublist 3	Sublist 3	Sublist 3	Sublist 5
02040206 040030-01	Salem R (Fenwick Ck to the Canal dam [= Mannington Meadows])	Sublist 2	Sublist 3	Sublist 3	Sublist 3	Sublist 3	Sublist 3	Sublist 5

Source: NJDEP, Bureau of Freshwater and Biological Monitoring

Key to Integrated Report Sublists

Sublist 1	There is sufficient data to assess all applicable designated uses for the waterbody and the assessment indicates **full attainment** for all designated uses.
Sublist 2	Waterbodies are placed on this Sublist when an assessment for an individual designated use is complete and results for that assessment indicate **full attainment but other designated uses are unassessed**, **assessed as non-attaining or have an approved TMDL**. When all designated uses are assessed as fully attaining, these waterbodies will be moved to Sublist 1.
Sublist 3	Waterbodies are placed on this Sublist when the designated use assessment indicated **insufficient or no data** to assess the designated use.
Sublist 4A	Waterbodies are placed on this Sublist when the designated use is **non-attained** and the impairment is not caused by a pollutant.
Sublist 5	Designated use assessment is complete and results for the assessment indicate **non-attainment**.

According to NJDEP, for non-attaining subwatersheds, the individual pollutants causing the non-attainment of the designated uses will be identified on the "303(d) List of Impaired Waterbodies by Parameter with Ranking." The pollutant will be listed if known, or "pollutant unknown" or "toxic unknown" will be used when the pollutant is not known. The table below, ***Table 13***, lists those parameters for impaired subwatersheds within Mannington Township in the *2006 Integrated List of Impaired Waterbodies*.

Table 13: New Jersey's 303(d) List of Impaired Waters with Priority Ranking, December 2006

Assessment Unit ID (subwatershed)	Assessment Unit Name	Parameter	Ranking
02040206030040-01	Salem R (Courses Landing [Rte 646] to County Home Rd [near Rte 45])	Phosphorus	Medium
		Temperature	Low
		Total Suspended Solids	Low
02040206030060-01	Salem R (Canal dam to Courses Lndg [to Rte 646 = upstream from dam])	Phosphorus	Medium
		Temperature	Low
02040206040020-01	Fenwick Creek / Keasbeys Creek	Dioxin	Medium
		PCBs	Medium
02040206040030-01	Salem R (Fenwick Ck to Canal dam [= Mannington Meadows])	Dioxin	Medium
		PCBs	Medium

Source: NJDEP, Bureau of Freshwater and Biological Monitoring

In summary, the following waters in and around Mannington are impaired as follows:

For fecal coliform.

- Major Run at Sharptown (Kings Highway), Pilesgrove Township
- Salem River at Courses Landing (Pointer-Auburn Road), Carneys Point Township
- Salem River at Woodstown

Because a fecal coliform TMDL has been approved, these waters have been "delisted" (removed) from the impaired waters list. See the description of a Total Maximum Daily Load (TMDL) that follows this section.

For phosphorus

- Major Run at Sharptown (Kings Highway), Pilesgrove Township
- Salem River at Woodstown

The Salem River at Courses Landing has been "delisted" for phosphorus. The reason for this is not clear. Eight possible reasons for delisting are given in the *2006 Integrated List.*

For temperature and total suspended solids

- Major Run at Sharptown

For aquatic life:

- Major Run for the length of the stream
- Sections of the Salem River north of and at the Mannington-Pilesgrove border
- The entire length of Swedes Run
- An unnamed tributary of Culliers Run

In the *2004 Integrated List*, the above stream segments were listed as impaired for aquatic life. Although they were all delisted in 2006, due to new methods of monitoring, the

subwatersheds into which they fall are included there. All of Major Run and the Salem River from Route 45 to where the canal begins near Hawks Bridge Road (two subwatersheds) are listed as impaired for aquatic life. Other subwatersheds in Mannington are shown as having "insufficient data."

Knowing the actual condition of streams and stream banks, and planning for their improvement, requires fuller surveys and more frequent monitoring than the state can provide. The state only monitors main channels and only does biological assessments on a five-year cycle. Stream surveys by local organizations are much needed, along with regular monitoring of water quality on all of a community's waterways.

Total Maximum Daily Loads

For impaired waters (waters on Sublist 5), the state is required to establish total maximum daily loads (TMDLs). A TMDL quantifies the amount of a pollutant a waterbody can assimilate (its loading capacity) without violating water quality standards. A TMDL's purpose is to initiate a management approach or restoration plan based on identifying the sources of a pollutant and determining the percent reductions of the pollutant that must be achieved by each source of the pollutant. These sources can be point sources such as sewage treatment plants or nonpoint sources such as runoff from various types of residential, commercial, or agricultural lands.

Two TMDLs have been either approved or proposed for Mannington waters. In September 2003, a TMDL for fecal coliform was approved for the Salem River segment that forms Mannington's northern boundary with Pilesgrove and Carneys Point. In May 2005 a TMDL for fecal coliform was proposed for Major Run, the tributary to the Salem River that begins in Mannington and forms the border between Mannington and Pilesgrove townships.

See **Appendix B: Total Maximum Daily Loads Supplementary Information** for details of the TMDLs.

Implementation of the TMDLs will involve substantial
reductions in the amount of these pollutants from each known source. Some further analysis is necessary to determine sources more precisely, in the case of the fecal coliform impairments. However, in general, implementation relies on actions mandated by the Municipal Stormwater Management program, including the ordinances required to be adopted by municipalities under that permit, and on voluntary improvements to land and runoff management in agricultural areas. A list of U.S. Department of Agriculture and New Jersey programs that provide funding and technical assistance on relevant projects for farm landowners is included in **Appendix D: Federal and State Conservation Programs for Farmers**.

Causes of Water Quality Impairments

Stormwater Runoff

Stormwater runoff and other nonpoint source pollution (pollution coming from a wide variety of sources rather than from a single point such as a discharge pipe) have the largest effect on the water quality and channel health of streams in Mannington. These sources are also the most difficult to identify and remediate because they are diffuse, widespread, and cumulative in their effect. Most nonpoint source pollution in the Salem River watershed is known to derive from stormwater drainage off paved surfaces such as streets, commercial/industrial areas, and residential sites (with and without detention basins), and from agricultural fields that lack adequate vegetative buffers. Some of this runoff comes to the water- ways from similar sources in upstream townships, including runoff from agricultural land uses and from animal husbandry practices. Some of it derives from Mannington land uses. Specifically, the agricultural land uses in Mannington may contribute significant silt-laden runoff to the area's streams.

Photo by Nicholas Culver

Cows in a farm pond

In March 2003 the NJDEP issued a new Stormwater Management Rule, as required by the US Environmental Protection Agency's Phase II Stormwater Management Program for Municipal Separate Stormwater Sewer Systems (MS4). The rule lays out guidance and requirements for management of and education about stormwater at the local level. It applies to all towns in New Jersey, all county road departments, and all public institutional facilities on large sites (such as hospitals and colleges). Beginning in 2004, every municipality was required to obtain a New Jersey Pollution Discharge Elimination System (NJPDES) general permit for the stormwater system, and its discharges, within municipal borders, and to comply over a five year period.

The volume of runoff that is carried to a stream also impacts stream channel condition. Increased volume usually results from increased impervious surface within a subwatershed. Although impervious surface coverage in Mannington is currently minimal, township development will cause an increased level of impervious surfaces. As an area becomes developed, more stormwater is directed to the streams from neighborhood storm drains, residential and commercial stormwater facilities, and road drainage. In general, scientists have found that levels of impervious cover of 10 percent or more within a subwatershed are directly linked to increased stormwater runoff, enlargement of stream channels, increased stream bank erosion, lower dry weather flows, higher stream temperatures, lower water quality, and declines in aquatic wildlife diversity. When impervious cover reaches 25 percent to 30 percent, streams can become severely degraded.

Figure 6: Stormwater Management Basic Requirements

Stormwater Management Statewide Basic Requirements
Tier B* Towns (Mannington)

1. Control post-construction stormwater management in new development and redevelopment through:
    - Adoption of a stormwater management plan in accordance with N.J.A.C. 7:8.
    - Adoption and implementation of a stormwater control ordinance in accordance with N.J.A.C. 7:8. This ordinance requires retention on site of 100% of preconstruction recharge, and use of low-impact design in stormwater facilities, among other features.
    - Ensuring compliance with Residential Site Improvement Standards for stormwater management. The RSIS is currently being revised to incorporate the low-impact design and other requirements of the stormwater control ordinance.
    - Ensuring long-term operation and maintenance of Best Management Practices on municipal property.
    - Requiring that new storm drain inlets meet new design standards.

2. Conduct local public education:
    - Distribute educational information (about stormwater requirements, nonpoint source pollution, and stewardship) annually to residents and businesses and conduct a yearly "event" (such as a booth with these messages at a community day).
    - Have all municipal storm drain inlets labeled with some type of "don't dump" message.
    - Distribute information annually regarding fertilizer/pesticide application, storage, disposal, and landscaping alternatives and regarding proper identification, handling, and disposal of wastes including pet waste and litter
    - Adopt specific ordinances to control waste disposal and other nonpoint sources.

* Tier B municipalities are communities with lower population levels and densities. They have fewer stormwater requirements imposed on them. See the NJDEP Stormwater website www.njstormwater.org for more information.

Inadequate Stream Buffers

The stream buffer is the region immediately beyond the banks of a stream that serves to limit the entrance of sediment, pollutants, and nutrients into the stream itself. Stream buffers are quite effective at filtering substances washing off the land. The vegetation of the buffer traps sediment and can actually utilize (uptake) a percentage of the nutrients flowing from lawns and farm fields. When forested, a stream buffer promotes bank stability and serves as a major control of water temperature. The buffer region also serves as a green corridor, a greenway, for wildlife to move between larger forested habitat areas. Residents can utilize these greenways for recreation with the addition of trails, bikeways, and access points to water for fishing and canoe/kayak launching.

The importance of a healthy, intact buffer zone (also referred to as a "riparian corridor") has been well documented scientifically over the past 20 years, especially for headwater streams. There is less agreement and much continuing research on the appropriate minimum width of a buffer. In literature on this issue, a recommended minimum buffer width of 100 feet is most common, with differing activities permitted in each of three zones within the buffer. Buffers of up to 300 feet are recommended for wildlife corridors and potential passive recreational use, such as walking trails.

The New Jersey Freshwater Wetlands Protection Act incorporates buffer requirements into its wetland protection regulations. The width of the "transition zone" extending beyond a wetland is determined by the value of the wetland, based on its current use and on the documented presence/absence of threatened or endangered species. Municipalities may not establish buffers on wetlands that exceed those required by the state statute. However, the municipality can make certain that those limits are accurate through its review of the wetlands delineation process, and it can also monitor use of the land within the transition area and take action against encroachments.

Restoration of stream buffers on agricultural lands is supported by various programs of the US Department of Agriculture and the New Jersey Department of Agriculture, such as the Conservation Reserve Program (CRP), administered by the USDA's Farm Service Agency (FSA), and the New Jersey version of this program which is labeled as CREP. This program is designed to help farmers reduce impairments from agricultural water runoff sources in an effort to improve water quality. The program compensates farming landowners for the loss of land being converted to a buffer or other habitat. It also funds or directly creates new buffers where they are absent. Programs such as the Environmental Quality Incentive Program (EQIP), administered by the Natural Resources Conservation Service (NRCS) of USDA, encourage the "due care" management of agricultural lands, involving the proper levels of fertilizer and pesticide applications to farmland. It funds up to 75 percent of the costs of eligible conservation practices. These are all programs in which individual landowners volunteer to take part. See **Appendix D: Federal and State Conservation Programs for Farmers** for a listing of these programs. The New Jersey Audubon Society's stewardship program provides direct assistance to farmers in the Mannington Meadows area who are interested in investigating or applying for these programs.

Photo by Brian Marsh

An example of a good wooded buffer along the water's edge

Point Sources of Pollution

Point sources of pollution, which come from a single source or "point" such as an industrial pipe discharge, are regulated by NJDEP through the New Jersey Pollution Discharge Elimination System (NJPDES). New Jersey created NJPDES in response to the Federal Clean Water Act of 1972, which mandated that each state develop water quality standards and regulate the amount of pollution entering water bodies. The Act classified all water pollution into one of two categories: "point source" pollution and "nonpoint source" pollution (coming from many diffuse sources, such as through stormwater), but only required states to regulate point sources until recently.

NJDEP, through the Division of Water Quality and the Bureau of Point Source Permitting, administers the NJPDES program (*N.J.A.C. 7:14A*). Under NJPDES, any facility discharging domestic or industrial wastewater directly into surface water or groundwater (usually through a septic system) must apply for and obtain a permit for discharging. Rather than creating individually tailored permits for every facility, the Division of Water Quality uses scientific standards to create and issue general permits for different categories of dischargers. NJDEP enforces the terms of NJPDES permits by visiting discharging facilities and requiring facilities to conduct water quality, biological, and toxicological analyses, and thermal impact and cooling water assessments periodically.

Under the Open Public Records Act (OPRA) of 2002, a list of active NJPDES permits is available. As of June 26, 2006, five NJPDES permits were issued to three individual facilities in Mannington. These are shown in **Table 14: Mannington NJPDES Permits**.

Since the adoption of the federal Clean Water Act in 1972 and the implementation of NJPDES in subsequent years, water pollution from point sources has decreased drastically. However, as development has continued to spread throughout New Jersey, nonpoint source pollution has increased substantially in recent decades. NJDEP's new Stormwater Management Rules, described previously, focus on reducing and controlling nonpoint sources of water pollution.

Table 14: Mannington NJPDES Permits

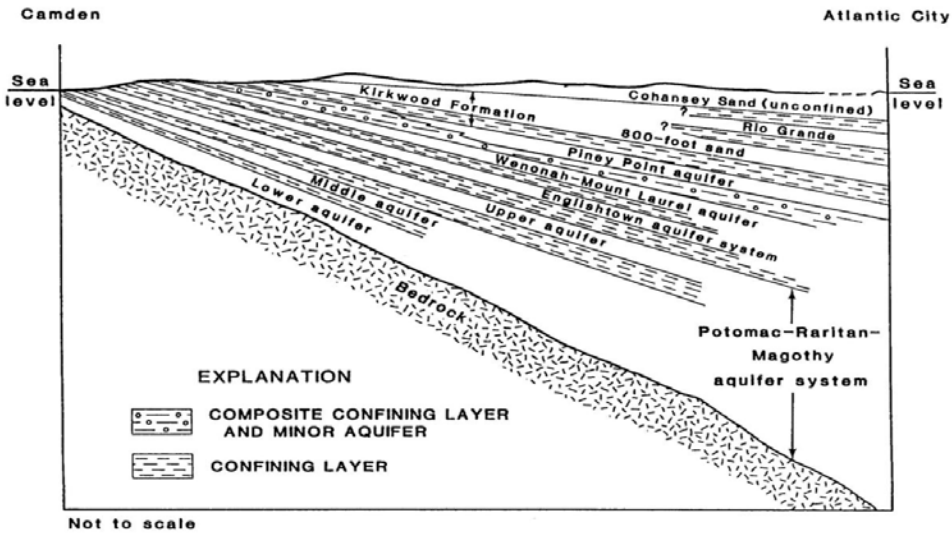
NJPDES Permit #	Facility Name	Effective Start Date	Expiration Date	Discharge Category Description	Street Address
NJ0102156	Mannington Mills, Inc.	2/1/06	1/31/11	Discharge to Groundwater	75 Mannington Road
NJ0136361	Mannington Mills, Inc.	4/1/02	8/31/06	Significant Indirect User	75 Mannington Road
NJG0130877	Mannington Mills, Inc.	6/1/02	5/31/07	Basic Industrial Stormwater	75 Mannington Road
NJG0134783	Red Bird Egg Farm, Inc.	6/1/03	2/29/08	Concentrated Animal Feeding Operation	112 Cemetery Road
NJG0151173	Mannington Township	9/1/05	2/28/09	Tier B Municipal Stormwater	491 Rt 45
NJG0163635	Sam Taylor & Sons Natural Earth Prod Pit	6/01/06	4/30/10	Mining and Quarrying Activity Stormwater	Dubois Road

Source: NJDEP, NJ OPRA, Active Permit List

GROUNDWATER

The geology of the New Jersey Coastal Plain can be visualized as a tilted layer cake, with its "layers" or strata formed of gravels, sands, silts, and clays. The saturated gravel and sand layers, with their large pore spaces, are the aquifers from which water is drawn. The silt and clay layers, which impede the movement of water, are called confining beds.

A cross section across southern New Jersey from west to east would show that the layers are not horizontal but tilt downward toward the southeast, getting deeper as they cross the state toward the Atlantic Ocean. Because of this tilting, each layer formation emerges on the land surface in a sequential manner. The deepest formations emerge on the surface near the Delaware River. Where a formation emerges is its "outcrop" area. The Potomac-Raritan-Magothy (PRM) formation, the deepest and most abundant aquifer, is a major water source for Inner Coastal Plain communities. Other smaller aquifers on top of the PRM are the Englishtown, the Wenonah-Mount Laurel, and the Kirkwood-Cohansey. The Kirkwood-Cohansey is a formation composed of two thick layers, the Kirkwood (lower) and the Cohansey (upper), that overlie the older formations. It begins east of the inner/outer coastal plain divide. Because Mannington Township is situated on the coastal plain divide, the township contains a large area of the Kirkwood-Cohansey aquifer outcrop area.



Source: US Geological Survey

Figure 7: Aquifers of Southern New Jersey along a line from Camden to Atlantic City

Aquifers

Several aquifers underlie parts of Mannington Township. Three major aquifers – the Potomac-Raritan-Magothy (PRM), the Wenonah-Mount Laurel, and the Englishtown – provide public and private drinking water for Mannington residents. A preliminary search of well records indicated that the majority of domestic wells in Mannington are between 30 and 160 feet deep, although some wells are up to 500 or 600 feet deep. In general, the majority of wells most likely tap the

Englishtown system, although some wells appear to draw water from the Upper PRM system. While most residents rely on private well water, public water departments in nearby Salem and Woodstown provide drinking water to a few Mannington homes and businesses. The Salem water department utilizes the Wenonah-Mount Laurel aquifer, and the Woodstown public water system taps both the Wenonah-Mount Laurel and the Potomac-Raritan-Magothy aquifers. The Kirkwood-Cohansey, Wenonah-Mount Laurel, and Englishtown aquifer systems outcrop in the township.

Potomac-Raritan-Magothy Aquifer System (PRM)

The Potomac-Raritan-Magothy (PRM) is the primary source of drinking water for Woodstown public wells, which provide water to some facilities in Mannington. This multiple aquifer system is actually a large series of formations that have been combined and described as a single unit because the individual formations – the Potomac group and the Raritan and Magothy formations – are lithologically indistinguishable from one another over large areas of the Coastal Plain. That is, they are composed of materials of like kind and size laid down by both an advancing and retreating sea across southern New Jersey and by deposits of material that came from the breakdown and erosion of the Appalachian and Catskill mountains beginning in the Cretaceous Period (60 to 150 million years ago).

In southern New Jersey, three aquifers have been distinguished within the PRM system – designated as lower, middle, and upper, divided by two confining units or layers between the three water-bearing strata. The aquifers themselves are largely made up of sands and gravels, locally interbedded with silt and clay. The lower aquifer sits on the bedrock surface. Confining beds between the aquifers are composed primarily of very fine-grained silt and clay sediments that are less permeable and thus reduce the movement of water between the aquifers. They also help to slow the entry of any contaminants on the surface down into the groundwater.

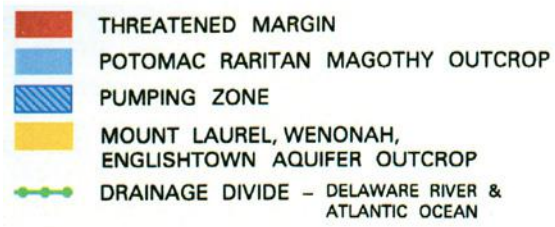


Figure 8: Water Supply Critical Area Number 2

Source: DVRPC

The PRM is the primary source of drinking water to New Jersey residents from Burlington to Salem counties, as well as to communities in Delaware. Because of such high usage, PRM aquifer water levels have declined. The water level drop became so serious that the New Jersey Department of Environmental Protection established Water Supply Critical Area #2 in 1986. All water supply companies within Critical Area #2 were given annual limits on water withdrawals in the PRM. Usage from the PRM was cut back by over 20 percent and no increases in pumping were allowed. Piping of treated Delaware River water filled the gap in much of the region. Neither Woodstown nor Mannington are within the boundary of the Critical Area, but the threatened margin is just to the north of Pilesgrove.

There is increased concern that additional pumping from the aquifer in the borderline areas will necessitate the expansion of the Critical Area boundaries. Thus, water supply companies in Gloucester and Salem counties have and will continue to have difficulty getting approvals from the New Jersey Department of Environmental Protection for any additional water allocations from the PRM.

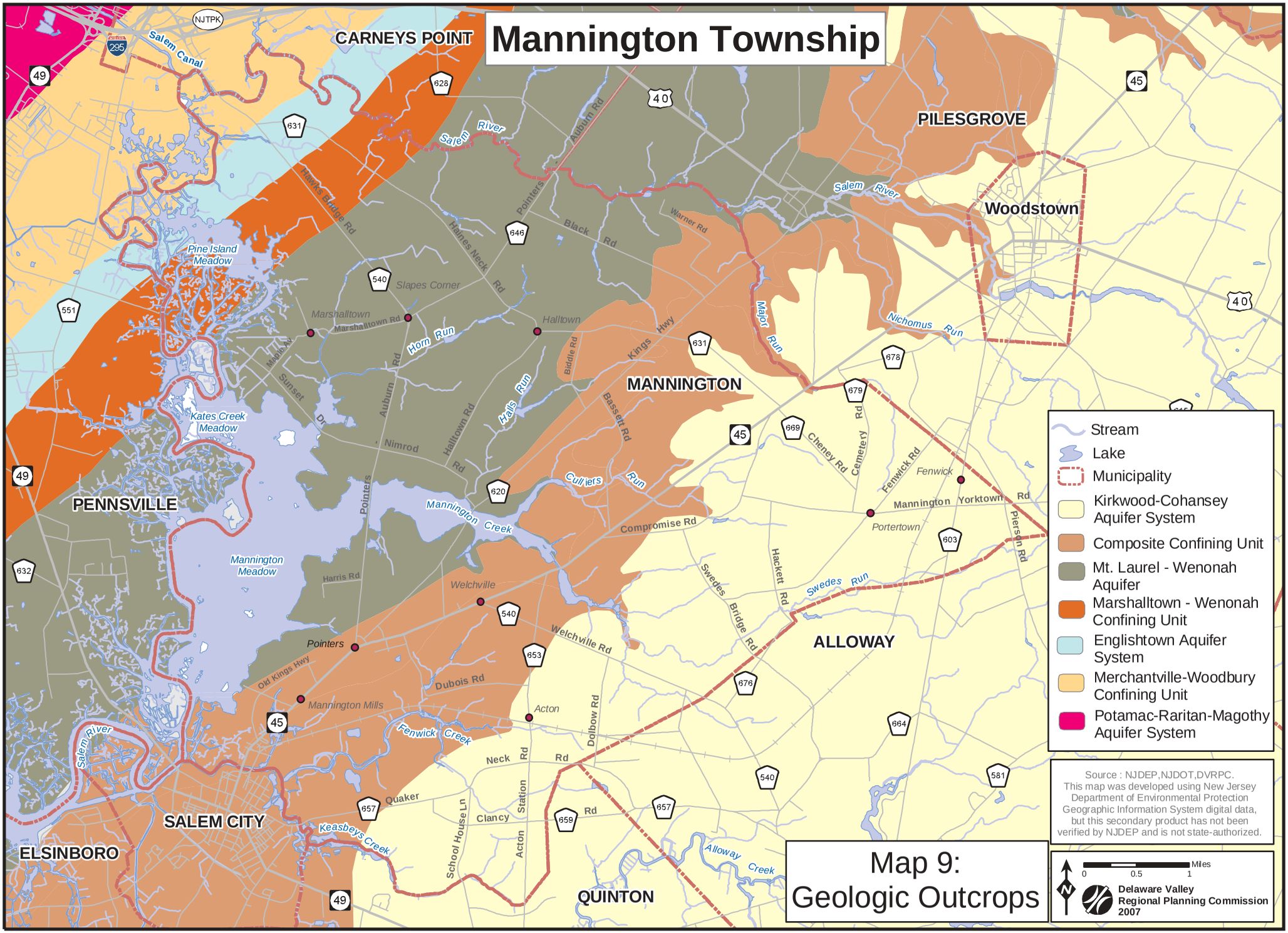
In Gloucester and Salem counties, use of the lower PRM aquifer for drinking water is limited due to high chloride concentrations (salt water intrusion). This is thought to be very ancient seawater within the lower aquifer, resulting from movement from the southeastern side, which is in contact with ocean water. Whatever the cause, most of the lower aquifer is not usable as a drinking supply. There are also problems with salinity levels in the upper and middle PRM aquifers, especially for wells closest to the Delaware River where pumpage has increased the amount of slightly saline water from the river to be drawn into the aquifers. In Woodstown, three public water supply wells were tested by the USGS and found to have elevated chloride levels. In 2004, the Woodstown Borough Council proposed a program to provide in-home, reverse-osmosis water treatment systems to residents who are medically required to reduce sodium intake in their diet. This program was withdrawn because NJDEP indicated that the measure was not strong enough to mitigate the health risk. Whatever the cause of saltwater intrusion, use of the lower aquifer for drinking supply is problematic in many areas.

The PRM does not outcrop in Woodstown Borough or Mannington Township; rather it outcrops under and immediately beside the Delaware River in New Jersey and Pennsylvania. River water actually enters and recharges the upper and middle PRM aquifers. Because an outcrop is the area where the aquifer emerges on the land surface, preventing contamination of the land in outcrop areas is extremely important in order to maintain a safe drinking water supply.

See **Map 9: Geologic Outcrops** for a depiction of these land areas.

Englishtown Aquifer System

The Englishtown Formation, of late Cretaceous age (100 to 60 million years ago), outcrops in the Inner Coastal Plain in an irregular band that extends from Raritan Bay to the Delaware River in Salem County. The aquifer outcrops in the northwest corner of Mannington. Where the Englishtown Formation is exposed, the primary components are fine- to medium-grained sands. In parts of Burlington, Camden, Gloucester, and Salem counties, the aquifer is commonly less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Salem River
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678
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Stream
Lake
Municipality
Kirkwood-Cohansey Aquifer System
Composite Confining Unit
Mt. Laurel - Wenonah Aquifer
Marshalltown - Wenonah Confining Unit
Englishtown Aquifer System
Merchantville-Woodbury Confining Unit
Potamac-Raritan-Magothy Aquifer System
Source : NJDEP,NJDOT,DVRPC.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
Map 9:
Geologic Outcrops
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than 40 feet thick. It is not a major source of water in Salem County due to its thinness and greater proportion of fine-grained sediments, resulting in lower yields. More productive aquifers lie above and below it.

Marshalltown-Wenonah Confining Unit
The Marshalltown-Wenonah confining unit lies between the Englishtown and Wenonah-Mount Laurel aquifers. The unit comprises the silt and sand of the Marshalltown Formation and the lower, fine-grained portion of the Wenonah Formation. Both formations are of the late Cretaceous period. The Marshalltown formation is thin and somewhat permeable in some areas. As a result, the unit is a leaky confining bed.

PRIVATE DRINKING WELLS

Private wells, supplying potable water, are not routinely monitored like public community water systems (public water) and public non-community wells. Beginning in 2002, the State of New Jersey, under the Private Well Testing Act, required that well water be tested for contaminants when properties are sold or leased. Prior to 2002, each county health department mandated what parameters were to be tested for real estate transactions.

See **Appendix C: Private Well Testing Act** for more information about private wells and drinking water in Salem County.

Wenonah-Mount Laurel Aquifer System

The Wenonah-Mount Laurel aquifer is composed of the Wenonah Formation and the Mount Laurel Sand Formation, both of late Cretaceous age. It is thickest in Burlington, Camden, Gloucester, and Salem counties, reaching 100 to 120 feet in width. The aquifer outcrops in the western portion of Mannington. Both the Salem City and Woodstown water departments, which provide water to some Mannington residences and businesses, draw water from this aquifer.

The Wenonah-Mount Laurel aquifer is affected by withdrawals from the Englishtown aquifer, which lies below the Wenonah-Mount Laurel. As a result of Englishtown withdrawals, more Wenonah-Mount Laurel water leaks through the confining layer to the Englishtown aquifer. Reductions in the Potomac-Raritan-Magothy Aquifer System also negatively affect water levels in the Wenonah-Mount Laurel aquifer.

Composite Confining Unit
A composite confining unit overlies the Wenonah-Mount Laurel aquifer. The Navesink Formation, Red Bank Sand, Tinton Sand, Hornerstown Sand, the Vincentown Formation, the Manasquan Formation, Shark River Marl, the Piney Point Formation and the basal clay of the Kirkwood Formation form this unit. These geologic formations, ranging in age from late Cretaceous to Miocene, are dominated by silty and clayey glauconitic quartz sands. Red Bank sand and the Vincentown and Piney Point formations are somewhat permeable and function as aquifers in some locales.

Kirkwood-Cohansey Aquifer System

The Kirkwood-Cohansey aquifer system is considered one of the largest sources of groundwater in New Jersey. The Kirkwood Formation, along coastal areas, appears as thick clay beds, with interbedded zones of sand and gravel. The Cohansey Sand, also of Miocene age, is coarser grained than the underlying Kirkwood Formation. It contains minor amounts of pebbly sand and interbedded clay. Some local clay beds within the Cohansey Sand are relatively thick.

The surficial nature of the Kirkwood-Cohansey makes it vulnerable to contamination from various land uses. The Kirkwood-Cohansey has a large outcrop area in the eastern part of Mannington. Industrial chemicals, agricultural chemicals used for crop production and residential landscaping, pesticides, and products of septic tank effluent have all been found in water from the aquifer in various areas in southern New Jersey. Where possible, care must be taken to prevent contamination on the land surface because it can so easily enter the groundwater of this unconfined aquifer (lacking protective clay layers above it). In addition, it is important to site wells to avoid proximity to deleterious land use and contamination.

Groundwater Recharge

Recharge of groundwater is an important issue in southern New Jersey because of the dependence on aquifers for drinking water supply and agricultural use. The amount of rainwater that actually enters an aquifer and reaches the saturated zone to become groundwater is a function of many factors, including the nature and structure of the aquifer itself, climatic conditions, the nature of the soil, and the vegetation of an area.

The New Jersey Geological Survey has developed a methodology for evaluating land areas for their ability to transmit water to the subsurface, using precipitation records, soil surveys, and land use/land cover data. NJDEP has used this methodology to map and rank land areas throughout the state as to groundwater recharge potential. Recharge is measured as the amount of precipitation that will reach the water table in one year.

In Mannington, lands with recharge from 11 to 14 inches per acre per year, the highest in the township, are found mainly in the north. Other high recharge patches are scattered throughout the township. Fourteen percent of lands (3,144 acres) recharge 11 to 14 inches per year. Thirty-eight percent (8,493 acres) of Mannington's land recharges 8 to 10 inches of groundwater a year. These moderate recharge areas are found in the central, southern, and western areas of the township. See **Map 10: Groundwater Recharge**.

In general, on high recharge lands, large amounts of paving and high impervious cover will have the most detrimental impact, although they are also usually the places that are most suitable for building because they are on well-drained soils. Conversely, these are also regions where the dilution of substances from septic systems, such as nitrates, may require a larger land area because the soils are usually more "porous." For example, minimum average lot sizes of two to four acres are often needed for proper nitrate dilution from septic systems in areas having ten or more inches per year of groundwater recharge.

Water Supply Wells

There are no active public water supply wells in Mannington. Public water supply wells in neighboring Salem City and Woodstown do supply some areas of the township with drinking water. Public water supply wells are listed in ***Table 15: Public Water Supply Wells***.

Three of the wells pump water from the PRM and four from the Wenonah-Mount Laurel aquifer. All public wells in the area are shown on **Map 11: Public Water Supply Wells**.

Table 15: Public Water Supply Wells

Well ID #	Original Owner	Aquifer	Depth to Top of Well (feet)	Depth to Bottom of Well (feet)
3014867	Salem Water Department	Mount Laurel-Wenonah	108	168
3015191	Salem Water Department	Mount Laurel-Wenonah	102	162
5000042	Salem Water Department	Mount Laurel-Wenonah	110	150
3009510	Woodstown Water Department	Mount Laurel-Wenonah	100	144
3001441	Woodstown Water Department	Potomac-Raritan-Magothy	692	712
5000038	Woodstown Water Department	Potomac-Raritan-Magothy	670	705
3013120	Woodstown Water Department	Potomac-Raritan-Magothy	570	670

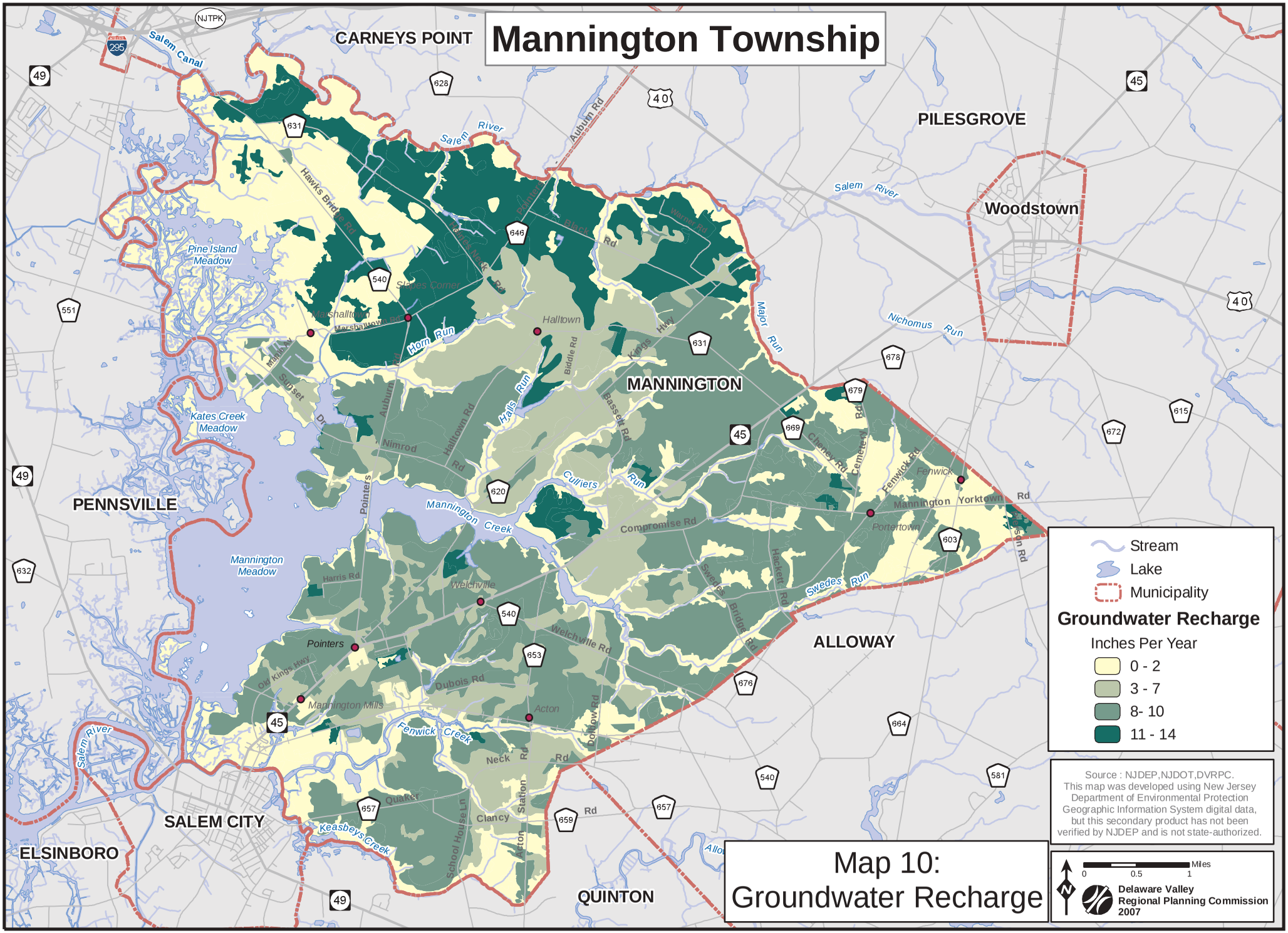
Source: NJDEP, Bureau of Geographic Information System

Public non-community wells are another part of a public water system. There are two types of non-community water systems, transient and non-transient, referring to the types of populations who utilize them. A non-transient water system serves at least 25 of the same people daily at a minimum of six months per year, at places like schools, factories, and office parks. A transient non-community water system serves at least 25 people each day, but the population changes each day. These systems are at such places as rest stops, gas stations, and restaurants. See ***Table 16: Public Non-Community Wells*** below.

Table 16: Public Non-Community Wells

Well ID #	Original Owner	Well Depth	Well Type
1705309	Michael Catalano Farms	160 feet	Transient
1705301	Mannington TWP school	Not available	Non-transient
1705306	Remsterville Learning Center	Not available	Non-transient

Source: NJDEP, Bureau of Geographic Information System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Nichomus Run
Pine Island Meadow
Kates Creek Meadow
Mannington Meadow
Halltown
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Slapes Corner
Welchville
Pointers
Mannington Mills
Acton
Fenwick
Mannington
Yorktown
Portertown
Stream
Lake
Municipality
Groundwater Recharge
Inches Per Year
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3 - 7
8- 10
11 - 14
Source : NJDEP,NJDOT,DVRPC.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
Map 10:
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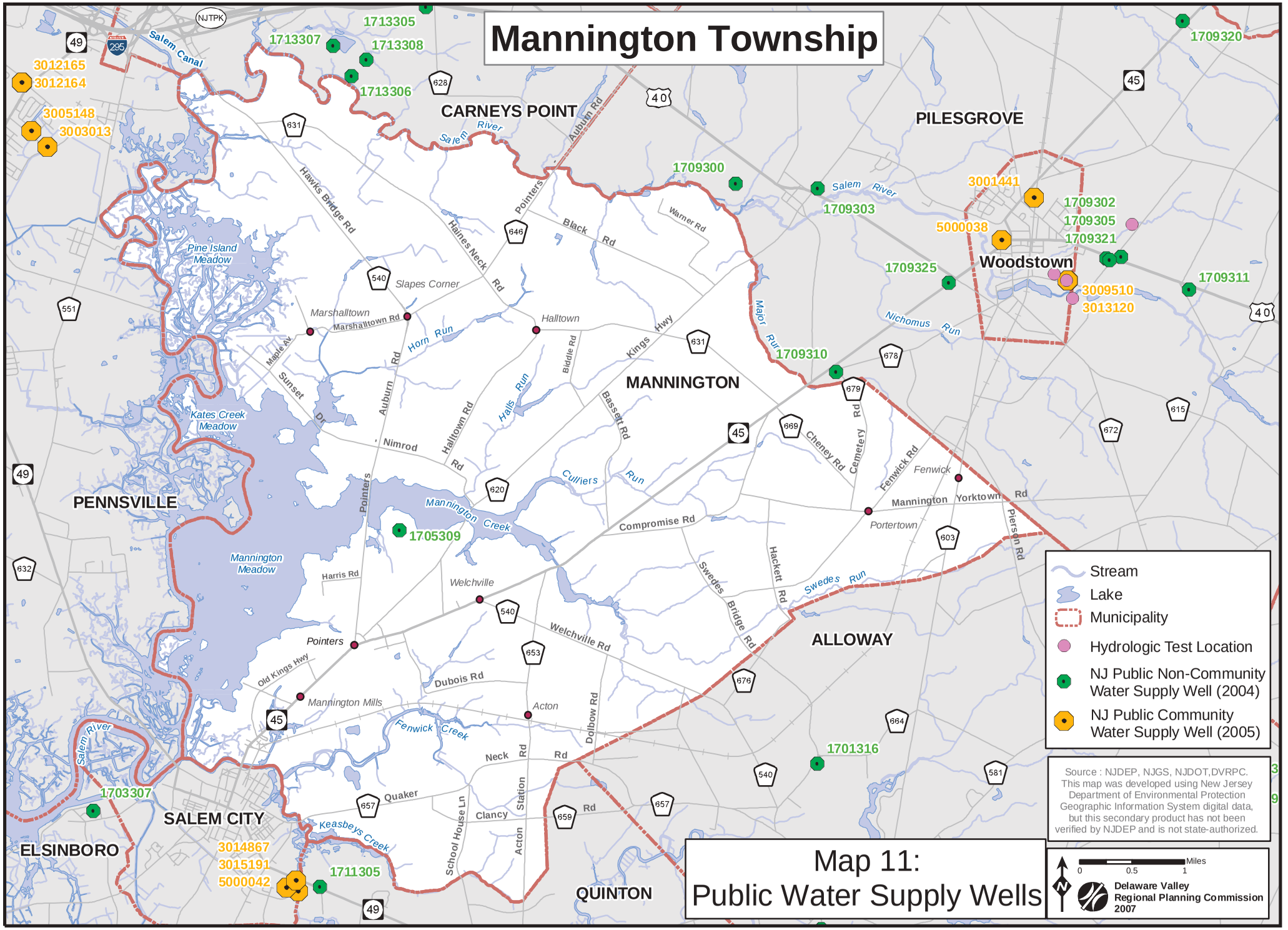
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1709325
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1703307
3014867
3015191
5000042
1711305
1701316
Stream
Lake
Municipality
Hydrologic Test Location
NJ Public Non-Community Water Supply Well (2004)
NJ Public Community Water Supply Well (2005)
Source : NJDEP, NJGS, NJDOT,DVRPC. This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
Map 11:
Public Water Supply Wells
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BIOLOGICAL RESOURCES

When a community protects wildlife and habitat, it is also protecting biodiversity, which enables many species, including humans, to thrive and live healthy lives. Biodiversity refers to the variety of genetic material within a species population, the variety of species (plants, animals, microorganisms) within a habitat, and the variety of ecosystems within a given region. Biodiversity facilitates adaptation and evolution, improving a species' chance of survival as the environment changes. A diversity of plant and animal species is also necessary to maintain healthy human environments, working landscapes, and productive ecosystems. Lower organisms, many not well known, contribute to nutrient cycling, decomposition of organic matter, soil rehabilitation, pest and disease regulation, pollination, and water filtering. Once biodiversity declines, it is extremely hard for an ecosystem to recover or replace species.

Mannington contains numerous types of natural habitats, all of which are important for maintaining biodiversity. Wetlands, which support plants that require constantly saturated soils, are the most abundant type of natural habitat in Mannington. Upland forests and freshwater tidal marshes are also major habitats present in Mannington. Within and around Mannington's waterbodies are submerged communities, which require persistent standing water. The following sections will identify and describe in more detail the plant and animal communities that inhabit these ecosystems within Mannington.

NATURAL VEGETATION

An area's vegetation is dependent on many factors, the most important of which are climate and soils. The region has a cool, temperate climate with rainfall averaging 46 inches per year. See the *Climate* section on page 24 for a detailed description of Mannington's variable climate. The majority of Mannington's soils are at least moderately well-drained soils, supporting a diversity of trees and crops. The area also has a substantial amount of poorly drained soils that exhibit ponding and sustain wetland plants. See the *Soils* section on pages 12-23 for a detailed description of Mannington's soils.

Mannington's natural vegetation types, along with human-influenced types of land cover, have been tabulated and mapped by NJDEP's 2002 land cover analysis. This data, based on infrared aerial photography, is the most recent available. The designation of a particular land cover as a vegetation type is based on definitions provided by the Anderson Land Use Classification System, created by the U.S. Geologic Survey. See ***Table 17: Mannington Township Natural Vegetation*** and **Map 12: Natural Vegetation (2002**).

Table 17: Mannington Township Natural Vegetation

Type of Vegetation	Acres	% of Total Land Area of Township
Deciduous Forest	1620.68	6.63%
Coniferous Forest	27.98	0.11%
Mixed Forest (> 50% deciduous)	31.03	0.13%
Mixed Forest (> 50% coniferous)	55.34	0.23%
Brush/Shrubland - deciduous	85.20	0.35%
Brush/Shrubland - coniferous	33.60	0.14%
Brush/Shrubland - mixed	325.20	1.33%
Old Field (< 25% brush covered)	155.85	0.64%
Wetlands (freshwater tidal marsh)	589.99	2.42%
Wetlands - herbaceous	1055.59	4.32%
Wetlands (deciduous wooded)	1886.63	7.72%
Wetlands (coniferous wooded)	0.62	0.00%
Wetlands (deciduous scrub/shrub)	356.57	1.46%
Wetlands (coniferous scrub/shrub)	2.77	0.01%
Wetlands (mixed scrub/shrub, deciduous dominated)	32.21	0.13%
Wetlands (mixed scrub/shrub, coniferous dominated)	3.83	0.02%
Modified wetlands (managed in maintained lawn greenspace)	14.06	0.06%
Modified Wetlands (former agricultural)	12.67	0.05%
Modified Wetlands (right-of-way)	42.70	0.17%
Modified Wetlands (disturbed wetlands)	15.00	0.06%
Artificial Lakes	163.16	0.67%
Streams and Canals	2.64	0.01%
Tidal Waters	3196.96	13.09%
Total Natural Vegetation Land Cover	**9,710.28**	**39.09%**

Source: NJDEP (2002 Land Cover)

Wetlands

Wetlands are a critical ecological resource, supporting both terrestrial and aquatic animals and boasting biological productivities far greater than those found on dry land. Wetlands play a vital role in maintaining water quality by cleaning surface and ground waters. The ecological importance of wetlands, however, has not always been appreciated. For over three centuries people drained, dredged, filled and leveled wetlands to make room for development and agriculture. Although the pace of wetland destruction has slowed markedly in the past three decades, human activities have destroyed approximately 115 million of the original 221 million acres of wetlands in the United States since the beginning of European settlement.

Most wetlands in Mannington are found in association with major streams and their tributaries, including the Salem River, Major Run, Fenwick Creek, Keasbey Creek, and Mannington Creek. Wetlands are dominant in the northwest by the Pine Island Meadow and in the east around

Portertown. Wetlands provide high-quality animal and plant habitat, purify surface and groundwater, and create picturesque landscapes that add immeasurably to the quality of life for area residents. According to the Anderson Land Use Classification System, Mannington has three major types of unmodified wetlands: (1) wooded wetlands dominated by deciduous trees, (2) freshwater tidal marshes, and (3) herbaceous (nonwoody) wetlands, dominated by *Phragmites*. Five other types of wetlands exist in Mannington, and are listed in ***Table 17***.

Common throughout Mannington are deciduous wooded wetlands (sometimes referred to as forested wetlands). Deciduous wooded wetlands occupy 1,887 acres of Mannington and support mixed hardwoods that flourish in low elevations. Some common trees in the area's deciduous wooded wetlands are red maple, black tupelo, ash, black willow, American beech, swamp white oak, willow oak, southern red oak, and sweetgum.

Closely associated with deciduous wooded wetlands are deciduous or deciduous-dominated mixed scrub/shrub wetlands, occupying 389 acres of Mannington. These areas are generally composed of young, medium-height woody plants. In these wetlands, vegetation is composed of over 75 percent deciduous species. Associated with scrub/shrub wetlands are young saplings of red maple, dogwood, and sweetgum, and dominated by shrub species like silky dogwood, red-osier dogwood, gray dogwood, mimosa, southern arrowhead, and hazel alder.

Swaths of deciduous wooded wetlands and scrub/shrub wetlands are found along stream corridors and in the northwest, eastern and southern reaches of the township. In some areas, fragile wetlands are associated with and protected by upland forests. However, most wetlands, especially those along stream corridors, are adjacent to large agricultural operations

Herbaceous wetlands are the second most common type of wetland found in Mannington, occupying 1,056 acres in the township. Two types of herbaceous wetlands exist. By far the largest are *Phragmites*-dominated wetlands, covering 1,027 acres. This plant, also called the common reed, colonizes easily and pushes into wetland areas from adjoining dryer land, growing through underground shoots that make it difficult to eradicate. As it spreads, it tends to trap silt and gradually to raise the land level, converting the habitat to one that is dryer. This conversion, plus its manner of growth, enables *Phagmites* to push out other wetland species of plants. *Phragmites* is found in large colonies around Mannington meadows and along major streams. It is also found in smaller patches along small tributaries.

Photo by Nathaniel Culver

Marsh vegetation including Phragmites and cattails, with a red-winged blackbird.

The second type of freshwater herbaceous wetland includes plants such as Jack-in-the-pulpit, jewelweed, ferns, rice cutgrass, reed canary grass, pond lily, tearthumb, arrow-leafed tearthumb, and broadleaf cattail. In Mannington, herbaceous wetlands are rare, occupying only 186 acres of combined land area. Herbaceous wetlands are mainly scattered in small patches around streams, in particular near Fenwick Creek and the Salem River in the north.

Freshwater tidal marshes are the third most common type of wetland found in Mannington, occupying 590 acres in the township. Tidal marshes are located mainly in Mannington Meadow, Kates Creek Meadow, and Pine Island Meadow, as well as in Mannington, Fenwick and Keasbey creeks. A freshwater tidal marsh is dominated by annual and perennial herbaceous plants including wild rice, water hemp, jewelweed, pickerelweed, and splatterdock.

Modified wetlands are areas that have been altered by human activities and do not support natural wetland vegetation, but which do show signs of soil saturation on aerial infrared surveys. Agricultural wetlands, described in some detail on page 32, occupy 465 acres of land that is now under cultivation. This figure may be larger because not all modified agricultural wetlands show well on aerial infrared photos. Other modified wetlands encompass former agricultural wetlands, disturbed wetlands and wetlands that occur in maintained greenspaces such as open lawns, golf courses, and storm water swales. In total, modified wetlands occupy 550 acres or 2.2 percent of Mannington's land area.

Upland Forests

Upland areas are those locations without water at or near the soil surface. More than 6 percent of Mannington is composed of upland forests. Most of the area's original upland forests have been cleared and converted to farms. The remaining upland forests are primarily located near stream corridors and in the very eastern section of the township.

Upland forests are the fourth most abundant land cover type in Mannington after agriculture, wetlands, and water. Approximately 1,735 acres of Mannington is upland forest, of which the vast majority is deciduous forest. The composition of Mannington's upland deciduous forests is largely one of mixed oaks – black, red, chestnut, and willow oaks – joined by other hardwoods such as American beech, hickory and sweetgum. The understory is dominated by flowering dogwood, American holly, greenbriar, and sassafras. Vines, such as Virginia creeper, wild grapes, Japanese honeysuckle, and poison ivy, are common. Spicebush, arrowwood, and black haw are common shrubs in moister locations.

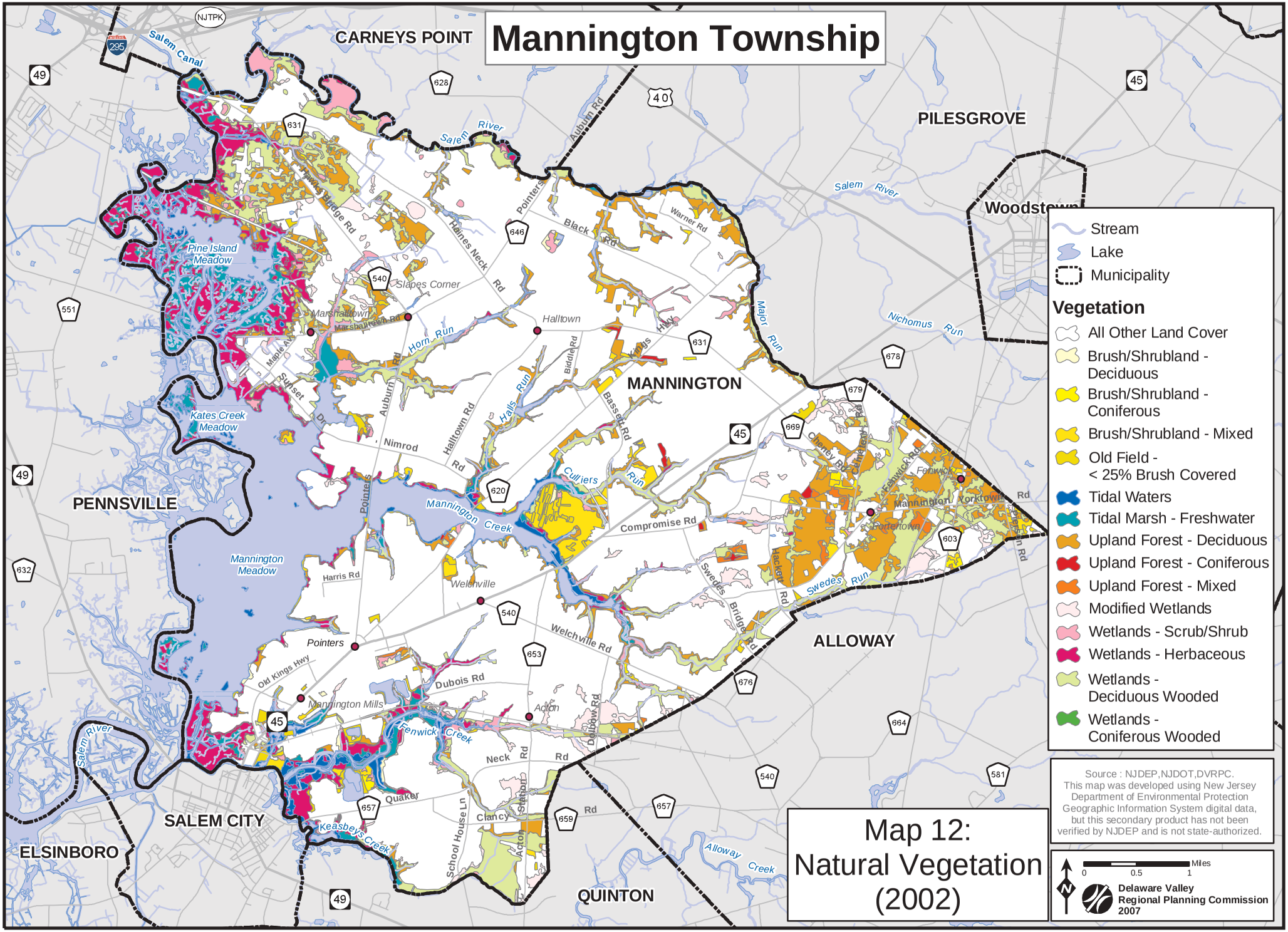
Photo by Nicholas Culver

Plowing under the cover crop

Coniferous trees occur on about 83 acres of Mannington. These forests are mostly made up of successional, or pioneer, plants – like Virginia pine, scrub pine, and pitch pine – which will eventually be overgrown by dominant deciduous trees, such as ash, birch, oak, and hickory.

Grasslands and Agricultural Lands

NJDEP defines grassland habitat as brushland, shrubland or old fields that were cleared or disturbed at one time and then abandoned. Following abandonment, old fields are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Welchville
Pointers
Mannington Mills
Acton
Fenwick
Porterstown
Yorktown
Stream
Lake
Municipality
Vegetation
All Other Land Cover
Brush/Shrubland - Deciduous
Brush/Shrubland - Coniferous
Brush/Shrubland - Mixed
Old Field - < 25% Brush Covered
Tidal Waters
Tidal Marsh - Freshwater
Upland Forest - Deciduous
Upland Forest - Coniferous
Upland Forest - Mixed
Modified Wetlands
Wetlands - Scrub/Shrub
Wetlands - Herbaceous
Wetlands - Deciduous Wooded
Wetlands - Coniferous Wooded
Source : NJDEP,NJDOT,DVRPC.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
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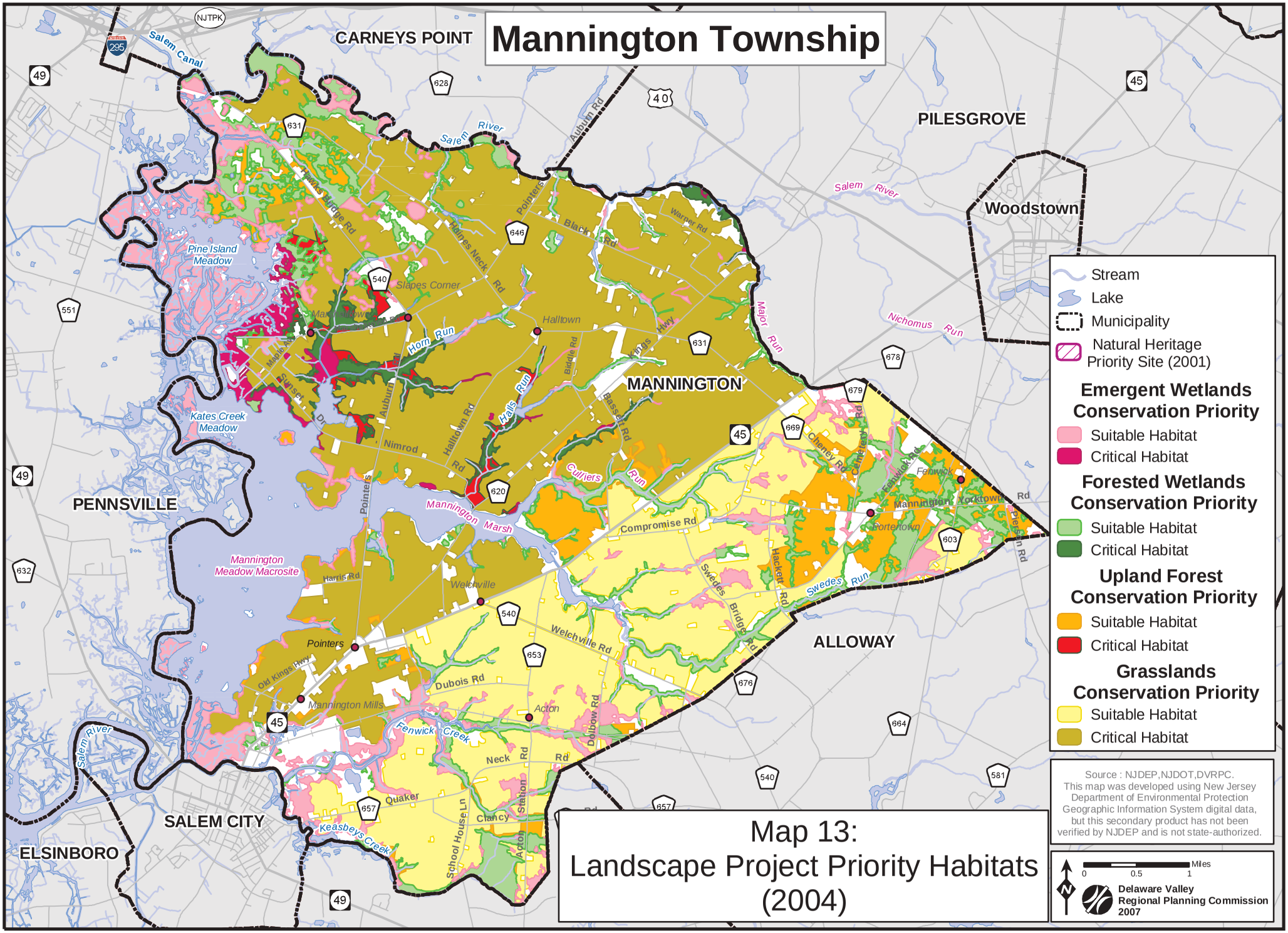
Delaware Valley Regional Planning Commission 2007
Map 12:
Natural Vegetation
(2002)


Mannington Township
CARNEYS POINT
PILESGROVE
Woodstown
MANNINGTON
PENNSVILLE
ALLOWAY
SALEM CITY
ELSINBORO
Salem Canal
Salem River
Nichomus Run
Major Run
Horn Run
Halls Run
Culliers Run
Swedes Run
Fenwick Creek
Keasbeys Creek
Mannington Marsh
Pine Island Meadow
Kates Creek Meadow
Mannington Meadow Macrosite
Slapes Corner
Halltown
Pointers
Mannington Mills
Acton
Welchville
Porterstown
Fenwick
Yorktown
Auburn Rd
Halltown Rd
Nimrod Rd
Compromise Rd
Welchville Rd
Dubois Rd
Quaker Neck Rd
Hackett Rd
Swedes Bridge Rd
Cheney Rd
Bassett Rd
Biddle Rd
Haines Neck Rd
Warner Rd
Black Rd
Harris Rd
Old Kings Hwy
School House Ln
Acton Station Rd
Dolbow Rd
Yorktown Rd
Pleasant Rd
NJTPK
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Stream
Lake
Municipality
Natural Heritage Priority Site (2001)
Emergent Wetlands Conservation Priority
Suitable Habitat
Critical Habitat
Forested Wetlands Conservation Priority
Suitable Habitat
Critical Habitat
Upland Forest Conservation Priority
Suitable Habitat
Critical Habitat
Grasslands Conservation Priority
Suitable Habitat
Critical Habitat
Source : NJDEP,NJDOT,DVRPC.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
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Delaware Valley Regional Planning Commission 2007
Map 13:
Landscape Project Priority Habitats
(2004)

overgrown by perennial herbs and grasses. These pioneer plants remain the dominant species for 3 to 20 years time. Later, woody plants take over. This habitat is visible especially along wood edges, roadsides, and in landscapes where mowing is infrequent and where woody plants are not yet the dominant vegetation.

According to 2002 NJDEP land cover data, about 2.5 percent of Mannington's land cover consists of brushland, shrubland or old fields. Old fields are sections of Mannington's farmland that have become idle and have transitioned to land suitable for grassland and brushland species habitat. About 156 acres of Mannington, mostly located in the center of the township near the confluence of Mannington Creek and Culliers Run, is old agricultural field transitioning to brushland. Brushland and shrubland is scattered in patches throughout the township.

In addition to brushland and old fields, active agricultural cropland and pastureland is considered suitable "grassland" habitat for wildlife. Agricultural cropland and pastureland is the single most abundant type of vegetative land cover in Mannington Township, covering about 53 percent, or 12,986 acres, of the township's land area in 2002.

LANDSCAPE PROJECT PRIORITY HABITATS

The Landscape Project, developed by the Endangered and Nongame Species Program of the NJDEP Division of Fish & Wildlife, documents the value of various types of habitats within New Jersey. It categorizes these habitats into one of five groups according to their importance (five being the highest). Categories three through five are "critical" habitats throughout the state that possess two exceptional conditions: (1) a documented occurrence of one or more species on either the federal or the state threatened and endangered species lists, and (2) a sufficient amount of habitat type to sustain these species. These habitats are collectively known as "critical habitat." Category two habitats have one or more occurrences of at least one non-listed state priority species, and category one area habitat is deemed suitable for species that are included on the state or federal threatened and endangered species lists but for which there are no documented occurrences or sightings. These habitats are labeled "suitable habitats."

The Landscape Project identifies both "critical" and "suitable" habitat in Mannington. It is important to preserve both levels of habitat in order to maintain the diversity of species that still exists in the area. The rankings in Mannington are primarily the result of habitat being either "critical" or "suitable" for rare bird species such as the bald eagle, bobolink, and vesper sparrow or for endangered reptiles and amphibians such as the bog turtle. See ***Table 18: Landscape Project Habitat Rankings – Acreage in Mannington*** and **Map 13: Landscape Project Priority Habitats**.

Photo by Nathaniel Culver

Great Blue Heron

Table 18: Landscape Project Habitat Rankings – Acreage in Mannington

Category	Rank	Acres	% of Total Habitat	% of All Land
Grassland	Suitable Habitat (1)	4,761.4	23.4%	19.5%
	Suitable Habitat (2)	1,484.9	7.3%	6.1%
	Critical Habitat (5)	6,701.9	33.0%	27.4%
Upland Forest	Suitable Habitat (1)	2,328.1	11.5%	9.5%
	Suitable Habitat (2)	161.9	0.8%	0.7%
	Critical Habitat (5)	571.8	2.8%	2.3%
Wetland Forest	Suitable Habitat (1)	1,948.4	9.6%	8.0%
	Critical Habitat (5)	304.0	1.5%	1.2%
Emergent Wetlands	Suitable Habitat (1)	1,791.1	8.8%	7.3%
	Critical Habitat (5)	251.6	1.2%	1.0%
Total Habitat		**20,305.0**	**100.0%**	**83.1%**
Total Mannington Land		**24,445.6**		**100.0%**

Source: NJDEP

Landscape Project Data on Wetland Habitat

The Landscape Project divides wetland habitats into two types – emergent and forested wetlands. Emergent wetlands are marshy areas characterized by low-growing shrubs and herbaceous (nonwoody) plants in standing water. About 252 acres in Mannington are identified as priority emergent wetlands habitat and are ranked at the "critical" level. In Mannington, 1,791 acres are ranked at the "suitable" level. Emergent wetland habitat is found throughout the township, mainly along waterways. Animal species that can be found in these wetland habitats include endangered turtles, rare fish, mollusks, crustaceans, and insects. Emergent wetlands are also important habitats for migratory waterfowl and passerines (smaller perching birds) such as migrating flycatchers and thrushes.

The Landscape Project designates Mannington's forested wetlands as occupying 2,252 acres, of which 304 acres are ranked as critical. "Critical" forested wetland habitat in Mannington is located primarily along Horn Run, Halls Run, the Salem River, and Culliers Run. Another patch of critical forested wetland habitat is located north of Marshalltown Road. "Suitable" forested wetland habitat supports wildlife in the northwestern, eastern, and southern corners of the township and is found along many of the township's streams. Forested wetlands support species such as migratory and nesting warblers, many of which are species of special concern. They can also be home to various rare amphibians (frogs and salamanders).

Landscape Project Data on Upland Forest Habitat

The Landscape Project ranks more than 12 percent of Mannington's total land cover as "suitable" upland forest habitat. Over 571 acres are ranked as "critical" upland forest habitat. Upland forest habitat can be found in scattered patches, with larger tracts of land in the center of the township near the confluence of Culliers Run and Mannington Creek and in the eastern corner of the township.

Landscape Project Data on Grassland-Species Habitat

The Landscape Project designates nearly all of Mannington's remaining land (53 percent) as "suitable" or "critical" grassland-species habitat. Approximately 6,702 acres of Mannington's farmland are ranked as "critical" grassland-species habitat. Grassland-dependent species (mostly birds) are the most threatened group of species in New Jersey, primarily because the most common form of habitat used by these species, agricultural fields, is the most threatened habitat in the state due to development pressure and rising land values. "Critical" habitat is primarily mapped north of Route 45, and "suitable" habitat is mainly located south of Route 45. Obviously, Route 45 served as a dividing boundary for assessments of the area, using the ranking methodology of the Landscape Project, which applies documented occurrences of rare species to large contiguous tracts of habitat. Such occurrences were documented in the large contiguous cluster of land north of Route 45, but not south of it.

Nearly all of Mannington's agricultural land is designated as "critical" or "suitable" grassland-species habitat, whether under cultivation or not, for some of the following reasons: (1) migrating birds cannot visually distinguish cropland from grassland; (2) cropland turns into grassland when it is fallow for one year or more; (3) some crops like alfalfa and soybeans provide suitable nesting habitat for some birds, especially for sparrows; and (4) all or most of the birds on the endangered and threatened lists are area-sensitive, requiring large ranges that include agricultural lands. The Landscape Project includes this land in its assessment because agricultural lands provide important disturbance buffers between rare/endangered wildlife species and both humans and widespread predatory animals like dogs and cats.

Examples of grassland-dependent species that use grassland habitat for nesting or feeding include the vesper sparrow and some species of butterflies and moths. Mannington's designated grasslands provide habitat for these species and others, such as the bobolink, that rely on agricultural lands, as well as for bog turtles that breed in wet areas found in agricultural fields.

Photo by Nicholas Culver

A mockingbird in a winterberry shrub

ANIMAL COMMUNITIES

Although no comprehensive inventory of the different animal species within New Jersey, Salem County, or Mannington exists, there are records of sightings, biological studies of range, environmental impact assessments, and evaluations of endangered and threatened status. Using federal, state, scientific, and nonprofit sources, it is possible to identify and describe known and possible animals of Mannington.

Invertebrates

Photo by Nicholas Culver

Black swallowtail butterfly caterpillars on Queen Anne's Lace – a principal food for the young of this species.

Invertebrates are the basis of a healthy environment and are part of every food chain, either as food for amphibians and fish, or as a part of nutrient cycling systems that create and maintain fertile soils. Invertebrates consist of insects (beetles, butterflies, moths, dragonflies, ants, termites, bees, wasps, flies, and others), arachnids (spiders, ticks and mites), crustaceans (crayfish, microscopic copepods), mollusks (mussels, clams, snails, and slugs), and worms.

Macroinvertebrates are invertebrates that are visible to the naked eye but smaller than 50 millimeters. Benthic (bottom dwelling) macroinvertebrate communities provide a basis for ecological monitoring and are relatively simple to collect from shallow stream bottoms. These communities consist largely of the juvenile stages of many insects, such as dragonflies and mayflies, as well as mollusks, crustaceans, and worms. Monitoring for diverse assemblages of macroinvertebrates reveals the effect of pollutants over a long period of time. The Ambient Biomonitoring Network (AMNET) surveys streams for macroinvertebrate communities, which indicate certain levels of water quality, as was discussed in the Surface Water Quality section of this document (page 39).

There are nine endangered invertebrate species (two beetle species, four butterfly species, and three mussel species) and eight threatened invertebrate species (three butterfly species and five mussel species) in the State of New Jersey. Of particular interest are freshwater mussels. At one time freshwater mussels were abundant in the streams of the area and were a major food source for native peoples. Parts of the Salem River provided suitable mussel habitat. Unfortunately, due to destruction of suitable aquatic habitats by dams and pollution, the native mussel population has sharply declined, although they are still present in the river. Of those species on the New Jersey Endangered and Threatened list, one, the dwarf wedgemussel, is listed as endangered under the federal Endangered Species Act.

Vertebrates

Vertebrates are less numerous than invertebrates but their larger size makes them much more visible, and thus better studied and recorded. Fish species are fairly well documented, as are mammals. Birds that nest in Mannington are known, and some migrants that depend on the township's marshes as stopover sites in which to rest and feed have been inventoried.

Mammals

Mammals appear to be abundant because they tend to be larger and live in habitats also ideal for human development. There are over 80 mammal species in New Jersey, of which nine are listed by the state as endangered or threatened. Some common mammals found in Mannington include cottontail rabbits, eastern gray squirrels, skunks, little brown bats, raccoons, opossums and white-tailed deer.

Photo by Nicholas Culver

Virginia opossum in a tree

Management of white-tailed deer is an issue in New Jersey. While many residents prize the presence of mammalian life, deer often come into conflict with humans in suburban and farm areas. According to the US Department of Agriculture, deer cause more damage to agricultural crops than any other vertebrate wildlife species. Farmers in densely human-populated areas appear to be the most affected. Additionally, deer can devastate the understory of forests through overgrazing, destroying the growth of seedlings and young trees. Finally, as most motorists are aware, collisions between deer and automobiles frequently result in serious damage.

Controlling deer numbers has become increasingly difficult in New Jersey, primarily because suburban landscaping provides year-round food, which supports population growth; and because the principal method of culling the population – hunting – is not feasible in suburban environments.

To minimize human-deer conflicts, the New Jersey Agricultural Experiment Station recommends both lethal and nonlethal deer management options for community-based deer management programs. For example, municipalities can extend the hunting season, issue depredation permits to private landowners, engage in sharpshooting, and employ traps and euthanasia to reduce deer numbers. Alternatively, communities and private landowners can choose to apply nonlethal, although more costly, deer management strategies such as installing reflectors and reducing speed limits on rural roads to decrease deer-vehicle collisions, modifying habitat by planting bad tasting plants on commercial and residential properties, using taste-based and odor-based repellents, and employing traps and translocation techniques.

Birds

There are between 350 and 500 species of birds in New Jersey, which is an exceptional number given the state's small size. New Jersey is an important location for migratory birds heading

south for the winter. Not only is the state an important "rest stop" for birds migrating to warmer climates in Central and South America, but the New Jersey Atlantic Coast and the Delaware Bay are major parts of the Eastern Flyway (established migratory air route) in North America.

Common birds in Salem County are ducks, owls, woodpeckers, swallows, crows, grackles, robins, starlings, cardinals, finches, sparrows, and vultures. The bald eagle (an endangered bird species), the osprey (a threatened bird species), and other rare and endangered species have been sighted in the township.

Many thousands of snow geese are also found in Mannington during the winter. These waterfowl, and Canada geese also, are found on open agricultural land during this season, in various parts of Salem County. Their numbers and their feeding habits make them a pest species to farmers.

Mannington Meadows Important Bird Area

Mannington contains a New Jersey Important Bird Area (IBA). IBAs are defined as sites that provide essential habitat for one or more species of bird. IBAs contain both private and public land, and the areas may be protected or not protected from development. In order to qualify as an IBA, an area must support species that are at risk because they are of conservation concern (for example, threatened or endangered), not widely distributed, concentrated in one general habitat type or biome, or occur at high densities due to their congregatory behavior.

The majority of the 18,000-acre Mannington Meadows IBA falls within Mannington's borders. In general, the IBA is bound by Salem River to the north and Route 45 to the south, although the IBA does extend south of Route 45 along Mannington, Fenwick and Keasbeys creeks. The area extends westward over the Pennsville-Mannington boundary. Several species of conservation concern inhabit the Mannington Meadows IBA: the bald eagle, pied-billed grebe, least bittern, and king rail. The meadows also support American black ducks, clapper rails, mallards, northern pintails, willets, and osprey. The area is also noted for exceptional diversity, waterfowl concentrations in the winter, wading bird concentrations, and single species concentrations.

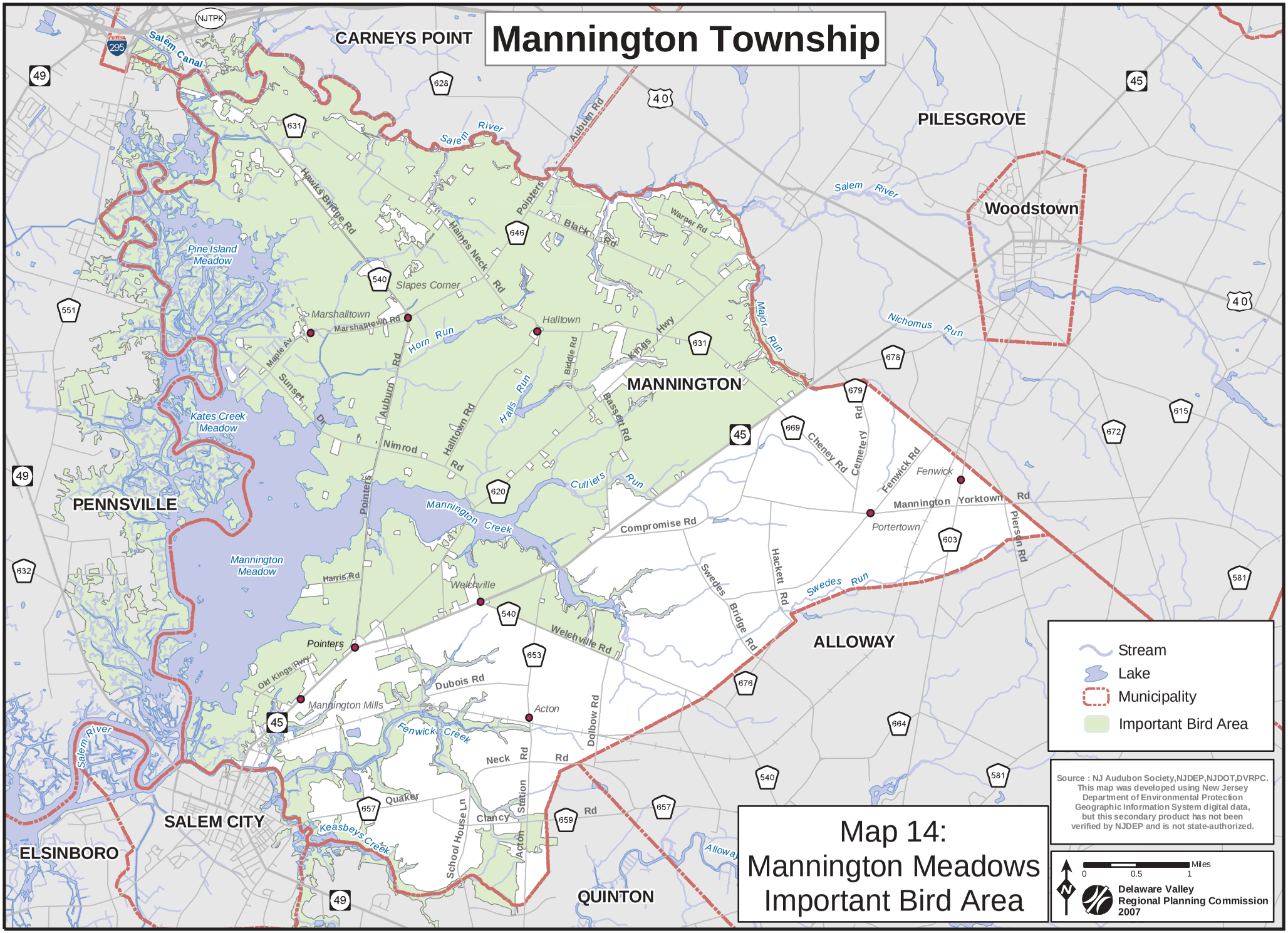
See the boxed *Figure 9: Mannington Meadow Description* on the importance of Mannington Meadow, written by Francis G. Rapa. See also **Map 14: Mannington Meadows Important Bird Area** and ***Appendix E: Mannington Meadows Important Bird Area*** for the Conservation Plan for this IBA, developed by the New Jersey Audubon Society.

Common Reptiles and Amphibians

Reptiles can be quite elusive when surveys attempt to find and record them. Some species, such as the endangered bog turtle, have been well documented in Mannington. Amphibians of some types are abundant, such as bullfrogs. Other species are rare because they depend on vernal ponds, as was discussed in the Surface Waters – Vernal Pools section of this document (page 33). The eastern box turtle (*Terrapene carolina*), a species of special concern, has also been sighted in Mannington.

Photo by Nathaniel Culver

Eastern painted turtles – a fairly common species in the area.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Stream
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Municipality
Important Bird Area
Source : NJ Audubon Society,NJDEP,NJDOT,DVRPC. This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
Map 14:
Mannington Meadows
Important Bird Area
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Delaware Valley Regional Planning Commission
2007

Mannington Meadows* as a Regionally/Nationally/Internationally Significant Bird Habitat

Francis G. Rapa

*NOTE: While project boundaries may vary, the terms "Mannington Meadow(s), Mannington Marsh and Salem River Meadows" are used by various agencies and organizations to represent the same geographic ecosystem.

Ramsar Convention Treaty. An international convention, held in Ramsar, Iran in 1971, established a framework for the conservation of wetlands of the greatest international importance as waterfowl habitat. Mannington Meadow is part of the Delaware Bay Estuary Ramsar Site, one of only 22 Ramsar sites in the entire United States. (Source: Salem Meadows FWMA appears on a list of public lands within the Delaware Bay Ramsar Site in *US Ramsar Site Contact Address List*. US Ramsar Committee. 2004)

North American Wetlands Conservation Act. Since the early 1990s the NJDEP, the United States Fish and Wildlife Service, Ducks Unlimited and The Nature Conservancy (TNC) have administered the "Salem River Meadows" project area under the North American Waterfowl Management Plan, an international program among the governments of the United States, Canada and Mexico. Under the program, the Salem River Meadows Project Area has received federal funds to protect the area's diversity and abundance of several high-priority waterfowl species. The project seeks to protect over 17,000 acres through acquisitions and easements. It is important to note that one of the key stated objectives of the Salem River project is to preserve both wetlands and associated upland habitat buffering the Salem River Meadows. The project also specifically cites the objectives of protecting upland grassland bird habitat and bald eagle breeding and wintering habitat. Five State-endangered plant species are also known to occur within the project site.

Atlantic Coast Joint Venture. A focus area of the North American Waterfowl Management Plan (above), the Salem River Meadows project is a conservation priority under this partnership of federal, state and regional agencies working cooperatively to protect important bird habitat along the Atlantic Flyway from Maine to Puerto Rico. The Salem River Meadows is recognized as one of the most important migrating and wintering habitat for several species of waterfowl on the entire Atlantic Coast. (Source: <http://www.acjv.org/documents/NJ06.pdf>)

NJ Important Bird and Birding Areas program. The New Jersey Audubon Society has designated Mannington Meadow as one of New Jersey's 114 Important Bird Areas. The program is an offshoot of a worldwide initiative, begun by Birdlife International, to identify and protect outstanding habitat for birds. (Source: <http://www.njaudubon.org/Conservation/IBBA/>)

Natural Heritage Priority Sites. The New Jersey Natural Heritage Program, administered by the NJDEP Office of Natural Lands Management, is part of the Natural Heritage Network, comprising 74 independent scientific research centers in the United States, Canada, Latin America and the Caribbean. The Mannington Meadows Macrosite is one of about 410 priority sites in New Jersey. The sites are designated by the New Jersey Natural Heritage Program to identify and help plan for the protection of the State's best habitats for rare plants and animals. Within the Mannington Meadows Macrosite is the Mannington Marsh standard site, which includes the intertidal marshes along the Mannington Creek.

New Jersey Wildlife Action Plan (WAP). The WAP explicitly calls for the "protection of the tidal brackish marsh and river drainages of the Mannington Meadows Macrosite" as a priority conservation action (page 338). This action is part of its objective to protect important and unique natural areas and habitats within the State's Piedmont Plains Landscape. (Source: New Jersey Department of Environmental Protection, Division of Fish and Wildlife. 2006. New Jersey Wildlife Action Plan. Trenton, NJ. See <http://www.nj.gov/dep/fgw/ensp/wap/pdf/wap_draft.pdf>)

Revised September 26, 2006

Figure 9: Mannington Meadows Description *Source: New Jersey Audubon Society*

Fishes

When European settlers arrived in present-day Salem County, they encountered American Indians who regularly fished along the inland streams and gathered shellfish in the Delaware River. Due to the unintended consequences of urban development, industrial advancement, and mechanized agriculture, the amount and diversity of aquatic life has decreased dramatically throughout most of New Jersey.

The New Jersey Division of Fish and Wildlife, under the Bureau of Freshwater Fisheries, monitors and actively aids the propagation, protection, and management of the state's freshwater fisheries. The bureau raises several million fish for stocking in suitable waterbodies, and conducts research and management surveys. Mannington's freshwater streams may contain sunfish, blue gill, shiner, pumpkinseed, eastern mudminnow, common carp, largemouth bass, perch, darter, catfish, and the American eel. Other fish species are documented for Mannington in the "Annotated Checklist and Distribution of New Jersey Freshwater Fishes…" by Rudolf G. Arndt. See ***Sources of Information*** on page 95.

N.J. DEPARTMENT OF ENVIRONMENTAL PROTECTION FRESHWATER FISH ADVISORIES

Fishing provides enjoyable and relaxing recreation and many people like to eat the fish they catch. Fish are an excellent source of protein, minerals and vitamins, are low in fat and cholesterol, and play an important role in maintaining a healthy, well-balanced diet.

However, certain fish may contain toxic chemicals, such as polychlorinated biphenyls (PCBs), dioxins, and mercury, which accumulate in water and aquatic life. Chemical contaminants such as dioxin and PCBs are classified by the U.S. Environmental Protection Agency as probably cancer-causing substances in humans. Elevated levels of mercury can pose health risks to the human nervous system. Infants, children, pregnant women, nursing mothers, and women of childbearing age are considered to be at higher risk from contaminants in fish than other members of the general public. Since 1982, NJDEP catches fish at numerous sampling stations throughout the state and tests for contaminant levels, adopting advisories to guide residents on safe consumption practices.

In 2006, NJDEP issued specific freshwater fish advisories for waterbodies in Salem County for: Brown Bullhead, Chain Pickerel, Largemouth Bass, and Black Crappie. Statewide advisories for the following fish were also issued in 2006: Largemouth Bass, Smallmouth Bass, Chain Pickerel, Yellow Bullhead, Sunfish (includes Bluegill, Pumpkinseed, and Redbreast), Brown Bullhead, Striped Bass, Bluefish, American Eel, and American Lobster. Recreational fishermen and women should regularly check for local fish advisories on NJDEP's Division of Science, Research and Technology web site: http://www.state.nj.us/dep/dsr/njmainfish.htm.

Endangered Vertebrates

According to the Natural Heritage Database and the Landscape Project, a number of rare wildlife species have been sighted in Mannington. Brief descriptions, provided by the New Jersey Fish and Wildlife Service, of Mannington endangered and threatened species and their preferred habitat follow.

A bald eagle foraging area and bald eagle nest buffer are located in the township. The bald eagle (*Haliaeetus luecocephalus*) is an endangered species in New Jersey and a threatened species in the United States. Bald eagles mostly consume fish and thus often choose to build nests in forested areas near waterbodies. Population decline caused by shooting, poisoning, and egg collecting accelerated after the introduction of DDT into the New Jersey environment. The bald eagle was listed as an endangered species in New Jersey in 1974 and as endangered in the lower 48 states in 1978. Bald eagle populations in New Jersey have since increased from a single nest in 1970 to 27 nests in 2001.

The bog turtle (*Clemmys muhlenbergii*) is an endangered species in many eastern states, including New Jersey, and is listed as threatened on the federal list. It is the smallest native turtle in the United States. Bog turtles lay their eggs in stream banks and cover them with vegetation for protection. These turtles are one of the most difficult animals to find, as they are rare, elusive, and often dwell on swamp bottoms where they bury themselves in several inches of mud to escape predators. Suitable habitats are dwindling as wetlands are destroyed for human settlement or by pollution. The greatest numbers of bog turtles in the nation are found in the wetland areas of agricultural lands in northwestern and southwestern New Jersey.

FEDERAL ENDANGERED SPECIES ACT*

An "Endangered" species is in danger of extinction throughout all or a significant portion of its range.

A "Threatened" species is one that is likely to become endangered in the near future.

NEW JERSEY ENDANGERED SPECIES ACT**

An "Endangered" species is in danger of immediate extinction within the state due to one of several factors: loss or degradation of habitat, over-exploitation, predation, competition, disease, or environmental pollution.

A "Threatened" species is one that may become endangered if environment conditions continue to deteriorate. It is vulnerable due to one of several factors: small population size, restricted range, narrow habitat affinities, or significant population decline.

A species of "Special Concern" is one that warrants special attention because of the evidence of population decline, environmental deterioration, or habitat modification that would result in becoming Threatened. Special Concern status also extends to species whose population size is unknown or unstudied.

* Definitions adapted from U.S. Fish and Wildlife Service, "Listing a Species and Threatened or Endangered: Section 4 of the Endangered Species Act." Washington, DC: February 2001.
** Definitions adapted from N.J. Division of Fish, Game, and Wildlife, Endangered and Nongame Species Program, "Status Definition." Trenton, NJ: April 2002.

The bobolink (*Dolichonyx oryzivorus*) is a threatened species in New Jersey. The birds live in idle farmland and low-intensity agricultural fields as well as grass, forb, and wildflower meadows. During migration, bobolinks also reside in coastal and freshwater marshes. In the 1960s and 70s bobolink habitat declined as forests replaced some fields, development expanded into farmland, and agricultural practices evolved. The bobolink population decrease between 1966 and 1999 is attributed to habitat reduction. As farmers rotated hay crops more frequently, mowed hay earlier, grew more cool-season rather than warm-season grasses, and decreased plant diversity, bobolink habitat diminished. Due to declining populations, in 1979 the bobolink was listed as a threatened species in New Jersey.

The osprey (*Pandion haliaetus*) is a threatened species in New Jersey. Ospreys live near coastal and inland bodies of water that support adequate fish populations. The birds build nests near fishing areas on structures such as trees, telephone poles, and channel markers. Occasionally, ospreys nest on the ground in coastal marshes. Habitat destruction, the loss of nesting trees, egg collecting, and shooting contributed to population declines evident by the end of the nineteenth century. Osprey numbers then dropped rapidly after DDT was introduced into the New Jersey environment in the 1940s. As a result, the osprey was placed on the New Jersey Endangered Species list soon after the 1974 passage of the New Jersey Endangered Species Act. After DDT was banned, ospreys generally began to recover, and in 1985 the species was moved from the endangered to the threatened species list. However, populations along the Delaware Bay coast, especially in Salem County, did not recover as did populations in other areas of the state. Investigations revealed higher levels of chemicals such as DDE, DDD, and PCBs in the Delaware Bay birds. However, by the late 1990s, contamination levels in the birds had decreased and Delaware Bay populations were increasing.

The vesper sparrow (*Pooecetes gramineus*) is an endangered species in New Jersey. The vesper sparrow prefers open habitats, such as cultivated fields, grasslands, old fields, and pastures. This species will, ideally, nest in an old field or a fence-row adjacent to a cultivated area. Nests are found in herbaceous land cover that provides protection from predators and humans. The vesper sparrow was once a common summer bird in New Jersey. Due to their dependence on habitats created by farming, vesper sparrow populations started to decline in the 1950s as farm fields were replaced by residential development and farming methods changed. In 1979, the bird was listed as threatened on the state list, and upgraded to endangered in 1984. It is also listed as endangered in Connecticut and Rhode Island, threatened in Massachusetts, and of special concern in New York.

See **Appendix F** for a list of **Vertebrate Fauna of Mannington Township**.
See **Appendix G** for **A List of Wild Plants Likely Occurring in Mannington Township**.
See **Appendix H: Threatened and Endangered Species in Mannington** for **Rare Plant and Animal Species and Natural Communities Presently Recorded in the NJ Natural Heritage Database for Mannington** and for a list of **New Jersey Endangered and Threatened Species**.

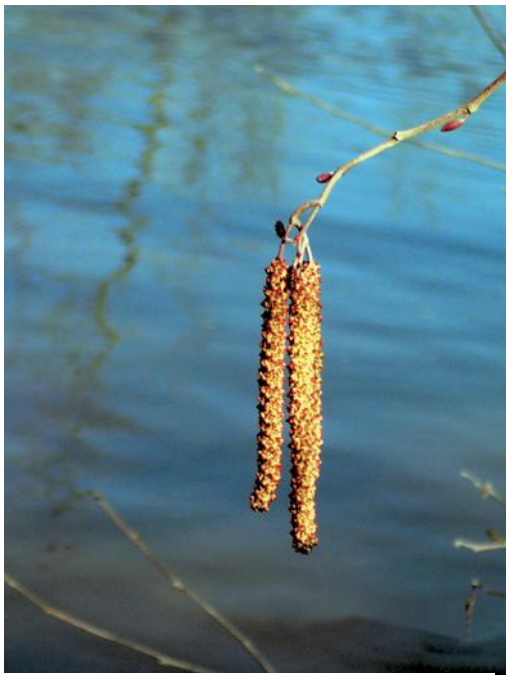


Photo by Nicholas Culver

Catkins over water

NATURAL HERITAGE DATABASE AND NATURAL HERITAGE PRIORITY SITES

Natural Heritage Priority (NHP) sites are areas designated by the New Jersey Division of Parks and Forestry's Office of Natural Lands Management as exemplary natural communities within the state that are critically important habitat for rare species. Preserving these areas is a top priority for efforts to conserve biological diversity in New Jersey.

Designation as a Natural Heritage Priority site does not carry any specific requirements or restrictions on the land. Rather, the designation is made because of a site's high biological diversity value. Owners of NHP sites are encouraged to become informed stewards of the property and to consider working with the local community, nonprofit groups, or the state to preserve the land permanently.

NHP designations are based on the records of the Natural Heritage Database, which lists documented sightings of endangered and threatened species. Information on particular sites may also be provided by the Nature Conservancy or by the NJDEP Endangered and Nongame Species Program, and especially through the latter agency's Landscape Project.

Mannington Township has within its borders 4 of 410 NHP sites in New Jersey: (1) the **Major Run NHP Site**, (2) the **Culliers Run NHP Site**, (3) the **Mannington Marsh NHP Site**, and (4) the **Mannington Meadows Macrosite NHP Site**. See **Map 13: Landscape Project Habitat Priorities,** on which the NHP sites are depicted.

The **Major Run NHP Site** is located along Major Run, a tributary of the Salem River, which forms a partial border with Pilesgrove Township. The site's delineation extends along Major Run from Pointers-Swedesboro Road (CR 620) and State Route 45. It is a rich wooded ravine, containing habitat for one critically imperiled plant species in New Jersey. A critically imperiled plant is a plant species that is extremely rare, with five or fewer occurrences, individual plants, or acres, in the entire state. The **Major Run NHP Site** has a biodiversity rating of B5, meaning the area is of general biodiversity interest.

The **Culliers Run NHP Site** is a floodplain in a wooded ravine along a stretch of an unnamed tributary of Culliers Run. Culliers Run is a tributary of Mannington Creek. The site is bound in part to the southeast by State Highway 45 and to the west by Bassett Road. Across Bassett Road to the southwest is a portion of the Salem River Wildlife Management Area. The Culliers Run site contains a good population of state endangered plant species, contiguous habitat for state endangered plant species, and a secondary boundary encompassing an undeveloped upland buffer. It has a biodiversity rating of B4, meaning the area is of moderate significance either because it is a possible site of a globally rare species or a state-imperiled species was documented on the site.

The **Mannington Marsh NHP Site** is a fresh intertidal marsh. Under drought conditions, some of the site's water may be brackish. The site extends southeast along Mannington Creek from Pointers Auburn Road. The border continues past State Route 45 for about a mile. Site boundaries encompass marshes on the edge of Mannington Creek; those marshes are primary habitat for rare plant species. A high quality incidence of two state-listed endangered plant

species, a low-quality occurrence of another state-listed endangered plant species, and two state endangered bird species have been documented at the site. The Mannington Marsh NHP Site also has a biodiversity rating of B4.

The **Mannington Meadows Macrosite**, part of the Salem River drainage, contains a tidal, brackish marsh and some marsh woodland on the edge. The site borders, extending west into Pennsville and southeast almost to the Mannington-Alloway border, include Mannington Meadow and Mannington Creek. The border also encloses the Mannington Marsh NHP site. The Mannington Meadows Macrosite supplies feeding and resting habitat to wintering birds, including a state endangered bird species. The Mannington Creek portion of the site encompasses a nest site for a state endangered bird species. The Mannington Meadows Macrosite has a biodiversity rating of B4.

Photo by Nicholas Culver

An Eastern tiger swallowtail on a butterfly bush. This butterfly is one of the most attractive local species and still fairly abundant.

The Natural Heritage Database also lists for Mannington several species of threatened and endangered plants and animals, or rare natural communities that have been found in other parts of the borough and township. The sighting records for the plants (only) are shown on topographic maps. These indicate where the sightings occurred, although the map information is deliberately nonspecific. The principal locations with the rarest plant or community records are wide areas along Mannington Meadow, Kates Creek Meadow, and Pine Island Meadow; along Mannington Creek; to the south near the border with Quinton; near the northern border toward Interstate 295; and around Mannington Hill. The Natural Heritage Database's individual records of animals have been incorporated into the Landscape Project, but plant listings are not a basis for the modeling.

It is important to note that the Natural Heritage Database lists primarily those sightings that have been submitted to it, along with some ecological community data. It incorporates both historically and recently documented sightings. Areas without sightings may never have been surveyed. Conversely, land use in areas with sightings may have changed considerably over recent years, and the species once found there may be gone. Local surveys to update the database and regular consultation of records before any development is approved are two measures that would help to increase the protection of threatened and endangered species.

See **Appendix H: Threatened and Endangered Species in Mannington Township** for information from the Natural Heritage Database.

Photo by Nicholas Culver

Sunset over Mannington Meadows

THE BUILT ENVIRONMENT

POPULATION

The 1990 U.S. Census listed a population of 1,693 residents for Mannington Township. By the 2000 Census, Mannington's population had decreased by 7.9 percent to 1,559 residents. The largest population drop between 1990 and 2000 was in the group-quarters population, which decreased from 258 to 140 persons within the decade. The household population of the township declined by only 16 persons, or 1.1 percent of the 1990 population.

According to 2000 U.S. Census data, the majority (66.5percent) of Mannington's housing units are single-family, owner-occupied homes. Housing is scattered along county roads and many homes are built on single lots adjacent to active farms. A concentration of housing lines State Route 45 near Salem City.

According to the 2000 Census, 22.6 percent (352 residents) of Mannington's population are under the age of 18. Of those residents under 18 years of age, approximately 266 are children between the ages of 5 and 18. This age group represents those residents who are most physically active in the community and most likely to use public recreational facilities.

TRANSPORTATION

U.S. Route 40 (Harding Highway) to the north of Mannington, completed in 1927, serves as a transportation route within and out of Salem County. In 1951, Route 40 was connected to the New Jersey Turnpike in Deepwater, providing easy access between Pennsylvania, New Jersey, and Delaware. The NJ Turnpike serves as a significant transportation artery for the entire region. Exits northwest of Mannington at Deepwater provide access to and from Mannington via County Road 540 (Hawks Bridge Road). U.S. Highway 295 also provides access to the north and west, with exits at Deepwater and State Route 48. Also in 1951, the Delaware Memorial Bridge opened, replacing a ferry service, which enabled easy travel between Delaware and New Jersey.

Although not in Mannington, State Route 55, constructed between 1965 and 1989, increases accessibility to and from Salem County with an exit (39) to U.S. Route 40. It has dramatically increased the speed with which residents can access other parts of southern New Jersey. State Route 45 (known as Salem-Woodstown Road in Salem County) is a significant northeast-southwest road in Mannington, serving as a route to both Woodstown and Salem City.

In Mannington, County Routes 540 (Hawks Bridge Road), 603 (Alloway-Woodstown Road), 620 (Kings Highway), and 657 (Quaker Neck Road) are considered rural major collectors by the New Jersey Department of Transportation. Other county roads within Mannington are Routes 631 (Haines Neck Road), 646 (Pointers-Auburn Road), 653 (Acton Station Road), 659 (Clancy Road), 669 (Cheney Road), and 679 (Cemetery Road). These roads provide access and connections within the township and county. Additional roads provide more local connections.

In addition, buses, trains, and airplanes operate in the township. Bus routes connect Mannington to the nearby communities of Woodstown, Salem, Quinton, Pennsville, Carney's Point, and Penn's Grove. New Jersey Transit bus stops in Mannington are at the Salem County Vo-Tech and at Memorial Hospital. Mannington is also served by a freight rail line. The line, owned by Salem County and leased to the Southern Railroad Company of New Jersey, serves Mannington Mills as well as nearby Anchor Glass and the Port of Salem. Recent funding has provided for rehabilitation of the 18-mile deteriorating railroad. In addition to bus and rail service, the township is also home to a private airfield.

UTILITIES AND SERVICES

Drinking Water

Most residences in Mannington Township are supplied with drinking water by private wells. Several institutions in the township are supplied drinking water from public systems located outside the township. The Salem City water department provides drinking water to Memorial Hospital, the Salem County Nursing Home, the Bank, and Mannington Mills. Several private residences along this line are also served by Salem City water. The Woodstown Department of Public Works provides drinking water to the county complex containing the Salem County Correctional Facility and Salem County Career and Technical High School. The Mannington elementary school, Remsterville Learning Center, and Michael Catalano farms utilize non-community water systems.

The public drinking-water wells that serve Mannington residents are listed in ***Table 15: Public Water Supply Wells*** on page 56. An explanation of non-community wells is also found there, along with ***Table 16: Public Non-Community Wells***. **Map 11: Public Water Supply Wells** shows their locations.

Sewer

Residences in Mannington utilize private sewer systems, although a few institutions in the township utilize public sewer. Public sewage treatment is provided to the Memorial Hospital, the nursing home, the bank, and Mannington Mills through the Salem Water and Sewer Department. The Woodstown Department of Public Works provides sewer service to the Salem County complex that contains the Salem County Correctional Facility and Salem County Career and Technical High School.

See **Map 15: Approved Sewer Service Areas (2004)** for the location of the currently approved sewer service area.

Municipal Services

Trash and Recycling

Municipal pickup service for trash and recycling is available in Mannington. Trash is picked up weekly, and each household is limited to 10 bags of trash per week. Plastics, paper, cardboard, aluminum, tin cans, and glass are collected with the trash on a rotating basis. Residents drop off hazardous waste at the Salem County Solid Waste Facility in Alloway during biannual household hazardous waste collection days.

Source: DVRPC

Walls and gates made from recycled bottles, along with other artwork, at a Mannington residence.

Education

Mannington has its own elementary school. Mannington Township School educates about 180 students each year, providing education from the pre-kindergarten level through the eighth grade. The school also has a special education program. After completing eighth grade at the Mannington Township School, children attend Salem High School or one of the vocational or academy schools in Salem County. Salem High School, located in Salem City, serves about 550 students each year from Salem City, Elsinboro, Lower Alloways Creek, Mannington, and Quinton.

The New Jersey Regional Day School in Mannington provides special education for students from Cumberland, Gloucester and Salem counties. The school serves students ages 5 through 21. In the 2004-2005 school year, the school enrolled 52 students.

Mannington also supports the Salem County Career and Technical High School. The school serves about 600 students in grades nine through twelve. Both full and share-time students attend classes.

Parks and Recreation

Fenwick Grove Park and Fenwick Grove Recreation Area provide Mannington residents with park facilities. The small Fenwick Grove Park is a Salem County park featuring a limited picnic area. Fenwick Grove Recreation Area, maintained by the township, was created in 1978-79 with funds from the Green Acres program. This park features a baseball field and basketball hoop.

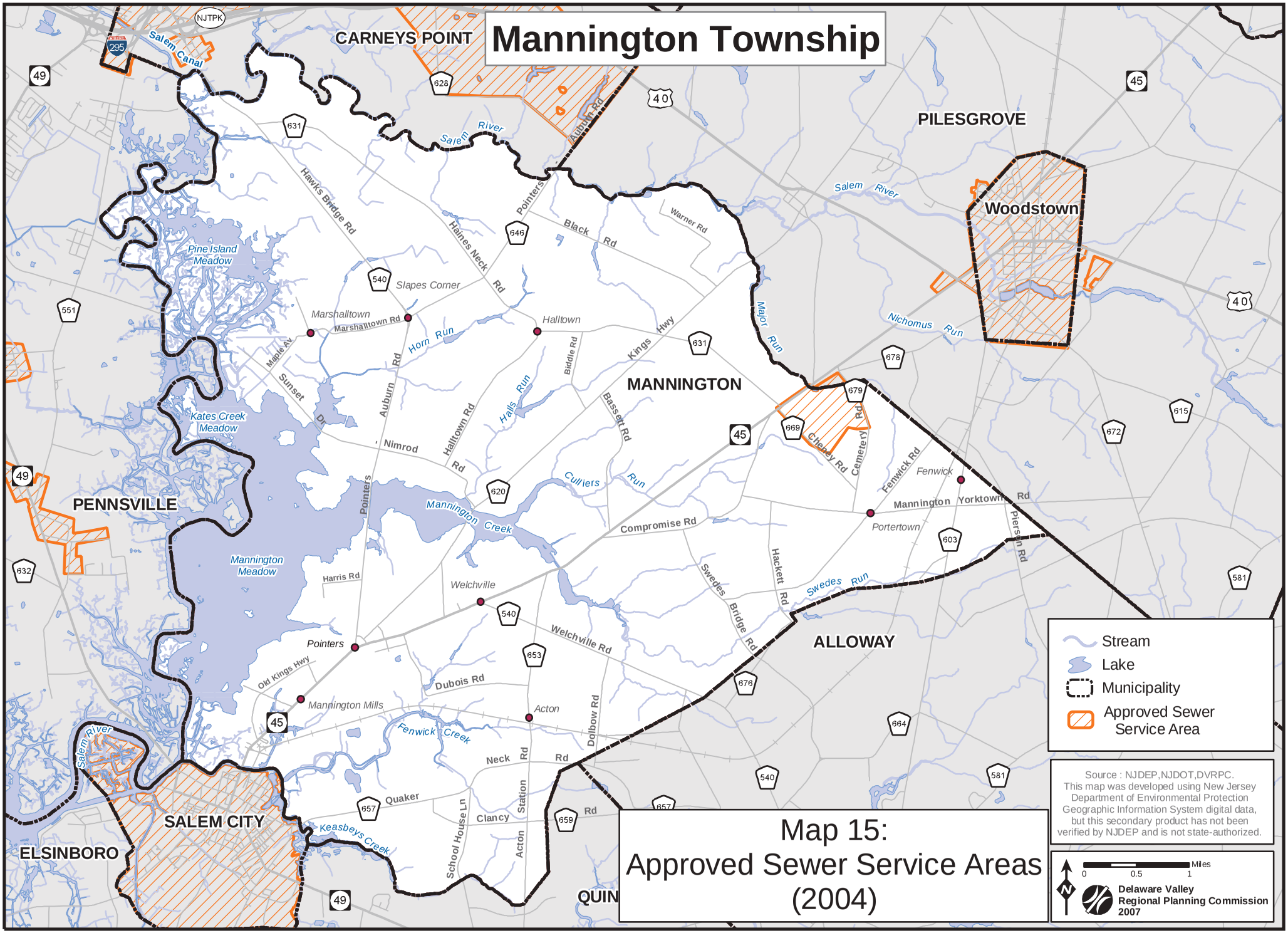
In addition to the two Fenwick facilities, Mannington also contains a large portion of the dispersed 2,695-acre Salem River Wildlife Management Area. Parts of the wildlife management area also fall within Carneys Point and Pilesgrove townships. Encompassing tidal wetlands, wooded swamps, and farm fields, the area is designed to preserve and restore upland buffers.

The land protects the Salem River and Mannington Meadows from pollution and disturbance. The Salem River Wildlife Management Area is a premier Atlantic Flyway migratory waterfowl habitat and provides habitat for deer, waterfowl, native pheasant, bald eagles, mute swans, Canada geese, and more. The New Jersey Division of Fish and Wildlife Bureau of Land Management administers the land.

See **Map 16: Preserved Farmland, Open Space and ADA (June 2006)**, which shows the amount of preserved farmland within the township and the boundaries of the County-approved Agricultural Development Area – the region within Mannington Township where farmland preservation is encouraged and authorized.

Source: DVRPC

Donald and Irene Emel's farm


Mannington Township
CARNEYS POINT
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ELSINBORO
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Salem Canal
Salem River
Auburn Rd
Hawks Bridge Rd
Haines Neck Rd
Pointers
Black Rd
Warner Rd
Major Run
Nichomus Run
Pine Island Meadow
Slapes Corner
Marshalltown
Marshalltown Rd
Halltown
Horn Run
Kings Hwy
Biddle Rd
Halls Run
Bassett Rd
Auburn Rd
Maple Av
Sunset Dr
Nimrod
Halltown Rd
Kates Creek Meadow
Cheney Rd
Cemetery Rd
Fenwick Rd
Fenwick
Mannington Yorktown Rd
Portertown
Piersin Rd
Culliers Run
Mannington Creek
Compromise Rd
Mannington Meadow
Harris Rd
Welchville
Welchville Rd
Swedes Bridge Rd
Hackett Rd
Swedes Run
Pointers
Old Kings Hwy
Dubois Rd
Mannington Mills
Acton
Dolbow Rd
Fenwick Creek
Neck Rd
Quaker
Clancy
Station
School House Ln
Keasbeys Creek
Salem River
NJTPK
295
49
45
40
551
632
631
628
646
540
678
679
669
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603
581
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Stream
Lake
Municipality
Approved Sewer Service Area
Source : NJDEP,NJDOT,DVRPC.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
Map 15:
Approved Sewer Service Areas
(2004)
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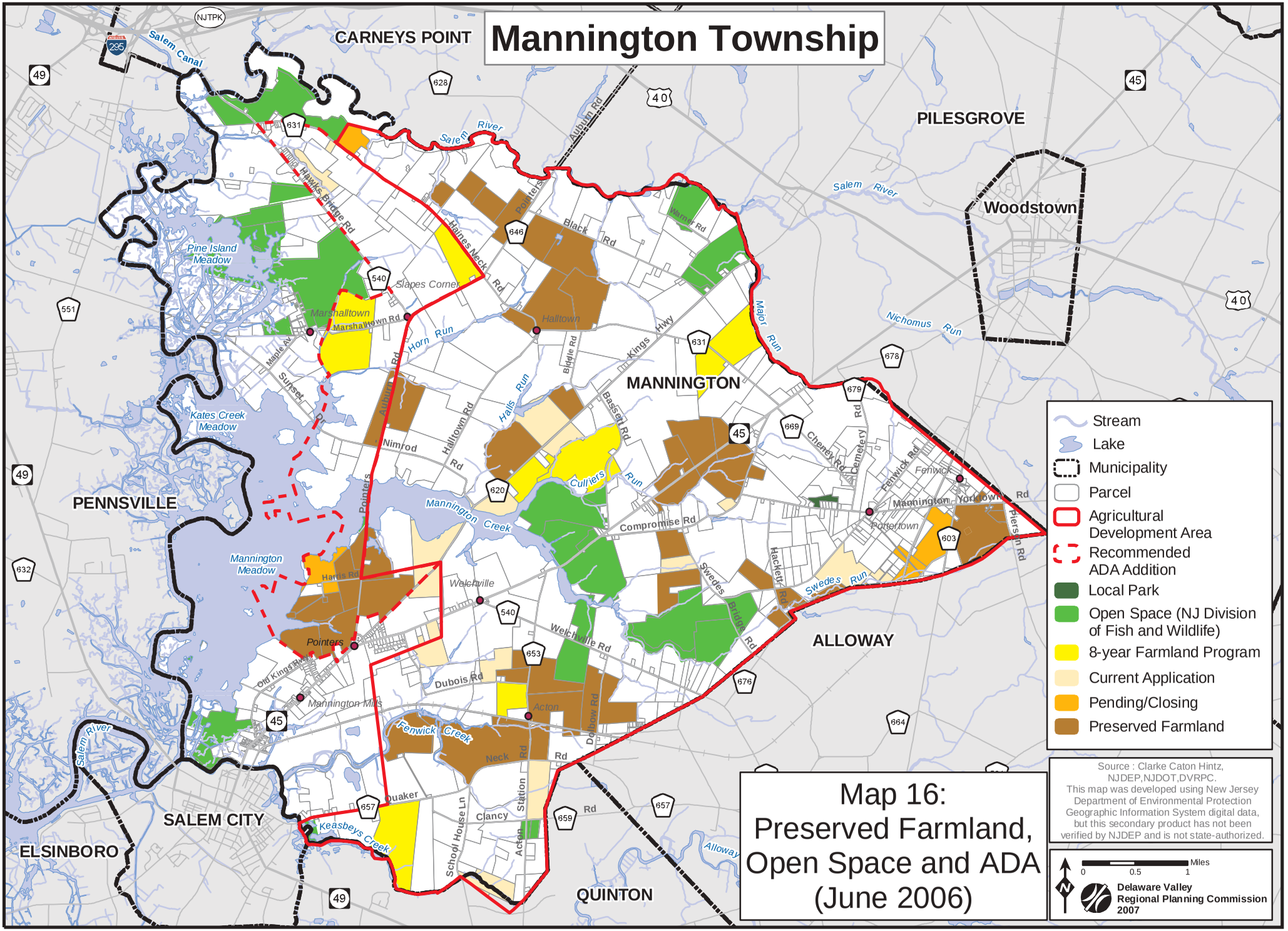
Delaware Valley Regional Planning Commission
2007


Mannington Township
CARNEYS POINT
PILESGROVE
Woodstown
MANNINGTON
PENNSVILLE
ALLOWAY
SALEM CITY
ELSINBORO
QUINTON
Salem Canal
Salem River
Nichomus Run
Major Run
Horn Run
Halls Run
Cullers Run
Mannington Creek
Swedes Run
Fenwick Creek
Keasbeys Creek
Alloway
Pine Island Meadow
Kates Creek Meadow
Mannington Meadow
Slapes Corner
Marshalltown
Halltown
Nimrod
Welchville
Pointers
Mannington Mills
Acton
Fenwick
Mannington
Potterstown
Yorktown
Stream
Lake
Municipality
Parcel
Agricultural Development Area
Recommended ADA Addition
Local Park
Open Space (NJ Division of Fish and Wildlife)
8-year Farmland Program
Current Application
Pending/Closing
Preserved Farmland
Map 16:
Preserved Farmland,
Open Space and ADA
(June 2006)
Source : Clarke Caton Hintz, NJDEP,NJDOT,DVRPC.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
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Delaware Valley Regional Planning Commission 2007

HISTORIC RESOURCES

Mannington has two sites – the William Smith House and the Richard Brick House – on the National and State Registers of Historic Places. Five additional sites were issued a State Historic Preservation Office (SHPO) Opinion, which determines if sites are eligible for inclusion on the State Register of Historic Places.[6] One additional site was issued a Certification of Eligibility (COE)[7].

See ***Table 19*** below for significant recorded historical sites in Mannington.

Table 19: Sites Listed on the National & State Registers of Historic Places in Mannington and Sites with State Historic Preservation Officer Opinions or Certificates of Eligibility

Name	Location	Register	ID#
William Smith House	NJ Route 45 and Bassett Road	Federal and State	Federal: 94000008; State: 2437
Richard Brick House	Compromise Rd	Federal and State	Federal: 76001183; State: 2435
Hackett House	119 Hackett Road	COE	State: 4168
Mannington Blacksmith Shop Site	NJ Route 45 and Acton Station Road	SHPO Opinion	State: 2436
Mannington Township Hall	NJ Route 45 / Salem-Woodstown Road at Welchville-Alloway Road	SHPO Opinion	State: 2900
Salem County Alms House and Insane Asylum	900 NJ Route 45	SHPO Opinion	State: 4343
Salem Motor Vehicle Inspection Station	185 NJ Route 45	SHPO Opinion	State: 2576
Woodnut Pottery Site	---	SHPO Opinion	State: 2438

Source: New Jersey State Historic Preservation Office, Last updated, July 20, 2006

[6] Filing an Environmental Impact Statement (EIS) usually prompts the issuance of a State Historic Preservation Office Opinion. Private individuals, companies, organizations, or governments that use federal funding are often required to file an EIS, which may result in the NJDEP recognizing possible threats to certain historic sites and identifying those sites as eligible for listing on the State Register of Historic Places.

[7] A Certification of Eligibility (COE) is issued by a New Jersey State Historic Preservation Officer. For properties not already listed on the New Jersey Register of Historic Places, a COE satisfies a prerequisite to apply for funds from the New Jersey Historic Trust, as well as several county preservation funding programs.

Historic Homes in Mannington

The historic homes and public buildings of Mannington are an important part of the area's historic record and local culture. The historic homes, along with the farms they stand on, contribute substantially to the rural viewscapes of the township. A remarkable number of historic homes have survived, many with only minor, reversible alterations, and, at this time, there are relatively few modern intrusions into most parts of the township. Mannington's historic homes and public buildings are an irreplaceable resource, which should be preserved for future generations.

During the early days of Fenwick's colony, the Proprietor (and later his estate) sold or granted very large parcels of Mannington land to first generation Quaker immigrants including John Pledger Sr., Hypolyte LeFevre, James Sherron, Samuel Hedge, Bartholomew Wyatt, William Hall, Samuel Jennings, and Anthony Sharp. These early landowners established plantations, farmed the land, and built fine dwellings. Eventually they began the process of dividing up their vast estates. Large tracts of land were given or bequeathed to their children, or sold to others outside of the family. Additional houses were built on these farms. The land use remained agricultural because of the rich soil and the numerous streams that facilitated transportation of farm products. A traditional farming lifestyle was established and handed down from generation to generation.

The process of dividing the land continued throughout the 18th and 19th centuries, up until around 1860. At that point, the size of an average family farm had shrunk to around 100 acres, which must have been the minimum economically sustainable size at that time. From the mid-19th century on, many children reared in Mannington who wanted to farm migrated to the Midwest to find adequate land. Very few new farm houses were built in Mannington after 1860, but active farming on the existing farms continues up to the present.

The numerous homes that survive in Mannington span the years between the founding of Fenwick's colony to the end of the land dividing process. Some well preserved examples of 18th century architecture include the pre-1717 James Barrett House, the circa 1720 Kiger House, the 1727 Pledger House, the circa 1730 William Nicholson House, the 1750 Richard Brick House, and the circa 1790 Waldac Farm. Some prime examples of 19th century architecture include the 1813 Jacob Fox House, the 1825 Hollyholme, the circa 1830 Magotha, the circa 1840 Benjamin Bassett House, and the circa 1845 Tidemill. Some important houses contain both 18th and 19th century elements, including the Boxwoods, Forkland, and the Bartholomew Wyatt House. There are few examples of later Victorian farmhouses, an exception being the Lawerence House. Most historic homes exist in the context of actively cultivated farmland, and many retain old, original outbuildings, which enhance their farmyards and compliment the houses.

The historic homes and public buildings of Mannington have been documented in an architectural inventory, which is included as an appendix to this report – **Appendix I: Mannington Historical Site Inventory**. The inventory includes pictures, addresses, and brief descriptions of 56 Mannington historic homes and public buildings. **Map 17: Historic Inventory** shows the approximate location of each structure in the township.

The current inventory should not be considered completely comprehensive. The descriptions are brief; there is much additional information that was excluded because of space limitations. There are also additional old houses in Mannington that could have been included if more time was available for research. A list of these houses is presented in Appendix I, following the Inventory of Historic Houses.

Municipal Protection of Historic Resources

The National Park Service and the New Jersey SHPO jointly administer the Certified Local Governments (CLG) program, which provides technical assistance and funding for community-based preservation efforts. As of October 2003, no municipalities in Salem County are CLGs. To participate, a municipality must maintain a historic preservation commission, survey local historic properties, provide opportunities for public participation in preservation activities, and develop and enforce local preservation laws. If a community were to become a CLG, it would be eligible to draw on an exclusive pool of matching federal and state funds for program implementation, and rehabilitation work consistent with historic preservation standards.

There are also federal incentives to individuals, organizations or firms who own historic properties and are interested in historic preservation. Interested parties can take advantage of the Rehabilitation Investment Tax Credit, a federal tax incentive to encourage the preservation and reuse of older income-producing properties, including offices, apartment buildings and retail stores.

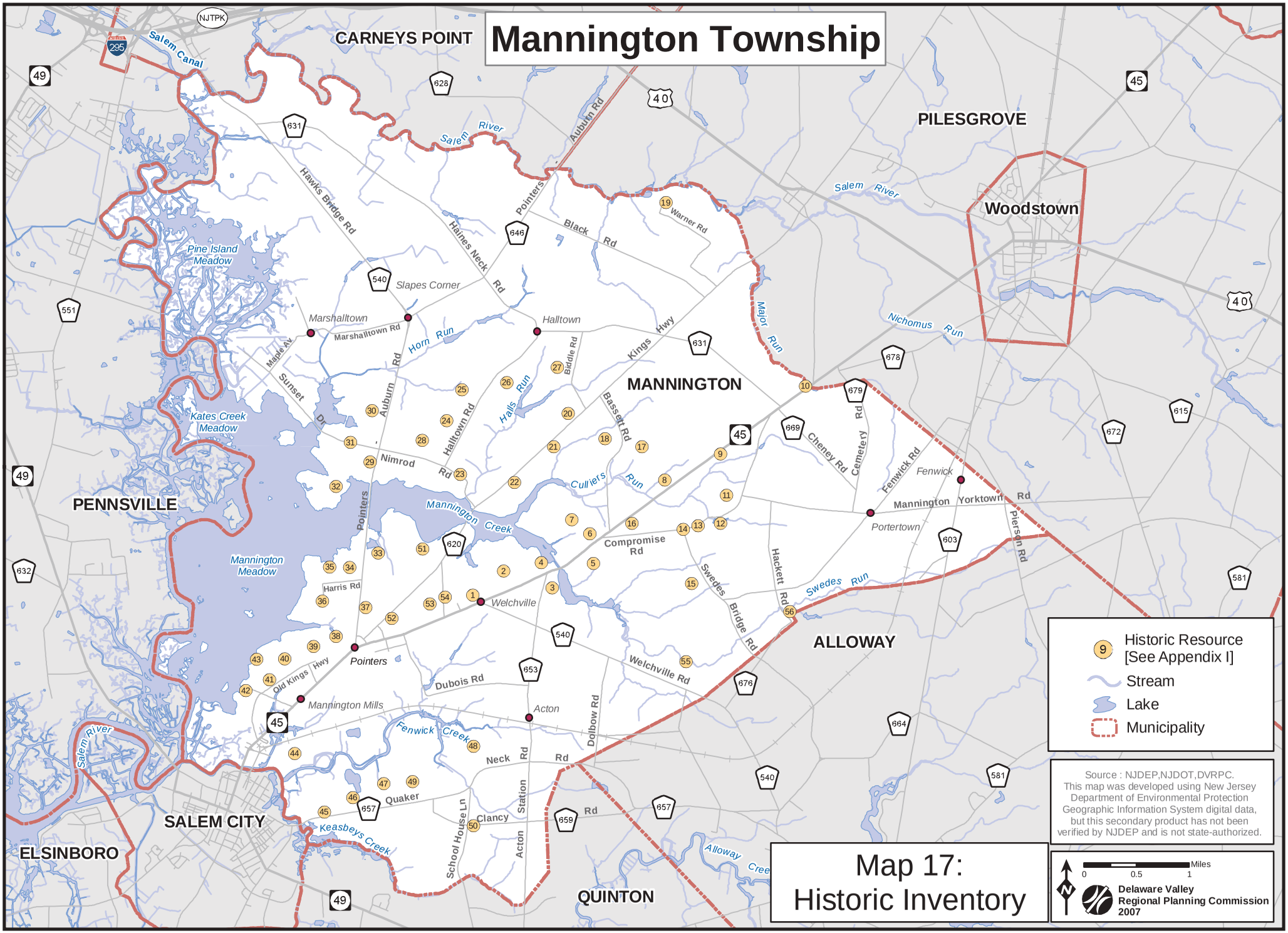
Investing in historic preservation efforts can provide municipalities with important and impressive returns. Private and public efforts to preserve and rehabilitate historic structures create attractive places to live, work and play. Furthermore, historic preservation maintains a municipality's character, distinctly separating it from other rural and suburban communities, for both new and established residents.

Source: DVRPC

18th century house on Compromise Road built by Richard Brick
(See #12 in the Historic House Inventory for details)

Source: DVRPC

Haines Neck United Methodist Church, founded in 1826. The current building was erected in 1888. In 1927 it was raised to permit the addition of a basement.


Mannington Township
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QUINTON
Salem Canal
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Kates Creek Meadow
Mannington Meadow
Mannington Creek
Fenwick Creek
Keasbeys Creek
Alloway Creek
Major Run
Nichomus Run
Horn Run
Halls Run
Culliers Run
Swedes Run
Marshalltown
Slapes Corner
Halltown
Welchville
Mannington Mills
Acton
Portertown
Fenwick
Hawks Bridge Rd
Haines Neck Rd
Pointers
Auburn Rd
Black Rd
Warner Rd
Kings Hwy
Biddle Rd
Bassett Rd
Cheney Rd
Cemetery Rd
Fenwick Rd
Mannington Yorktown Rd
Piersen Rd
Hackett Rd
Swedes Bridge Rd
Compromise Rd
Welchville Rd
Dubois Rd
Old Kings Hwy
Harris Rd
Nimrod Rd
Halltown Rd
Auburn Rd
Maple Av
Sunset Dr
Neck Rd
Quaker
Clancy
Station Rd
School House Ln
Acton
Dolbow Rd
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678
679
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603
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620
Historic Resource [See Appendix I]
Stream
Lake
Municipality
Source : NJDEP,NJDOT,DVRPC.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
Map 17:
Historic Inventory
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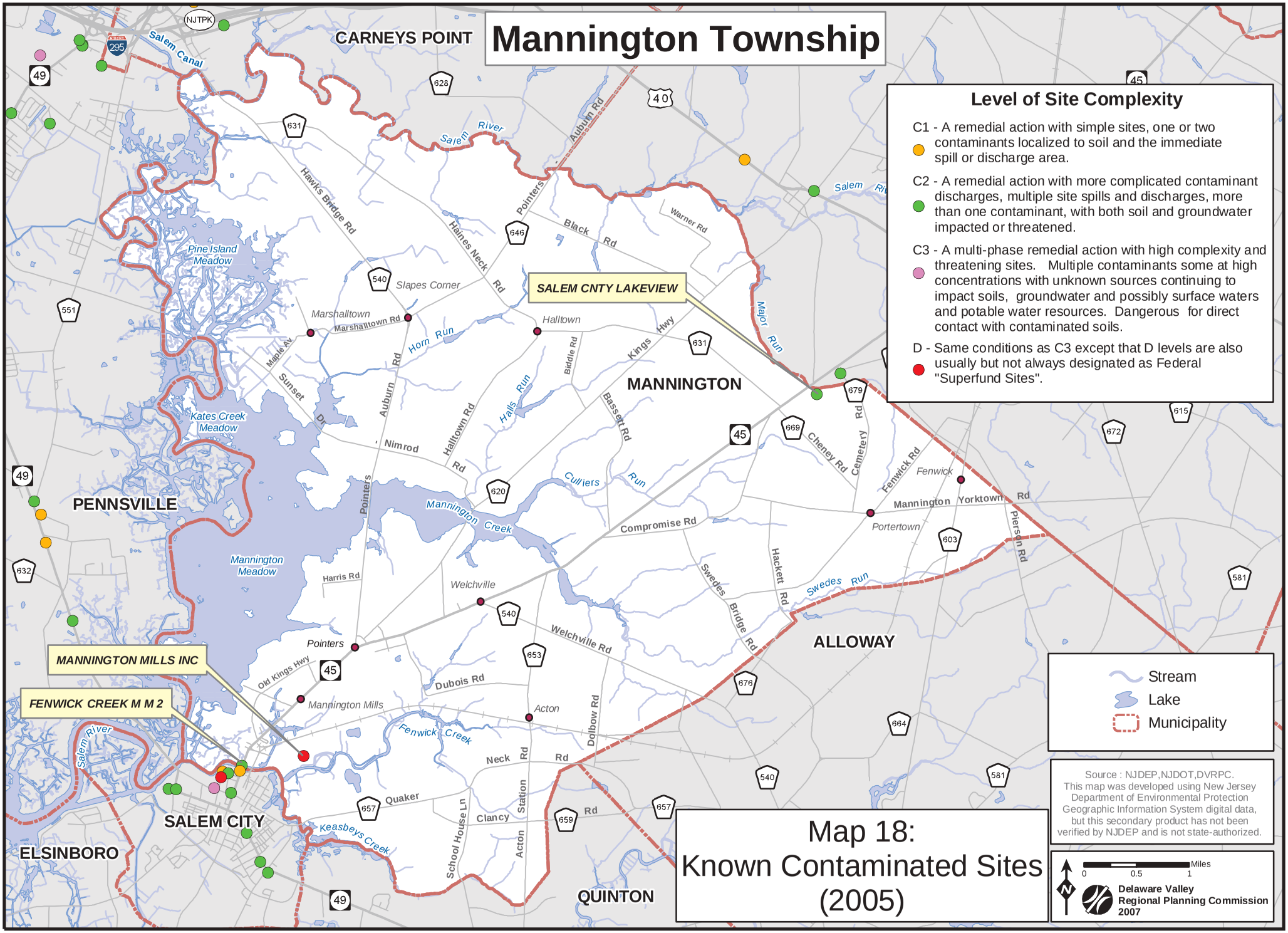
Mannington Township
CARNEYS POINT
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SALEM CITY
ELSINBORO
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MANNINGTON MILLS INC
FENWICK CREEK M M 2
Level of Site Complexity
C1 - A remedial action with simple sites, one or two contaminants localized to soil and the immediate spill or discharge area.
C2 - A remedial action with more complicated contaminant discharges, multiple site spills and discharges, more than one contaminant, with both soil and groundwater impacted or threatened.
C3 - A multi-phase remedial action with high complexity and threatening sites. Multiple contaminants some at high concentrations with unknown sources continuing to impact soils, groundwater and possibly surface waters and potable water resources. Dangerous for direct contact with contaminated soils.
D - Same conditions as C3 except that D levels are also usually but not always designated as Federal "Superfund Sites".
Stream
Lake
Municipality
Source : NJDEP,NJDOT,DVRPC.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
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Delaware Valley Regional Planning Commission 2007
Map 18:
Known Contaminated Sites
(2005)

ENVIRONMENTAL ISSUES

KNOWN CONTAMINATED SITES

NJDEP's 2006 inventory of Known Contaminated Sites reported 114 contaminated sites in Salem County. Three of these sites are located in Mannington. See **Appendix J: Known Contaminated Sites**. See also **Map 18: Known Contaminated Sites (2005)**.

The New Jersey *Known Contaminated Sites List* includes former factory sites, landfills, locations of current or former leaking underground storage tanks, sites where chemicals or wastes were once routinely discharged, and places where accidents have resulted in spills and pollution. Contamination may have affected soil, groundwater, surface water, or a combination of site conditions. The most dangerous sites, from a human health standpoint, can be listed as Superfund sites, which make them eligible for federal cleanup funds. Other sites are handled by state or individual programs, or through private funds. There are six active Superfund sites in Salem County, none of which are in Mannington.

RADON

Radon is a radioactive gas that comes from the natural decay of uranium found in nearly all soils. It is invisible, odorless, and tasteless. It moves up through the ground to the air above, and into all types of homes through cracks and other holes in foundations. A build-up of radon-contaminated air (internal alpha particle exposure hazard) within a home can pose a long-term health hazard to residents, specifically for lung cancer. The only method of detection is to conduct a test for alpha particles in the air within a home. Fortunately, radon testing is inexpensive. All radon test results conducted in the state are reported to DEP by certified companies, which perform the tests or manufacture the test kits. This data is used to classify municipalities into a three-tier system, which identifies the potential for homes with indoor radiation problems.

NJDEP classifies municipalities into three categories – high (Tier 1), moderate (Tier 2), or low (Tier 3) – as to the risk of having high radon levels. Mannington is listed as a Tier 2 municipality with moderate potential of having high radon levels in homes.

The criteria for a Tier 2 municipality designation is that 5 to 25 percent, of 25 or more homes tested, have radon concentrations greater than or equal to 4.0 picocuries per liter in air. The level at which homeowners should take immediate action is 4.0 picocuries per liter in air. If radon levels are high in a home, NJDEP suggests that the homeowner take the following actions: (1) prevent radon from entering the house by repairing cracks and insulation and (2) dilute radon concentrations currently in the house by installing a radon extraction system and/or frequently ventilating indoor air. NJDEP maintains www.njradon.org as an information source for concerned citizens. Free information packets are available upon request. All companies conducting radon testing and mitigations are certified by NJDEP and listed on their website.

OTHER ENVIRONMENTAL CONCERNS

Toxic Releases

According to the U.S. EPA annual Toxics Release Inventory (TRI), on- and off-site disposal or other releases of toxic chemicals to the environment by Mannington Mills was 2,002 pounds in 2004. Six pounds of the total releases were point air source emissions, and 1,996 pounds were disposed of in landfill.

Also according to the U.S. EPA annual Toxics Release Inventory (TRI), DuPont's Chambers Works facility in Deepwater, Salem County ranks high in the release of toxic chemicals to the environment in New Jersey. In 2004 (the most recent data available), approximately 4.05 million pounds of toxic chemicals were released to land, air, and water by the facility.

The Chambers Works facility is located in Deepwater, about two miles northwest of the Mannington border, on the Delaware River. Air releases from industrial sources pose a direct health and environmental risk to the Mannington area, particularly with prevailing winds from the west.

Point source and fugitive air emissions accounted for about 1.1 million pounds of the toxic releases in Salem County during 2004. Chambers Works accounted for approximately 520,000 pounds of air pollutants, followed by the Deepwater Generating Station with over 503,000 pounds. Salem County, as a whole, ranks first statewide in toxic releases with a total of 12 facilities cumulatively releasing 4.71 million pounds.

PSE&G Salem Nuclear Generating Station

The Mannington border is less than 10 miles north of three Public Service Electric & Gas (PSE&G) nuclear reactors – Salem 1, Salem 2 and Hope Creek – located in Lower Alloways Creek Township. The southern portion of Mannington Township is in Emergency Planning Zone 4. This area is in the "Plume" Zone, which extends out in a ten-mile radius of the facility. The Plume Zone is the area in which immediate evacuation and other protective actions would be taken in the event of a nuclear accident.

Historic Pesticides

New Jersey is one of the first states in the nation to address issues relating to toxic pesticide residuals, such as dichloro-diphenyl-trichloroethane (better known as DDT), arsenic, and lead that remain in the soil from past agricultural operations. In 1996, NJDEP convened a task force to study the extent of the historic pesticide problem in New Jersey and to develop strategies for protecting human health. The task force's findings were issued in an April 1999 report (see *Sources*). While the task force examined 18 agricultural sites throughout New Jersey (none in Salem County), it is estimated that 5 percent of the state's land area is impacted by residues from agricultural pesticides. The primary human health concern of residual contamination is the

ingestion of contaminated soil. Therefore, small children who may ingest soil are at the greatest health risk. This issue may affect residents of homes and subdivisions built on former cropland and orchards. Homeowners can take precautions such as maintaining grass coverage and washing hands and toys after playing in exposed soil. Some developers may be willing to address this problem by testing and removing the existing topsoil and bringing in clean topsoil before construction commences.

Photo by Nicholas Culver

Spraying the crops.

Photo by Nicholas Culver

Mannington Meadows

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To learn more about a contaminated site, contact one of the lead agencies overseeing the case or visit the web site: http://www.state.nj.us/dep/srp/. Site Remediation and Waste Management, formerly known as the Site Remediation Program, is a program unit within NJDEP that provides financial aid and technical guidance in cleaning up the state's more serious contaminated sites that pose a danger to

human health and the environment. SRWM maintains an inventory of 38,000 sites, of which 25,000 require no further remediation action. The bureaus within SRWM are listed in the table below for easy reference:

Lead Agencies:

Acronym	Bureau	Telephone No.	Acronym	Bureau	Telephone No.
BCFM	Contract & Fund Management	(609) 777-0101	BOMM	Operation, Maintenance & Monitoring	(609) 984-2990
BCM	Case Management	(609) 633-1455	BSCM	Southern Case Management (formerly BUST)	(609) 292-8761
BDC	Design & Construction	(609) 984-2991	CAS	Case Assignment Section	(609) 292-2943
BER-I	Emergency Response Region I	(973) 631-6385	INS	Initial Notice Section	(609) 633-1464
BER-II	Emergency Response Region II	(609) 584-4130	OBR	Office of Brownfield Reuse	(609) 292-1251
BFO-N	Field Operations - Northern Field Office	(973) 631-6401	OWR	Office of Wellfield Remediation	(609) 984-2990
BFO-S	Field Operations - Southern Field Office	(609) 584-4150	SA	Site Assessment	(609) 584-4280
BLRM	Landfill Compliance & Recycling Management	(609) 984-6650	STAR	Cleanup Star Program	(609) 292-1251
BNCM	Northern Case Management (formerly BEECRA)	(609) 777-0899			

Source: www.state.nj.us/dep/srp/

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Source: DVRPC

Chrysanthemums at LaRosa's Greenhouses

APPENDICES

A: Possible Vernal Pools in Mannington Township, Salem County

B: Total Maximum Daily Loads Supplementary Information

C: Private Well Testing Act

D: Federal and State Conservation Programs for Farmers

E: Mannington Meadows Important Bird Area

F: Vertebrate Fauna of Mannington Township

G: A List of Wild Plants Likely Occurring in Mannington Township

H: Threatened and Endangered Species in Mannington

I: Mannington Historical Site Inventory

J: Known Contaminated Sites

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APPENDIX A: Possible Vernal Pools in Mannington Township, Salem County

ID Number	X (UTM)	Y (UTM)	Vernal?
	Coordinates		
227icp	464919	4385166	not surveyed
289icp	459840	4389458	not surveyed
290icp	459800	4389586	not surveyed
291icp	460678	4390833	not surveyed
292icp	460762	4390819	not surveyed
293icp	461102	4390308	not surveyed
297icp	460970	4389917	not surveyed
298icp	460733	4390024	not surveyed
299icp	460823	4390080	not surveyed
300icp	460910	4389852	not surveyed
301icp	460839	4389917	not surveyed
302icp	460896	4389758	not surveyed
303icp	461077	4389703	not surveyed
304icp	459826	4390230	not surveyed
305icp	460027	4390435	not surveyed
306icp	459910	4390294	not surveyed
307icp	459888	4390044	not surveyed
308icp	459869	4389920	not surveyed
309icp	460003	4390053	not surveyed
310icp	460015	4389944	not surveyed
311icp	460212	4389366	not surveyed
312icp	460249	4389114	not surveyed

ID Number	X (UTM)	Y (UTM)	Vernal?
313icp	461358	4390005	not surveyed
314icp	461289	4390094	not surveyed
315icp	459811	4389990	not surveyed
316icp	460513	4390818	not surveyed
319icp	460508	4390468	not surveyed
320icp	460587	4390398	not surveyed
321icp	460413	4390256	not surveyed
322icp	460596	4390157	not surveyed
324icp	460958	4390144	not surveyed
324icp	460958	4390144	not surveyed
329icp	461321	4390253	not surveyed
331icp	462146	4389716	not surveyed
332icp	460459	4389666	not surveyed
333icp	460309	4389700	not surveyed
334icp	460242	4389575	not surveyed
335icp	460320	4389	not surveyed
336icp	462889	4389158	not surveyed
337icp	462804	4389199	not surveyed
338icp	462752	4389219	not surveyed
339icp	462674	4389087	not surveyed
340icp	462426	4389260	not surveyed
341icp	462564	4389169	not surveyed
342icp	462033	4388241	not surveyed

ID Number	X (UTM)	Y (UTM)	Vernal?
343icp	462114	4388151	not surveyed
368icp	460121	4390920	not surveyed
1419icp	464772	4389111	not surveyed
1421icp	462694	4388690	not surveyed
1423icp	466181	4386004	not surveyed
1424icp	460973	4389084	not surveyed
1425icp	460980	4390514	not surveyed
1426icp	460984	4390654	not surveyed
1429icp	461492	4390447	not surveyed
1430icp	461419	4390192	not surveyed
1431icp	460625	4389368	not surveyed
1434icp	460212	4390446	not surveyed
2057ocp	470926	4385517	not surveyed
2058ocp	470890	4385368	not surveyed
2059ocp	470955	4385296	not surveyed
2060ocp	471295	4385437	not surveyed
2061ocp	471388	4385475	Yes
2093ocp	470512	4385972	not surveyed
2094ocp	470644	4385991	not surveyed
2095ocp	470743	4385913	not surveyed
2096ocp	470693	4385934	not surveyed
2097ocp	470689	4385878	not surveyed
2098ocp	470669	4385899	not surveyed

ID Number	X (UTM)	Y (UTM)	Vernal?
2099ocp	470642	4385872	not surveyed
2100ocp	470636	4385814	not surveyed
2101ocp	470794	4385729	not surveyed
2103ocp	470708	4385591	not surveyed
2104ocp	470856	4385609	not surveyed
2105ocp	470790	4385641	not surveyed
2106ocp	470772	4385714	not surveyed
2107ocp	470509	4385545	not surveyed
2108ocp	470391	4385316	not surveyed
2109ocp	470859	4385434	not surveyed
2110ocp	470935	4385392	not surveyed
2113ocp	469957	4385602	not surveyed
2113ocp	469957	4385602	not surveyed
2114ocp	470182	4385667	not surveyed
2115ocp	470119	4385726	not surveyed
2116ocp	470135	4385786	not surveyed
2117ocp	470297	4385528	not surveyed
2118ocp	470201	4384866	not surveyed
2119ocp	470138	4384772	not surveyed
2120ocp	470307	4384826	not surveyed
2121ocp	470594	4384653	not surveyed
2122ocp	469478	4384466	not surveyed
2123ocp	469560	4384410	not surveyed
2124ocp	469548	4384320	not surveyed
2125ocp	469519	4384231	not surveyed
2126ocp	469567	4384259	not surveyed
2127ocp	469605	4384263	not surveyed

ID Number	X (UTM)	Y (UTM)	Vernal?
2128ocp	469640	4384245	not surveyed
2129ocp	469592	4384141	not surveyed
2130ocp	469707	4384155	not surveyed
2131ocp	469815	4384346	not surveyed
2132ocp	469769	4384455	not surveyed
2133ocp	469673	4384505	not surveyed
2134ocp	469728	4384571	not surveyed
2135ocp	469728	4384479	not surveyed
2136ocp	470009	4384493	not surveyed
2137ocp	469629	4384434	not surveyed
2138ocp	469654	4384384	not surveyed
2139ocp	469614	4384368	not surveyed
2140ocp	470004	4384217	not surveyed
2141ocp	470012	4384152	not surveyed
2142ocp	470116	4384141	not surveyed
2143ocp	468617	4384652	not surveyed
2144ocp	468541	4384746	not surveyed
2145ocp	468478	4384617	not surveyed
2146ocp	468489	4384539	not surveyed
2147ocp	468478	4384455	not surveyed
2148ocp	468586	4384532	not surveyed
2149ocp	468986	4384508	not surveyed
2150ocp	468975	4384449	not surveyed
2151ocp	469081	4384549	not surveyed
2152ocp	469085	4384489	not surveyed
2153ocp	469027	4384346	not surveyed
2154ocp	469123	4384333	not surveyed

ID Number	X (UTM)	Y (UTM)	Vernal?
2155ocp	468787	4384426	not surveyed
2156ocp	470046	4384637	not surveyed
2157ocp	470074	4384477	not surveyed
2158ocp	470022	4384026	not surveyed
2159ocp	469684	4384113	not surveyed
2160ocp	469815	4384081	not surveyed
2161ocp	468682	4384095	not surveyed
2162ocp	468924	4384107	not surveyed
2163ocp	469845	4384994	not surveyed
2164ocp	470056	4384867	not surveyed
2165ocp	469901	4385135	not surveyed
2166ocp	469734	4386021	not surveyed
2172ocp	471873	4384731	not surveyed
2173ocp	471680	4384928	not surveyed
2178ocp	471819	4384562	not surveyed
2179ocp	471835	4384608	not surveyed
2180ocp	471954	4384616	not surveyed
2181ocp	471677	4384529	not surveyed
2251ocp	471607	4385032	not surveyed
2252ocp	471513	4384798	not surveyed
2278ocp	471005	4385714	not surveyed
2279ocp	470942	4385820	not surveyed
2280ocp	471112	4385742	not surveyed
2886ocp	464112	4379581	not surveyed
2895ocp	465550	4385204	not surveyed
4936ocp	472036	4384894	not surveyed
4939ocp	470345	4386357	not surveyed

ID Number	X (UTM)	Y (UTM)	Vernal?
4940ocp	470322	4385438	not surveyed
4942ocp	471195	4385055	Yes
4943ocp	471120	4385186	not surveyed
4944ocp	471712	4385146	not surveyed
4945ocp	471737	4384835	not surveyed
4946ocp	471667	4384826	not surveyed
12293icp	460811	4389488	not surveyed
12294icp	460458	4389384	Yes
12342ocp	470050	4384558	Yes
12343ocp	468472	4384288	Yes
13252icp	460039	4390448	Yes
13253icp	459813	4390255	Yes
13254icp	459898	4390058	Yes
13255icp	459862	4389938	Yes
13256icp	460399	4390270	Yes
13257icp	460591	4390379	Yes
13258icp	460586	4390182	Yes
13259icp	461304	4390263	Yes
13260icp	461394	4390186	Yes
13261icp	461477	4390450	Yes
13262icp	460608	4389397	Yes
13263icp	462411	4389281	Yes
13264icp	462556	4389198	Yes
13265icp	462879	4389200	Yes
13323ocp	471153	4385231	Yes
13324ocp	470932	4385401	Yes
13325ocp	470768	4385628	Yes

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APPENDIX B: Total Maximum Daily Loads Supplementary Information

From TMDL Report: "Fecal Coliform in 27 Stream Segments in the Lower Delaware Water Region"							
Date Proposed	**Date Approved**	**Station Name/Waterbody**	**Site ID**	**River Miles/Water-shed Acres**	**% Reduction Required (w/ MOS) – LA[1]**	**% Reduction Required – WLA[2]**	**Implementation – Segment Specific Recommendations**
04/21/03	Sept. 2003	Salem River at Woodstown and at Courses Landing - watershed upstream of Salem River's confluence with Game Creek (in Carneys Point).	1482500 & 1482537	73.5 mi/ 27,211 ac	84%	84%	There are horse farms, dairy farms, a poultry farm, an agricultural products operation, and a rodeo in the watershed. Cattle were observed in the stream. Both Woodstown Lake and Avis Mill Pond attract large Canada Goose population. The Township of Woodstown receives sewer service; the remainder of the watershed is on septic systems. Monitoring: Long segment would benefit from fecal coliform sampling to narrow scope of impairment.
04/21/03	Sept. 2003	Two Penny Run at Danceys Corner and Courses Landing - watershed downstream to Laytons Lake (in Carneys Point). Full length of Two Penny Run & its watershed in Pilesgrove.	1482560	8.9 mi/ 4,989 ac	90%	90%	Majority of watershed is agricultural land, good buffer on one side of stream. Many horse farms as well as a large cow and sheep farm observed. Potential septic impacts from homes on septic systems, including trailer parks. Monitoring: coliphage to determine if septic systems are a source. Strategies: prioritize for EQIP/SCCSP funds to install agricultural BMPs.
From TMDL Report: "Fecal coliform to address 3 stream segments in the Lower Delaware Water Region"							
5/2/05		Major Run at Sharptown – watershed upstream from confluence of Major Run and Salem River	1482530	4.19 mi/ 2,152 ac	98%	98%	The watershed that drains this segment is largely agricultural. It is possible that manure application for fertilizer and livestock may be of concern. Small pockets of residences are present. Much of the segment has a wooded buffer. A lake is present above the sampling site. Monitoring: Additional fecal coliform monitoring is suggested in order to locate potential sources. Strategies: The lake area should be investigated for presence of excessive numbers of geese and if needed a goose management program should be implemented; prioritize for EQIP funds to install agricultural BMPs; Phase II stormwater program.

[1] LA = Load allocation from nonpoint and stormwater sources
[2] WLA = Waste load allocation from any point sources

Source: NJDEP Division of Watershed management

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APPENDIX C: Private Well Testing Act

The Private Well Testing Act (*N.J.S.A. 58:12A-26 et seq.*), passed in 2002 and administered by NJDEP, requires that well water be tested for contaminants when properties served by certain types of drinking water wells are sold or leased. The law does not prohibit the sale of property if the water fails one or more drinking water test standards. Rather, the fundamental goal of the PWTA is to ensure that purchasers and lessees of properties served by private potable wells are fully aware of the quality of the untreated drinking water sources prior to sale or lease. The state law allows the buyer and seller to determine which party will pay for the test, as well as what actions, if any, need to be taken if test results indicate a contaminant is present in the water above an applicable standard. However, individual county health rules may mandate that certain actions are required in order for a real estate transaction to be finalized.

The PWTA program requires that water be tested for primary contaminants (health-based) and secondary parameters (aesthetic characteristics). Primary contaminants are contaminants that may cause a potential health risk if consumed on a regular basis above the established maximum contaminant level (MCL). New Jersey regulates 18 primary contaminants, five more than federal EPA requirements. Primary contaminants include bacteriological (fecal coliform and *E. coli*), Volatile Organic Compounds (VOCs), inorganics (arsenic, lead, mercury, and nitrates), and Radiological (radium decay) substances. A certified laboratory must collect a water sample at a point before the water goes through any treatment. This sample represents the condition of the ground water in the aquifer, which may be different from water out of a kitchen faucet. Property owners may choose to also have the tap water tested to assure that filters or treatments are working effectively.

Volatile Organic Compounds regulated by NJDEP

- Benzene
- Carbon Tetrachloride
- meta-Dichlorobenzene
- ortho-Dichlorobenzene
- para-Dichlorobenzene
- 1, 1-Dichloroethane
- 1, 2-Dichloroethane
- 1, 1-Dichloroethylene
- *cis* – 1, 2-Dichloroethylene
- *trans* – 1, 2-Dichloroethylene
- 1, 2-Dichloropropane
- Ethylbenzene
- Methyl tertiary butyl ether
- Methylene Chloride
- Monochlorobenzene
- Naphthalene
- Styrene
- 1, 1, 2, 2-Tetrachloroethane
- Tetrachloroethylene
- Toluene
- 1, 2, 4-Trichlorobenzene
- 1, 1, 1-Trichloroethane
- 1, 2, 2-Trichloroethane
- Trichloroethylene
- Vinyl Chloride
- Xylenes (Total)

The PWTA program requires tests for three naturally occurring secondary parameters: pH, iron, and manganese. Secondary drinking water standards address aesthetics such as corrosivity, taste, and color, and testing for these parameters determines if water is suitable for laundering, plumbing, and showering. For example, due to the nature of soils and geology in southern New Jersey, the ground waters tend to be acidic (pH below 7), while ground waters in the northern part are neutral (pH=7) to basic (pH above 7). If the pH is too low (less than 6.5) water has a bitter metallic taste, and causes corrosion of pipes and fixtures. If the pH is too high (greater than 8.5) the water has a slippery feel, it tastes like soda, and deposits can form on plumbing fixtures.

Test results are reported by the lab to the person who requested the testing, to NJDEP, and to the local health authority. Suspicious or unexpected results are neither confirmed nor verified by NJDEP. Local health authorities will investigate

suspect results, if necessary.

In February 2004, NJDEP released an online report summarizing the initial well test results reported to the agency during the PWTA program's first six months (September 2002 to March 2003). Results for 5,179 wells are included, which represent approximately 1 percent of private wells used as potable water supplies in New Jersey. The compilation of water test results is organized by county and municipality but does not include the names of specific property owners, their addresses, or well locations, because releasing that information is prohibited by law. About 92 percent of the 5,179 wells passed all the required (health-based) standards, with the exception of lead. Of the 8 percent (417 wells) of wells sampled that exceeded the maximum contaminant level for primary contaminants, the most common reason for failure statewide was nitrate (inorganics), followed by fecal coliform (bacteriological), and VOCs. Nitrates are found in groundwater due to a number of factors, including natural deposits, runoff from fertilizer, leaching from septic tanks, and from sewage pipes.

More wells in northern New Jersey were found to have fecal coliform or *E. coli* bacteria than in southern New Jersey. The northern/southern difference is probably due to the different geology in these regions. Northern New Jersey is characterized by limestone subject to solution cavities, fractured bedrock, or gravel water-bearing zones, while the southern part of the state is composed mainly of coastal plain sand and gravel, which appears to provide better protection of groundwater from fecal contaminants.

For those wells in the counties where mercury testing is required, 14 wells failed for mercury. Nine southern counties, including Burlington, Camden, Gloucester, and Salem, are required to test for mercury, which has been linked to neurological problems.

The test results for Salem County, Mannington are summarized in the table below. NJDEP's initial report indicates the presence of several drinking water contaminants, including mercury, gross alpha (radium), 1,2,3 trichloropropane, and 1,2 dichloropropane, in the county's groundwater.

Summary of PWTA Test Results for Salem County (September 2002 – March 2003)

Municipality	**# Wells sampled**	**Total # Wells over the MCL***	**Fecal coliform/ E. coli**	**Nitrate**	**Mercury**	**Any VOC** over the MCL**
Mannington Township	4	0	0	0	0	0
Salem County Totals	***101***	***9***	***0***	***9***	***1***	***0***

Source: NJDEP, Division of Science, Research, and Technology (DSRT)

* MCL – Maximum Contaminant Level, set as the limit of a particular substance allowable to achieve a water quality standard
** VOC – Volatile Organic Compound.

APPENDIX D: Federal and State Conservation Programs for Farmers

There are several financial and economic incentive programs and technical assistance to help farmers plan and use conservation practices on their farms. The United States Department of Agriculture Natural Resources Conservation Service (NRCS) has a Farm Service Agency office in Waretown, Mannington Township, Salem County that serves Salem and Gloucester counties. NRCS staff members are available to work with farmers to help identify their conservation goals and then craft appropriate conservation plans to meet those goals.

Numerous programs provide financial incentives to help farmers voluntarily engage in these practices. Financial incentives can include rental payments to farmers for reserved land, easement payments, and cost sharing, up to 100 percent for some programs, to develop and follow conservation plans.

The **Conservation Reserve Program (CRP)** is offered by NRCS and administered by the Farm Service Agency. It provides technical and financial aid and gives farmers assistance in complying with federal, state and tribal environmental laws. The primary environmental goals of this program include reducing soil erosion, reducing sedimentation in streams and lakes, improving water quality, establishing wildlife habitat, and enhancing forest and wetland resources. Website: http://www.nrcs.usda.gov/programs/crp/.

The State of New Jersey partnered with the USDA to help farmers protect water quality by establishing a $100 million **Conservation Reserve Enhancement Program (CREP)**, which is the New Jersey version of the federal program**.** Under an agreement signed by Governor McGreevy in February 2004, the USDA provides $77 million and the state contributes $23 million for New Jersey farmers to install stream buffers, in order to reduce the flow of nonpoint source pollution into the state's waterways. New Jersey's goal is to enroll 30,000 acres of agricultural land into this state-federal program over a 10-year period. Types of buffers to be installed include trees, shrubs, vegetative filter strips, contour grass strips and grass waterways. Under the program, a landowner installs and maintains approved practices through a 10- or 15-year rental contract agreement. A landowner entering the state Farmland Preservation Program or Green Acres Program also may opt for a permanent easement under the Conservation Reserve Enhancement Program. This would provide additional payment for permanent maintenance of approved conservation practices. The program will pay landowners annual rental and incentive payments for participating in the program as well as 100 percent of the cost to establish approved practices. Additional information can be found at www.fsa.usda.gov or contact the local FSA office or Soil and Water Conservation District Office.

Another program targeted for wetlands preservation is called the **Wetlands Reserve Program (WRP)**. WRP is a voluntary resource conservation program that provides landowners the opportunity to receive financial incentive to restore, protect and enhance wetlands in exchange for returning marginal land from agriculture. WRP is made possible by a reauthorization in the Farm Security and Rural Investment Act of 2002 known as the Farm Bill. The program has three enrollment options: permanent easement, 30-year easement, or restoration cost-share agreement,

which has a minimum 10-year commitment. Applications are accepted on a continuous basis and may be obtained and filed at any time. Please see the website for more details: www.nrcs.usda.gov/programs/farmbill/2002/

The **Grassland Reserve Program (GRP)** is another conservation program authorized by the Farm Bill 2002. GRP is a voluntary program that protects grasslands, pasturelands, and rangelands without prohibiting grazing. Participants voluntarily put limitations on the future land use of their land while retaining the ability and right to conduct grazing practices, hay production, mow or harvest for seed production, conduct fire rehabilitation, and construct firebreaks and fences. There are four enrollment options: permanent easement; 30-year easement; rental agreement, which is available in 10, 15, 20 or 30-year contracts; and restoration agreement. Participants are compensated in different ways according to the enrollment option. For more information and application procedures visit the GRP website: www.fsa.usda.gov/dafp/GRP/default1.htm

The **Wildlife Habitat Incentives Program (WHIP)** is similar to those above in that it is also a USDA voluntary program, but differs in that WHIP targets landowners who want to preserve and protect fish and wildlife habitat on nonfederal lands. The program provides technical and cost sharing provisions to protect these environments. Enrollment consists of a cost share agreement lasting from 5 to 10 years. In New Jersey, NRCS has received over $900,000 to implement WHIP since 1998, where the majority of funds have been used for cost share payments to landowners. A state plan has been developed in New Jersey and targets several areas as priority wildlife habitat areas. NRCS has also targeted a priority species: the bog turtle, for protection. For more information visit the NRCS New Jersey website: www.nj.nrcs.usda.gov

The **Environmental Quality Incentives Program (EQIP)** is also a part of the reauthorized Farm Bill of 2002. EQIP is a voluntary program that focuses on conservation that promotes both agricultural production and environmental quality. The program itself offers technical and financial assistance with installation and implementation of structural and management practices on agricultural land. EQIP features a minimum contract term compared to other programs lasting a maximum of 10 years. Landowners are eligible for incentive and cost share payments of up to 75 percent and sometimes up to 90 percent while still engaging in livestock or agricultural production activities. For more information please visit the website: www.nrcs.usda.gov/programs/eqip

The **Conservation Security Program (CSP)** is a voluntary program administered by the NRCS and authorized by the Farm Bill 2002. This program is intended to promote conservation and improvement of soil, water, air, energy, plant and animal life, etc. on tribal and private working lands. Working lands refer to a variety of land types including cropland, grassland, prairie land, improved pasture and rangeland. In some cases forested lands would also be included in this category. CSP is available in 50 states as well as the Caribbean and Pacific Basin areas and provides equal access to funding. For more information please visit the website: www.nrcs.usda.gov/programs/csp/

The **Forestland Enhancement Program (FLEP)** is also authorized through the Farm Bill 2002 and replaces the Stewardship Incentives Program (SIP) and the Forestry Incentives Program

(FIP). FLEP is a voluntary program for landowners of nonindustrial private forest and provides technical, educational and cost-sharing assistance in an effort to promote the conservation of these forested areas. Landowners must have a forest management plan and are limited to 1,000 acres per year for the cost-share practices. For more information about this program please visit the website: http://www.fs.fed.us/spf/coop/programs/loa/flep.shtml and the National Association of State Foresters website to find your local agency: www.stateforesters.org

The **Farm and Ranch Lands Protection Program (FRPP)** is a voluntary land conservation program that assists farmers to keep their lands for agricultural purposes. FRPP provides matching funds to those provided by state, tribal, local government or nongovernment organizations offering farm and ranch protection programs designed to purchase conservation easements. The FRPP is authorized by the Farm Bill 2002 and managed by the NRCS. Conservation easements are purchased by the state, tribal or local entity. The participating landowner agrees not to convert their land to nonagricultural uses, as well as to develop a conservation plan for any highly erodable lands. Landowners do, however, maintain all of their rights to utilize their land for agricultural purposes. For more information about FRPP please visit the website: www.nrcs.usda.gov/programs/farmbill/2002/ and search for the Farm and Ranch Lands Protection Program.

The **State Agricultural Development Committee (SADC) in New Jersey** has made soil and water conservation grants available as part of the Farmland Preservation Program. The grants give landowners up to 50 percent of costs associated with approved soil and water conservation projects. Farms are only eligible if they are already enrolled in a permanent or eight-year easement program. Soil projects can include measures to prevent or control erosion, control pollution on agricultural land, and improve water management for agricultural purposes. Projects must be completed within three years of SADC funding approval. However, under special circumstances the grant may be renewed for an additional year. For more information contact the local Soil Conservation District or the State Agricultural Development Committee at (609) 984-2504 or visit the website: http://www.state.nj.us/agriculture/sadc/sadc.htm for additional details.

The **Landowner Incentive Program (LIP)** is a preservation program for private landowners who wish to protect and conserve rare wildlife habitat and species. LIP is funded by the U.S. Fish and Wildlife Service and administered by the New Jersey Department of Environmental Protection's Division of Fish and Wildlife Endangered Nongame Species Program. Participating landowners receive both technical and financial assistance through this competitive grant program. Last year $1.12 million was awarded for a variety of preservation programs including habitat improvements, habitat management and habitat protection projects. Generally a five-year minimum commitment is required and longer terms are preferred. A 25 percent cost share is required of the landowner. While the LIP is seeking funding for additional habitat protection projects, it may be another year before grants are available. Interested landowners are encouraged to contact Kim Korth, ENSP assistant zoologist at (609) 984-1581 for additional details. To learn more about the program in general visit the website: http://www.state.nj.us/dep/fgw/ensp/lip_prog.htm or http://www.state.nj.us/dep/fgw/ensp/pdf/lip_broch.pdf

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Mannington Meadows Important Bird Area (IBA)
Conservation and Management Plan
Prepared by the NJ Audubon Society

Site name: Mannington Meadows Important Bird Area (IBA)

Location: Salem County, New Jersey. The majority of the IBA is within the Mannington Township. Fringes of the IBA are located in Salem City, Pennsville, Woodstown, Carney's Point, and Quinton Townships.

Area: 18,593 acres

Ownership and Managing Agencies: The vast majority of land within this IBA is in private ownership. The NJ Department of Environmental Protection's (DEP) Division of Fish and Wildlife manages several tracts of public land, including the Salem River Wildlife Management Area (WMA), located within the IBA.

Description: The Mannington Meadows IBA is formed by the Salem River on its northern and western boundaries and encompasses stretches of Fenwick, Mannington, and Keasbeys Creeks. Agricultural land surrounds the waterways and wetlands of this IBA. The IBA is composed mainly of wetlands, agricultural lands, and rural development with the only significant development at the southern end in Salem City (see Fig. 1).

Historic and Current Land Use: The city of Salem was founded in the late 1600s. The township of Mannington, surrounding the northern and eastern boundaries of Salem, has mainly been in agricultural use with the exception of a few industries. Businesses such as Mannington Mills, PSE&G, and DuPont operate within or close to this IBA. The township's dedication to an agricultural lifestyle is apparent; with 22% of Mannington Township enrolled in land preservation programs (see Fig. 2). Agriculture and open space are still the main forms of land use within this IBA; however, development pressure is increasing throughout the area (see Fig. 3). As a result, the township has initiated a Transfer of Development Rights (TDR) study to plan where future development occurs within this community.

The Mannington Meadow itself has a long and varied history. The meadow is formed by the Salem River, running north-south, and the Mannington Creek, which runs east-west. Much of the meadow is shallow because of the Salem River's proclivity to expand far beyond its banks. Historically, the meadow was diked and farmed to produce salt hay and wild rice. However, an early 1900s hurricane destroyed most of the impoundments, which were not rebuilt. Meadow companies still exist in the Mannington Township and still maintain areas of fresh water for farmland irrigation. One such area is known as Mannington Lake located on the Mannington Creek east of the County Route 540 Bridge. A sluice gate at the Route 540 Bridge keeps tidal water out of the lake. While

most of the Mannington Meadow is brackish, waters upstream of sluice gates are fresh, except in times of floods where brackish water can spill over water control structures.

A sizeable proportion of land in the Mannington Township (as well as the IBA) is categorized as wetlands (Fig. 4). There are many more acres of wetlands that were drained and converted to farmland. However, regulations that protect wetlands and the use of incentive programs have resulted in farmland reverting back to natural wetland habitat (Fig. 3 and 4). Forested coverage within this IBA is increasing but is still minimal (Fig. 3). The amount of developed land is restricted in the township, but is also increasing.

Key IBA Criteria:

Criteria	*Species
1a Conservation Concern – State-endangered	Bald Eagle (B) *Haliaeetus leucocephalus*
1a Conservation Concern – State-endangered	Pied-billed Grebe (B) *Podilymbus podiceps*
1a Conservation Concern – State-endangered	Least Bittern (B) *Ixobrychus exilis*
1a Conservation Concern – State-endangered	King Rail (B) *Rallus elegans*
2 Regional Responsibility Species - BCR 30 Salt marsh/Wetland	American Black Duck *Anas rubripes* Clapper Rail *Rallus longirostris* Marsh Wren *Cistothorus palustris* Virginia Rail *Rallus limicola* Mallard *Anas platyrhynchos* Northern Pintail *Anas acuta*
3a Significant Congregations of Waterfowl	
3c Significant Congregations of Wading Birds	
3d Significant Congregations – Exceptional Single Species Concentration	Caspian Tern (FM) *Hydroprogne caspia*
3d Significant Congregations – Exceptional Single Species Concentration	Pectoral Sandpiper (SM) *Calidris melanotos*
3e Significant Congregations – Exceptional Diversity	
5 Long-term Research/Monitoring	

***** B=breeding; FM=fall migration; SM=spring migration

Essential Habitat Types: Open water, emergent wetlands, potential grassland and agricultural land, forested wetlands.

Vision Statement: To protect and conserve the Mannington Meadows IBA, we will strive to protect water quality, increase the quality of riparian habitat, restore natural wetlands and grasslands, maintain the agricultural character of the community, and engage the community in protecting its natural resources through education and outreach efforts and the establishment of habitat demonstration sites.

Operation and Management Considerations:

Habitat Management Needs

Riparian zone restoration: Much of the littoral zone of the Mannington Meadow is dominated by a monoculture of *Phragmites*. Restoration of native species of vegetation is recommended to increase diversity of habitat types to support the broad community of waterfowl and other avian species that depend upon the IBA for breeding, wintering, and stop-over habitat. In addition, funding is available from various incentive programs to take marginal crop land out of production and restore to riparian habitat.

Wetland restoration: Some of the farmland in the IBA is converted wetlands. In addition, the hydrology of many forested wetlands within the IBA has been modified by ditching. Funding is available from various incentive programs to engage farmers and landowners in wetland restoration.

Restore hydrologic flow: The hydrology of the Mannington Meadow has been altered over time by water control structures, diversion of the Salem River via a canal, and impoundments.

Management of grassland habitat: The majority of the Mannington Meadows IBA is agricultural land, which is modeled as potential grassland in the DEP's Landscape Project. Funding is available from various incentive programs to compensate landowners who voluntarily choose to engage in grassland restoration or management of hay fields for increased productivity of grassland birds.

Threats or potential problems

Invasive species (Phragmites): Habitat diversity has been reduced by an invasion of non-native species in the *Phragmites* genus.

Mute swans: A population of the non-indigenous mute swan resides in the Mannington Meadows. Mute swans are capable of reducing availability of food resources for native avifauna.

Development pressure: Mannington Township is experiencing increased development pressure because of its proximity to Philadelphia, PA and Wilmington, DE.

Agricultural runoff (nonpoint source pollution): Given the amount of land in crop rotation in Mannington Township, agricultural runoff may be a concern.

Education, Outreach, and Research Considerations:

Access to open space is currently limited. Recommend developing interpretative trails and watchable wildlife areas.

Education and outreach

Private lands biologists will work to increase awareness of incentive programs and to assist landowners in engaging in conservation practices that conserve soil, improve water quality, and increase availability of wildlife habitat.

Build partnerships with public and private landowners to increase opportunities for outdoor education and recreation. Seek funding to establish watchable wildlife areas.

Establish demonstration sites to increase awareness of the importance of grassland habitat for soil conservation and biodiversity. Demonstration site will also serve to educate land managers about grassland management techniques.

Research

Potential research questions include:
What are the effects of *Phragmites* on biovidersity and water quality?
What are the effects of competition with Mute Swans on native fauna?
What are the sources and effects of nonpoint source pollution?

Implementation Strategies:

1. Increase the use of soil, water, and wildlife conservation practices on private lands.
    - Build partnerships with resource management agencies, private land owners, and farmers to facilitate enrollment in voluntary incentive programs.
    - Increase the proportion of Landowner Incentive Program (LIP) and Farm Bill dollars allocated to NJ, and specifically to the Mannington area.
    - Provide landowners with information about the various incentive programs for which they may qualify.
    - Assist landowners who are interested in incentive programs with designing grant proposals and provide support during the application and implementation process.

2. Maintain agricultural character of the community by encouraging sustainable growth.
    - Encourage nature-based tourism by promoting utilization of NJAS' Birding and Wildlife Trails Guide and supporting the leasing of hunting rights.
    - Work with partners to support development of heritage trails and identification of cultural values.
    - Work with land use planners to prioritize areas for farmland preservation and open space.
    - Work with land preservation partners to direct more funding to private lands within the IBA.

3. Engage community in stewardship of its natural resources
   - Implement educational programs about the value of the communities' natural resources
   - Facilitate opportunities for volunteer activities at restoration projects.
   - Enlist citizen scientists to monitor IBA (habitat, threats, populations)
   - Empower community to advocate their natural resources

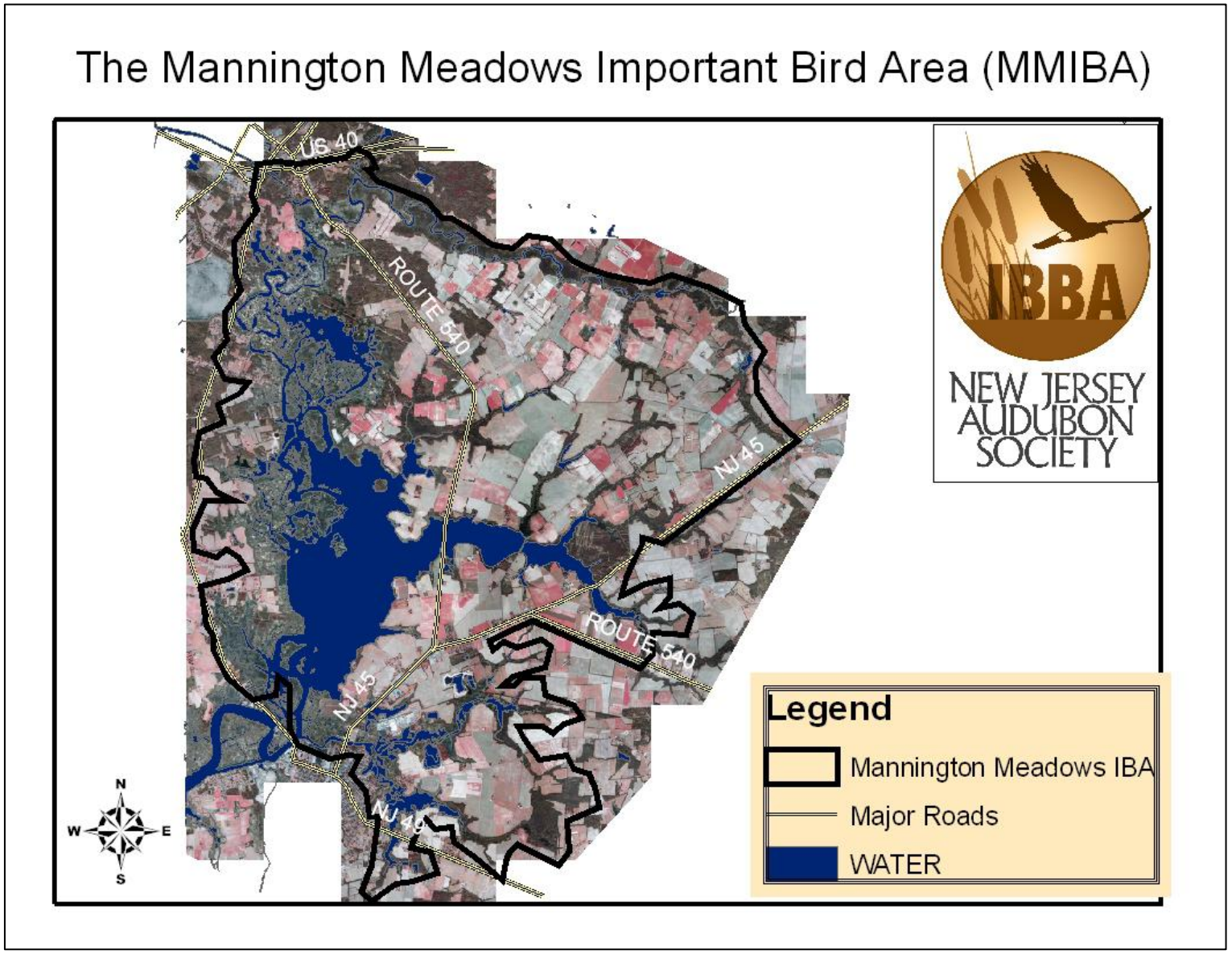
4. Provide outdoor educational and recreational opportunities
   - Increase access to open space
   - Increase educational programs
   - Increase access to bird-watching areas and other recreational opportunities

5. Establish demonstration sites for model stewardship activities
   - Riparian restoration: identify contiguous area of degraded shoreline for riparian restoration.
   - Grassland restoration and/or management: identify parcel at least 50 acres in size for grassland restoration; or identify a hayfield at least 50 acres in size for delayed mowing. Mowing after July 15 greatly increases grassland bird productivity because by that date the majority of hatching have fledged.
   - Interpretative trails: seek funding to provide recreational and educational opportunities on demonstration sites.

Appendices

A. Riparian Restoration Plan
B. Grassland Breeding Bird Objectives

Figure 1. Boundaries of the Mannington Meadows Important Bird Area in Salem County, New Jersey.



Appendix A.
Mannington Meadows Important Bird Area
Riparian Restoration Plan

As part of the Mannington Meadows Important Bird Area Conservation Plan, the New Jersey Audubon Society (NJAS), the United States Fish and Wildlife Service (USFWS), Ducks Unlimited, the United States Department of Agriculture's Farm Services Agency (FSA) and Natural Resource Conservation Service (NRCS), the New Jersey Department of Environmental Protection (NJDEP), and the Mannington Township Environmental Commission have partnered with dedicated private landowners to implement a plan to reduce the amount of *Phragmites australis*, locally referred to as common reed grass, within the Mannington Meadows Important Bird Area (MMIBA).

Need

Phragmites is a genus of aquatic grass that contains species both native and non-native to North America. Recently, a non-native strain has become so successful that it dominates much of the MMIBA, displacing native habitat types. Because of its invasive nature, *Phragmites* is generally considered to be undesirable and reflects a degraded ecosystem. *Phragmites* tends to out-compete native vegetation and often times will establish a monoculture stand (Chambers et al 1999), contiguous along miles of the littoral zone of many water bodies in southern New Jersey. The recent *Phragmites* invasion is also addressed in the Comprehensive Conservation Management Plan for the Delaware Estuary. Action H4.7 under the Habitat and Living Resources section is to "reduce *Phragmites* cover in tidal wetlands." As with many parts of the Delaware Estuary, the majority of the shoreline of the Mannington Meadows is dominated by a non-native strain of *Phragmites*, which has led to a reduction of native habitat types within the MMIBA. Our objective is to increase the diversity of habitat types within the MMIBA by restoring sections of the Mannington Meadows shoreline to native species of vegetation.

Expected benefits

The Mannington Meadows is an important area for waterfowl and supports the largest diversity of duck species in the state (Ted Nichols, NJDEP, pers. comm.). *Phragmites* stands are considered suboptimal habitat because they support a lower density and diversity of macro-invertebrates (Angradi et al 2001) and seed resources than native *Spartina* marshes. Waterfowl utilize the MMIBA as stop-over habitat for rest and fuel during migration and winter. By reducing the amount of *Phragmites* cover and increasing the amount of native vegetation in the MMIBA, we expect that waterfowl will benefit from an increased availability of quality food resources.

Phragmites, however, can provide adequate cover habitat for waterbirds and waterfowl (Kane 2001). In particular, secretive marsh birds, such as bitterns and rails, can benefit from the structure of *Phragmites* and often utilize it for nesting habitat. Therefore, our goal is not to completely eradicate *Phragmites* from the MMIBA, but to reduce its dominance within the ecosystem to a habitat type found within a matrix of native vegetation. We believe that secretive marsh birds will also benefit from an increase in vegetative diversity and available food resources within the MMIBA.

Project Area

The Mannington Meadows IBA is located in Salem County, NJ. The project area is located in Mannington Township. Habitat restoration will take place on several adjacent tracts of private land and one tract of the Salem River Wildlife Management Area (WMA), covering approximately 40 acres or two miles of shoreline. The project area begins at the Route 540 causeway that crosses Mannington Creek and extends approximately two miles southwest of the causeway (Figure 1). All of the properties are privately owned farmland, except for one residential home and one parcel owned by the state and managed by the NJDEP (Figure 1).

Restoration Plan

Restoration will include conversion of a *Phragmites* monoculture to native vegetation and augmentation of the existing riparian zone. From the agricultural fields to the water's edge *Phragmites*, where it exists, will be removed and native trees, shrubs, and herbaceous vegetation will be planted (Table 1). The riparian buffer will also be augmented by installing forested riparian buffers and grass filter strips.

The preferred means to control *Phragmites* is through application of a glyphosate-based herbicide (*e.g.*, Rodeo™ or Glypro™) with a surfactant (*e.g.*, LI-700™) suitable for safe aquatic application. Application may be made via one or a combination of methods: back-pack sprayers, tank and pump applicator mounted on a pick-up truck or a Marsh Master™ (a semi-amphibious vehicle) or aerial spraying. Application will take place approximately within one month of September 15 and again at the same time the following year. During September, the growth of common reed is still vigorous and nutrients are being transported from the leaves into the roots, thus facilitating herbicide efficacy. However, other desirable marsh species, such *Spartina* spp., are generally dormant during September and are usually not significantly affected by the herbicide. Care will be taken during herbicide application to minimize accidental exposure of trees.

The spring following 2 consecutive seasons of herbicide application, a variety of shrubs and trees will be planted along the shoreline (see Table 1). Re-vegetating provides several benefits including: replacement of cover lost due to

removal of *Phragmites*, helps prevent reinvasion by out-competing *Phragmites*, increases plant diversity, and provides desirable seed sources for future natural reseeding of adjacent areas. The USFWS' Partners for Fish and Wildlife and Coastal Programs will provide the shrubs and trees. Volunteers from the community, coordinated by the NJ Audubon Society, will do the planting. Species planted will be those with particularly high value for pollinators and migratory birds as well as having at least some tolerance to brackish water in the soil, during infrequent flooding, or in sea spray.

Timeline

- Fall 2006: first herbicide application of *Phragmites*
- Spring 2007: mow non-native species in existing riparian zone, such as multiflora rose (*Rosa multiflora*). Plant native trees and shrubs in place
- Summer 2007: mow *Phragmites.* Begin monitoring program.
- Fall 2007: second herbicide application of P*hragmites.* Begin planting trees and filter strips in area for riparian augmentation.
- Spring 2008: plant *Phragmites* area with native vegetation. Continue planting trees and filter strips in area for riparian augmentation.
- Fall 2008: complete replanting of *Phragmites* area. Complete planting in riparian augmentation areas.
- 2009 – 2011: continue to monitor project site.

Measures of Success

Likelihood of success is considered high for this project because of the scale and placement of the project. The restoration project begins at the Route 540 causeway, beyond which is freshwater because of the existence of a sluice gate. In addition, the road should serve as an effective barrier to rhizomatic re-colonization of *Phragmites*. Restoration will extend 2 miles downstream and will be coupled with riparian augmentation providing a solid core of source native vegetation and a reliable seed bank. Furthermore, the replanting of trees and shrubs is expected to out-compete *Phragmites* by blocking access to light and resources.

Criteria for success revolve around the establishment of native vegetation. Birds are expected to respond positively, however, avian response will be difficult to isolate. The native plants are expected to provide food resources that will attract birds, but seeds will also disperse, so total avian benefit would be difficult to measure. Therefore, criteria for success will be determined by the extent of *Phragmites* removal and duration of absence of *Phragmites*. The project will be deemed successful if at least 75% of the *Phragmites* is removed from the project site for at least 5 years.

Monitoring

Anecdotal monitoring will be conducted by biologists with the various partner organizations for at least 5 years. Avian response will be monitored via existing surveys conducted by the NJDEP's waterfowl biologist and by NJ Audubon Society's Citizen Scientist Program. In addition, vegetation surveys will be conducted by students at a partner University. Vegetation surveying will continue for at least 2 years post treatment. After 2 years, we may retain another intern or a biologist to continue to monitor the project site qualitatively.

Literature Cited

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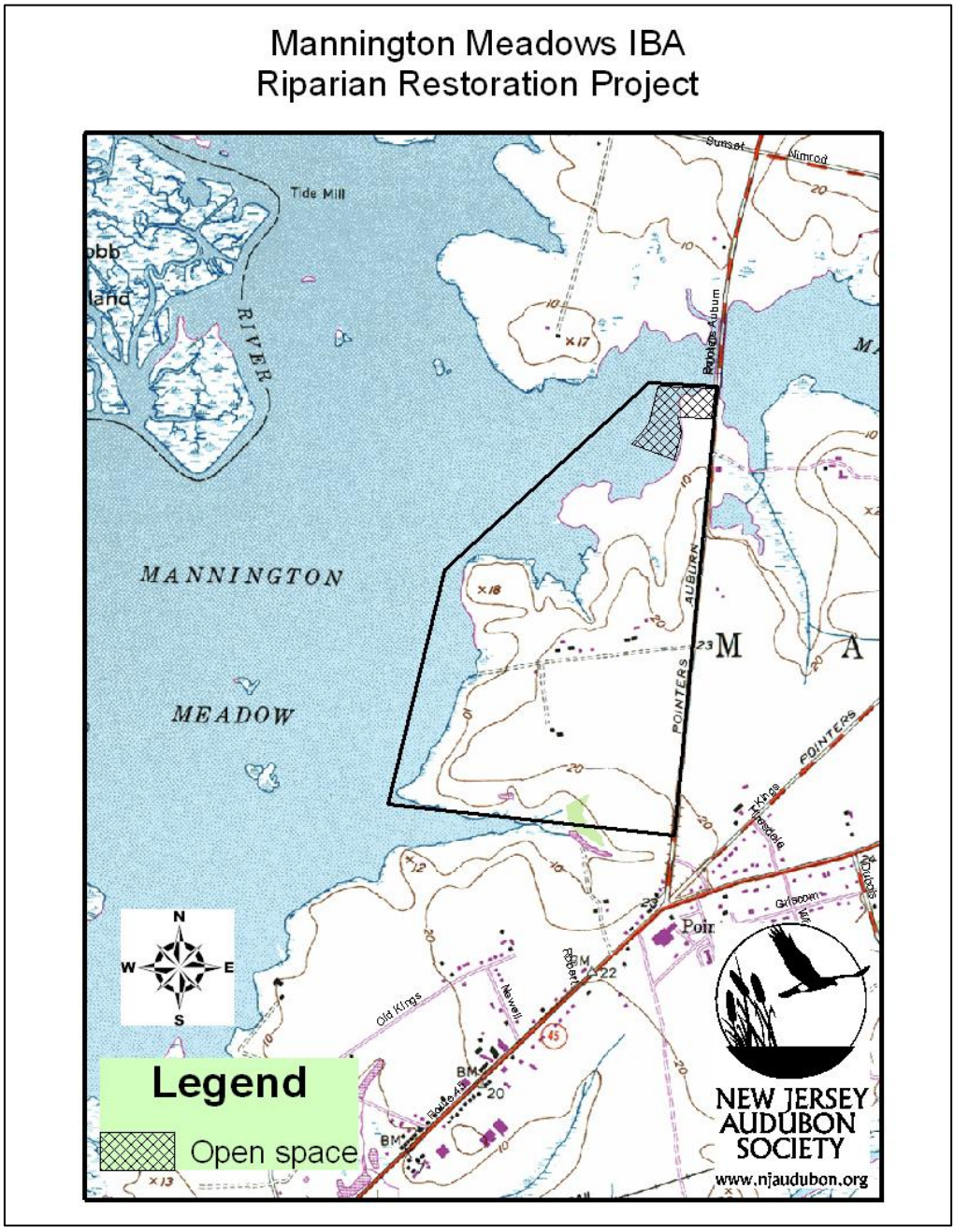
Chambers R. C., L. A. Meyerson, K. Saltonstall. 1999. Expansion of *Phragmites australis* into tidal wetlands of North America. Aquatic Botany. 64:261–273.

Kane, R. 2001. Phragmites use by birds in New Jersey. NJAS Opinion.

Table 1. Potential shrub and tree species for use along the shoreline of Mannington Meadows

Species	Common name	Wetland indicator	Shade	Deer browse resistance	Wildlife value	Height in feet
Amelanchier canadensis	serviceberry	FAC	sun to partial shade	resistant	spring flowers and early summer fruits	15
Aronia arbutifolia	red chokeberry	FACW	sun to partial sun	resistant	summer flowers and late fall fruits	10
Baccharis halimifolia	groundsel tree	FAC	full sun	?	cover	15
Celtis occidentalis	hackberry	FACU	sun to partial sun	moderate	fruits available during winter	40-60
Clethra alnifolia	sweet pepperbush	FACW	partial sun to partial shade	resistant	good nectar source and provides fruits	8
Iva frutescens	Marsh elder	FACW	full sun	?	cover	4
Lindera benzoin	spicebush	FACW	sun to partial shade	resistant	summer flowers and fall fruits	12
Myrica pensylvanica	bayberry	FAC	sun to partial sun	resistant	fruits available during winter	15
Nyssa sylvatica	sourgum	FAC	sun to partial shade	resistant	fruits available in late summer and fall	40-60
Rhus typhina	staghorn sumac	FACU	sun to partial sun	?	fruits available in winter	20
Sambucus canadensis	elderberry	FACW-	sun to partial shade	moderate	fruits available in midsummer	12
Viburnum dentatum	arrowwood	FAC	sun to partial sun	resistant	spring flowers and fall fruits	15
Ilex glabra	inkberry	FACW-	sun to shade	resistant	fruits available during winter	6-8
Juniperus virginiana	eastern red cedar	FACU	full sun	resistant	good cover and fruits available in winter	30-40

Figure 1. Riparian Restoration Project site within the Mannington Meadows IBA, Salem County, NJ.



Appendix B.
Mannington Meadows Important Bird Area
Grassland Breeding Bird Objectives

Introduction

The Mannington Meadows Important Bird Area (MMIBA) contains patches of the most ecologically significant areas for grassland restoration in New Jersey, as identified by the New Jersey Habitat Incentive Team's (NJHIT) grassland priority model. This model identifies, ranks, and maps the largest and most significant patches of grassland habitat in New Jersey (Figure 1). By identifying priority parcels for grassland restoration, habitat protection and restoration efforts can be focused in key areas around the state. The grassland model prioritizes grassland patches utilizing the NJ Department of Environmental Protection's (NJDEP) Landscape Project and these variables:

1. Grasslands greater than or equal to 500 acres
2. Grasslands within a ½ mile of open space
3. Grasslands within a ¼ mile of preserved farmland
4. Grasslands coded with a state or federal listed species

The highest ranking patches (containing all four variables) are assumed to have the highest likelihood of attracting grassland breeding birds. Because high ranking patches are located within the MMIBA, grassland restoration projects within this area should be prioritized. To facilitate restoration efforts, we identified grassland bird management targets and developed population and habitat goals.

Methodology

To guide implementation of the Mannington Meadows Important Bird Area (MMIBA) Conservation Plan, NJAS has developed population and habitat goals needed to support the target species of grassland breeding birds in the MMIBA. We followed the methodology developed by the Raritan Piedmont Wildlife Habitat Partnership utilized in the Grassland Conservation Plan. Methodology is summarized below; however, for more details and a complete literature review, please view the Grassland Conservation Plan available at:
http://www.njaudubon.org/conservation/PDF/FinalRPWHPPlan_20060915.pdf

Target Species

The species of grassland breeding birds that will serve as management targets for restoration activities are listed in Table 1. Target species were identified as priority within the NJDEP Wildlife Action Plan (WAP). Because the WAP incorporates the priorities of all national plans (see p. 48 of the NJ WAP) it is the most comprehensive source for clearly defining species priorities for any part of New Jersey. As such, the WAP provides a comprehensive list of all Federal and State-endangered and -threatened species as well as others of State and Regional Conservation Concern. The WAP is the State's blueprint for the future conservation of NJ's species of greatest

conservation need because it identifies goals and conservation actions to mitigate threats to declining species. The WAP is divided into regional landscape conservation zones. The MMIBA is located within the Southern Piedmont Plains Conservation Zone.

Goals and conservation actions for the Southern Piedmont Plains include (from the WAP):

- Identify, protect, maintain, enhance, and/or restore important grassland (areas with >75 % herbaceous and <25% woody vegetation)
- Maintain viable populations of area-sensitive grassland species
- Increase the number of acres with an established mosaic of meadow, hay and row crops within open field habitats.
- Encourage landowners to delay mowing through public education and incentive programs to allow grassland-dependent species to successfully breed.
- Increase the number of acres converted from existing hay and/or row crops to warm season grass fields, where appropriate, using landowner incentive programs.
- Where appropriate, create large grasslands areas by eliminating hedgerows, fences, or tree lines in areas where open land occupies a considerable amount of the surrounding landscape and grassland management is a reasonable management alternative.

Implementation of the MMIBA Conservation Plan, particularly of the Grassland Breeding Bird Objectives, is direct implementation of the WAP. The complete plan for the Southern Piedmont Plains zone is available at:
http://www.state.nj.us/dep/fgw/ensp/wap/pdf/15.pdf

Population and Habitat Goals

Population goals and the corresponding habitat goals to support grassland breeding bird populations were developed for each of the priority species. We started with current population estimates for the state of NJ that have been stepped-down from continental estimates (see RPWHP plan for details). Table 1 lists current population estimates for the MMIBA management targets. From there, we estimated what the population goals are for NJ. Because our management targets are species of conservation concern, population goals are an increase over current estimates. To determine the MMIBA's contribution to achieving the statewide population goal for each species, we determined the percentage of grassland habitat available within the IBA. Of the Landscape Project patches modeled as grassland habitat, approximately 2.4% occur within the IBA. Hence, 2.4% of the statewide population goals can be attributed to the MMIBA. This is true for all target species except for the upland sandpiper and vesper sparrow (Table 1). Because 2.4% of the statewide goal for these species is less than the minimum viable population size, we increase the MMIBA population goal above 2.4% to a number assumed to support a minimum viable population.

Interpreting Project Acreage Goals

With specific habitat goals established for all target species, it is essential to make sure these goals are interpretable into real numbers that can be understood by land managers and partners. It is important to recall that we have made every attempt to be conservative with these goals; therefore achievement of the project's habitat acreage goals should accommodate the population objectives for the target species. Also, habitat for each species need not be managed independently from other species. In many cases habitat for one species can accommodate the needs of other species (see Table 2). For more information about grassland breeding birds within the Southern Piedmont Region of the WAP, refer to the Summary of Grassland Bird Traits at the end of this document.

Upland Sandpiper
MMIBA Population Goal: 3 pair.
MMIBA Habitat Goal: 30 hectare

A target of 30 hectares of habitat in contiguous patches for nesting Upland Sandpiper that can support an IBA population goal of 3 breeding pairs was set. Upland Sandpiper should be a primary stewardship target on the largest parcels of land available for acquisition and/or stewardship because it requires larger habitat patches than any of the other primary target species. To improve patches identified as high priority for Upland Sandpiper, all trees and wooded hedgerows within fields, separating adjacent fields, and extending into the interior of the fields must be removed. Where possible and feasible, small, narrow woodlots should be removed to increase the amount of core nesting habitat available for this and all target species.

Some form of disturbance must be employed to maintain the habitat in optimal condition. For Upland Sandpiper, this is more difficult, because Upland Sandpiper require three distinctive vegetation conditions to fulfill three ecological needs: nesting cover, brood habitat, and foraging habitat. These can be addressed through a rotational disturbance regime.

Upland Sandpiper sites should represent the largest tracts that can be assembled within the MMIBA boundaries. The grassland can be composed of cool season or warm season grasses, however warm season plantings should be dominated by little blue stem to address the proclivity of Upland Sandpiper to avoid tall vegetation for nesting. Active disturbance is a necessity and can include conservation-grazing, burning or mowing. Moderate grazing can be employed but should be delayed until after mid-June. Burning should occur from March – April or October – November. Mowing should be delayed as long as possible, but if necessary to create a crop, should be conducted no earlier than mid-July. Mowing should be done at a height of 15 – 30 cm.

Placement of Eastern Bluebird and Tree Swallow nest boxes should be encouraged throughout Upland Sandpiper sites, but they should not extend above the surrounding

vegetation. These boxes would help address the Upland Sandpiper's preference of perches scattered throughout the habitat.

American Kestrel
MMIBA Population Goal – 29 pair.
MMIBA Habitat Goal – Not calculated. Size requirements for this species are highly variable.

A population goal of 29 pair was set for American Kestrel in the MMIBA. To achieve this goal, American Kestrel nest boxes should be placed throughout the entire region, expanding upon the DEP's nest box program. Boxes could be placed on telephone poles or on poles erected at the edges of suitable habitat that includes open agricultural fields, hayfields, and even large manicured lawns (e.g. schoolyards or golf courses). The normal occupancy rate of nest boxes by kestrels should be determined and the number of boxes needed to achieve the goal distributed. Monitoring of boxes is essential to prevent colonization by European Starlings. Volunteers could be utilized to monitor and maintain boxes.

Grasshopper Sparrow
MMIBA Population Goal – 58 pair.
MMIBA Habitat Goal – 116 hectares

A population goal of 58 pair supported within a core habitat of 116 hectares in patches no smaller than 30 hectares was set for Grasshopper Sparrow within the MMIBA. Grasshopper Sparrows occupy grasslands at an early successional stage, reaching peak abundance in the years immediately following a disturbance. Woody vegetation should be eliminated from grasslands managed for this species. 20 – 30% of large patches should be treated with disturbance annually with mowing, burning, and light grazing all acceptable. On smaller patches, 50-60% should be disturbed at a time.

Savannah Sparrow
MMIBA Population Goals – 10 pair.
MMIBA Habitat Goals – 5 hectares

A population goal of 10 pair supported within a core habitat of 5 ha was set for the MMIBA. Savannah Sparrows reach peak abundance 1 – 5 years after a management burn. Trees and shrubs should be removed from the nesting habitat. Mowing, light grazing, or burning should be applied on a 3-year rotation, within sites > 50 ha having 30 % of their total area disturbed and smaller sites having 50% treated at a time.

Eastern Meadowlark
MMIBA Population Goals – 31 pair
MMIBA Habitat Goals - 71 hectares

A total of 71 hectares of habitat should be managed for Eastern Meadowlark within the MMIBA to support a population of 31 pair on patches no smaller than 5-10 ha, with larger patches preferred. This species requires grasslands at a later succesional stage, but absent of woody vegetation, and habitat should be burned on a 3-5 year interval. Patches exceeding 80 ha should have 20-30% of the habitat disturbed annually. Smaller patches should have 50-60% of habitat burned at a time.

Bobolink
MMIBA Population Goals – 37 pair
MMIBA Habitat Goals – 56 hectares

A total of 56 hectares of grassland habitat should be managed to sustain 37 pair of Bobolink in patches > 10 ha within the MMIBA, with larger patches preferred. Burning is the preferred habitat management method for this species but light grazing and mowing can also be used on a 2-3 year rotation.

For more information about grassland breeding birds within the Southern Piedmont Region of the WAP, refer to the Summary of Grassland Bird Traits at the end of this document.

Table 1. Management targets, population goals and habitat goals for the Mannington Meadows IBA.

Grassland Breeding Birds of Conservation Concern	NJ Pop. Estimate (present # of pairs)	Statewide Goal (target # of pairs)	*MMIBA pop. goal (pairs)	Avg. Territory size (ha)	MMIBA habitat goal (ha)
American kestrel (Falco sparverius)	963	1445	29	NA	NA
Bobolink (Dolichonyx oryzivorus)	1227	1840	37	1.5	56
Eastern Meadowlark (Sturnella magna)	767	1535	31	2.3	71
Grasshopper sparrow (Ammodramus savannarum)	1441	2882	58	2	116
Savannah sparrow (Passerculus sandwichensis)	71	143	10	0.5	5
Upland sandpiper (Bartramia longicauda)	NA	NA	3	10	30
Vesper sparrow (Pooecetes gramineus)	58	117	10	1.65	17
				[1]Total:	**295 ha [708 ac]**

*Mannington Meadows IBA = 2.4% of available grassland patch in NJ.
[1] Habitat goal is approximately 4% of the IBA.

****To view the full text of recommendations, please visit: http://www.njaudubon.org/Conservation/DelBayStewardship.html.****

Appendix F: Vertebrate Fauna of Mannington Township

An inventory of known or probable wild animal species in Mannington Township

Modified Version of a List Compiled by Francis G. Rapa for the Woodstown-Pilesgrove Joint Environmental Commission

Key to Notes:
B - *Breeding.* (birds only) This species breeds in Salem County.
M(AS) – *Mannington* ***(Audubon Society*)**. (birds only) This species has been reported in Mannington by New Jersey Audubon Society.
M (NH) – *Mannington* ***(Natural Heritage*)**. This species is listed as occurring in Mannington by the New Jersey Natural Heritage Program.
S(NH) - *Salem County (Natural Heritage).* This species is listed as occurring in Salem County by the New Jersey Natural Heritage Program.
E - *Endangered.* This is a State-listed Endangered Species.
T - *Threatened.* This is a State-listed Threatened Species.
EX - *Exotic* - This is a non-indigenous species.

BIRDS

Common Name	**Scientific Name**	**Notes**
Red-throated Loon	*Gavia stellata*	
Common Loon	*Gavia immer*	
Pied-billed Grebe	*Podilymbus podiceps*	B, E, S(NH)
Horned Grebe	*Podiceps auritus*	
Red-necked	*Grebe Podiceps*	
Northern Gannet	*Morus bassanus*	
Great Cormorant	*Phalacrocorax carbo*	
Double-crested Cormorant	*Phalacrocorax auritus*	B
American Bittern	*Botaurus lentiginosos*	B, E
Least Bittern	*Ixobrychus exilis*	B, M(AS)
Great Blue Heron	*Ardea herodias*	B
Great Egret	*Casmerodius albus*	B
Snowy Egret	*Egretta thula*	B
Little Blue Heron	*Egretta caerulea*	B
Tricolored Heron	*Egretta tricolor*	
Cattle Egret	*Bubulcus ibis*	B
Green-backed Heron	*Butorides striatus*	
Green Heron	*Butorides virescens*	B
Black-crowned Night Heron	*Nycticorax nycticorax*	B, T
Yellow-crowned Night Heron	*Nyctanassa violaceus*	T
Glossy Ibis	*Plegadis falcinellus*	B
Sandhill Crane	*Grus canadensis*	B
Tundra Swan	*Cygnus columbianus*	B,
Mute Swan	*Cygnus olor*	B
Snow Goose	*Chen caerulescens*	M(AS)
Ross's Goose	*Chen rossii*	
Brant	*Branta bernicla*	
Canada Goose	*Branta canadensis*	B
Wood Duck	*Aix sponsa*	B
Green-winged Teal	*Anas crecca*	

Blue-winged Teal	*Anas discors*	B
American Black Duck	*Anas rubripes*	B
Mallard	*Anas platyrhynchos*	B
Northern Pintail	*Anas acuta*	
Northern Shoveler	*Anas clypeata*	
Gadwall	*Anas Strepera*	B
Eurasian Wigeon	*Anas penelope*	
American Wigeon	*Anas americana*	B
Canvasback	*Aythya valisineria*	
Redhead	*Aythya americana*	
Ring-necked Duck	*Aythya collaris*	
Greater Scaup	*Aythya marila*	
Lesser Scaup	*Aythya affinis*	
Common Eider	*Somateria mollissima*	
King Eider	*Somateria spectabilis*	
Common Goldeneye	*Bucephala clangula*	
Bufflehead	*Bucephala albeola*	
American Woodcock	*Philohela minor*	B
Hooded Merganser	*Lophodytes cucullatus*	
Common Merganser	*Mergus merganser*	
Red-breasted Merganser	*Mergus serrator*	
Ruddy Duck	*Oxyura jamaicensis*	B
Black Vulture	*Coragyps atratus*	B
Turkey Vulture	*Cathartes aura*	B
Osprey	*Pandion haliaetus*	B, T, M(NH)
Swallowtail Kite	*Elanoides forficodus*	
Mississippi Kite	*Ictinia mississippiensis*	
Bald Eagle	*Haliaeetus leucocephalus*	B, E, M(NH)
Golden Eagle	*Aquila chrysaetos*	
Northern Harrier	*Circus cyaneus*	B, E, S(NH)
Sharp-shinned Hawk	*Accipiter striatus*	
Cooper's Hawk	*Accipiter Cooperii*	B, T, S(NH)
Northern Goshawk	*Accipiter gentilis*	E
Red-shouldered Hawk	*Buteo lineatus*	B, E, S(NH)
Broad-winged hawk	*Buteo platypterus*	B
Red-tailed Hawk	*Buteo jamaicensis*	B
Rough-legged Hawk	*Buteo lagopus*	
American Kestrel	*Falco sparverius*	B
Merlin	*Falco columbarius*	
Peregrine Falcon	*Falco peregrinus*	B, E, S(NH)
Common Barn Owl	*Tyto alba*	B
Eastern Screech Owl	*Otus asio*	B
Great Horned Owl	*Bubo virginianus*	B
Snowy Owl	*Nyctea scandiaca*	
Barred Owl	*Strix varia*	B, T, S(NH)
Long-eared Owl	*Asio otus*	T
Short-eared Owl	*Asio flammeus*	E
Northern Saw-whet Owl	*Aegolius acadicus*	
Ring-necked Pheasant	*Phasianus colchicus*	B, EX
Ruffed Grouse	*Bonasa umbellus*	
Eastern Wild Turkey	*Meleagris gallopavo*	B
Chukar	*Alectoris graeca*	
Northern Bobwhite	*Colinus virginianus*	B
Yellow Rail	*Coturnicops noveboracensis*	
Black Rail	*Laterallus jamaicensis*	T
Clapper Rail	*Rallus longirostris*	B
King Rail	*Rallus elegans*	B

Virginia Rail	*Rallus limocola*	B
Sora	*Porzana carolina*	
Common Moorhen	*Gallinula chloropus*	B, M(AS)
American Coot	*Fulica americana*	B
Black-bellied Plover	*Pluvialis squatarola*	
Lesser/American Golden Plover	*Pluvialis dominica*	
Semipalmated Plover	*Charadrius semipalmatus*	
Piping Plover	*Charadrius melodus*	E
Killdeer	*Charadrius vociferus*	B
Black-necked Stilt	*Himantopus mexicanus*	
American Avocet	*Recurvirostra americana*	
Greater Yellowlegs	*Tringa melanoleuca*	
Lesser Yellowlegs	*Tringa flavipes*	
Willet	*Catoptrophorus semipalmatus*	B
Solitary Sandpiper	*Tringa solitaria*	
Spotted Sandpiper	*Actitis macularia*	B
Upland Sandpiper	*Bartramia longicauda*	B, E
Semipalmated Sandpiper	*Calidris pusilla*	
Western Sandpiper	*Calidris mauri*	
Least Sandpiper	*Calidris minutilla*	
White-rumped Sandpiper	*Calidris fuscicollis*	
Baird's Sandpiper	*Calidris bairdii*	
Pectoral Sandpiper	*Calidris melanotos*	M(AS)
Purple Sandpiper	*Calidris maritima*	
Curlew Sandpiper	*Calidris ferruginea*	
Stilt Sandpiper	*Calidris himantopus*	
Dunlin	*Calidris alpina*	
Buff-breasted Sandpiper	*Tryngites subruficollis*	
Ruff	*Philomachus pugnax*	
Short-billed Dowitcher	*Limnodromus griseus*	
Long-billed Dowitcher	*Limnodromus scolopaceus*	
Common Snipe	*Gallinago gallinago*	
Hudsonian Godwit	*Limosa limosa*	
American Woodcock	*Scolopax minor (Philohela minor)*	B
Wilson's Phalarope	*Phalaropus tricolor*	
Red-necked Phalarope	*Phalaropus lobatus*	
Laughing Gull	*Larus atricilla*	
Little Gull	*Larus minutus*	
Common Black-headed Gull	*Larus ridibundus*	
Lesser Black-backed Gull	*Larus fuscus*	
Black-headed Gull	*Larus ridibundus*	
Bonaparte's Gull	*Larus philadelphia*	
Ring-billed Gull	*Larus delawarensis*	[1]
Herring Gull	*Larus argentatus*	
Iceland Gull	*Larus glaucoides*	
Glaucous Gull	*Larus hyperboreusi*	
Great Black-backed Gull	*Larus marinusi*	
Gull-billed Tern	*Sterna nilotica*	
Caspian Tern	*Sterna caspia*	M(AS)
Royal Tern	*Sterna maxima*	
Roseate Tern	*Sterna dougallii*	E
Common Tern	*Sterna hirundo*	
Forster's Tern	*Sterna forsteri*	B
Least Tern	*Sterna antillarum*	E
Black Tern	*Childonias niger*	

[1] New Jersey Audubon Society reports 8,000 Ring-billed Gulls at Sharptown on April 4, 1983.

Black Skimmer	*Rynchops niger*	E
Rock Dove	*Columba livia*	B
Mourning Dove	*Zenaida macroura*	B
Black-billed Cuckoo	*Coccyzus erythropthalmus*	B
Yellow-billed Cuckoo	*Coccyzus americanus*	B
Common Nighthawk	*Chordeiles minor*	
Chuck-will's-widow	*Caprimulgus carolinensis*	B
Whip-poor-will	*Caprimulgus vociferus*	B
Chimney Swift	*Chaetura pelagica*	B
Ruby-throated Hummingbird	*Archilochus colubris*	B
Belted Kingfisher	*Ceryle alcyon*	B
Red-headed Woodpecker	*Melanerpes erythrocephalus*	B, T, S(NH)
Red-bellied Woodpecker	*Melanerpes carolinus*	B
Yellow-bellied Sapsucker	*Sphyrapicus varius*	
Downy Woodpecker	*Picoides pubescens*	B
Hairy Woodpecker	*Picoides villosus*	B
Northern Common Flicker	*Colaptes auratus*	B
Pileated Woodpecker	*Dryocopus pileatus*	
Olive-sided Flycatcher	*Contopus borealis*	
Eastern Wood Pewee	*Contopus virens*	B
Yellow-bellied Flycatcher	*Empidonax flaviventris*	
Acadian Flycatcher	*Empidonax virescens*	B
Alder Flycatcher	*Empidonax alnorum*	
Willow Flycatcher	*Empidonax traillii*	B
Least Flycatcher	*Empidonax minimus*	
Eastern Phoebe	*Sayornis phoebe*	B
Great Crested Flycatcher	*Myiarchus crinitus*	B
Western Kingbird	*Tyrannus verticalis*	
Eastern Kingbird	*Tyrannus Tyrannus*	B
Horned Lark	*Eremophila alpestris*	B
Purple martin	*Progne subis*	B
Tree Swallow	*Tachycineta bicolor*	B
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	B
Bank Swallow	*Riparia riparia*	B
Cliff Swallow	*Hirundo pyrrhonota*	B
Barn Swallow	*Hirundo rustica*	B
Blue Jay	*Cyanocitta cristata*	B
American Crow	*Corvus brachyrhynchos*	B
Fish Crow	*Corvus ossifragus*	B
Common Raven	*Corvus corax*	
Black-capped Chickadee	*Paurs atricapillus*	
Carolina Chickadee	*Parus carolinensis*	B
Boreal Chickadee	*Parus hudsonicus*	
Tufted Titmouse	*Parus bicolor*	B
Red-breasted Nuthatch	*Sitta canadensis*	
White-breasted Nuthatch	*Sitta carolinensis*	B
Brown Creeper	*Certhia americana*	
Carolina Wren	*Thryothorus ludovicianus*	B
House Wren	*Troglogytes aedon*	B
Winter Wren	*Troglodytes troglodytes*	
Sedge Wren	*Cistothorus platensis*	B, E, S(NH)
Marsh Wren	*Cistothorus palustris*	B
Golden-crowned Kinglet	*Regulus satrapa*	
Ruby-crowned Kinglet	*Regulus calendula*	
Blue-gray Gnatcatcher	*Polioptila caerulea*	B
Eastern Bluebird	*Sialia sialis*	B
Veery	*Catharus fuscescens*	

Gray-cheeked Thrush	*Catharus minimus*	
Swainson's Thrush	*Catharus ustulatus*	
Hermit Thrush	*Catharus guttatus*	
Wood Thrush	*Hylocichla mustelina*	B
American Robin	*Turdus migratorius*	B
Catbird	*Dumetella carolinensis*	B
Northern Mockingbird	*Mimus polyglottos*	B
Brown Thrasher	*Toxostoma rufum*	B
Water Pipit	*Anthus rubescens*	
Cedar Waxwing	*Bombycilla cedrorum*	B
Northern Shrike	*Lanius exubitor*	
Loggerhead Shrike	*Lanius ludovicianus*	E
European Starling	*Sturnus vulgaris*	B, EX
White-eyed Vireo	*Vireo griseus*	B
Solitary Vireo	*Vireo solitarius*	
Yellow-throated Vireo	*Vireo flavifrons*	B
Warbling Vireo	*Vireo gilvus*	B
Philadelphia Vireo	*Vireo philadelphicus*	
Red-eyed Vireo	*Vireo olivaceus*	B
Blue-winged Warbler	*Vermivora pinus*	B
Golden-winged Warbler	*Vermivora chrysoptera*	
Tennesee Warbler	*Vermivora peregrina*	
Orange-crowned Warbler	*Vermivora celata*	
Nashville Warbler	*Vermivora reficapilla*	
Northern Parula	*Parula americana*	B
Yellow Warbler	*Dendroica petechia*	B
Chestnut-sided Warbler	*Dendroica pensylvanica*	
Magnolia Warbler	*Dendroica magnolia*	
Cape May Warbler	*Dendroica tigrina*	
Black-throated Blue Warbler	*Dendroica caerulescens*	
Yellow-rumped Warbler	*Dendroica coronata*	
Black-throated Green Warbler	*Dendroica virens*	
Blackburnian Warbler	*Dendroica fusca*	
Yellow-throated Warbler	*Dendroica dominica*	
Pine Warbler	*Dendroica pinus*	B
Prairie Warbler	*Dendroica discolor*	B
Palm Warbler	*Dendroica palmarum*	
Bay-breasted Warbler	*Dendroica castanea*	
Blackpoll Warbler	*Dendroica striata*	
Cerulean Warbler	*Dendroica cerulea*	
Black and White Warbler	*Miniotilta varia*	B
American Redstart	*Setophaga ruticilla*	B
Prothonotary Warbler	*Protonotaria citrea*	B
Worm-eating Warbler	*Helmitheros vermivorus*	B
Ovenbird	*Seiurus aurocapillus*	B
Northern Waterthrush	*Seiurus noveboracensis*	
Louisiana Waterthrush	*Seiurus motacilla*	B
Kentucky Warbler	*Oporornis formosus*	B
Connecticut Warbler	*Oporornis agilis*	
Mourning Warbler	*Oporornis philadelphia*	
Common Yellowthroat	*Geothlypis trichas*	B
Hooded Warbler	*Wilsonia citrina*	B
Wilson's Warbler	*Wilsonia pusilla*	
Canada Warbler	*Wilsonia canadensis*	
Yellow-breasted Chat	*Icteria virens*	B
Summer Tanager	*Piranga rubra*	B
Scarlet Tanager	*Piranga olivacea*	B

Northern Cardinal	*Cardinalis cardinalis*	B
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	
Blue Grosbeak	*Guiraca caerulea*	B
Indigo Bunting	*Passerina cyanea*	B
Dickcissel	*Spiza americana*	
Rufous-sided Towhee	*Pipilo erythrophthalmus*	B
American Tree Sparrow	*Spizella arborea*	
Chipping Sparrow	*Spizella passerina*	B
Field Sparrow	*Spizella pusilla*	B
Vesper Sparrow	*Pooecetes gramineus*	B, E, M(NH)
Lark Sparrow	*Chondestes grammacus*	
Savannah Sparrow	*Passerculus sandwichensis*	B, T
Grasshopper Sparrow	*Ammodramus savannarum*	B, T
Henslow's Sparrow	*Ammodramus henslowii*	E
Sharp-tailed Sparrow	*Ammodramus caudacutus*	
Seaside Sparrow	*Ammodramus maritima*	B
Fox Sparrow	*Passerella iliaca*	
Song Sparrow	*Melospiza melodia*	B
Lincoln's Sparrow	*Melospiza lincolnii*	
Swamp Sparrow	*Melospiza georgiana*	B
White-throated Sparrow	*Zonotrichia albicollis*	
White-crowned Sparrow	*Zonotrichia leucophrys*	
House Sparrow	*Passer domesticus*	B, EX
Dark-eyed Junco	*Junco hyemalis*	
Lapland Longspur	*Calcarius lapponicus*	
Snow Bunting	*Plectophenax nivalis*	
Bobolink	*Dolichonyx oryzivorus*	B, T, M(NH)
Eastern Meadowlark	*Sturnella magna*	B
Red-winged Blackbird	*Agelaius phoeniceus*	B
Rusty Blackbird	*Euphagus carolinus*	
Brewer's Blackbird	*Euphagus cyanocephalus*	
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	
Boat-tailed Grackle	*Quiscalus major*	B
Common Grackle	*Quiscalus quiscula*	B
Brown-headed Cowbird	*Molothrus ater*	B
Orchard Oriole	*Icterus spurius*	B
Northern Oriole (Baltimore Oriole)	*Icterus galbula*	B
Pine Grosbeak	*Pinicola enucleator*	
Purple Finch	*Carpodacus purpureus*	
House Finch	*Carpodacus mexicanus*	B
Red Crossbill	*Loxia curvirostra*	
White-winged Crossbill	*Loxia leucoptera*	
Common Redpoll	*Carduelis flammea*	
Pine Siskin	*Carduelis pinus*	
American Goldfinch	*Carduelis tristis*	B
Evening Grosbeak	*Hesperiphona vespertinus*	

MAMMALS

Common NameScientific Name		Notes
Opossum	*Didelphis marsupialis*	
Masked Shrew	*Sorex cinereus*	
Short-tailed Shrew	*Blarina brevicauda*	
Least Shrew	*Crytotis parva*	
Hairy-tailed Mole	*Parascalops breweri*	
Eastern Mole	*Scalopus aquaticus*	
Star-nosed Mole	*Condylura cristata*	
Little Brown Bat	*Myotis lucifugus*	
Northern Long-Eared Bat, Keen Myotis	*Myotis septentrionalis*	
Small-footed Bat	*Myotis leibii*	
Silver-haired Bat	*Lasionycteris noctivagans*	
Eastern Pipistrel	*Pipistrellus subflavus*	
Big Brown Bat	*Eptesicus fuscus*	
Red Bat	*Lasiurus borealis*	
Hoary Bat	*Lasiurus cinereus*	
Evening Bat	*Nycticeius humeralis*	
Eastern Cottontail	*Sylvilagus floridanus*	
Eastern Chipmunk	*Tamias striatus*	
Woodchuck	*Marmota monax*	
Gray Squirrel	*Sciurus carolinensis*	
Red Squirrel	*Tamiasciurus hudsonicus*	
Southern Flying Squirrel	*Glaucomys volans*	
Beaver	*Castor candensis*	
Nutria	*Myocastor coypus*	EX
Marsh Rice Rat	*Oryzomys palustris*	
White-footed Mouse	*Peromyscus leucopus*	
Meadow Vole	*Microtus pennsylvanicus*	
Pine Vole	*Microtus pinetorum*	
Muskrat	*Ondatra zibethicus*	
Southern Bog Lemming	*Synaptomys cooperi*	
Brown Rat, Norway Rat	*Rattus norvegicus*	EX
House mouse	*Mus musculus*	EX
Meadow Jumping Mouse	*Zapus hudsonius*	
Eastern Coyote	*Canis latrans var.*	
Red Fox	*Vulpes vulpes*	
Gray Fox	*Urocyon cinereoargenteus*	
Raccoon	*Procyon lotor*	
Long-tailed Weasel	*Mustela frenata*	
Mink	*Mustela vison*	
Striped Skunk	*Mephitis mephitis*	
River Otter	*Lutra canadensis*	
Bobcat	*Felis rufus*	E, S(NH) [2]
White-tailed Deer	*Odocoileus virginianus*	

[2] The NJ Endangered and Non-game species program (ENSP) and NJ Natural Heritage Program have documented recorded sightings of bobcats in Salem County, although scent-post surveys have failed to provide physical evidence of their presence. A highly reclusive animal, bobcat have been reported in or around Upper Pittsgrove Township and suitable habitat exists throughout the county.

REPTILES

Common Name	Scientific Name	Notes
Common Snapping Turtle	*Chelydra s. serpentina*	
Stinkpot	*Sternotherus odoratus*	
Eastern Mud Turtle	*Kinosternon s. subrubrum*	
Spotted Turtle	*Clemmys guttata*	
Bog Turtle	*Clemmys muhlenbergi*	E, M(NH)
Eastern Box Turtle	*Terrapene c. carolina*	M(NH)
Red-bellied Turtle	*Pseudemys rubriventris*	
Red-eared Turtle	*Pseudemys scripta elegans*	EX
Eastern Painted Turtle	*Chrysemys p. picta*	
Midland Painted Turtle	*Chrysemys picta marginata*	
Northern Fence Lizard	*Sceloporus undulatus hyacinthinus*	
Five-lined Skink	*Eumeces fasciatus*	
Northern Water Snake	*Nerodia s. sipedon*	
Northern Brown Snake	*Storeria d. dekayi*	
Northern Red-bellied Snake	*Storeria o. occipitomaculata*	
Eastern Garter Snake	*Thamnophis s. sirtalis*	
Eastern Ribbon Snake	*Thamnophis s. sauritus*	
Eastern Smooth Earth Snake	*Virginia v. valeriae*	
Eastern Hognose Snake	*Heterodon platyrhinos*	
Northern Ringneck Snake	*Diadophis punctatus edwardsi*	
Southern Ringneck Snake	*Diadophis p. punctatus*	
Eastern Worm Snake	*Carphophis a. amoenus*	
Northern Black Racer	*Coluber c. constrictor*	
Rough Green Snake	*Opheodrys aestivus*	
Black Rat Snake	*Elaphe o. obsoleta*	
Eastern King Snake	*Lampropeltis g. getulus*	
Eastern Milk Snake	*Lampropeltis triangulum triangulum*	
Scarlet Kingsnake	*Lampropeltis triangulum elapsoides*	
"Coastal Plain" Milk Snake intergrade	*L. t. triangulum x L. t. elapsoides*	

AMPHIBIANS

Common Name	Scientific Name	Notes
Marbled Salamander	*Ambystoma opacum*	
Spotted Salamander	*Ambystoma maculatum*	E
Eastern Tiger Salamander	*Ambystoma t. tigrinum*	E, S(NH)
Red-spotted Newt	*Notophthalmus v. viridescens*	
Red-backed Salamander	*Plethodon c. cinereus*	
Slimy Salamander	*Plethodon g. glutinosus*	
Four-toed	*Salamander Hemidactylium scutatum*	
Northern Red Salamander	*Pseudotriton r. ruber*	
Eastern Mud Salamander	*Pseudotriton m. montanus*	T
Northern Two-lined Salamander	*Eurycea b. bislineata*	
Eastern Spadefoot Toad	*Scaphiopus h. holbrookii*	
Fowler's Toad	*Bufo woodhousii fowleri*	
Northern Cricket Frog	*Acris c. crepitans*	
Northern Spring Peeper	*Hyla c. crucifer*	
Northern Gray Treefrog	*Hyla versicolor*	
New Jersey Chorus Frog	*Pseudacris triseriata kalmi*	
Bullfrog	*Rana catesbeiana*	
Green Frog	*Rana clamitans melanota*	
Wood Frog	*Rana sylvatica*	
Southern Leopard Frog	*Rana spenocephala*	
Pickerel Frog	*Rana palustris*	

FRESHWATER FISHES

Species that have been recorded in the Salem River watershed or adjacent portions of the Delaware River.

EX – Exotic - This is a non-indigenous species.

Common Name	**Scientific Name**	**Notes**
Sea Lamprey	*Petromyzon marinus*	
Atlantic Sturgeon	*Acipenser oxyrinchus*	
American Eel	*Anguilla rostrata*	
Blueback Herring	*Alosa aestivalis*	
Alewife	*Alosa pseudoharengus*	
American Shad	*Alosa sapidissima*	
Gizzard Shad	*Dorosoma cepedianum*	
Goldfish	*Carassius auratus*	EX
Satinfin Shiner	*Cyprinella analostana*	
Common Carp	*Cyprinus carpio*	EX
Eastern Silvery Minnow	*Hybognathus regius*	
Golden Shiner	*Notemigonus crysoleucas*	
Spottail Shiner	*Notropis hudsonius*	
White Sucker	*Catostomus commersoni*	
Creek Chubsucker	*Erimyzon oblongus*	
White Catfish	*Ameiurus catus*	
Channel Catfish	*Ictalurus punctatus*	
Yellow Bullhead	*Ameiurus natalis*	
Brown Bullhead	*Ameiurus nebulosus*	
Tadpole Madtom	*Noturus gyrinus*	
Redfin Pickerel	*Esox americanus*	
Northern Pike	*Esox lucius*	EX
Chain Pickerel	*Esox niger*	
Rainbow Smelt	*Osmerus mordax*	
Pirate Perch	*Aphredoderus sayanus*	
Inland Silverside	*Menidia beryllina*	
Banded Killifish	*Fundulus diaphanus*	
Mummichog	*Fundulus heteroclitus*	
Western Mosquitofish	*Gambusia affinis*	EX
Eastern Mosquitofish	*Gambusia holbrooki*	
Threespine Stickleback	*Gasterosteus aculeatus*	
White Perch	*Morone americana*	
Striped Bass	*Morone saxatilis*	
Mud Sunfish	*Acantharchus pomotis*	
Blackbanded Sunfish	*Enneacanthus chaetodon*	
Bluespotted Sunfish	*Enneacanthus gloriosus*	
Banded Sunfish	*Enneacanthus obesus*	
Redbreast Sunfish	*Lepomis auritus*	
Green Sunfish	*Lepomis cyanellus*	EX
Pumpkinseed	*Lepomis gibbosus*	
Warmouth	*Lepomis gulosus*	
Bluegill	*Lepomis macrochirus*	EX
Largemouth Bass	*Micropterus salmoides*	EX
White Crappie	*Pomoxis annularis*	EX
Black Crappie	*Pomoxis nigromaculatus*	EX
Tessellated Darter	*Etheostoma olmstedi*	
Yellow Perch	*Perca flavescens*	
Hogchoker	*Trinectes maculatus*	

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APPENDIX G: A List of Wild Plants Likely Occurring in Mannington Township
Base List Compiled by Francis G. Rapa
Modified and Occurrence Determined by Joseph R. Arsenault

Bold typeface = Species known to be in Mannington Township; Remaining (non-bold) species are probable or possible but need to be verified

Scientific Name	Common Name(s)	Notes (See key at end of list)
Acalypha gracilens	slender threeseed mercury	
Acalypha rhomboidea	**Virginia threeseed mercury**	
Acer negundo	**boxelder**	
Acer platanoides	**Norway maple**	**NEX**
Acer rubrum var. trilobum	**red maple**	
Acer rubrum	**red maple**	
Acorus calamus	**alamus**	
Adiantum pedatum	northern maidenhair	
Agalinis fasciculata	beach false foxglove	
Agalinis paupercula var. paupercula	smallflower false foxglove	
Agalinis purpurea	**purple false foxglove**	
Agalinis setacea	threadleaf false foxglove	
Agastache nepetoides	yellow giant hyssop	
Agrimonia parviflora	**harvestlice**	
Agrimonia rostellata	beaked agrimony	
Agrostemma githago	**common corncockle**	
Ailanthus altissima	**tree of heaven**	**NEX**
Aira caryophyllea	**silver hairgrass**	
Albizia julibrissin	**mimosa**	**NEX**
Aletris farinosa	white colicroot	
Allium canadense var. canadense	meadow garlic	
Allium vineale ssp. vineale	wild garlic	NEX
Alnus serrulata	**azel alder**	
Alopecurus aequalis var. *aequalis*	hortawn foxtail	
Alopecurus carolinianus	Carolina foxtail, tufted meadow-foxtail	M(NH)
Amaranthus arenicola	sandhill amaranth	
Amaranthus cannabinus	**tidalmarsh amaranth**	
Amaranthus rudis	tall amaranth	
Amaranthus spinosus	spiny amaranth	
Ambrosia artemisiifolia	**annual ragweed**	
Ambrosia trifida	**great ragweed**	
Amelanchier canadensis	**Canadian serviceberry**	
Amelanchier obovalis	coastal serviceberry	
Amelanchier stolonifera	running serviceberry	
Amianthium muscitoxicum	flypoison	
Amorpha fruticosa	**desert false indigo**	
Amphicarpaea bracteata var. *bracteata*	American hogpeanut	

Anagallis arvensis	**scarlet pimpernel**	
Andropogon gerardii	big bluestem	
Andropogon gyrans var. *gyrans*	Elliott's bluestem	
Anemone quinquefolia	**nightcaps**	
Angelica atropurpurea	purplestem angelica	
Antennaria parlinii	Parlin's pussytoes	
Antennaria plantaginifolia	**woman's tobacco**	
Anthemis arvensis	corn chamomile	
Anthoxanthum odoratum	**sweet vernalgrass**	**NEX**
Apios americana	**groundnut**	
Aplectrum hyemale	Adam and Eve, Puttyroot	SE
Apocynum cannabinum	**Indianhemp**	
Apocynum floribundum	[none]	
Aquilegia canadensis	red columbine	
Arabidopsis thaliana	**mouseear cress**	
Aralia spinosa	devil's walkingstick	
Arisaema triphyllum	**Jack in the pulpit**	
Aristida lanosa	woollysheath threeawn	S(NH), SE
Aristida longispica	slimspike threeawn	
Aristida oligantha	prairie threeawn	
Aristida purpurascens var. virgata	arrowfeather threeawn	
Aristolochia serpentaria	Virginia snakeroot	
Armoracia rusticana	horseradish	
Arrhenatherum elatius var. *elatius*	tall oatgrass	NEX
Artemisia ludoviciana	white sagebrush	
Asclepias amplexicaulis	clasping milkweed	
Asclepias incarnata	swamp milkweed	
Asclepias purpurascens	purple milkweed	
Asclepias syriaca	**common milkweed**	
Asclepias tuberosa	butterfly milkweed	
Asclepias variegata	redring milkweed	
Asclepias verticillata	whorled milkweed	
Asplenium platyneuron	**ebony spleenwort**	
Athyrium filix-femina	common ladyfern	
Athyrium filix-femina ssp. angustum	subarctic ladyfern	
Athyrium filix-femina ssp. aspleniodes	asplenium ladyfern	
Atriplex patula	spear saltbush	
Atriplex prostrata	triangle orache	
Baccharis halimifolia	**eastern baccharis**	
Barbarea verna	early yellowrocket	
Berberis thunbergii	**Japanese barberry**	**NEX**
Berteroa incana	hoary false madwort	
Betula nigra	river birch	
Bidens aristosa	**bearded beggarticks**	**NUS**
Bidens coronata	**crowned beggarticks**	
Bidens discoidea	small beggarticks	
Bidens frondosa	**devil's beggartick**	
Boehmeria cylindrica	**smallspike false nettle**	
Botrychium dissectum	**cutleaf grapefern**	

Botrychium matricariifolium	matricary grapefern	
Botrychium virginianum	rattlesnake fern	
Brassica rapa var. *rapa*	field mustard	NEX
Bromus japonicus, B. inermis	**Japanese brome**	
Bromus racemosus, B. seculina	bald brome	
Bromus tectorum, B. sterilis	**cheatgrass**	**NEX**
Buglossoides arvensis	corn gromwell	
Calamagrostis canadensis var. *canadensis*	bluejoint	
Callitriche heterophylla	**twoheaded water-starwort**	
Callitriche terrestris	terrestrial water-starwort	
Caltha palustris	yellow marsh marigold	
Calystegia sepium ssp. sepium	**hedge false bindweed**	
Calystegia spithamaea ssp. spithamaea	low false bindweed	
Calystegia spithamaea	low false bindweed; erect bindweed	S(NH), SE
Camelina microcarpa	littlepod false flax	
Campanula aparinoides	**marsh bellflower**	
Campsis radicans	trumpet creeper	
Cardamine bulbosa	bulbous bittercress	
Cardamine concatenata	cutleaf toothwort	
Cardaria draba	whitetop	
Carex abscondita	thicket sedge	
Carex alata	broadwing sedge	
Carex albolutescens	**greenwhite sedge**	
Carex amphibola	**eastern narrowleaf sedge**	**SE**
Carex annectens	yellowfruit sedge	
Carex argyrantha	hay sedge	
Carex atlantica ssp. atlantica	prickly bog sedge	
Carex atlantica ssp. capillacea	prickly bog sedge	
Carex atlantica	prickly bog sedge	
Carex barrattii	Barratt's sedge	S(NH)
Carex brevior	shortbeak sedge	
Carex bullata	button sedge	
Carex canescens	silvery sedge	
Carex caroliniana	Carolina sedge	
Carex cephalophora	oval-leaf sedge	
Carex collinsii	Collins' sedge	
Carex comosa	longhair sedge	
Carex complanata	hirsute sedge	
Carex crinita	**fringed sedge**	
Carex debilis	**white edge sedge**	
Carex digitalis	slender woodland sedge	
Carex festucacea	fescue sedge	
Carex folliculata	**northern long sedge**	
Carex frankii	Frank's sedge	S(NH); M(NH)
Carex glaucodea	blue sedge	
Carex granularis	limestone meadow sedge	
Carex hirsutella	fuzzy wuzzy sedge	
Carex hormathodes	marsh straw sedge	
Carex hyalinolepis	shoreline sedge	S(NH)

Carex hystericina	bottlebrush sedge	
Carex interior	inland sedge	
Carex intumescens	**greater bladder sedge**	
Carex lacustris	hairy sedge	
Carex laevivaginata	smoothsheath sedge; woollyfruit sedge	
Carex lasiocarpa	[none]	
Carex laxiculmis	spreading sedge	
Carex laxiflora	broad looseflower sedge	
Carex lupulina	hop sedge	
Carex lurida	**shallow sedge**	
Carex nigromarginata	**black edge sedge**	
Carex pensylvanica	**Pennsylvania sedge**	
Carex prasina	drooping sedge	
Carex rosea	rosy sedge	
Carex scoparia	**broom sedge**	
Carex seorsa	weak stellate sedge	
Carex silicea	beach sedge	
Carex sparganioides	burr reed sedge	
Carex squarrosa	squarrose sedge	
Carex stipata	owlfruit sedge	
Carex straminea	eastern straw sedge	
Carex stricta	**upright sedge**	
Carex styloflexa	bent sedge	
Carex swanii	**swan's sedge**	
Carex tenera	quill sedge	
Carex tetanica	rigid sedge	
Carex tribuloides	blunt broom sedge	
Carex typhina	cattail sedge	S(NH); M(NH)
Carex umbellata	parasol sedge	
Carex utriculata	Northwest Territory sedge	
Carex venusta var. *minor*	darkgreen sedge	
Carex venusta	darkgreen sedge	
Carex vestita	velvet sedge	
Carex vulpinoidea	**fox sedge**	
Carpinus caroliniana	**American hornbeam**	
Carya alba	**mockernut hickory**	
Carya glabra	**pignut hickory**	
Carya ovata	shagbark hickory	
Carya pallida	sand hickory	
Castanea dentata	**American chestnut**	
Catalpa speciosa	**Northern catalpa**	**NUS**
Celastrus orbiculata	**Asian bittersweet**	**NEX**
Celtis occidentalis	**common hackberry**	
Cenchrus longispinus	mat sandbur	
Cenchrus tribuloides	sanddune sandbur	
Centaurea nigrescens	Tyrol knapweed	
Ceratophyllum demersum	coon's tail	
Chaerophyllum procumbens	spreading chervil	
Chamaecrista fasciculata* var. *fasciculata	**sleepingplant**	

Chasmanthium laxum	**slender woodoats**	
Chelidonium majus	celandine	NEX
Chelone glabra	**white turtlehead**	
Chenopodium ambrosioides	Mexican tea	NEX
Chimaphila maculata	**striped prince's pine**	
Chimaphila umbellata	pipsissewa	
Chrysopsis mariana	Maryland goldenaster	
Chrysosplenium americanum	American golden saxifrage	
Cinna arundinacea	**sweet woodreed**	
Circaea lutetiana ssp. canadensis	**broadleaf enchanter's nightshade**	
Cirsium arvense	**Canada thistle**	**NEX**
Cirsium discolor	**field thistle**	
Cirsium horridulum var. *horridulum*	yellow thistle	
Cirsium muticum	swamp thistle	
Cirsium vulgare	bull thistle	NEX
Claytonia virginica* var. *virginica	**Virginia springbeauty**	
Clematis terniflora	**sweet autumn virginsbower**	**NEX**
Clematis virginiana	**devil's darning needles**	
Clethra alnifolia	**coastal sweetpepperbush**	
Comandra umbellata	**bastard toadflax**	
Commelina communis var. *communis*	Asiatic dayflower	NEX
Commelina diffusa	climbing dayflower	
Comptonia peregrina	**sweet fern**	
Conoclinium coelestinum	blue mistflower	
Coreopsis rosea	pink tickseed	S(NH)
Cornus alternifolia	alternateleaf dogwood	
Cornus amomum	**silky dogwood**	
Cornus florida	**flowering dogwood**	
Cornus racemosa	gray dogwood	
Corylus americana	American hazelnut	
Crataegus crus-galli	cockspur hawthorn	
Crataegus pruinosa	waxyfruit hawthorn	
Crataegus uniflora	dwarf hawthorn	
Crotalaria sagittalis	arrowhead rattlebox	
Cryptotaenia canadensis	Canadian honewort	
Cunila origanoides	common dittany	
Cuscuta cephalanthi	buttonbush dodder	SE
Cuscuta compacta	compact dodder	
Cuscuta coryli	hazel dodder	S(NH)
Cuscuta gronovii	**scaldweed**	
Cuscuta pentagona var. *pentagona*	fiveangled dodder	
Cuscuta polygonorum	smartweed dodder	S(NH)
Cynodon dactylon	**Bermudagrass**	**NEX**
Cyperus bipartitus	slender flatsedge	
Cyperus dentatus	toothed flatsedge	
Cyperus diandrus	umbrella flatsedge	
Cyperus engalmannii	Engalmann's flatsedge	M(NH)
Cyperus erythrorhizos	**redroot flatsedge**	

Cyperus esculentus	**chufa flatsedge**	
Cyperus filicinus	fern flatsedge	
Cyperus flavescens	yellow flatsedge	
Cyperus grayi	Gray's flatsedge	
Cyperus lancastriensis	manyflower/Lancaster flatsedge	SE
Cyperus odoratus	fragrant flatsedge	S(NH)
Cyperus refractus	reflexed flatsedge	SE
Cyperus strigosus	**strawcolored flatsedge**	
Cypripedium acaule	**moccasin flower, pink lady's slipper**	
Cytisus scoparius	scotchbroom	NEX
Danthonia compressa	flattened oatgrass	
Danthonia spicata	**poverty oatgrass**	
Decodon verticillatus	**swamp loosestrife**	
Dennstaedtia punctilobula	eastern hayscented fern	
Deschampsia flexuosa	wavy hairgrass	
Desmodium canescens	hoary ticktrefoil	
Desmodium laevigatum	smooth ticktrefoil	
Desmodium obtusum	stiff ticktrefoil	
Desmodium ochroleucum	cream ticktrefoil	S(NH)
Desmodium paniculatum* var. *paniculatum	**panicledleaf ticktrefoil**	
Desmodium viridiflorum	velvetleaf ticktrefoil	
Dianthus armeria	**Deptford pink**	**NEX**
Dicentra cucullaria	dutchman's breeches	
Dichanthelium acuminatum, var. *fasciculatum*	western panicgrass	
Dichanthelium acuminatum, var. *lindheimeri*	Lindheimer panicgrass	
Dichanthelium boscii	Bosc's panicgrass	
Dichanthelium clandestinum	**deertongue**	
Dichanthelium depauperatum	starved panicgrass	
Dichanthelium dichotomum,* var. *dichotomum	**cypress panicgrass**	
Dichanthelium dichotomum	cypress panicgrass	
Dichanthelium ovale var. *addisonii*	Addison's rosette grass	
Dichanthelium scoparium	**velvet panicum**	
Dichanthelium sphaerocarpon,* var. *isophyllum	**roundseed panicgrass**	
Dichanthelium spretum	Eaton's rosette grass	
Dichanthelium villosissimu,* var. *villosissimum	**whitehair rosette grass**	
Dichanthelium wrightianum	Wright's rosette grass	
Digitaria filiformis	slender crabgrass	
Digitaria ischaemum	smooth crabgrass	
Dioscorea quaternata	fourleaf yam	
Dioscorea villosa	**wild yam**	
Diospyros virginiana	**common persimmon**	
Dipsacus fullonum	Fuller's teasel	NEX
Dirca palustris	eastern leatherwood	S(NH), M(NH)
Doellingeria infirma, umbellata	cornel-leaf whitetop	
Draba verna	**spring draba**	
Drosera intermedia	spoonleaf sundew	
Dryopteris campyloptera	mountain woodfern	
Dryopteris carthusiana	spinulose woodfern	
Dryopteris carthusiana x intermedia	[none]	

Dryopteris cristata	crested woodfern	
Dryopteris intermedia	intermediate woodfern	
Dryopteris marginalis	marginal woodfern	
Dulichium arundinaceum	threeway sedge	
Echinochloa crus-galli	barnyardgrass	
Echinochloa muricata var. *muricata*	rough barnyardgrass	
Echinochloa walteri	**coast cockspur grass**	
Eclipta prostrata	false daisy	
Elaeagnus umbellata* var. *parvifolia	**autumn olive**	**NEX**
Elatine americana	American waterwort	
Eleocharis acicularis var. *acicularis*	needle spikerush	
Eleocharis acicularis	needle spikerush	
Eleocharis fallax	creeping spikerush	
Eleocharis flavescens var. flavescens	yellow spikerush	
Eleocharis melanocarpa	blackfruit spikerush	S(NH), SE
Eleocharis olivacea	**bright green spikerush**	
Eleocharis palustris	common spikerush	
Eleocharis parvula	dwarf spikerush	
Elephantopis carolinianus	Carolina elephantsfoot	S(NH), SE
Eleusine indica	Indian goosegrass	
Elodea nuttallii	western waterweed	
Elymus canadensis	Canada wildrye	
Elymus repens	quackgrass	NEX
Epigaea repens	trailing arbutus	
Epilobium coloratum	**purpleleaf willowherb**	
Equisetum arvense	**field horsetail**	
Eragrostis capillaris	lace grass	
Eragrostis cilianensis	stinkgrass	
Eragrostis hypnoides	teal lovegrass	
Eragrostis pilosa	Indian lovegrass	
Erigeron strigosus var. beyrichii	Beyrich's fleabane	
Eriocaulon compressum	flattened pipewort	
Erodium cicutarium	redstem stork's bill	
Erythronium americanum	dogtooth violet	
Euonymus americana	**strawberry bush**	
Euonymus atropurpurea var. *atropurpurea*	eastern wahoo	
Euonymus atropurpurea	eastern wahoo	
Eupatorium dubium	**coastalplain joepyeweed**	
Eupatorium hyssopifolium	**hyssopleaf thoroughwort**	
Eupatorium leucolepis var. *leucolepis*	justiceweed	
Eupatorium maculatum var. maculatum	spotted joepyeweed	
Eupatorium perfoliatum	**common boneset**	
Eupatorium purpureum	sweetscented joepyeweed	
Eupatorium rotundifolium	**roundleaf thoroughwort**	
Eupatorium serotinum	**lateflowering thoroughwort**	
Euphorbia corollata	flowering spurge	
Euphorbia cyparissias	cypress spurge	NEX
Euphorbia ipecacuanhae	**American ipecac**	
Euphorbia purpurea	Darlington's glade spurge	SE
Eurybia radula	low rough aster	S(NH), SE

Eurybia spectabilis	western showy aster	
Euthamia graminifolia* var. *graminifolia	**flat-top goldentop**	
Euthamia graminifolia	**flat-top goldentop**	
Fagus grandifolia	**American beech**	
Festuca subverticillata	nodding fescue	
Fimbristylis autumnalis	slender fimbry	
Fimbristylis caroliniana	Carolina fimbry	
Fragaria virginiana	**wild strawberry**	
Fraxinus americana	**white ash**	
Fraxinus pennsylvanica	green ash	
Froelichia gracilis	**slender snakecotton**	**NUS**
Fumaria officinalis ssp. officinalis	drug fumitory	
Galactia regularis	eastern milkpea	
Galactia volubilis	downy milkpea	SE
Galearis spectabilis	showy orchid	
Galium aparine	stickywilly	
Galium asprellum	rough bedstraw	
Galium circaezans var. *circaezans*	licorice bedstraw	
Galium tinctorium	stiff marsh bedstraw	
Galium trifidum	threepetal/small bedstraw	SE
Galium triflorum	fragrant bedstraw	
Galium verum	Yellow Spring bedstraw	NEX
Gamochaeta purpurea	spoonleaf purple everlasting	
Gaura biennis	biennial beeblossom	
Gaylussacia baccata	**black huckleberry**	
Gentiana saponaria	harvestbells	
Geranium carolinianum	**Carolina geranium**	
Geranium maculatum	**spotted geranium**	
Geum virginianum	cream avens	
Glechoma hederacea	**ground ivy**	**NEX**
Gleditsia triacanthos	honeylocust	
Glyceria acutiflora	creeping mannagrass	
Glyceria canadensis	rattlesnake mannagrass	
Glyceria obtusa	**Atlantic mannagrass**	
Glyceria septentrionalis	floating mannagrass	
Glyceria striata	**fowl mannagrass**	
Gratiola neglecta	**clammy hedgehyssop**	
Gratiola virginiana	roundfruit hedgehyssop	
Gymnopogon ambiguus	bearded skeletongrass	
Hamamelis virginiana	**American witchhazel**	
Helenium autumnale	common sneezeweed	
Helenium flexuosum	purplehead sneezeweed	
Helianthemum bicknellii	oary frostweed	
Helianthus angustifolius	swamp sunflower	
Helianthus decapetalus	thinleaf sunflower	
Helianthus giganteus	giant sunflower	
Helianthus laetiflorus	cheerful sunflower	
Helianthus strumosus	paleleaf woodland sunflower	
Hemerocallis fulva	**orange daylily**	**NEX**

Hepatica nobilis var. *obtusa*	roundlobe hepatica	
Heteranthera multiflora	bouquet mudplantain	S(NH)
Heteranthera reniformis	**kidneyleaf mudplantain**	
Heuchera americana	American alumroot	
Hibiscus moscheutos ssp. moscheutos	**crimsoneyed rosemallow**	
Hibiscus moscheutos	crimsoneyed rosemallow	
Hibiscus syriacus	rose of Sharon	NEX
Hieracium caespitosum	meadow hawkweed	
Hieracium gronovii	**queendevil**	
Hieracium piloselloides	tall hawkweed	
Hieracium venosum	**rattlesnakeweed**	
Holcus lanatus	**common velvetgrass**	**NEX**
Holosteum umbellatum	jagged chickweed	
Houstonia caerulea	azure bluet	
Huperzia lucidula	shining clubmoss	
Humulus lupulus var. lupulus	common hop	
Hydrocotyle ranunculoides	floating marshpennywort	S(NH), SE
Hydrocotyle umbellata	manyflower marshpennywort	
Hydrophyllum virginianum	Shawnee salad	
Hylotelephium telephium ssp. telephium	witch's moneybags	
Hypericum adpressum	creeping/Bartons St. Johnswort	S(NH), SE
Hypericum boreale	northern St. Johnswort	
Hypericum canadense	lesser Canadian St. Johnswort	
Hypericum denticulatum	coppery St. Johnswort	
Hypericum hypericoides ssp. hypericoides	St. Andrew's cross	
Hypericum mutilum	**dwarf St. Johnswort**	
Hypericum perforatum	**common St. Johnswort**	
Hypericum punctatum	**spotted St. Johnswort**	
Ilex glabra	inkberry	
Ilex laevigata	smooth winterberry	
Ilex opaca	**American holly**	
Ilex verticillata	**common winterberry**	
Impatiens capensis	**jewelweed**	
Ipomoea coccinea	redstar	
Ipomoea hederacea	ivyleaf morning-glory	NEX
Ipomoea pandurata	man of the earth	
Iris pseudacorus	**paleyellow iris**	**NEX**
Isoetes engelmannii	Appalachian quillwort	
Isoetes riparia	shore quillwort	
Isoetes tenella	spiny-spore quillwort	
Isotria verticillata	purple fiveleaf orchid	
Itea virginica	Virginia sweetspire	
Juncus acuminatus	tapertip rush	
Juncus debilis	weak rush	
Juncus dichotomus	**forked rush**	
Juncus effusus var. *solutus*	lamp rush	
Juncus effusus	**common rush**	
Juncus scirpoides	needlepod rush	
Juncus subcaudatus	woodland rush	

Juncus tenuis	**poverty rush**	
Juniperus virginiana	**eastern redcedar**	
Kalmia latifolia	**mountain laurel**	
Kosteletzkya virginica	Virginia saltmarsh mallow	
Krigia virginica	Virginia dwarfdandelion	
Kyllinga brevifolia	shortleaf spikesedge	
Lactuca biennis	tall blue lettuce	
Lactuca canadensis	**Canada lettuce**	
Lamium amplexicaule	**henbit deadnettle**	**NEX**
Lamium purpureum	**purple deadnettle**	**NEX**
Laportea canadensis	Canadian woodnettle	
Lathyrus japonicus var. *maritimus*	beach pea	
Lathyrus japonicus var. *pellitus*	beach pea	
Lathyrus palustris	marsh pea	
Leersia oryzoides	**rice cutgrass**	
Leersia virginica	**whitegrass**	
Lemna minor	minute duckweed	S(NH), SE
Leontodon taraxacoides ssp. taraxacoides	lesser hawkbit	
Lepidium campestre	field pepperweed	
Lepidium virginicum	**Virginia pepperweed**	
Leptochloa fusca ssp. fascicularis	bearded sprangletop	
Lespedeza violacea	violet lespedeza	
Leucothoe racemosa	swamp doghobble	
Liatris pilosa var. *pilosa*	shaggy blazing star	
Ligustrum vulgare	European privet	NEX
Lindera benzoin* var. *benzoin	**northern spicebush**	
Lindera benzoin var. *pubescens*	northern spicebush	
Lindera benzoin	**northern spicebush**	
Lindernia dubia* var. *anagallidea	**yellowseed false pimpernel**	
Lindernia dubia	**yellowseed false pimpernel**	
Linum medium	stiff yellow flax	
Liquidambar styraciflua	**sweetgum**	
Liriodendron tulipifera	**tuliptree, yellow poplar**	
Lobelia cardinalis	**cardinalflower**	
Lobelia inflata	**Indian-tobacco**	
Lobelia puberula	downy lobelia	
Lolium perenne ssp. perenne	perennial ryegrass	
Lolium pratense	**meadow ryegrass**	**NEX**
Lonicera japonica	**Japanese honeysuckle**	**NEX**
Ludwigia alternifolia	**seedbox**	
Ludwigia palustris	**marsh seedbox**	
Ludwigia peploides ssp. glabrescens	floating primrose-willow	
Ludwigia sphaerocarpa	globefruit primrose-willow	
Luzula acuminata	hairy woodrush	M(NH)
Luzula bulbosa	bulbous woodrush	
Luzula multiflora ssp. Multiflora;* var. *multiflora	**common woodrush**	
Lycopodiella copelandii	[none]	
Lycopodium clavatum	running clubmoss	
Lycopodium dendroideum	tree groundpine	

Lycopodium digitatum	**fan clubmoss**	
Lycopodium obscurum	**rare clubmoss**	
Lycopodium tristachyum	deeproot clubmoss	
Lycopus americanus	**American water horehound**	
Lycopus amplectens	clasping water horehound	
Lycopus europaeus	gypsywort	
Lycopus rubellus	taperleaf water horehound	
Lycopus uniflorus	**northern bugleweed**	
Lycopus virginicus	**Virginia water horehound**	
Lyonia ligustrina var. ligustrina	maleberry	
Lyonia ligustrina	maleberry	
Lysimachia ciliata	**fringed loosestrife**	
Lysimachia hybrida	lowland yellow loosestrife	
Lysimachia quadrifolia	whorled yellow loosestrife	
Lysimachia terrestris	earth loosestrife	
Lythrum salicaria	**purple loosestrife**	**NEX**
Maclura pomifera	osage orange	NUS
Magnolia virginiana	**sweetbay**	
Maianthemum canadense	Canada mayflower	
Maianthemum racemosum ssp. racemosum	feathery false lily of the vally; false solomons seal	
Maianthemum stellatum	starry false lily of the vally	
Marrubium vulgare	horehound	
Medeola virginiana	Indian cucumber	
Melampyrum lineare var. *latifolium*	narrowleaf cowwheat	
Melilotus officinalis	**yellow sweetclover**	**NEX**
Melissa officinalis	common balm	
Menispermum canadense	common moonseed	
Mentha arvensis	wild mint	
Mentha spicata	spearmint	
Mikania scandens	**climbing hempvine**	
Mimulus alatus	sharpwing monkeyflower	
Miscanthus sinensis	Chinese silvergrass	NEX
Mitchella repens	**partridgeberry**	
Monotropa hypopithys	pinesap	
Monotropa uniflora	**Indianpipe**	
Morella caroliniensis	southern bayberry	
Morella pensylvanica	northern bayberry	
Morus alba	**white mulberry**	**NEX**
Muhlenbergia mexicana	Mexican muhly	
Muhlenbergia schreberi	**nimblewill**	
Myosotis arvensis	field forget-me-not	
Myosotis laxa	bay forget-me-not	
Myosotis verna	spring forget-me-not	
Myriophyllum humile	low watermilfoil	
Myriophyllum pinnatum	cutleaf watermilfoil	S(NH), SE
Najas flexilis	nodding waternymph	
Najas gracillima	slender waternymph	
Nelumbo lutea	**American lotus**	**SE; M(NH)**
Nelumbo nucifera	sacred lotus	

Nuphar lutea ssp. advena	**yellow pond-lily**	
Nuphar lutea ssp. pumila	yellow pond-lily	SE
Nuphar lutea ssp. rubrodisca	yellow pond-lily	
Nuttallanthus canadensis	Canada toadflax	
Nymphaea odorata ssp. odorata	American white waterlily	
Nymphaea odorata	**American white waterlily**	
Nyssa sylvatica	**tupelo, blackgum**	
Obolaria virginica	Virginia pennywort	
Enothera biennis	common evening-primrose	
Oenothera fruticosa ssp. fruticosa	narrowleaf evening-primrose	
Oenothera fruticosa	narrowleaf evening-primrose	
Oldenlandia uniflora	clustered mille graines	
Onoclea sensibilis	**sensitive fern**	
Onosmodium virginianum	wild Job's tears	S(NH), SE
Ophioglossum pusillum	northern adderstongue	
Ophioglossum vulgatum	southern adderstongue	
Opuntia humifusa	**devil's tongue cactus, eastern prickly pear**	
Ornithogalum umbellatum	sleepydick	NEX
Orontium aquaticum	goldenclub	
Osmunda cinnamomea	**cinnamon fern**	
Osmunda claytoniana	interrupted fern	
Osmunda regalis var. *spectabilis*	royal fern	
Osmunda regalis	**royal fern**	
Oxalis stricta	**common yellow oxalis**	
Panax trifolius	dwarf ginseng	
Panicum amarum	bitter panicgrass	
Panicum anceps	**beaked panicgrass**	
Panicum dichotomiflorum	**fall panicgrass**	
Panicum philadelphicum	Philadelphia panicgrass	
Panicum rigidulum var. elongatum	redtop panicgrass	
Panicum rigidulum var. pubescens	redtop panicgrass	
Panicum rigidulum var. rigidulum	redtop panicgrass	
Panicum rigidulum	redtop panicgrass	
Panicum verrucosum	**warty panicgrass**	
Panicum virgatum var. virgatum	switchgrass	
Panicum virgatum	**switchgrass**	
Parthenocissus quinquefolia	**Virginia creeper**	
Paspalum dissectum	mudbank crowngrass	
Paspalum laeve	field paspalum	
Paspalum setaceum	thin paspalum	
Paulownia tomentosa	**princesstree**	**NEX**
Pedicularis lanceolata	swamp lousewort	
Peltandra virginica	**green arrow arum**	
Phalaris arundinacea	**reed canarygrass**	**NUS**
Phaseolus polystachios var. *polystachios*	wild kidney bean	
Phleum pratense	**timothy**	**NEX**
Phlox maculata ssp. maculata	Spotted phlox	M(NH)
Phlox maculata	wild sweetwilliam	
Phlox paniculata	fall phlox	

Photinia floribunda	purple chokeberry	
Photinia melanocarpa	black chokeberry	
Phragmites australis	**common reed**	**NUS**
Phyllostachys aurea	golden bamboo	NEX
Phyllostachys viridiglaucescens	greenwax bamboo	NEX
Physalis heterophylla	**clammy groundcherry**	
Physalis longifolia var. subglabrata	longleaf groundcherry	
Phytolacca americana	**American pokeweed**	
Pilea pumila	**Canadian clearweed**	
Pinus echinata	**shortleaf pine**	
Pinus strobus	**eastern white pine**	
Pinus taeda	**loblolly pine**	**S(NH)**
Pinus virginiana	**Virginia pine**	
Plantago aristata	**largebracted plantain**	
Plantago lanceolata	**English plantain**	**NEX**
Plantago major	**common plantain**	NUS
Plantago virginica	**Virginia plantain**	
Platanthera lacera	green fringed orchid	
Pluchea odorata var. succulenta	sweetscent	
Poa annua	**annual bluegrass**	
Poa trivialis	**rough bluegrass**	**NEX**
Podophyllum peltatum	**mayapple**	
Polemonium reptans	**Greek valerian**	**SE, M(NH)**
Polygala incarnata	procession flower	SE
Polygala lutea	orange milkwort	
Polygala mariana	Maryland milkwort	M(NH)
Polygala sanguinea	purple milkwort	
Polygonatum biflorum var. *commutatum*	smooth Solomon's seal	
Polygonella articulata	coastal jointweed	
Polygonum arifolium	halberdleaf tearthumb	
Polygonum aviculare	prostrate knotweed	
Polygonum careyi	Carey's smartweed	
Polygonum convolvulus	**black bindweed**	
Polygonum cuspidatum	**Japanese knotweed**	**NEX**
Polygonum hydropiperoides	**swamp smartweed**	
Polygonum lapathifolium	**curlytop knotweed**	
Polygonum orientale	kiss me over the garden gate	NEX
Polygonum pensylvanicum	**Pennsylvania smartweed**	
Polygonum perfoliatum	**Asiatic tearthumb**	**NEX**
Polygonum persicaria	spotted ladysthumb	NEX
Polygonum punctatum	dotted smartweed	
Polygonum robustius	stout smartweed	
Polygonum sagittatum	**arrowleaf tearthumb**	
Polygonum scandens var. *scandens*	climbing false buckwheat	
Polygonum setaceum	bog smartweed	
Polypodium virginianum	rock polypody	
Polystichum acrostichoides var. *acrostichoides*	Christmas fern	
Pontederia cordata	**pickerelweed**	
Populus alba	white poplar	NEX

Populus grandidentata	**bigtooth aspen**	
Populus heterophylla	swamp cottonwood	
Populus nigra	Lombardy poplar	
Potamogeton crispus	**curly pondweed**	**NEX**
Potamogeton epihydrus	**ribbonleaf pondweed**	
Potamogeton nodosus	longleaf pondweed	
Potamogeton pulcher	spotted pondweed	
Potamogeton pusillus ssp. pusillus	small pondweed	
Potamogeton pusillus	small pondweed	
Potentilla argentea	silver cinquefoil	
Potentilla canadensis	**dwarf cinquefoil**	
Potentilla norvegica	Norwegian cinquefoil	
Potentilla simplex	**common cinquefoil**	
Prenanthes alba	white rattlesnakeroot	
Prenanthes serpentaria	cankerweed	
Prenanthes trifoliolata	gall of the earth	
Proserpinaca intermedia	intermediate mermaidweed	
Proserpinaca palustris	marsh mermaidweed	
Proserpinaca pectinata	combleaf mermaidweed	
Prunella vulgaris	**common selfheal**	
Prunus americana	American plum	
Prunus angustifolia	Chickasaw plum	S(NH), SE
Prunus cerasus, P. avium	sour cherry, bird cherry	NEX
Prunus serotina	**black cherry**	
Pseudognaphalium obtusifolium	rabbittobacco	
Pseudosasa japonica	arrow bamboo	NEX
Pteridium aquilinum var. *latiusculum*	western brackenfern	
Pteridium aquilinum	**western brackenfern**	
Ptilimnium capillaceum	herbwilliam	
Pueraria montana var. lobata	kudzu-vine	NEX
Pycnanthemum setosum	awned mountainmint	
Pycnanthemum tenuifolium	narrowleaf mountainmint	
Pycnanthemum verticillatum var. *verticillatum*	whorled mountainmint	
Pycnanthemum verticillatum	**whorled mountainmint**	
Pyrola americana	American wintergreen	
Quercus alba	**white oak**	
Quercus bicolor	**swamp white oak**	
Quercus falcata	**southern red oak**	
Quercus marilandica	blackjack oak	
Quercus michauxii	swamp chestnut oak	
Quercus palustris	**pin oak**	
Quercus phellos	**willow oak**	
Quercus prinus	**chestnut oak**	
Quercus rubra var. ambigua	northern red oak	
Quercus rubra	**northern red oak**	
Quercus rudkinii	[none]	
Quercus saulii	[none]	
Quercus stellata	post oak	
Quercus velutina	**black oak**	

Ranunculus abortivus	**littleleaf buttercup**	
Ranunculus bulbosus	**St. Anthony's turnip**	**NEX**
Ranunculus ficaria	**fig buttercup**	**NEX**
Ranunculus hispidus var. nitidus	**bristly buttercup**	
Ranunculus pusillus	low spearwort	
Ranunculus recurvatus	blisterwort	
Ranunculus repens	creeping buttercup	
Ranunculus sceleratus	cursed buttercup	
Ranunculus trichophyllus var. trichophyllus	threadleaf crowfoot	
Rhexia mariana var. mariana	Maryland meadowbeauty	
Rhexia virginica	handsome Harry	
Rhododendron atlanticum	dwarf azalea	S(NH), SE
Rhododendron periclymenoides	pink azalea	
Rhododendron viscosum	**swamp azalea**	
Rhus copallinum	**flameleaf sumac**	
Rhynchospora capitellata	**brownish beaksedge**	
Rhynchospora macrostachya	tall horned beaksedge	
Rhynchospora scirpoides	longbeak beaksedge	S(NH)
Ribes hirtellum	hairystem gooseberry	
Robinia hispida	bristly locust	NUS
Robinia pseudoacacia	**black locust**	**NUS**
Robinia viscosa	clammy locust	
Rorippa nasturtium-aquaticum	watercress	
Rorippa palustris ssp. hispida	hispid yellowcress	
Rorippa palustris	bog yellowcress	
Rorippa sylvestris	**creeping yellowcress**	
Rosa carolina	Carolina rose	
Rosa multiflora	**multiflora rose**	**NEX**
Rosa palustris	**swamp rose**	
Rotala ramosior	lowland rotala	
Rubus cuneifolius	**sand blackberry**	
Rubus flagellaris	**northern dewberry**	
Rubus hispidus	**bristly dewberry**	
Rubus idaeus	American red raspberry	
Rubus laciniatus	cutleaf blackberry	NEX
Rubus occidentalis	**black raspberry**	
Rudbeckia laciniata	**cutleaf coneflower**	
Rumex verticillatus	swamp dock	
Sagina decumbens	trailing pearlwort	
Sagina procumbens	birdeye pearlwort	
Sagittaria calycina var. spongiosa	hooded arrowhead	
Sagittaria latifolia	**broadleaf arrowhead**	
Sagittaria montevidensis	**giant arrowhead**	
Sagittaria rigida	sessilefruit arrowhead	
Salix alba	white willow	NEX
Salix fragilis	crack willow	NEX
Salix humilis var. tristis	prairie willow	
Salix humilis	prairie willow	
Salix interior	sandbar willow	

Salix nigra	**black willow**	
Salix sericea	silky willow	
Sambucus nigra ssp. canadensis	**common elderberry**	
Sanguinaria canadensis	bloodroot	
Sanguisorba canadensis	Canadian burnet	
Sanicula odorata	clustered blacksnakeroot	
Sassafras albidum	**sassafras**	
Saxifraga pensylvanica	eastern swamp saxifrage	
Saxifraga virginiensis	early saxifrage	
Schoenoplectus americanus	chairmaker's bulrush	
Schoenoplectus fluviatilis	river bulrush	
Schoenoplectus pungens var. pungens	**common threesquare**	
Schoenoplectus smithii	Smith's bulrush	
Schoenoplectus tabernaemontani	**softstem bulrush**	**M(NH)**
Scirpus atrovirens	**green bulrush**	
Scleranthus annuus	German knotgrass	
Scleria triglomerata	whip nutrush	
Scrophularia lanceolata	lanceleaf figwort	
Scrophularia marilandica	carpenter's square	
Scutellaria elliptica	hairy skullcap	
Scutellaria galericulata	marsh skullcap	
Scutellaria integrifolia	**helmet flower**	
Scutellaria lateriflora	**blue skullcap**	
Scutellaria parvula var. missouriensis	Leonard's skullcap, small skullcap	S(NH), SE
Selaginella apoda	meadow spikemoss	
Senna hebecarpa	American senna	
Sericocarpus asteroides	**toothed whitetop aster**	
Sericocarpus linifolius	narrowleaf whitetop aster	
Setaria faberi	**Japanese bristlegrass**	**NEX**
Setaria magna	giant bristlegrass"	
Setaria parviflora	marsh bristlegrass	
Sherardia arvensis	blue fieldmadder	
Sida spinosa	prickly fanpetals	
Silene antirrhina	sleepy silene	
Silene latifolia ssp. alba	bladder campion	
Silene stellata	widowsfrill	
Sisymbrium officinale	hedgemustard	
Sisyrinchium atlanticum	eastern blue-eyed grass	
Sisyrinchium fuscatum	coastalplain blue-eyed grass	
Sisyrinchium mucronatum	needletip blue-eyed grass	
Sium suave	hemlock waterparsnip	
Smilax pseudochina	bamboo vine	
Smilax rotundifolia	**roundleaf greenbrier**	
Solanum carolinense	Carolina horsenettle	
Solanum dulcamara	climbing nightshade	
Solanum physalifolium	hoe nightshade	
Solanum ptychanthum	West Indian nightshade	
Solidago canadensis v. scabra	**Canada goldenrod**	
Solidago latissimifolia	Elliott's goldenrod	

Solidago nemoralis	**gray goldenrod**	
Solidago rugosa	**wrinkleleaf goldenrod**	
Solidago uliginosa	bog goldenrod	
Solidago ulmifolia	elmleaf goldenrod	
Sonchus asper	spiny sowthistle	
Sparganium americanum	**American bur-reed**	
Spartina cynosuroides, S. pectinacea	big cordgrass	
Spergula morrisomii	corn spurry	
Sphenopholis intermedia	slender wedgescale	
Sphenopholis nitida	shiny wedgescale	
Sphenopholis obtusata	prairie wedgescale	
Sphenopholis pensylvanica	swamp oats	M(NH)
Spiraea prunifolia	bridalwreath spirea	
Spiraea tomentosa	**steeplebush**	
Spirodela polyrrhiza	common duckmeat	
Sporobolus clandestinus	rough dropseed	
Sporobolus vaginiflorus	poverty dropseed	
Stachys aspera	hyssopleaf hedgenettle	
Stachys hyssopifolia	hyssopleaf hedgenettle	
Stachys palustris	marsh hedgenettle	
Staphylea trifolia	American bladdernut	
Strophostyles helvula	**trailing fuzzybean**	
Strophostyles umbellata	**pink fuzzybean**	
Stylosanthes biflora	sidebeak pencilflower	S(NH)
Symphyotrichum dumosum var. dumosum	rice button aster	
Symphyotrichum lanceolatum ssp., lanceolatum var. lanceolatum	white panicle aster	
Symphyotrichum lateriflorum var. lateriflorum	calico aster	
Symphyotrichum novae-angliae	**New England aster**	
Symphyotrichum pilosum	**hairy white oldfield aster**	
Symphyotrichum puniceum var. puniceum	purplestem aster, shining aster	SE
Symphytum officinale	common comfrey	
Taenidia integerrima	yellow pimpernel	
Taraxacum officinale	**common dandelion**	**NUS**
Taxodium distichum	bald cypress	
Tephrosia virginiana	Virginia tephrosia	
Teucrium canadense	**Canada germander**	
Thalictrum pubescens	king of the meadow	
Thalictrum thalictroides	**rue anemone**	
Thelypteris noveboracensis	**New York fern**	
Thelypteris palustris var. pubescens	eastern marsh fern	
Thelypteris palustris	**eastern marsh fern**	
Thelypteris simulata	bog fern	
Thlaspi arvense	field pennycress	
Tilia americana	American basswood	
Tipularia discolor	crippled cranefly	S(NH)
Torreyochloa pallida (var. pallida)	pale false mannagrass	
Toxicodendron radicans ssp. radicans	**eastern poison ivy**	
Toxicodendron radicans	**eastern poison ivy**	
Tradescantia virginiana	Virginia spiderwort	

Triadenum virginicum	Virginia marsh St. Johnswort	
Trichostema setaceum	narrowleaf bluecurls	
Tridens flavus var. flavus	**purpletop tridens**	
Trientalis borealis	starflower	
Trifolium aureum	golden clover	NEX
Trifolium pratense	**red clover**	**NEX**
Trifolium repens	**white clover**	**NEX**
Triodanis perfoliata var. perfoliata	clasping Venus' looking-glass	
Triodanis perfoliata	**clasping Venus' looking-glass**	
Triplasis purpurea	purple sandgrass	
Tripsacum dactyloides	eastern gamagrass	
Typha angustifolia	narrowleaf cattail	
Typha latifolia	**broadleaf cattail**	
Ulmus americana	**American elm**	
Ulmus rubra	slippery elm	
Urtica dioica ssp. gracilis	California nettle	
Urtica dioica	stinging nettle	NUS
Utricularia gibba	humped/two-flower bladderwort	S(NH), SE
Utricularia inflata	swollen bladderwort	
Utricularia macrorhiza	common bladderwort	
Utricularia purpurea	eastern purple bladderwort	S(NH)
Uvularia perfoliata	perfoliate bellwort	
Uvularia sessilifolia	sessileleaf bellwort	
Vaccinium angustifolium	lowbush blueberry	
Vaccinium corymbosum	**highbush blueberry**	
Vaccinium fuscatum	black highbush blueberry	
Vaccinium pallidum	**Blue Ridge blueberry**	
Veratrum viride	green false hellebore	
Verbena hastata	swamp verbena	
Vernonia glauca	broadleaf ironweed	SE
Vernonia noveboracensis	**New York ironweed**	
Veronica agrestis	green field speedwell	
Veronica americana	American speedwell	
Veronica hederifolia	ivyleaf speedwell	NEX
Veronica officinalis	**common gypsyweed**	
Veronica persica	birdeye speedwell	
Viburnum acerifolium	mapleleaf viburnum	
Viburnum dentatum	**southern arrowwood**	
Viburnum nudum var. cassinoides	withe-rod	
Viburnum prunifolium	**blackhaw**	
Vicia tetrasperma	**lentil vetch**	
Vicia villosa ssp. varia	winter vetch	
Vicia villosa	**winter vetch**	
Viola affinis	sand violet	
Viola arvensis	**European field pansy**	
Viola bicolor	**field pansy**	
Viola brittoniana	**northern coastal violet**	
Viola conspersa	American dog violet	
Viola cucullata	**marsh blue violet**	

Viola hirsutula	southern woodland violet	
Viola lanceolata	bog white violet	
Viola palmata	early blue violet	
Viola pedata	birdfoot violet	
Viola primulifolia	**[none]**	
Viola pubescens var. pubescens	downy yellow violet	
Viola pubescens	downy yellow violet	
Viola sagittata var. sagittata	arrowleaf violet	
Viola sagittata	arrowleaf violet	
Viola sororia	**common/northern blue violet**	**SE**
Vitis aestivalis	**summer grape**	
Vitis labrusca	**fox grape**	
Vitis riparia	riverbank grape	
Vitis vulpina	**frost grape**	
Vulpia sciurea	squirreltail fescue, Squirreltail six-weeks grass	SE
Vulpia octoflora	**sixweeks fescue**	
Wolffia brasiliensis	Brazilian watermeal	
Wolffia columbiana	**Columbian watermeal**	
Wolffiella gladiata	Florida mudmidget, sworb bogmat	SE, M(NH)
Woodwardia areolata	**netted chainfern**	
Woodwardia virginica	**Virginia chainfern**	
Xanthium strumarium var. canadense	**Canada cockleburr**	
Yucca filamentosa	Adam's needle	
Zizania aquatica	**annual wildrice**	

Key:

M(NH) - Mannington, Natural Heritage: This is an endangered plant species that is documented as occurring within Mannington Township by the New Jersey Natural Heritage Program.

S(NH) - Salem, Natural Heritage: This is an endangered plant species that is documented as occurring within Salem County by the New Jersey Natural Heritage Program.

NUS - Nonindigenous US Native - This plant species' native range includes portions of the United States outside of southern New Jersey. It has colonized or grows wild in natural areas within Salem County.

NEX - Nonindigenous Exotic - This plant species is native to foreign countries and it has colonized or grows wild in natural areas within Salem County.

SE - State Endangered - This plant species is listed on New Jersey's official endangerd species list

FE - Federal Endangered - This plant species is listed as an endangered species by the US Fish and Wildlife Service.

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APPENDIX H: Threatened and Endangered Species in Mannington

Rare Plant and Animal Species and Natural Communities Presently Recorded in the NJ Natural Heritage Database for Mannington				
Scientific name	**Common Name**	**Federal Status***	**NJ Status***	**State Rank****
Terrestrial Community - Other Classification				
Brackish tidal marsh complex				S2?
Vascular Plants				
Alopecurus carolinianus	Tufted Meadow-foxtail			S2
Carex frankii	Frank's Sedge			S3
Carex typhina	Cat-tail Sedge			S3
Cyperus engelmannii	Engelmann's Flat Sedge			S2
Dirca palustris	Leatherwood			S2
Luzula acuminata	Hairy Wood-rush		E	S2
Nelumbo lutea	American Lotus		E	S1
Phlox maculata var. maculata	Spotted Phlox			S3
Polemonium reptans	Greek-valerian		E	S1
Polygala mariana	Maryland Milkwort			S2
Schoenoplectus novae-angliae	New England Bulrush			S2
Sphenopholis pensylvanica	Swamp Oats			S2
Wolffiella floridana	Sword Bogmat		E	S1
Habitat				
Bald eagle foraging area		LT	E	S1B, S2N
Bald eagle nest buffer		LT	E	S1B, S2N
Vertebrates				
Dolichonyx oryzivorus	Bobolink		T/T	S2B
Clemmys muhlenbergii	Bog turtle	LT	E	S2
Terrapene carolina	Eastern box turtle		Special Concern	S5B
Pandion haliaetus	Osprey		T/T	S2B
Pooecetes gramineus	Vesper sparrow		E	S1B, S2N

*** Key to Federal and State Status Codes**

T	Threatened species – may become endangered if conditions surrounding the species begin to or continue to deteriorate. Status separated by a slash (/) indicate a dual status. First status refers to the state breeding population, and second status refers to the migratory or winter population.
E	Endangered species – one whose prospects for survival within the state are in immediate danger due to one or many factors.
Special Concern	Species of Special Concern in New Jersey – warrants special attention because of evidence of decline, inherent vulnerability to environmental deterioration, or habitat modification that would result in their becoming a threatened species.
LT	Taxa formerly listed as threatened

**** Key to State Element Rank**

S1	Critically imperiled in NJ because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres).
S2	Imperiled in NJ because of rarity (6 to 20 occurrences).

S3	Rare in state with 21 to 50 occurrences. Includes elements which are widely distributed but with small populations/acreage, or with restricted distribution but locally abundant.
S4	Apparently secure in state, with many occurrences.
S5	Demonstrably secure in state and essentially ineradicable under present conditions.
B	Refers to the breeding population in the state
N	Refers to the non-breeding population in the state
?	It has not been determined if the record is indicative of significant habitat, or the indentification of the species or community may be confusing or disputed.

Sources: New Jersey Department of Environmental Protection, Division of Fish and Wildlife, "Wildlife Species of Special Concern in New Jersey," http://www.state.nj.us/dep/fgw/spclspp.htm

New Jersey Department of Environmental Protection, Division of Parks and Forestry, "Special Plants of NJ - Appendix I - Categories & Definition," http://www.state.nj.us/dep/parksandforests/natural/heritage/spplant_ap1.html

CAUTIONS AND RESTRICTIONS ON NATURAL HERITAGE DATA

The quantity and quality of data collected by the Natural Heritage Program is dependent on the research and observations of many individuals and organizations. Not all of this information is the result of comprehensive or site-specific field surveys. Some natural areas in New Jersey have never been thoroughly surveyed. As a result, new locations for plant and animal species are continuously added to the database. Since data acquisition is a dynamic, ongoing process, the Natural Heritage Program cannot provide a definitive statement on the presence, absence, or condition of biological elements in any part of New Jersey. Information supplied by the Natural Heritage Program summarizes existing data known to the program at the time of the request regarding the biological elements or locations in question. They should never be regarded as final statements on the elements or areas being considered, nor should they be substituted for on-site surveys required for environmental assessments. The attached data is provided as one source of information to assist others in the preservation of natural diversity.

This office cannot provide a letter of interpretation or a statement addressing the classification of wetlands as defined by the Freshwater Wetlands Act. Requests for such determination should be sent to the DEP Land Use Regulation Program, P.O. Box 401, Trenton, NJ 08625-0401.

The Landscape Project was developed by the Division of Fish & Wildlife, Endangered and Nongame Species Program to map critical habitat for rare animal species. Some of the rare species data in the Landscape Project is in the Natural Heritage Database, while other records were obtained from other sources. Natural Heritage Database response letters will list all species (if any) found during a search of the Landscape Project. However, any reports that are included with the response letter will only reference specific records if they are in the Natural Heritage Database. This office cannot answer any inquiries about the Landscape Project. All questions should be directed to the DEP Division of Fish and Wildlife, Endangered and Nongame Species Program, P.O. Box 400, Trenton, NJ 08625-0400.

This cautions and restrictions notice must be included whenever information provided by the Natural Heritage Database is published.

NJ Department of Environmental Protection
Division of Parks and Forestry
Natural Lands Management

New Jersey Endangered and Threatened Species

Birds			
Endangered		**Threatened**	
American Bittern	*Botaurus lentiginosos*	Bobolink	*Dolichonyx oryzivorus* BR
Eagle, bald	*Haliaeetus leucocephalus* BR **	Bald Eagle	*Haliaeetus leucocephalus* NB **
Falcon, peregrine	*Falco peregrinus*	Cooper's Hawk	*Accipiter cooperii*
Goshawk, northern	*Accipiter gentilis* BR	Red-shouldered Hawk	*Buteo lineatus* NB
Grebe, pied-billed	*Podilymbus podiceps**	Black-crowned night-heron	*Nycticorax nycticorax* BR
Harrier, northern	*Circus cyaneus* BR	Yellow-crowned night-heron	*Nyctanassa violaceus*
Hawk, red-shouldered	*Buteo lineatus* BR	Red knot	*Calidris canutus* BR
Owl, short-eared	*Asio flammeus* BR	Osprey	*Pandion haliaetus* BR
Plover, piping	*Charadrius melodus***	Barred owl	*Strix varia*
Sandpiper, upland	*Batramia longicauda*	Long-eared owl	*Asio otus*
Shrike, loggerhead	*Lanius ludovicianus*	Black rail	*Laterallus jamaicensis*
Skimmer, black	*Rynchops niger* BR	Black skimmer	*Rynchops niger* NB
Sparrow, Henslow's	*Ammodramus henslowii*	Grasshopper sparrow	*Ammodramus savannarum* BR
Sparrow, vesper	*Pooecetes gramineus* BR	Savannah sparrow	*Passerculus sandwichensis* BR
Tern, least	*Sterna antillarum*	Vesper sparrow	*Pooecetes gramineus* NB
Tern, roseate	*Sterna dougallii***	Red-headed woodpecker	*Melanerpes erythrocephalus*
Wren, sedge	*Cistothorus platensis*		

Reptiles			
Endangered		**Threatened**	
Rattlesnake, timber	*Crotalus h. horridus*	Snake, northern pine	*Pituophis m. melanoleucus*
Snake, corn	*Elaphe g. guttata*	Turtle, Atlantic green	*Chelonia mydas***
Snake, queen	*Regina septemvittata*	Turtle, wood	*Clemmys insculpta*
Turtle, bog	*Clemmys muhlengergii***		
Atlantic hawksbill	*Eretmochelys imbricata***		
Atlantic leatherback	*Dermochelys coriacea***		
Atlantic loggerhead	*Caretta caretta***		
Atlantic Ridley	*Lepidochelys kempi***		

Amphibians			
Endangered		**Threatened**	
Salamander, blue-spotted	*Ambystoma laterale*	Salamander, eastern mud	*Pseudotriton montanus*
Salamander, eastern tiger	*Ambystoma tigrinum*	Salamander, long-tailed	*Eurycea longicauda*
Treefrog, southern gray	*Hyla chrysocelis*	Treefrog, pine barrens	*Hyla andersonii*

New Jersey Endangered and Threatened Species

Invertebrates			
Endangered		**Threatened**	
Beetle, American burying	*Nicrophorus mericanus***	Elfin, frosted (butterfly)	*Callophrys irus*
Beetle, northeastern beach tiger	*Cincindela d. dorsalis***	Floater, triangle (mussel)	*Alasmidonta undulata*
Copper, bronze	*Lycaena hyllus*	Fritillary, silver-bordered (butterfly)	*Bolaria selene myrina*
Floater, brook (mussel)	*Alasmidonta varicosa*	Lampmussel, eastern (mussel)	*Lampsilis radiata*
Floater, green (mussel)	*Lasmigona subviridis*	Lampmussel, yellow (mussel)	*Lampsilis cariosa*
Satyr, Mitchell's (butterfly)	*Neonympha m. mitchellii***	Mucket, tidewater (mussel)	*Leptodea ochracea*
Skipper, arogos (butterfly)	*Atrytone arogos arogos*	Pondmussel, eastern (mussel)	*Ligumia nasuta*
Skipper, Appalachian grizzled (butterfly)	*Pyrgus wyandot*	White, checkered (butterfly)	*Pontia protodice*
Wedgemussel, dwarf	*Alasmidonta heterodon***		

Mammals		Fish	
Endangered		Endangered	
Bat, Indiana	*Myotis sodalis***	Sturgeon, shortnose	*Acipenser brevirostrum***
Bobcat	*Lynx rufus*		
Whale, black right	*Balaena glacialis***		
Whale, blue	*Balaenoptera musculus***		
Whale, fin	*Balaenoptera physalus***		
Whale, humpback	*Megaptera novaeangliae***		
Whale, sei	*Balaenoptera borealis***		
Whale, sperm	*Physeter macrocephalus***		
Woodrat, Allegheny	*Neotoma floridana magister*		

**** Also on the federal Endangered and Threatened list**
BR – Breeding population only
NB – Non-breeding population only

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APPENDIX I: Mannington Historical Site Inventory

1. 491 Route 45
Mannington Town Hall. Built on land originally donated for a Quaker school in 1793.[1] Nothing is known about the early school house, except that it apparently became a public school at some point. In 1858, the original school was replaced by this brick Greek Revival building built to serve both as a school, and as the Mannington Town Hall. The second story continued to be used as a school into the 1960s. The building now serves as the municipal building for the township.

2. 555 Route 45
Waldac Farm: Fine example of Georgian architecture. South side circa 1790, north side thought to be earlier.[2] Owned by David Bassett in 1st half 19th century. Brick construction. Retains original interior including paneled walls, chair rails, and corner fireplaces with chip carved mantels

3. 350 Acton Station Road
Lawrence House: Fine example of Victorian architecture built by the Lawrence family, circa 1870. Family history indicates that a somewhat earlier house was lost in a fire, and was replaced by this structure.[3]

4. 579 Route 45
Top of the Hill: Built by Jediah Allen in 1805. Brick construction stuccoed over. Originally part of a small community known as Mannington Hill, which contained wheelwright, blacksmith, and shoemaker shops as well as a country store. [2]

5. 622 Route 45
Hedgefield: Built by Thomas Mason in 1722, this house stands on land originally granted by John Fenwick to his son-in-law, Samuel Hedge.[1] The house has been extensively remodeled over the years, and the original brick is now covered with stucco.

6. 635 Route 45
Mid 19th century. Brick construction. Fine example of Greek Revival architecture retaining original interior paneling. Site of Centreton Nurseries operated by Frank Pettit in 2nd half of 19th century. [4]

7. Bassett Road and Rt. 45
William Smith House: This very important side passage Georgian house was built circa 1760 by William Smith, a Quaker descended from the emigrant John Smith who purchased ½ of the 2000 acre Hedgefield tract.[5] Very original early 18th century interior. Original wood exterior surfaces preserved under later siding. Condition: extremely fragile, partially vandalized, and very threatened. Picture obscured by uncontrolled plant undergrowth. Listed on the National Register of Historic Places

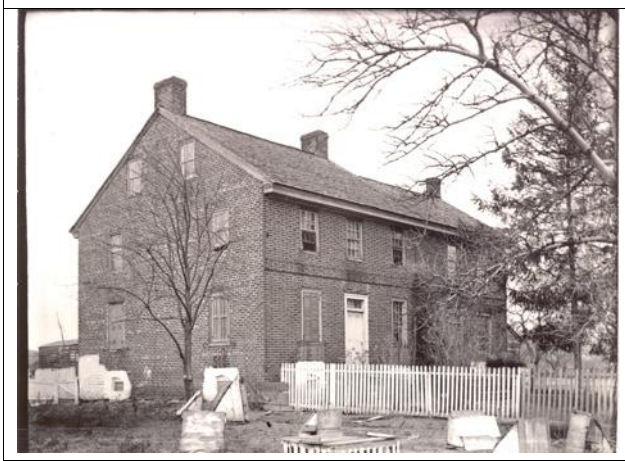
8 741 Route 45
Handsome mid 19th century frame Greek Revival house. Located within 1 mile of the Centreton Nurseries House, and similar in design to that brick structure house except for materials of construction. Aluminum siding added. Front porch not original.

9. 768 Rte 45

Important brick colonial built by William Hall, Jr in 1724.[1, 2&5] The smaller section was added to the north end around 1790. The original front façade shown in picture, which faces Cullier's Run rather than the modern road, is currently used as the rear of the house. It features Flemish bond with fired headers and a belt course. The pent eave is missing. The south gable end has fired headers outlining the roofline, similar to the William Nicholson House.

10. 900 Rte 45, Bldg 1

Salem County Alms House: Built in 1845 after original 1807 Alms House burned. According to Thomas H. Bowen[6], the Alms House was constructed by Richard C. Ballinger (mason), Levi Dubree and Charles Sharp (carpenters), and Joseph Inskip and Joseph Moore (plasterers). The smaller section on right side was added in 1870 to house inmates deemed to be "insane." Current condition of building: threatened. It is in need of stabilization and restoration.



11. 139 Compromise Road

Brick mansion house built by Samuel Smith, son of John Smith of Smithfield, about 1718 according to Shourds.[7] Front façade: Flemish bond with belt course four bricks wide. This historic photo [8] taken by Thomas Yorke in 1887 shows original front door position. Modifications include addition of a porch and a change in the location of the front door.

12. 110 Compromise Road

Very important 18th century hall-parlor plan brick house built by Richard Brick. The front façade on the larger right hand section features Flemish bond with fired headers, a belt course and pent eave, and a projecting water table. Sickler[9] dates the house to about 1750. The smaller kitchen wing on the left side appears to have been added slightly later.[5] It also has Flemish bond with fired headers. The Richard Brick House is listed on the National Register of Historic Places.

13. 86 Compromise Road
Compromise School: This brick schoolhouse was built in 1885, one of nine one-room schools formerly used in the township.[1] It has been converted to a residence.

14. 2 Swedes Bridge Road
Mannington Grange. This frame structure was built in 1906.[1] Aluminum siding and modern porch have been added. Its purpose was to house Grange functions. It is currently used by Mannington Ruritan Club for meetings and special events.

15. 52 Swedes Bridge Road
William Nicholson House: built about 1730.[6] This 1887 historic photograph [8] shows front façade Flemish bond with fired headers, and a gable end with fired headers outlining the roofline. Also note the intact original put-log holes. William and his brother Samuel Nicholson were sons of Abel Nicholson, builder of a well known 1722 patterned end house in Elsinboro. The building currently has stucco covering original brickwork.

16. 19 Compromise Road
Late 18th or early 19th century brick structure. Date of construction may be indicated by 1804 carved on a block of wood under an eave.[2] Retains original kitchen fireplace and several corner fireplaces.

17. 90 Bassett Road
William Wilkinson House: The first deed for the land this house stands on is dated August 11, 1686, from the executors of John Fenwick's estate to William Wilkinson. A log cabin was built first, and the brick section was added in the late 18th century. The log cabin was torn down in 1912, and replaced with the frame section.[2] Many original interior details remain.

18. 71 Bassett Road
Fine brick structure. The right side was built in the early 18th century. Architectural details include Flemish bond, a belt course with alternating fired headers for decoration, indications of a pent eave (currently missing), a projecting water table, and arched cellar windows. The left side is a fine federal addition with an extremely fine doorway of the period. The Victorian porch was added later.

19. 140 Warner Road
Kiger House. Early brick structure built by Richard Robinson around 1720. Initials RR and 1725 are scratched above the doorway. Outstanding use of Flemish bond with fired headers on west wall. Exterior and interior very well preserved. Named for two early owners, German glassblowers named Kiger. Also called the Jesuit Mission House because of masses routinely celebrated there secretly by Jesuit priests, contrary to the laws of the time [9].

20. 655 Kings Highway
Poplar Tree Farm. In 1823 the Sherron family added the large left-hand section to the existing 18th century structure (center). The lean-to on the right side has evidence of a large cooking fireplace and was either part of the 18th century structure[2] or was added soon after the original construction.

21. 738 Kings Highway
Mid 19th century Georgian frame house. Aluminum siding added.

22. 550 Kings Highway
Hugh Middleton House. 18th century house said to have been built by Hugh Middleton in 1735.[2] A large house for the period: the interior has 4 ground floor rooms with an enclosed staircase located toward the rear of the house. Hugh Middleton was a member of the provincial legislature and a judge. This historic picture taken by Thomas Yorke [8] in 1887 shows the front of the house with a Victorian porch, which was later removed.

23. 55 Nimrod Road
Very fine brick Georgian structure built in 1813 by Jacob Fox. Original exterior including classical front doorway and shutters. Interior retains original chip carved mantels [2]. Modern additions include kitchen to left side, and large room for entertaining to the rear.

24. 31 Halltown Road
Benjamin Bassett House: Benjamin and Mary (Acton) Bassett were married in 1828 and built this house later, probably around 1840. Their initials (BMB) are set in an inset marble block.[2] Brick construction with center hall. Flat roof. Retains original marble mantels downstairs, plainer wooden mantels upstairs. Still has large cooking fireplace and oven which may have been part of a summer kitchen no longer standing. Architecture very similar to Tidemill.

25. 61 Halltown Road
Rachel Bassett Allen House. Frame House built around 1855 or 60. Now covered with aluminum siding. Built by Benjamin Bassett for his daughter, Rachel, who married Collins Allen.[2]

26. 132 Halltown Road
Benjamin Wright House. About 1770 Benjamin and Ruth Wright came from Chesterfield in Burlington County to build this exceptionally fine Georgian frame house. Most of its interior architectural details including corner fireplaces with chip-carved mantels, chair rails, and original stairways have been preserved. [2] Exterior now covered with aluminum siding.

27. Biddle Road
Late 18th or early 19th century frame house, now covered with aluminum siding. History not known at this time.

28. 84 Nimrod Road
Sarah Bassett Griscom House. Frame Greek Revival house built by Benjamin Bassett for his daughter Sarah and her husband Barclay Griscom about 1854. The original house did not have fireplaces because it was designed to be heated with Franklin stoves.[2] Exterior now covered with aluminum siding.

29. 177 Pointers-Auburn Road
Joseph Bassett, Jr House. The brick side dates from the early 19th century. It features a very fine classical doorway and a granite foundation (unusual because granite is not found locally). The frame side appears to be a 19th century addition, but the basement contains evidence that it replaced a much earlier structure. Much of the original woodwork in the brick side is preserved.

30. 233 Pointers-Auburn Road
Lydia Zerns House: Greek Revival frame house built in 1859 by Joseph Bassett, Jr for his daughter Lydia and husband William Zerns.[2] Important details include the original front porch and unusual fretwork grilles on 3rd floor windows. The side porch appears to be original, but has some Victorian details added. Original siding covered with aluminum siding.

31. 31 Sunset Drive
Magotha: Fine brick house probably dating to 1830 was added to an earlier house dated 1789.[2] Front and side porches appear original to the 1830 structure. One outstanding feature is the "curly" maple stair rail in the center hall. Architecture is similar to Hollyholme.

32. 29 Sunset Drive
Joseph Bassett, Sr. House: In 1777 Elisha Bassett III willed "half of my land when he is 21" to his 12 year old son Joseph. At some time after receiving his inheritance, Joseph married Mary Allen and built this house. The frame section, which contains a large cooking fireplace, is earlier than the brick side, and may have replaced an even earlier structure. The brick portion has the date 1828 stamped into several bricks.[2] The house contains a "curly" maple stair rail like Magotha and Hollyholme. Picture by Roger Nathan [10.]

33. 84 Pointers-Auburn Road
Hollyholme: In 1825, John Wistar (grandson of Wistarburg Glass founder Caspar Wistar) built this house for his son Caspar. There is some evidence that the right side might be slightly earlier. The porch was added around 1850. This house retains most of its original interior, including the "curly" maple stair rail, King-of-Prussia marble mantles, yellow pine floors, interior pine doors painted to simulate mahogany, and original hardware. Shown on 1830 survey map in possession of owners. Continuously owned by Hancock family for over one hundred and fifteen years.

34. 120 Harris Road
Bartholomew Wyatt House: This house has evolved into its present form. The left side has the date 1788 inscribed in the basement ceiling plaster. On the right side, toward the rear of the house, is a room with a large cooking fireplace which may have been the original structure. A "dogtrot," constructed at a later date, connected these two sections. Finally, a larger structure was added to incorporate all of the parts, and create a traditional center hall in the Georgian style. Much of the early interior is intact. The original house was probably built around 1730 by Bartholomew Wyatt, son of Bartholomew Wyatt, the immigrant who purchased 1200 acres from Fenwick's heirs. Richard Wistar, son of Caspar, the founder of Wistarburg Glass Works, was a prominent owner

35. 130 Harris Road
Meadowview: Main section of house likely built by Andrew Thompson after he purchased the farm in 1837. Rear portion could be earlier.[11] Greek Revival and Italianate influences can be seen in architecture. Original wood siding appears to be intact under asbestos siding.

36. 155 Harris Road
19th century frame House. Appears on 1861 map[12] at the Salem County Historical Society, but not on an 1848 map[13], so probably built between those dates. Builder: Andrew Thompson, or his son, Clarkson Thompson. Picture by Roger Nathan [10].

37. 367 Kings Highway
Hiresdale: Very fine Italianate brick house. Dated 1865. Named for the Hires family who ran a very successful dairy from this farm.

38. 279 Rte 45
Fine federal home which appears to date from the 1st quarter of the 19th century. Owned by Andrew Thompson in mid 19th century. [12 & 13] Porch added, in late 19th century. Aluminum sided.

39. 227 Old Kings Highway
Frame house probably dating to 1830-1840. Located facing the original route of Old Kings Highway. Now aluminum sided.

40. 203 Old Kings Highway
James Barrett House: Very fine, early brick Georgian House built by James Barrett on land purchased from Hypolyte LeFevre. Probably the "plantation house" mentioned in Barrett's 1717 will. [14] Appears on 1764 survey map.[16] The wooden keystones are a wonderful detail only seen on one other Salem County home, the 1737 Mecum House in Lower Penns Neck. The dental molding on the eave box is also exceptional. The Greek Revival porch is a later addition. The interior contains much original woodwork, including a very fine paneled room end.

41. 128 Old Kings Highway
Georgian frame house with classic doorway built by John Denn in 1809. John Denn was a hatter. [15] The 1809 structure was added to an existing 18th century dwelling. The earlier section (partially visible on the left side) retains large cooking fireplace. The original clap board siding has been covered with vinyl siding.

42. 98 Old Kings Highway
Very interesting brick house, probably dating to early 18th century, c 1725 or 30. James Whitton was an early owner, and perhaps the builder. Owned by the Cripps family in the mid 18th century.[14] Appears on 1764 survey map.[16] Brick now covered with stucco. Said to retain much original interior.

43. 50 Tidemill Road
Tidemill: Imposing Greek revival house built by George Abbott around 1845. Flat roof. Front porch appears original. House sits next to the Mannington Meadow, which is tidal. The Tidemill name derives from a mill constructed near the house that used tidal flow to grind grains. This farm is where the well known Abbott Dairy was founded. Beginning in 1876, milk was shipped from here to Philadelphia and Cape May by train. The milk was cooled by ice cut from the Mannington creek in winter and preserved in an ice house on the farm.[2] Photo by Roger Nathan[10].

44. Mannington Mills Road
The Pledger House; Very important brick mansion built by John Pledger, Jr in 1727.
A large 2 ½ story hip roof structure, it features Flemish bond with fired headers on the front, back, and both ends. The interior has been altered, but retains some original woodwork. The historic photo by Thomas Yorke[8] shows the front of the Pledger house in 1887. Pledger's father, along with Hypolyte LeFevre, had purchased 6000 acres from Fenwick. During the Revolutionary War, the house was occupied by British troops. The family, including 7 year old future historian Robert Gibbon Johnson, were imprisoned in the cellar but escaped.

45. 663 Quaker Neck Road
Brick section may have been built in the last quarter of the 18th century. The porch is a later addition. The frame section is dated 1811. The frame section was re-sided in the 1990's. The interior of both sides has been altered.

46. 606 Quaker Neck Road
House appears to have been built in early 19th century. The house has been covered with vinyl siding, and the porch has been added.

47. 510 Quaker Neck Road
Unrestored brick house circa 1775. Brick exterior has been stuccoed. Late porch added. Most of original interior is gone, except for several very nice 18th century doors on the second floor.

48. 466 Quaker Neck Road
Hypolyte LeFevre House. This important brick house was built by Hypolyte LeFevre, Jr in the very early 18th century. A brick with the date 1707 was found, which may indicate the year of construction.[2] The historic photo by Thomas Yorke[8] shows how the house looked in 1887. The left side appears to have been built after the right, but still sometime in the early 18th century. The house has survived a disastrous fire and is quite altered today. Hypolyte LeFevre Sr., a French Huguenot escaping religious persecution in France, migrated to Fenwick's colony and purchased 6000 acres along with John Pledger. He died in 1698, and his son subsequently built this house on his inherited 3000 acre plantation.[2]

49. 570 Quaker Neck Road
The left side of this frame house appears to have been built in the early 19th century. The right side seems much later. The siding is now covered with aluminum siding.

50. 88 Sandy Ridge Road
Battleground Farm. This pleasant brick house appears to have been built around 1810 – 1820. The pent eave is thought to be unoriginal, and not appropriate for a house of this period. Fine interior woodwork was removed from this house and installed in the Rumsey Parlor of the Salem County Historical Society where it can be seen today. The house gets its name from its proximity to the site of the Battle of Quinton Bridge during the Revolutionary War.

51. 465 Kings Highway
The Boxwoods. Very important historic house, garden and grounds. The original brick section on the left was built by James Sherron in the very early 18th century. The circa 1790 frame section on the south side retains magnificent raised panel wainscot and raised panel arched doorways with fluted pilaster trim. The center hall features a rare free-standing circular staircase. Early outbuildings include an original privy, smokehouse, workshop, wagon shed, and later barn.[17] The gardens date from the 19th century. The Boxwoods has been the home of the Carpenter family since 1760.

52. 421 Route 45
Fairview Farm: Frame farmhouse that appears to date to the early 19th century. Porch added later. Original wood siding now covered with aluminum siding.

53. 455 Route 45
Original brick structure on left hand side believed to have been built by the Miller family around 1800. The frame section on the right hand side appears to be mid 19th century. The siding is now covered with aluminum siding. Modern colonial style dormers and doorway have been added.

54. 465 Route 45
Miller Farm. Wyatt Miller and his family lived here in the mid 19th century. The original brick section on the right dates to the late 18th century. The frame section on the right appears to have been added in the early 19th century. Some original interior woodwork has been preserved. A dairy barn stands adjacent to the house on the property.

55. 324 Welchville Road
Forkland: An original one room log cabin is preserved under the clapboard in the section on the right. Construction date of the cabin is not known but is likely very early 18th century. It retains its large cooking fireplace with pentagonal niche. The brick section, added around 1800, retains original corner fireplaces and original interior woodwork. The land, which was originally part of John Pledger Sr's 3000 acre tract, descended to his son, John Pledger Jr., and daughter-in-law, Elizabeth.

56. 119 Hackett Road
Hackett Farm: Very large Greek Revival farmhouse with 3 full stories. Owned d by J.R. Hackett in the late 19th century. It was on this farm that the skeleton of a mastodon was found in a marl pit.[18] It is on display at Rutgers University in New Brunswick, NJ.

Footnotes:

Footnotes:

1. Ruth Ann Wright, *Mannington Township History* (in the Salem County Historical Society Newsletter, 1992)
2. *Souvenir Map of Historic Sites in Mannington Township* (written and compiled by R. L. Culver for the Mannington Bicentennial Commission, 1976)
3. Communication from Marian Lawrence Cadwallader, granddaughter of the builder.
4. Combination Atlas Map of Salem & Gloucester Counties, (Compiled, Drawn and Published from Personal Examinations and Surveys by Everts and Stewart, Philadelphia, 1876, and reprinted by the Gloucester County Historical Society, 1970)
5. Gabrielle M. Lanier, *The Delaware Valley in the Early Republic: Architecture, Landscape, and Regional Identity*, (The Johns Hopkins University Press, Baltimore and London, 2005)
6. Thomas H. Bowen, *Lakeview buildings date from 1945 fire,* in Today's Sunbeam, Salem, NJ, May 5, 1967
7. Thomas Shourds, *History and Genealogy of Fenwick's Colony* (originally published Bridgeton, New Jersey, George F. Nixon, Publisher, 1876, and republished by Genealogical Publishing Co, Inc, Baltimore, 1976)
8. Historic photo by Thomas Yorke from the collection of the Salem County Historical Society. Reproduced with the permission of the Society.
9. Joseph S. Sickler, *The Old Houses of Salem County* 2nd ed. (Sunbeam Publishing Company, Salem New Jersey) 1949
10. Contemporary photo by Roger Nathan from the collection of the Salem County Historical Society. Reproduced with the permission of the Society.
11. Communication from William C. Hancock III based on research done by George Maharay and Mr. Hancock.
12. *Map of the Vicinity of Philadelphia Camden from Actual Surveys* by D. J. Lake and S. N Beers, (C. K. Stone, A Pomeroy Publishers, Philadelphia, 1861)
13. *A map of the Counties of Salem and Gloucester NJ from original surveys* by Alex C. Stansbie, James Keily, and Samuel M Rea Surveyors, 1848
14. Communication from William Saunderlin, a former resident of the Barrett House who has done extensive research on the Barrett House and other neighboring historic structures.
15. Communication from John Skwirut, current owner of the Denn House.
16. Survey map in collection of Salem County Historical Society
17. *James Sherron House also known as "Boxwoods*" (by Joseph Ross, David Doerr, and Ruth Ann Wright, Salem County Historical Society): *in Salem County Architecture: An Overview* (published by Delaware Division of Historical and Cultural Affairs, Dover, Delaware, Stephen G. Del Sordo, editor, for The Vernacular Architecture Forum, 1984)
18. *Fenwick's Colony*. (published by the Salem County Tercentenary Committee, 1964)

Additional Old Houses in Mannington Township

Several old Mannington houses were not included in the Historical House Inventory. While these houses, or parts of them, appear to date to the 19th century or before, there was insufficient time to research and document them for the inventory. But they are a part of Mannington's history, and they contribute to the township's historic viewscapes. The decision was made to list them in this appendix for reference, with the hope that they can be researched and documented in the future.

The additional old houses, identified by address, are listed below. The order is not significant.

1. 97 Compromise Road
2. 82 Dolbow Road
3. 124 Swedes Bridge Road
4. 60 Oeschle Road
5. 41 Hackett Road
6. 362 Welchville Roaqd
7. 440 Welchville Road
8. 525 Welchville Road
9. 566 Route 45
10. 378 Acton Station Road
11. 315 Acton Station Road
12. 243 Acton Station Road
13. 240 Acton Station Road
14. 477 Quaker Neck Road
15. 73 Sandy Ridge Road
16. 116 Clancy Road
17. 45 Old Kings Hwy
18. 790 Kings Hwy
19. 429 Pointers-Auburn Road
20. 21 Marshalltown Road
21. 30 Sunset Drive
22. 136 Black Road
23. 153 Black Road
24. 16 Warner Road
25. 92 Warner Road
26. 81 DuBois Road
27. 48 DuBois Road
28. 576 Haines Neck Road
29. 22 Compromise Road

APPENDIX J: Known Contaminated Sites

Table: Known Contaminated Sites in Mannington

Site ID	Name	Address	Status	Lead Agency	Remedial Level
G000040531	Fenwick Creek M M 2*	Rte 45 Section 2d	Active	BSCM	C2
008336	Mannington Mills Inc	Mannington Mills Rd & Rte 45	Active	BCM	D
006115	Salem Cnty Lakeview	Lakeview Office Complex	Active	BSCM	C2

(Source: NJ DEP, Site Remediation and Waste Management, Salem County: Mannington Twp, Sites with On-Site Sources of Contamination, from Known Contaminated Sites in New Jersey Report, 7th edition, Spring 2006, http://www.nj.gov/dep/srp/kcs-nj/salem/kcs1705.htm#G000040531)

***** UST [Underground Storage Tank] Active Remediation

Lead Agencies and Contact Information

Acronyms	Bureau	Telephone No.		Acronym	Bureau	Telephone No.
BCM	Case Management	(609) 633-1455		BSCM	Southern Case Management (formerly BUST - Bureau of Underground Storage Tanks)	(609) 292-8761

See Sources of Information, page 100, for a table of all Lead Agencies and their contact information.

Explanation of Remedial Levels

Remedial Level	Explanation of Site Complexity
B	A single-phase remedial action in emergency response; simple removal activities of contaminants; usually no impact to soil or groundwater.
C1	A remedial action with simple sites; one or two contaminants localized to soil and the immediate spill or discharge area.
C2	A remedial action with more complicated contaminant discharges; multiple site spills and discharges; more than one contaminant, with both soil and groundwater impacted or threatened.
C3	A multiphase remedial action with high complexity and threatening sites. Multiple contaminants some at high concentrations with unknown sources continuing to impact soils, groundwater, and possibly surface waters and potable water resources. Dangerous for direct contact with contaminated soils.
D	Same conditions as C3 except that D levels are also usually, but not always, designated as federal "Superfund Sites."
NA	Not assessed

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DELAWARE VALLEY REGIONAL PLANNING COMMISSION

Publication Abstract

Title: ***Environmental Resource Inventory for Mannington Township, Salem County, New Jersey***

Date Published: **2007**
Publication No. **07011**

Geographic Area Covered: Mannington Township, Salem County, New Jersey

Key Words: Conservation, conservation planning, endangered species, environment, environmental resource inventory, environmental commission, history, historic houses, Important Bird Area, Mannington Marsh, Mannington Meadows, Mannington Township, master planning, natural resources, New Jersey, Salem County, threatened species, wildlife.

ABSTRACT

This publication documents the natural and community resources of Mannington Township, Salem County, New Jersey. The natural resource information includes descriptions, tables and maps of land use; soils; steep slopes; drinking water aquifers and wells; surface waters including watersheds, streams, wetlands, vernal pools, and floodplains; impacts on water resources; aquifers and groundwater; vegetation including forests and grasslands and a lengthy plant list; animal communities including information on the Mannington Meadows Important Bird Area; threatened and endangered species; NJ Landscape Project, Heritage Priority Sites; and known contaminated sites. Community resources that are briefly described include population, transportation, township utilities and services, and protected open space. A short history of the community is also included, along with a substantial inventory of historic houses in Mannington.

For More Information Contact:

Delaware Valley Regional Planning Commission
190 North Independence West
Philadelphia, PA 19106-1572
Phone: 215-592-1800
Fax: 215-592-9125
Internet: www.dvrpc.org

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Suzanne McCarthy, Project Planner	215-238-2934	smccarthy@dvrpc.org
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for the TOWNSHIP of

MANNINGTON

SALEM COUNTY, NEW JERSEY

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Regional Planning
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