NATURAL RESOURCE INVENTORY / ENVIRONMENTAL RESOURCE INVENTORY

MILLSTONE TOWNSHIP
MONMOUTH COUNTY, NEW JERSEY

PREPARED FOR:

MILLSTONE TOWNSHIP

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TABLE OF CONTENTS

LIST OF TABLES

PAGE

LIST OF FIGURES

APPENDIX

A. PHOTOGRAPHS OF MILLSTONE TOWNSHIP

B. NATURAL HERITAGE DATABASE RESULTS

C. SOILS OF MILLSTONE TOWNSHIP

D. AERIAL PHOTOGRAPHS

INTRODUCTION

A Natural Resource Inventory was last prepared for Millstone Township in 1992 which addressed the following topics: Land Use, Climate, Air Quality, Soils, Surface Water Quality, and Wells. A 1991 Natural Resource Inventory was prepared for the Township which addressed: Vegetation; Wildlife; and Wetlands. Millstone Township contracted environmental firms to perform studies within the Township including a Watershed Assessment report in 2002 and an Evaluation of Groundwater Resources in 2003.

Millstone officials recognize that many changes have occurred within the Township physically through ongoing development and open space acquisition; and legally with the implementation of new local ordinances, Monmouth County and State regulations. Millstone Township retained the firm Leon S. Avakian, Inc. to prepare an updated Natural Resource Inventory/Environmental Resource Inventory (NRI/ERI) for the Township. This NRI/ERI will not only update all of the aforementioned topics but also include: Open Space/Conservation Easements/Horse Trail Networks; Critically Sensitive Areas; Existing Contaminated Sites; Evaluation of Groundwater Resources; and updated Township Maps including GIS mapping.

An updated and comprehensive NRI/ERI will assist in the preservation and protection of Millstone Township's rural environment, threatened and endangered animal and plant habitats, and other natural resources; all of which contribute to the health and well being of the public. A current, consolidated NRI/ERI will provide the local approving agencies a vital tool to make appropriate decisions for smart, environmentally conscious growth.

This Natural Resource Inventory and Environmental Resource Inventory was prepared with the assistance of a grant from the Association of New Jersey Environmental Commissions (ANJEC).

LAND USE

Millstone Township is located in the southwestern portion of Monmouth County, New Jersey. The Township which was established February 28, 1844, is comprised on 23,700 acres or 37.36 miles of "rolling countryside." Neighboring communities include Monroe, Manalapan, Freehold, Upper Freehold, Jackson, Roosevelt and East Windsor Townships. The 2000 U.S. Census listed the population of Millstone to be 8,970 with a total of 2,708 households. According to petitioned 2004 U.S. Census records, the population of Millstone was 9,882 with a total of 3,196 households in 2004 (per the Township Tax Assessor). Like most municipalities within the State, Millstone Township is a growing community. As the Township attracts more residents, it is essential that proper planning be utilized to keep the integrity of the natural community healthy.

Millstone Township is an environmentally sensitive community. It is located within five (5) of the twenty (20) watershed management areas (WMA's) in the state, including the Lower Raritan, South River, and Lawrence (WMA 9); the Millstone (WMA 10); the Central Delaware (WMA 11); the Barnegat Bay (WMA 13) and the Assiscunk, Crosswicks and Doctors (WMA 20). The WMA's identified by the NJDEP include not only the surface waters and receiving waterways, but the entire land areas that drain into bodies of water such as streams, creeks, lakes and rivers. The land areas may be wooded, hilly and sloped, agricultural and other areas that have been developed.

In the past, the water quality in Millstone was recognized as one of the highest in the state. Additionally, the Township serves as a recharge area and headwaters for one of the fastest growing regions in the State. Recognizing these facts, the current and past administration have been very active in protecting the environmental characteristic of the town through zoning designation; being proactive in the incorporation of stormwater management regulations; and in the acquisition of open space and farmland preservation.

The Township Master Plan notes that "development should be designed to preserve open space and established woodlands and to protect environmentally sensitive areas. Major

developments should be designed in such a way that they will have minimal effect on the flow of traffic on the existing road system. Design techniques such as reverse frontage with conservation easements for homes along existing roads, residential density development concepts for single family uses, provisions to avoid monotony in housing appearance, reduced improvement standards for roads and drainage in exchange for larger lot sizes, and similar approaches should be used."

The primary objectives of the Township Land Use Plan are to maintain the rural character of the Township; preserve farmland and open space; and to protect the environment. To achieve these goals, two new planning areas were adopted into ordinance in 2003; the RU-P Rural Preservation Area and the RU-C Rural Conservation Areas.

The RU-P Zone covers approximately 47% of the Township land area. These areas consist of large tracts, typically greater than 10 acres, of existing farmland and prime agricultural soils. The RU-P Zone requires a minimum of 10 acres per dwelling unit. Lot size averaging and residential clustering are permitted on qualifying parcels. As an incentive to utilize the cluster provision of the ordinance, bonus lots are offered in exchange for dedicating 70% of the land area to farmland and/or open space. In an effort to ensure that buildable land is preserved, a condition is placed that a minimum of 50% of the open space area can not contain freshwater wetlands, wetland buffers, 100-year flood plains, areas of topographic slopes 15% or greater and/or stream corridor buffers required by Delaware & Raritan Canal Commission, Millstone Township, Monmouth County and/or the State of NJ.

The RU-C Zone covers approximately 2% of the Township land area. Regular and qualified farms represent the largest percentage of this area; however it also includes some substantial tracts of vacant land associated with environmentally sensitive areas such as wetlands, floodplains and headwater areas. The RU-C Zone requires a minimum of 6 acres per dwelling unit. Lot size averaging and residential clustering is permitted on qualifying parcels. As an incentive to utilize the cluster provision of the ordinance, bonus lots are offered in exchange for dedicating 75% of the land area to farmland and/or open

space. Like the RU-P Zone, in an effort to ensure that buildable land is preserved, a condition is placed that a minimum of 50% of the open space area can not contain freshwater wetlands, wetland buffers, 100-year flood plains, areas of topographic slopes 15% or greater and/or stream corridor buffers required by Delaware & Raritan Canal Commission, Millstone Township, Monmouth County and/or the State of NJ. The current zoning map is shown in Figure 1.

Additionally, Millstone Township adopted a new Land Use Ordinance in 2005 to provide monuments along conservation easements. The monuments will help to prevent homeowners from clearing woodlands that are contained within a conservation easement on their property.

There is a variety of existing land uses within the Township of Millstone. Farmland comprises the largest use occupying approximately 41.24% of the total land area. Figure 2 identifies existing farmland within Millstone Township per the Township Tax Assessor records. Residential use is the second largest use in the Township, occupying approximately 31.26%. Commercial and industrial use occupies a combined 1.95% of land area.

Current Land Use data was obtained from the computerized records of Millstone Township Tax Assessor on October 31, 2005. The following table provides a breakdown of current land use by acreage and by percentage of total land area.

Table One

Existing Land Use

Land Use	Acreage	Percentage of Land Area
Residential	7,126	31.26%
Commercial	409	1.80%
Industrial	35	0.15%
Vacant	2158	9.47%
Farm – Regular	299	1.31%
Farm – Qualified Farmland Assessment	9,102	39.93%
Public School	30	0.13%
Other School Property	15	0.07%
Public Property	3,400	14.92%
Churches & Charities	21	0.09%
Cemeteries & Graveyards	35	0.15%
Other Exempt Properties	165	0.72%
Total	22,795	100.00%

In 1992, based on Tax Assessor records, approximately 72.5% of the Township was comprised of either farmland or vacant land and only 19% was occupied by residential, commercial or industrial use. The current land use indicates that 50.7% of the Township is now comprised of farmland or vacant land, a decline of 21.8% from 1992. Additionally, the current percentage of land use dedicated to residential, commercial or industrial use is 33.2%, indicating a rise of 14.2% since 1992.

Proper land planning and preservation of open space is essential in maintaining the quality of the Township's natural resources. The addition of the RU-P and RU-C zones; allowance of clustering new developments along with mandatory preservation of open space on the development tract; the requirements of conservation easements and horse trail easements; and the success of open space land acquisition and farmland preservation are key elements to attaining the goals set within the Township Master Plan and proper land use planning.

WETLANDS

Wetlands are generally thought to be areas of standing water such as swamps, marshes or bogs. However, many wetlands do not have standing water present throughout the year. Some wetland areas have temporary flooding while others have a high seasonal water table with no surface water present. The New Jersey Department of Environmental Protection defines a wetland as "an area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation" (NJSA 13:9B-3).

For many years, wetlands were thought of as wasted land that should be drained for farming or filled in for development. By the 1970s and 1980s, more than half of the nation's wetlands had been destroyed. The loss of wetlands was accompanied by the decline or extinction of several animal and plant species, an increase in flood damage and a deterioration of water quality. Wetlands contribute to the social, economic and environmental health of our community in many ways. Wetlands filter out chemicals, pollutants and sediments that would pollute our drinking water. Wetlands provide natural flood control by absorbing runoff from heavy rain storms and melting snow. During droughts, wetlands release stored flood waters. Wetlands provide critical habitat for many of our State's fish and wildlife, including endangered, commercial and recreational species. Wetlands provide high quality open space for recreational purposes as well as tourism.

In July of 1987, the New Jersey legislature passed the New Jersey Freshwater Wetlands Protection Act. The Act took effect on July 1, 1988 and gave the State the authority to regulate all activities within freshwater wetlands and their adjacent upland transition areas. No work may occur within a freshwater wetland or transition area without a permit approved by the NJDEP. The absence or presence of freshwater wetlands and/or transition areas must be identified prior to any proposed development or land improvement.

The US Army Corps of Engineers (USACOE) in conjunction with the US Environmental Protection Agency (USEPA), the US Fish and Wildlife Service (USFWS) and the USDA Soil Conservation Service (SCS) formed the Federal Interagency Committee for Wetland Delineation (FICWD). This committee created a methodology for delineating wetlands. The procedures are outlined in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands (January, 1989). The manual was adopted by the NJDEP as the technical basis for delineating wetlands in New Jersey.

In accordance with this manual, three parameters are indicative of wetlands: 1) the area is dominated by hydrophytic vegetation; 2) the substrate is hydric soil; and 3) evidence of hydrology.

A hydrophyte is any plant that can grow, effectively compete, reproduce, and/or persist in areas that are subject to prolonged inundation or saturated soil conditions. Many plant species will tolerate a variety of growing conditions; therefore individual species are not always restricted to wetland or upland communities. The USFWS produced a publication entitled "National List of Plant Species That Occur in Wetlands: Northeast Region" in May of 1988. Plant classifications are as follows:

Classification	Occurrence in Wetlands
Obligate (OBL)	> 99 %
Facultative Wet (FACW)	67 % - 99 %
Facultative (FAC)	34 % - 66 %
Facultative Upland (FACU)	1 % - 33 %
Upland (UPL)	< 1 %

Hydrophytic vegetation is present if greater than fifty percent of the dominant plant species are classified as OBL, FACW and/or FAC. When all dominant species are FAC or the number of species wetter than FAC equals the number of species drier than FAC, the wetland determination is based on the soil and hydrology parameters. Occasionally greater than fifty percent of the dominant plant species are classified as FACU and/or UPL, however the soils are hydric and wetland hydrology is present. The area would be

considered a wetland, because in some locations, FACU species will grow in wetlands. If the dominant plants are FACU and/or UPL, yet no hydric soils or wetland hydrology exist; the area is considered to be upland.

Hydric soil is defined as "a soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic vegetation" (US Department of Agriculture (USDA) Soil Conservation Service (SCS) 1985, as amended by the National Technical Committee for Hydric Soils (NTCHS) in December 1986). Hydric soils are classified into two broad categories: organic (histosols) and mineral. Histosols develop in locations of nearly continuous saturation and/or inundation. Organic hydric soils are commonly referred to as peat and muck. All other hydric soils are mineral soils. Mineral soils have a broad range of textures (sandy to clayey) and colors (red to gray). Mineral soils are considered hydric when they are periodically saturated for an adequate time period to produce chemical and physical soil properties associated with a reducing environment. They are usually gray and/or mottled immediately below the surface horizon or have thick, dark-colored surface layers overlying gray or mottled subsurface horizons.

The presence or absence of hydric soil is determined in the field with a hand-held auger. Soils are typically examined to a depth of twenty inches. Hydric soils are identified by low chroma color (gleyed soils), the presence of mottling, accumulation of organic matter, and/or a high water table. Gleyed soil is a result of anaerobic conditions which cause a distinct chemical reduction of iron, manganese, and other elements, thus producing gray soil colors. Mottles are defined as "marked with spots of contrasting color." Soils that have brightly colored mottles and a low matrix chroma indicate a fluctuating water table.

Some soils such as those with a significant coloration due to the nature of the parent material, sandy soils and alluvial soils require more careful evaluation under the procedures for problem area wetlands outlined by the Federal Manual for Identifying and Delineating Jurisdictional Wetlands.

Although the soil survey prepared by the Soil Conservation Service is a useful tool to estimate the location of wetlands on a site, it is not an acceptable substitution for performing a field soil survey to determine the presence or extent of hydric soils and wetlands.

Evidence of hydrology is sometimes difficult to determine, however examples include: drainage patterns, drift lines, sediment deposition, watermarks, stream gage data and flood predictions, historic records, visual observation of saturated soils, and visual observation of inundation. Hydrology varies with the season and amount of recent precipitation. Therefore, the hydrology criteria cannot always be a major determining factor, but it assists in the final verification of a wetland limit. Hydrologic indicators can be obtained from recorded data and field data. Recorded data may be obtained from aerial photographs, soil survey maps, floodplain delineations, stream/tidal/lake gauge data, and historical records. Field data may include: visual observations of inundation of water; soil saturation, watermarks on woody vegetation or fixed objects, such as fences, posts, etc.; drift lines; sediment deposits; and/or drainage patterns within the wetlands.

In order to determine a definitive wetland area, an application for a Letter of Interpretation (LOI) must be submitted to the New Jersey Department of Environmental Protection Land Use Regulation Program (LURP). The Department issues three types of LOIs: 1) a presence/absence LOI for a site or portion of a site; 2) a line delineation LOI for a site that is less than one acre; and 3) a line verification LOI. All applications require the following: a LURP application form; a fee; proof of public notification; copies of the USGS quadrangle map, street map, tax map, and county soil survey map outlining the site; color photographs; and a copy of all past NJDEP approvals for activities on the site. An application for a line delineation LOI also requires a survey. For a line verification LOI, a survey or site plan with several additional items is required. If wetlands do exist on a property, the NJDEP will verify that the wetland delineation submitted with the application is accurate as shown on the wetland plan and will assign a resource value to the wetland. The Freshwater Wetlands Protection Act requires the NJDEP to regulate virtually all activities proposed within a wetland; however some minor activities may be

authorized by the issuance of a general permit. A listing of general permits required to perform activities within a freshwater wetland is provided within the NJAC 7:7A-5.

The NJDEP classifies wetlands by three resource values: 1) exceptional resource value; intermediate resource value; or ordinary resource value. The resource value is utilized in determining the size of the transition area, evaluating alternatives to the proposed activity and in ascertaining the amount and/or type of mitigation that may be required.

A freshwater wetland is assigned an exceptional resource value in the following circumstances:

1. The wetland discharges into FW1 or FW2 trout production waters or their tributaries;
2. The wetland is presently known to be habitat for threatened or endangered species; or
3. The wetland is documented as habitat for threatened or endangered species and continues to be suitable for breeding, resting or feeding by these species.

The NJDEP identifies documented or present habitat for threatened or endangered species in the resource determination based on the Natural Heritage Program Database and on the Landscape Project, which identifies habitat areas that are required to support local populations of rare species.

The standard width of a transition area adjacent to a freshwater wetland that has been classified as an exceptional resource value is 150 feet. This width may only be modified with the issuance of a Transition Area Waiver.

A freshwater wetland is assigned an ordinary resource value in the following situations:

1. The wetland does not meet any of the requirements to be classified as an exceptional resource value;

2. The wetland is considered isolated in accordance with the requirements set forth in the New Jersey Administrative Code (N.J.A.C.) 7:7A-1.4;
3. The wetland is a drainage ditch;
4. The wetland is a swale; or
5. The wetland is a man made detention facility and was created in an area that was once uplands.

A freshwater wetland with an ordinary resource value has no required transition area.

Any freshwater wetland that is not defined as exceptional or ordinary is a freshwater wetland of intermediate resource value. The standard width of a transition area adjacent to a freshwater wetland of intermediate resource value is 50 feet. This width may only be modified with the issuance of a Transition Area Waiver.

A transition area functions as an ecological zone between uplands and wetlands which provides temporary refuge for wildlife during periods of high water; provides critical habitat for animals that do not reside in but depend on wetlands; and protects the wetlands boundary which may vary over time due to hydrological factors or changes in climate. The transition area also protects the wetland by acting as a buffer from the sediment and stormwater resulting from development. The NJDEP regulates most activities within a transition area. There are some activities that may be permitted within a transition area with the issuance of a general permit by the NJDEP.

A Transition Area Waiver is a permit issued by the NJDEP authorizing regulated activities in accordance with N.J.A.C. 7:7A-2.6 within a transition area. There are several types of transition area waivers. Some change the shape or size of a transition area while others allow certain regulated activities within the transition area.

There are several sources that can be utilized to perform a preliminary wetland assessment for a site including a review of the Landscape Project; soil survey maps, USGS quadrangle maps and the USGS quarter quadrangle maps. Although these

references are a useful tool for a preliminary assessment, they are not a substitution for a field survey of the property. Prior to planning a development, a field investigation by a qualified individual should be performed to determine if wetlands are present on or adjacent to the property. If wetlands are present on or within 150 feet of the subject property, an application for a Letter of Interpretation is a requirement.

The Landscape Project identifies both emergent and forested wetlands throughout the State. Freshwater wetlands throughout Millstone Township based on the NJDEP Landscape Project are shown in Figure 3.

VEGETATION

Due to varied topography, soil type, soil moisture content and physiographic location, there is a wide diversity of vegetative species within Millstone Township. In 1990, Millstone Township contracted an environmental firm, Amy S. Greene Environmental Consultants, Inc. (ASG) to perform detailed field surveys and prepare a Natural Resource Inventory for three major topics: vegetation, wildlife and wetlands throughout the Township. ASG conducted detailed vegetation surveys in various locations throughout the Township representative of six vegetative communities: Mixed Hardwood Forest; Successional Field; Forested Wetlands; Scrub/Shrub Wetlands; Emergent Wetlands; and Pine Barrens. Study areas did not include commercial, industrial or residential developments since these areas either do not have significant vegetation or have been landscaped with lawns and ornamental species.

In 1994, the New Jersey Department of Environmental Protection adopted a "landscape level approach" to imperiled species conservation that was created by the Division of Fish and Wildlife's Endangered and Nongame Species Program. This approach was deemed necessary since New Jersey is one of the most densely populated states in the nation and as population grows, we continue to lose or impact the remaining natural areas of the State. Different habitats function in different ways to protect our natural resources. For example, wetlands assist in lessening the damage from floods and breaking down contaminants in the environment. Forests and grasslands protect the quality of our drinking water, help to purify air and provide areas for outdoor recreation. According to the NJDEP, the goal of the Landscape Project is to "protect New Jersey's biological diversity by maintaining and enhancing imperiled wildlife populations within healthy, functioning ecosystems." The Landscape Project has classified different land cover into five habitat types: Beach; Emergent Wetlands; Forested Wetlands; Forest; and Grassland. Per the Landscape Project database, Millstone Township contains four of the habitat types. No beaches were identified within the Township. The Landscape Project mapping of all land cover habitats throughout the Township is shown in Figure 4. In order to provide the most current vegetation listing, the Landscape Project habitat types will be

utilized within this report. The Pine Barrens vegetative community will be addressed separately.

Due to budget limitations, further vegetation surveys were not possible for the preparation of this report. The vegetation compiled in this report has been accumulated by the NRI prepared by ASG, from information detailed in a Watershed Management Assessment report prepared by Shaw, and from information compiled during site inspections for wetland delineation by this office.

Wetland vegetation occurs in areas that contain wet soil conditions. These areas generally include areas along streams and are caused by frequent flooding and/or a shallow depth to groundwater. Emergent wetlands, commonly referred to as marshes or wet meadows, are typically located in permanently flooded areas including along the bank of a lake or stream or they are located in newly created wetland areas. Emergent wetlands also commonly occur in wetland areas that have been disturbed by natural causes or human interference. In many areas throughout the Township, unplowed portions of agricultural fields with wet soil conditions can be classified as emergent wetlands. The Landscape Habitat classification of 'Emergent Wetlands' includes: agricultural wetlands; former agricultural wetlands (shrub growth present); freshwater tidal marshes; herbaceous wetlands; saline marshes; severely burned wetlands; vegetated dune communities; and wetland rights-of-way. The Landscape Project mapping of Emergent Wetlands throughout the Township is shown in Figure 5. A listing of the dominant plant species occurring within the Emergent Wetland vegetative community is shown below:

Table 2 - Dominant Plant Species within Millstone Township

EMERGENT WETLANDS

Common Name	Botanical Name
GROUND COVER	
American Burreed	*Sparganium americanum*
Arrow Arum	*Peltandra virginica*
Arrow-leaved Tearthumb	*Polygonum sagittatum*
Beardgrass	*Eulalia viminea*
Bladder Sedge	*Carex intumescens*
Blue Flag	*Iris versicolor*
Blue-Joint Reedgrass	*Calamagrostis canadensis*
Boneset	*Eupatorium perfoliatum*
Branching Burreed	*Sparganium androcladum*
Bristly Blackberry	*Rubus hispidus*
Broadleaf Arrowhead	*Sagittaria latifolia*
Bugleweed	*Lycopus virginicus*
Burreed	*Sparganium spp.*
Clearweed	*Pilea pumila*
Common Cattail	*Typha latifolia*
Common Duckweed	*Lemna minor*
Common Reedgrass	*Phragmites australis*
Common Rush	*Juncus effusus*
Deer Tongue Grass	*Dichanthelium clandestinum*
Eastern Blue-Eyed Grass	*Sisyrinchium atlanticum*
False Nettle	*Boehmeria cylindrica*
Flat topped Goldenrod	*Euthamia graminifolia*
Fox Sedge	*Carex vulpinoidea*
Fringed Sedge	*Carex crinita*
Goldthread	*Coptis trifolia*
Hairy Willowherb	*Epilobium hirsutum*
Halberd-Leaved Tearthumb	*Polygonum arifolium*
Ladies Thumb	*Polygonum persicaria*
Lady Fern	*Athyrium felix-femina*
Mannagrass	*Glyceria spp.*
Marsh Fern	*Thelypteris thelypteroides*
Meadowsweet	*Spiraea latifolia*
Netted Chain Fern	*Woodwardia areolata*
New England Aster	*Aster novae-angliae*
Painted Broom Sedge	*Carex scoparia*
Pickerelweed	*Pontederia cordata*
Pennsylvania Smartweed	*Poygonum pensylvanicum*
Porcupine Sedge	*Carex inflata*
Purple Loosestrife	*Lythrum salicaria*
Reed Canary Grass	*Phalaris arundinacea*
Rice Cutgrass	*Leersia oryzoides*
Rough Bedstraw	*Galium asprellum*

Common Name	Botanical Name
Roughleaf Goldenrod	*Solidago patula*
Royal Fern	*Osmunda regalis*
Sallow Sedge	*Carex lurida*
Seedbox	*Ludwigia alternifolia*
Sensitive Fern	*Onoclea sensibilis*
Skunk Cabbage	*Symplocarpus foetidus*
Slender Rush	*Juncus tenuis*
Smooth Goldenrod	*Solidago gigantea*
Soft-Stem Bulrush	*Scirpus validus*
Spatterdock	*Nuphar advena*
Spikerush	*Eleocharis spp.*
Spotted Jewelweed	*Impatiens capensis*
Stalk-Grain Sedge	*Carex stipata*
Swamp Milkweed	*Asclepias incarnata*
Sweetflag	*Acorus calamus*
Switchgrass	*Panicum virgatum*
Tall Meadow Rue	*Thalictrum pubescens*
Tickseed Sunflower	*Bidens aristosa*
Tussock Sedge	*Carex stricta*
Twisted Yellow-Eyed Grass	*Xyris torta*
Water Hoarhound	*Lycopus americanus*
Water Shield	*Brassenia schreberi*
Woolgrass	*Scirpus cyperinus*
Yellow Fruited Sedge	*Carex annectens*
Yellow Iris	*Iris pseudacorus*
SHRUBS	
Bristly blackberry	*Rubus setosus*

Forested wetlands are typically found on floodplains and at the headwaters of streams where the groundwater table fluctuates seasonally. The majority of the forested wetlands throughout the Township contain a canopy comprised of deciduous hardwoods. Scrub/shrub wetland areas occur in wet areas that are less frequently inundated with water than the emergent wetlands. Scrub/shrub wetlands are commonly found between emergent and forested wetlands. The Landscape Habitat classification of 'Forested Wetlands' includes: Atlantic white-cedar swamps; coniferous scrub/shrub wetlands; coniferous wooded wetlands; deciduous scrub/shrub wetlands; deciduous wooded wetlands; mixed forested wetlands; and mixed scrub/shrub wetlands. The Landscape Project mapping of Forested Wetlands throughout the Township is shown in Figure 6. A listing of the dominant plant species occurring within the Forested Wetland vegetative community is shown below:

Table 3 - Dominant Plant Species within Millstone Township

FORESTED WETLANDS

Common Name	Botanical Name
GROUND COVER	
Beardgrass	*Eulalia viminea*
Blue Flag	*Iris versicolor*
Cinnamon Fern	*Osmunda cinnamomea*
Jack-in-the-Pulpit	*Arisaema triphyllum*
Jack-In-The-Pulpit	*Arisaema triphyllum*
Japanese Stiltgrass	*Microstegium vimineum*
Leconte's Violet	*Viola affinis*
Marsh Fern	*Theylpteris thelypteroides*
New York Fern	*Thelypteris noveboracensis*
Putty Root	*Aplectrum hyemale*
Royal Fern	*Osmunda regalis*
Rush	*Juncus spp.*
Sedge	*Carex spp.*
Sensitive Fern	*Onoclea sensibilis*
Skunk Cabbage	*Symplocarpus foetidus*
VINES	
Common Greenbrier	*Smilax rotundifolia*
Frost Grape	*Vitis vulpina*
Japanese Honeysuckle	*Lonicera japonica*
Poison Ivy	*Toxicodendron radicans*
SHRUBS	
Autumn Olive	*Elaeagnus umbellata*
Buttonbush	*Cephalanthus occidentalis*
Common Elderberry	*Sambucus canadensis*
Cranberry Viburnum	*Viburnum trilobum*
Fetterbush	*Leucothoe racemosa*
Highbush Blueberry	*Vaccinium corymbosum*
Inkberry	*Ilex glabra*
Northern Arrowwood	*Viburnum dentatum*
Red Osier Dogwood	*Cornus stolonifera*
Silky Dogwood	*Cornus amomum*
Smooth Alder	*Alnus serrulata*
Spicebush	*Lindera benzoin*
Staggerbush	*Lyonia mariana*
Steeplebush	*Spiraea tomentosa*
Swamp Azalea	*Rhododendron viscosum*
Swamp Rose	*Rosa palustris*
Sweet Pepperbush	*Clethra alnifolia*
Sweetbay Magnolia	*Magnolia virginiana*
Winterberry	*Ilex verticillata*

Common Name	Botanical Name
Winterberry	*Ilex verticillata*
TREES	
American Holly	*Ilex opaca*
Atlantic White-Cedar	*Chamaecyparis thyoides*
Black Willow	*Salix nigra*
Blackgum	*Nyssa sylvatica*
Box Elder	*Acer negundo*
Common Witch Hazel	*Hamamelis virginiana*
Green Ash	*Fraxinus pennsylvanica*
Grey Birch	*Betula populifolia*
Ironwood	*Carpinus caroliniana*
Norway Maple	*Acer platanoides*
Pin Oak	*Quercus palustris*
Red Maple	*Acer rubrum*
River Birch	*Betula nigra*
Silver Maple	*Acer saccharinum*
Speckled Alder	*Alnus rugosa*
Swamp White Oak	*Quercus bicolor*
Sweetbay Magnolia	*Magnolia virginiana*
Sweetgum	*Liquidambar styraciflua*
Sycamore	*Platanus occidentalis*
Weeping Willow	*Salix babylonica*
Willow Oak	*Quercus phellos*

Mixed hardwood forest dominates the ridges and side slopes that occur within the central portion of the Township. This upland vegetative community can also be found bordering or intermixed with forested wetlands. The mixed hardwood forest represents the most mature stage in the natural succession of the plant communities; however does include several stages of upland forest from early to mature succession. The Landscape Habitat classification of 'Forest' includes: coniferous brush/shrubland; coniferous forest; deciduous brush/shrubland; mixed deciduous/coniferous brush/shrubland; mixed forest; old fields (>25% brush covered); plantation; and severely burned upland vegetation. The Landscape Project mapping of Forest Habitats throughout the Township is shown in Figure 7. A listing of the dominant plant species occurring within the Forest vegetative community is shown below:

Table 4 - Dominant Plant Species within Millstone Township

FOREST

Common Name	Botanical Name
GROUND COVER	
Beardgrass	*Eulalia viminea*
Bracken Fern	*Pteridium aquilinum*
Canada Mayflower	*Maianthemum canadense*
Christmas Fern	*Polystichium acrostichoides*
Common Blue Violet	*Viola papilionacea*
Enchanter's Nightshade	*Circaea lutetiana*
False Solomon's Seal	*Smilacina racemosa*
Garlic Mustard	*Allaria petiolata*
Ground Cedar	*Lycopodium tristachyum*
Hay-Scented Fern	*Dennstaedtia punctilobula*
Indian Cucumber	*Medeola virginiana*
Jack-in-the-Pulpit	*Arisaema triphyllum*
Marginal Shield Fern	*Dryopteris marginalis*
Moccasin Flower	*Cypripedium acaule*
New York Fern	*Thelypteris noveboracensis*
Rattlesnake Fern	*Botrychium virginianum*
Rue Anemone	*Thalictrum thalictroides*
Sarsaparilla	*Aralia nudicaulis*
Solomon's Seal	*Polygonatum biflorum*
Spotted Wintergreen	*Chimaphila maculata*
Trailing Arbutus	*Epigaea repens*
Winterberry	*Gaultheria procumbens*
VINES	
Catbrier	*Smilax glauca*
Fox Grape	*Vitis labrusca*
Poison Ivy	*Toxicodendron radicans*
Summer Grape	*Vitis aestivalis*
Virginia Creeper	*Parthenocissus quinquefolia*
SHRUBS	
Allegheny Blackberry	*Rubus alleghaniensis*
Arrowwood	*Viburnum dentatum*
Blackhaw Viburnum	*Viburnum prunifolium*
Dangleberry	*Gaylussacia frondosa*
Maple-Leaved Viburnum	*Viburnum acerifolium*
Mountain Laurel	*Kalmia latifolia*
Multiflora Rose	*Rosa multiflora*
Spicebush	*Lindera benzoin*
Staghorn Sumac	*Rhus typhina*

Common Name	Botanical Name
TREES	
American Beech	*Fagus grandifolia*
American Chestnut	*Castanea dentata*
American Holly	*Ilex opaca*
Black Birch	*Betula lenta*
Black Cherry	*Prunus serotina*
Black Locust	*Robinia pseudoacacia*
Black Oak	*Quercus velutina*
Black Walnut	*Juglans nigra*
Blackjack Oak	*Quercus marilandica*
Box Elder	*Acer negundo*
Chestnut Oak	*Quercus prinus*
Cottonwood	*Populus deltoides*
Eastern Hemlock	*Tsuga canadensis*
Eastern Red Cedar	*Juniperus virginiana*
Eastern White Pine	*Pinus strobus*
Flowering Dogwood	*Cornus florida*
Gray Birch	*Betula populifolia*
Hackberry	*Celtis occidentalis*
Ironwood	*Carpinus caroliniana*
Mockernut Hickory	*Carya tomentosa*
Northern Red Oak	*Quercus rubra*
Norway Maple	*Acer platanoides*
Pignut Hickory	*Carya glabra*
Pin Oak	*Quercus palustris*
Pitch Pine	*Pinus rigida*
Post Oak	*Quercus stellata*
Red Maple	*Acer rubrum*
Red Mulberry	*Morus rubra*
Red Pine	*Pinus resinosa*
River Birch	*Betula nigra*
Sassafras	*Sassafras albidum*
Scarlet Oak	*Quercus coccinea*
Scots Pine	*Pinus sylvestris*
Shadbush	*Amelanchier canadensis*
Shagbark Hickory	*Carya ovata*
Silver Maple	*Acer saccharinum*
Sweet Cherry	*Prunus avium*
Sweetgum	*Liquidambar styraciflua*
Tulip Poplar	*Liriodendron tulipifera*
White Ash	*Fraxinus americana*
White Oak	*Quercus alba*
Witch Hazel	*Hamamelis virginiana*

The successional field community type includes upland areas that are dominated by shrub or herbaceous vegetation. Some tree saplings may exist in these areas, however they do not predominate. Successional fields often occur in open areas that are not maintained; changes in species composition will occur over time. The Landscape Habitat classification of 'Grassland' includes: confined feeding operations; orchards/vineyards/ nurseries/horticultural areas; cropland and pastureland; other agriculture; other urban or built-up land; and some areas of transportation/communications/utilities. The Landscape Project mapping of Grassland Habitats throughout the Township is shown in Figure 8. A listing of the dominant plant species occurring within the Grassland vegetative community is shown below:

Table 5 - Dominant Plant Species within Millstone Township

GRASSLAND

Common Name	Botanical Name
GROUND COVER	
Beardgrass	*Eulalia viminea*
Bermuda Grass	*Cynodon dactylon*
Broom Sedge	*Andropogon virginicus*
Bull Thistle	*Cirsium vulgare*
Canada Goldenrod	*Solidago canadensis*
Canada Thistle	*Cirsium arvense*
Canadian Bluegrass	*Poa compressa*
Carolina cranesbill	*Geranium carolinianum*
Chickweed	*Stellaria media*
Cocklebur	*Xanthium strumarium*
Common Cinquefoil	*Potentilla simplex*
Common Milkweed	*Asclepias syriaca*
Common Plantain	*Plantago major*
Common St. John's Wort	*Hypericum perforatum*
Cow Vetch	*Vicia cracca*
Crab Grass	*Digitaria sanguinalis*
Field Garlic	*Allium vineale*
Curled Dock	*Rumex crispus*
Deptford Pink	*Dianthus armeria*
Downy Chess	*Bromus tectorum*
Dwarf Cinquefoil	*Potentilla canadensis*
Enchanter's Nightshade	*Circaea lutetiana*
English Plantain	*Plantago lanceolata*
Evening Primrose	*Oenothera biennis*
Small White Aster	*Aster vimineus*

Common Name	Botanical Name
Wild Garlic	*Allium canadense*
Field Mustard	*Brassica rapa*
Fleabane	*Erigeron philadelphicus*
Foxtail	*Setaria faberi*
Garlic Mustard	*Alliaria petiolata*
Great Ragweed	*Ambrosia trifida*
Groundnut	*Apios americana*
Horseweed	*Conyza canadensis*
Indian Strawberry	*Duchesnea indica*
Japanese Brome	*Bromus japonicus*
Japanese Stilt Grass	*Microstegium vimineum*
Kentucky Bluegrass	*Poa pratensis*
Ladies Thumb	*Polygonum persicaria*
Lamb's Quarters	*Chenopodium album*
Large Bracted Plantain	*Plantago aristata*
Little Bluestem	*Schizachyrium scoparium*
Moth Mullein	*Verbascum blattaria*
Mugwort	*Artemisia vulgaris*
New England Aster	*Aster novae-angliae*
Northern Dewberry	*Rubus flagellaris*
Orchard Grass	*Dactylis glomerata*
Panic Grass	*Dichanthelium spp.*
Pepper Grass	*Lepidium campestre*
Pokeweed	*Phytolacca americana*
Purple Love-Grass	*Eragrostis spectabilis*
Queen Anne's Lace	*Daucus carota*
Rabbit's Foot Clover	*Trifolium arvense*
Ragweed	*Ambrosia artemisiifolia*
Red Clover	*Trifolium pratense*
Rough Goldenrod	*Solidago rugosa*
Sheep Sorrel	*Rumex acetosella*
Late Goldenrod	*Solidago gigantea*
Strawberry	*Fragaria virginiana*
Sweet Vernal Grass	*Anthoxanthum odoratum*
Switchgrass	*Panicum virgatum*
Tall Goldenrod	*Solidago altissima*
Velvet Grass	*Holcus lanatus*
Venus' Looking Glass	*Triodanis perfoliata*
White Clover	*Trifolium repens*
White Sweet Clover	*Melilotus alba*
Yarrow	*Achillea millefolium*
Yellow Pond Lily	*Nuphar variegatum*
Yellow Foxtail	*Setaria glauca*
Wintercress	*Barbarea vulgaris*
VINES	
Japanese Honeysuckle	*Lonicera japonica*
Poison Ivy	*Toxicodendron radicans*
Tartarian Honeysuckle	*Lonicera tatarica*

Common Name	Botanical Name
Virginia Creeper	*Parthenocissus quinquifolia*
SHRUBS	
Autumn Olive	*Elaeagnus umbellata*
Blackberry	*Rubus allegheniensis*
Japanese Barberry	*Berberis thunbergii*
Multiflora Rose	*Rosa multiflora*
Red Raspberry	*Rubus idaeus*
Russian Olive	*Elaeagnus angustifolia*
Staghorn Sumac	*Rhus typhina*
Winged Sumac	*Rhus copallina*
TREES	
Apple	*Malus pumila*
Eastern Red Cedar	*Juniperus virginiana*
Princess Tree	*Paulownia tomentosa*
Quaking Aspen	*Populus tremuloides*
Sassafras	*Sassafras albidum*
Tree of Heaven	*Ailanthus altissima*
Wild Crabapple	*Malus coronaria*

ASG identified an area within the southeastern edge of the Township that is dominated by a vegetation community type typically referred to as Pine Barrens vegetation. The Pine Barrens occupy approximately 2000 square miles of the Outer Coastal Plain in southern New Jersey. The Pine Barrens support vegetation that can thrive in low fertility and drought-prone soils. Rare plants that are adapted to these types of soil conditions and climatic areas are found within the Pine Barrens region. According to ASG, a small portion of the Pine Barrens extends into the southern part of Millstone Township. The Pine Barrens vegetative community includes both wetland and upland species. Whereas the majority of the upland forests in the Township are dominated by a mixture of hardwoods, the Pine Barren uplands are dominated by pines and oaks. The wetland areas of the Pine Barrens community are dominated by hardwood swamp or pitch pine lowlands. A listing of the dominant plant species occurring within the Pine Barrens vegetative community is shown below:

Table 6 - Dominant Plant Species within Millstone Township

PINELANDS HABITAT

Common Name	Botanical Name
GROUND COVER	
Bracken Fern	*Pteridium aquilinum*
Cinnamon Fern	*Osmunda cinnamomea*
Cow Wheat	*Melampyrum lineare*
Goldenrod	*Solidago spp.*
Moccasin Flower	*Cypripedium acaule*
Partidge Berry	*Mitchella repens*
Striped Wintergreen	*Chimaphila maculata*
Trailing Arbutus	*Epigaea repens*
Teaberry	*Gaultheria procumbens*
VINES	
Catbrier	*Smilax glauca*
Common Greenbrier	*Smilax rotundifolia*
Poison Ivy	*Toxicodendron radicans*
SHRUBS	
Azalea	*Rhododendron spp.*
Bayberry	*Myrica pensylvanica*
Black Huckleberry	*Gaylussacia baccata*
Dwarf Blueberry	*Vaccinium angustifolium*
Fetterbush	*Leucothoe racemosa*
Highbush Blueberry	*Vaccinium corymbosum*
Maleberry	*Lyonia ligustrina*
Sheep Laurel	*Kalmia angustifolia*
Spicebush	*Lindera benzoin*
Staggerbush	*Lyonia mariana*
Sweet Pepperbush	*Clethra alnifolia*
Wax Myrtle	*Myrica cerifera*
TREES	
Black Oak	*Quercus velutina*
Blackgum	*Nyssa sylvatica*
Chestnut Oak	*Quercus prinus*
Eastern Red Cedar	*Juniperus virginiana*
Northern Red Oak	*Quercus rubra*
Pin Oak	*Quercus palustris*
Pitch Pine	*Pinus rigida*
Post Oak	*Quercus stellata*
Red Maple	*Acer rubrum*
Scarlet Oak	*Quercus coccinea*
Shortleaf Pine	*Pinus echinata*
Swamp White Oak	*Quercus bicolor*
Sweetbay Magnolia	*Magnolia virginiana*
White Oak	*Quercus alba*

As previously stated, due to budget limitations, further vegetation surveys were not possible for the preparation of this report. The vegetation compiled in this report has been accumulated by the NRI prepared by ASG, from information detailed in a Watershed Management Assessment report prepared by Shaw, and from information compiled during site inspections for wetland delineations by this office.

Unique Communities

ASG also performed a study to determine if any unique communities exist within the Township. This study was based on field investigations and three prior studies: The Natural Features Study (Monmouth County Environmental Council (MCEC), 1975); The Unique Areas Study (MCEC, 1978); and a Draft Monmouth County Open Space Plan (MCOSP, 1990). The study found that although there were no "unique" communities either on a nation-wide or state-wide basis; there are natural areas that may be described as unique due to their limited occurrence within the Township. Those areas include the Pine Barrens community in the southern portion of the Township and three mature, upland forests located in the southwestern and central portions of the Township. The Monmouth County Environmental Council identified Roosevelt Marsh, which is located just outside of the western boundary of the Township, as a unique community. Other unique communities include habitats that contain rare plant or animal species.

The Pine Barrens community is located in the area of Route 537 and Millstone, Carrs Tavern and Brookside Roads. In addition to having a unique vegetative community, the area also has documented habitat for endangered species.

One of the mature, upland forests that was identified as "Area A" (MCOSP, 1990) as a unique community within the Township is located between Clarksburg, Millstone, Agress and Bittner Roads. The dominant species include chestnut oak, white oak, black cherry and red oak in the canopy. The understory is dominated by lowbush blueberry, dwarf huckleberry and mountain laurel. This upland forest is situated on a hill or ridge that has

a steep face on one side and gentle slope on the other, known as a cuesta. Although this geomorphologic feature is not unusual within this region, it is somewhat atypical of the gently rolling and level landscapes of the Township. Currently this area is zoned R-80, R-130 and RU-P and is nearly fully developed. However several conservation easements and wildlife corridors were instituted as part of the subdivision approval process. This area also contains the New Jersey Equine Clinic, an approximately 130 acre parcel that has been preserved with Green Acres funding.

A second mature, upland forest "Area B" (MCOSP, 1990) identified as a unique community is bordered by Clarksburg, Stagecoach and Millstone Roads. The area contains headwaters of Doctor's Creek. This mixed hardwood forest is dominated by oaks. This area is currently zoned R-80, R-130, R-170 and NC and is nearly developed, however several areas have been protected with conservation easements.

The third mature, upland forest "Area C" (MCOSP, 1990) identified as a unique community is bordered by Sweetman's Lane, Millstone, Backbone Hill and Halka Roads. This area contains headwaters of Rocky Brook and the Millstone River. This area is currently zoned R-80, R-130, R-170 and RU-P and is partially developed. There are two mines in this area: one has a valid mine permit and the other is no longer in use.

Although Roosevelt Marsh is located outside of the Township boundary, the Assunpink Creek corridor is located within the Township. Protection of this area is essential in the preservation of the quality of the marsh. The Roosevelt Marsh contains numerous reptile and amphibian species as well as plant species. Portions of the Assunpink Wildlife Management Area are located within Millstone Township and preserved by the State of New Jersey.

Several areas within Millstone Township provide habitat for threatened or endangered species. Numerous sightings of threatened or endangered species have occurred within the state protected Assunpink Wildlife Management Area. Successional fields near I-95 in the southern corner of the Township are known to provide nesting habitat for several

threatened and endangered bird species (Herpetological Associates, 1989). Additionally, many migratory birds utilize forested wetlands along Ivanhoe Brook which was identified as having "high ornithological significance" for New Jersey (Herpetological Associates, 1989).

Several parcels within these areas have been preserved as open space by the Township and/or or the State of New Jersey. The Township Open Space and Farmland Preservation Council has become far more active in acquiring lands for preservation since 2004.

Environmentally Sensitive Areas

All of the areas that were identified by the MCEC and ASG as being unique communities within the Township would also be classified as environmentally sensitive areas within the Township. Additionally stream corridors with their associated wetlands, the Assunpink Wildlife Management Area (AWMA), and all the streams, wetlands and upland forests that are contiguous with the AWMA communities are considered environmentally sensitive areas within the Township.

Stream corridors within the Township include the headwaters of Doctor's Creek, Assunpink Creek, Ivanhoe Brook, Rocky Brook, Manalapan Brook, Metedeconk Creek, Toms River, and Millstone River. The stream corridors and their associated wetlands provide essential habitat for wildlife, including threatened and endangered species; water quality; flood control; and recreation.

Forested areas are important resources for aesthetic quality; wildlife habitat; erosion control; to moderate local climate; to provide wind breaks and shade; and for their trees. Trees provide oxygen and help to reduce carbon dioxide that is emitted through human activities. Forested areas in the eastern portion of the AWMA and within the western boundary of Millstone Township have been confirmed as good habitat for forest interior birds, including many Kentucky warblers (NJ Conservation Foundation, 1990).

Freshwater wetland regulations help to preserve wetland areas and their transition areas; however the preservation of additional lands, including forested tracts is vital to enhance the quality of life within the Township. The conservation buffer requirements that have been established also help to provide wind breaks, shade and wildlife corridors throughout the Township.

Rare Plant Species

The NJDEP developed a listing of plant species that are endangered as a result of habitat destruction, over-collection, pollution or other man-made or natural factors. The list is extensive and preferred habitats of many of the species are present in Millstone Township.

The Natural Heritage Program maintains a database for documented occurrences of rare plant species. In September 2005, the Natural Heritage Database identified two endangered plant species that have been identified within the Township: Swamp Pink (*Helonias bullata*) and Purple Fringeless Orchid (*Platanthera peramoena*).

Swamp Pink is listed as endangered in the State and according to the US Fish and Wildlife Service is designated as federally threatened in its entire range. According to the database, two occurrences were reported; one in August of 2000 and the other in September 2002. Although not provided in the 2005 database results, swamp pink was also found in 2004 as part of an application for development within the Township.

Swamp Pink is an evergreen plant with a basal tuft or rosette of lance-shaped leaves. A cluster of bright pink flowers appears on a large hollow stalk in early spring. Swamp Pink occurs in a variety of wetland habitats including: swampy, forested wetlands bordering meandering streams; headwater wetlands; sphagnous, hummocky, dense Atlantic white-cedar swamps; meadows; bogs; and spring seepage areas. The most evident factor determining the suitability of habitat for Swamp Pink is a constant water supply. The groundwater influenced wetlands that support the species are perennially saturated and

rarely if ever inundated by floodwaters. The water table is at or very near the surface and fluctuates only slightly during spring and summer months.

The Purple Fringeless Orchid is listed as an endangered species in New Jersey. Rose-purple flowers appear on the one to three foot high stem during summer. The Purple Fringeless Orchid occurs in moist meadows and thickets.

The NJDEP Office of Natural Lands Management (ONLM) has identified critically important areas in an effort to conserve biological diversity within the State. Utilizing the Natural Heritage Database, ONLM has identified Natural Heritage Priority Sites which "represent some of the best remaining habitat for rare species and exemplary natural communities in the state." These priority site designations should be strongly considered when analyzing the area for planning and/or potential development.

The Natural Heritage Program has identified the 'JCP&L Swamp' as a Natural Heritage Priority Site which is partially located within Millstone Township (Figures 9 & 10). The boundaries of the JCP&L Swamp site were established in order to protect the wetland habitat that contains the Federally threatened and State endangered species, Swamp Pink (*Helonias bullata*). The JCP&L Swamp has a biological diversity ranking of B4 having a scattered, but widespread occurrence of a federally listed threatened plant species. As of 2005, the JCP&L Swamp is the only Natural Heritage Priority Site within Millstone Township and is within the North Branch of the Metedeconk River watershed, located along the eastern border of the Township.

Although the Natural Heritage Database only listed two endangered plant species documented to exist within the Township, other species may also exist. The Natural Heritage Program only provides previous sightings that were reported. The quantity and quality of the data provided from the NHP relies on observations and research from many individuals and organizations and is not all the result of comprehensive or site-specific vegetation surveys. Some areas have never been thoroughly surveyed and therefore the NHP does not provide a 'definitive' statement on the presence or absence of threatened or

endangered species in any area. Therefore, it is strongly recommended that prior to land development approval, a comprehensive vegetation survey be preformed by a qualified individual and submitted along with the Statement of Environmental Impact and Assessment. The vegetation survey should not be performed during winter months when many herbaceous species are absent. The survey should include all layers of the vegetative community: trees, shrubs, herbaceous species, and ground covers. Any threatened or endangered species that may be located should be reported to the NHP and appropriate measures can then be incorporated into development plans to preserve the rare species.

WILDLIFE

Millstone Township has a variety of vegetative communities including emergent wetlands, forested wetlands, open agricultural fields, successional fields, forested areas and a small area of Pinelands habitat as well as many streams, lakes and ponds. These environments offer food, shelter and breeding areas for a wide diversity of wildlife. The majority of wildlife species will utilize more than one habitat type. An abundant source of food is necessary for a healthy and diverse population of wildlife species. Trees, shrubs, vines and herbaceous plants produce seeds or fruits that provide a vital food source for many species that occur within the Township.

Some species occupy large, continuous tracts of a single habitat. Other species prefer "edge" areas or transition areas between two different vegetative communities. Wildlife corridors such as hedgerows allow species to travel between areas under a protective cover. Buffers along streambeds allow wildlife to move to higher ground during flooding. Water quality is essential to species that depend on wetlands or other aquatic habitats.

Land use has a profound impact on resident wildlife. Agricultural areas will offer food for some animals such as deer, however the limited variety of vegetation will force some animals to find a new feeding area. Pesticides eliminate a large number of insects that are a valuable food resource for some animals. Land clearing for development removes food supply, shelter and breeding areas for species within the area. Increase in human activities is a deterrent for many wildlife species. Although it is impractical to preserve all areas for wildlife, proper land planning will assist in the health and survival of many wildlife species.

In 1991, Amy S. Green Environmental Consultants Inc. (ASG) was contracted by the Township to perform detailed field surveys and prepare a Natural Resource Inventory for three major topics: vegetation, wildlife and wetlands throughout the Township. Wildlife field surveys were conducted during the summer to identify mammals, birds, amphibians and reptiles that reside within the Township. Survey areas represented different

vegetative communities within the Township. Due to budget limitations, further wildlife surveys were not possible for the preparation of this report. The wildlife listing included within this report has been accumulated from the NRI prepared by ASG; from information compiled during various site inspections by this office; and other accounts from personal observations within the Township.

Mammals

Mammalian species occupy the entire range of available habitats within the Township. Some mammal species are highly visible in developed portions of the Township such as the woodchuck, skunk, grey squirrel, raccoon and deer. Other common species are not often encountered, such as shrews, moles and bats. The largest mammal that ASG witnessed within the Township was white-tailed deer and the largest carnivores ASG witnessed within the Township were the red and gray fox. However, in early May of 2005, a black bear was observed in the southern portion of the Township (personal observations Spaziano and Rosati). Coyotes have also been observed within the Township (personal observations Boyce). A listing of mammal species reported by ASG with updates from personal observations follows:

Table 7
Partial List of Mammals That May Occur in Millstone Township

Common Name	Scientific Name
Big Brown Bat	*Eptesicus fuscus*
Black Bear	*Ursus americanus*
Coyote	*Canis latrans*
Deer Mouse	*Peromyscus maniculatus*
Eastern Chipmunk	*Tamias striatus*
Eastern Cottontail Rabbit	*Sylvilagus floridanus*
Eastern Gray Squirrel	*Sciurus carolinensis*
Eastern Mole	*Scalopus aquaticus*
Evening Bat	*Nycticeius humeralis*
Gray Fox	*Urocyon cinereoargenteus*
Least Shrew	*Cryptotis parva*
Little Brown Bat	*Myotis lucifugus*
Long-Tailed Weasel	*Mustela frenata*
Masked Shrew	*Sorex cinereus*
Meadow Jumping Mouse	*Zapus hudsonius*
Meadow Vole	*Microtus pennsylvanicus*
Mink	*Mustela vison*
Muskrat	*Ondatra zibethica*
Raccoon	*Procyon lotor*
Red Fox	*Vulpes fulva*
Red Squirrel	*Tamiasciurus hudsonicus*
Short-Tailed Shrew	*Blarina brevicauda*
Southern Flying Squirrel	*Glaucomys volans*
Star-Nosed Mole	*Condylura cristata*
Striped Skunk	*Mephitis mephitis*
Virginia Oppossum	*Didelphis virginiana*
White-Footed Mouse	*Peromyscus leucopus*
White-Tailed Deer	*Odocoileus virginianus*
Woodchuck	*Marmota monax*
Woodland Vole	*Pitymys pinetorum*

Birds

Avian species occupy all of the vegetative communities within the Township. Common species such as the song sparrow, crow, gray catbird, mourning dove, and American goldfinch are year round residents of the Township and have adapted to human development. Some species occur only during the summer or winter months such as the yellow warbler, golden crowned kinglet, and grosbeaks. Other species are transients, stopping in the Township to rest during their seasonal migration. New Jersey is an important migratory pathway for numerous species of raptors, shorebirds, waterfowl and songbirds. Migration habitat is essential to the survival of the birds. Loss of suitable migration habitat can result in a drastic reduction in species populations.

Human disturbance and development favor some species, while limiting populations of other species that are less adaptable to changes in habitat. Loss of habitat, destruction of wetlands, pesticide use and hunting has led to the imperilment of many avian species which are now listed as threatened or endangered species or as species of special concern. According to the Natural Heritage Program, a total of ten rare bird species: American Kestrel, Barred Owl, Black-Throated Green Warbler, Bobolink, Cooper's Hawk, Grasshopper Sparrow, Northern Parula, Savannah Sparrow, Vesper Sparrow and Yellow-Breasted Chat potentially occur within the Township. These species are addressed within the 'Threatened and Endangered Wildlife and Wildlife Species of Special Concern' section of this report. The following is a listing of avian species reported by ASG with updates from personal observations and their associated habitats: Emergent Wetlands (EM); Forested Wetlands (FW); Forest (F); and Grassland (G):

Table 8 - Partial List of Avian Species and Habitats Observed within Millstone Township

Common Name	Scientific Name	Vegetative Community
American Crow	*Corvus brachyrhynchos*	F, G
American Goldfinch	*Carduelis tristis*	F, G
American Kestrel	*Falco sparverius*	G
American Robin	*Turdus migratorius*	FW, F, G
American Woodcock	*Scolopax minor*	FW, F, G
Barn Swallow	*Hirundo rustica*	G
Barred Owl	*Strix varia*	FW, F
Black Vulture	*Coragyps atratus*	EM, FW, F, G
Black-Billed Cuckoo	*Coccyzus erythropthalmus*	FW, F
Black-Capped Chickadee	*Parus atricapillus*	FW, F, G
Blue Grosbeak	*Guiraca caerulea*	FW, G
Blue Jay	*Cyanocitta cristata*	FW, F, G
Bobolink	*Dolichonyx oryzivorus*	EM, G
Broad-Winged Hawk	*Buteo platypterus*	F
Brown Creeper	*Certhia americana*	F
Brown Thrasher	*Toxostoma rufum*	F, G
Brown-Headed Cowbird	*Molothrus ater*	F, G
Carolina Chickadee	*Parus carolinensis*	FW, F, G
Cedar Waxwing	*Bombycilla cedrorum*	F, G
Chimney Swift	*Chaetura pelagica*	G
Chipping Sparrow	*Spizella passerina*	F, G
Common Flicker	*Colaptes auratus*	F
Common Grackle	*Quiscalus quiscula*	FW, F, G
Common Yellowthroat	*Geothlypis trichas*	FW, F
Cooper's Hawk	*Accipiter cooperii*	F
Dark-Eyed Junco	*Junco hyemalis*	G
Downy Woodpecker	*Picoides pubescens*	F
Eastern Kingbird	*Tyrannus tyrannus*	F, G
Eastern Phoebe	*Sayornis phoebe*	F
Eastern Screech Owl	*Otus asio*	F, G
European Starling	*Sturnus vulgaris*	F, G
Evening Grosbeak	*Coccothraustes vespertinus*	F
Field Sparrow	*Spizella pusilla*	EM, G
Golden Crowned Kinglet	*Regulus satrapa*	F, G
Grasshopper Sparrow	*Ammodramus savannarum*	G
Gray Catbird	*Dumetella carolinensis*	FW, F, G
Great Blue Heron	*Ardea herodias*	EM, FW
Great-Horned Owl	*Bubo virginianus*	F, G
Hairy Woodpecker	*Picoides villosus*	
Hooded Warbler	*Wilsonia citrina*	FW, F
House Finch	*Carpodacus mexicanus*	G
House Sparrow	*Passer domesticus*	G

Common Name	Scientific Name	Vegetative Community
House Wren	*Troglodytes aedon*	G
Indigo Buntin	*Passerina cyanea*	G
Kentucky Warbler	*Oporornis formosus*	F
Killdeer	*Charadrius vociferus*	G
Mourning Dove	*Zenaida macroura*	FW, F, G
Northern Bobwhite	*Colinus virginianus*	FW, F, G
Northern Cardinal	*Cardinalis cardinalis*	FW, F, G
Northern Harrier	*Circus cyaneus*	EM, G
Northern mockingbird	*Mimus polyglottos*	FW, F, G
Northern Oriole	*Icterus galbula*	F
Northern Waterthrush	*Seiurus noveboracensis*	FW
Ovenbird	*Seiurus aurocapillus*	F
Pied-Billed Grebe	*Podilymbus podiceps*	EM
Purple Martin	*Progne subis*	EM, G
Red-Bellied Woodpecker	*Melanerpes carolinus*	FW
Red-Headed Woodpecker	*Melanerpes erythrocephalus*	FW, F
Red-Tailed Hawk	*Buteo jamaicensis*	G
Red-Winged Blackbird	*Agelaius phoeniceus*	EM, FW, G
Rose-Breasted Grosbeak	*Pheucticus ludovicianus*	F
Ruffed Grouse	*Bonasa umbellus*	F
Rufous-Sided Towhee	*Pipilo erythrophthalmus*	EM, FW, F
Savannah Sparrow	*Passerculus sandwichensis*	G
Scarlet Tanager	*Piranga olivacea*	F
Sharp-Shinned Hawk	*Accipter striatus*	F
Song Sparrow	*Melospiza melodia*	EM, FW, G
Tree Swallow	*Tachycineta bicolor*	EM, G
Tufted Titmouse	*Parus bicolor*	FW, F
Turkey Vulture	*Cathartes aura*	EM, FW, F, G
Veery	*Catharus fuscescens*	FW, F
Vesper Sparrow	*Pooecetes gramineus*	G
White-Breasted Nuthatch	*Sitta carolinensis*	F
White-Eyed Vireo	*Vireo griseus*	FW, G
White-Throated Sparrow	*Zonotrichia albicollis*	G
Wood Thrush	*Hylocichla mustelina*	FW, F
Yellow Warbler	*Dendroica petechia*	FW, F

Reptiles and Amphibians

Reptiles and amphibians primarily occupy wetlands, forested areas or old fields within the Township. These species are more secretive and are therefore less frequently encountered. Reptiles and amphibians play an important role in pest management within their habitats often feeding on insects and small rodents such as mice, voles and moles.

Several species of reptiles and amphibians are listed as threatened, endangered or species of special concern within New Jersey due to loss of habitat, destruction of habitat, water pollution and over-collection. Six reptile species: Northern Bog Turtle, Eastern Box Turtle, Spotted Turtle, Wood Turtle, Northern Pine Snake, and Timber Rattlesnake and two amphibian species: Fowler's Toad and Pine Barrens Treefrog are listed as either threatened, endangered or as a species of special concern and have been reported as potentially occurring within the Township. Wood turtle habitat throughout the Township is depicted within the NJDEP GIS mapping of the Landscape Project (Figure 11). The eight aforementioned species will be addressed in further detail within the 'Threatened and Endangered Wildlife and Wildlife Species of Special Concern' section of this report. A listing of reptiles and amphibians reported by ASG follows:

Table 9 - Partial List of Reptiles and Amphibian Species That May Occur Within Millstone Township

Common Name	Scientific Name
Amphibians	
American Toad	*Bufo americanus*
Bullfrog	*Rana catesbeiana*
Eastern Gray Treefrog	*Hyla versicolor*
Fowler's Toad	*Bufo woodhousii fowleri*
Green Frog	*Rana clamitans melanota*
Northern Dusky Salamander	*Desmognathus fuscus fuscus*
Northern Leopard Frog	*Rana pipiens*
Northern Spring Peeper	*Hyla crucifer crucifer*
Red-Backed Salamander	*Plethodon cinereus*
Red-Spotted Newt	*Notophthalmus viridescens viridescens*
Spotted Salamander	*Ambystoma maculatum*
Wood Frog	*Rana sylvatica*
Reptiles	
Black Rat Snake	*Elaphe obsoleta obsoleta*
Eastern Box Turtle	*Terrapene carolina carolina*
Eastern Garter Snake	*Thamnophis sirtalis sirtalis*
Eastern Hognose Snake	*Heterodon platirhinos*
Eastern King Snake	*Lampropeltis getula getula*
Eastern Milk Snake	*Lampropeltis triangulum triangulum*
Eastern Ribbon Snake	*Thamnophis sauritus sauritus*
Five-Lined Skink	*Eumeces fasciatus*
Northern Black Racer	*Coluber constrictor constrictor*
Northern Fence Lizard	*Sceloporus undulatus hyacinthinus*
Northern Ringneck Snake	*Diadophis punctatus edwardsii*
Northern Water Snake	*Nerodia sipedon sipedon*
Rough Green Snake	*Opheodrys aestivus*
Snapping Turtle	*Chelydra serpentina*
Wood Turtle	*Clemmys insculpta*

THREATENED AND ENDANGERED WILDLIFE SPECIES AND WILDLIFE SPECIES OF SPECIAL CONCERN

The New Jersey Nongame and Endangered Species Act mandates the identification and protection of rare and nongame wildlife species within the state. Endangered species are defined as "those whose prospects for survival in New Jersey are in immediate danger because of a loss or change in habitat, over-exploitation, predation, competition, disease, disturbance or contamination." Protection of endangered species is required to prevent future extinction. Threatened species are defined as "those who may become endangered if conditions surrounding them begin to or continue to deteriorate." A species of special concern or priority species is defined as an "animal species that warrant special attention because of some evidence of decline, inherent vulnerability to environmental deterioration, or habitat modification that would result in their becoming a threatened species."

In September of 2005, the NJDEP Natural Heritage Program prepared a listing of all rare species that are referenced within Millstone Township. Associated habitats for each species are also identified as follows: Emergent Wetlands (EM); Forested Wetlands (FW); Forest (F); and Grassland (G).

Table 10

Endangered Species

Common Name	Scientific Name	Federal Status	State Status	Habitat
Bog Turtle	*Clemmys muhlenbergii*	LT	E	EM & FW
Timber Rattlesnake	*Crotalus h. horridus*		E	FW & F
Vesper Sparrow	*Pooecetes gramineus*		E	G

Status Codes: LT Taxa formally listed as threatened prior to the most recent listing – the species remains on the Threatened Species list
E Endangered Species

Table 11
Threatened Species

Common Name	Scientific Name	Federal Status	State Status	Habitat
Northern Pine Snake	*Pituophis m. melanoleucus*		T	F & G
Pine Barrens Treefrog	*Hyla andersonii*		T	EM, FW & F
Wood Turtle	*Clemmys insculpta*		T	EM, FW, F & G
Frosted Elfin	*Callophrys irus*		T	EM, FW, F & G
Barred Owl	*Strix varia*		T/T	FW & F
Bobolink	*Dolichonyx oryzivorus*		T/T	G
Cooper's Hawk	*Accipiter cooperii*		T/T	FW, F & G
Savannah Sparrow	*Passerculus sandwichensis*		T/T	G
Grasshopper Sparrow	*Ammodramus savannarum*		T/S	G

Status Codes: T Threatened Species
/ Status for animals separated by a slash indicates a duel status. First status refers to the state breeding population and the second status refers to the migratory or winter population.
T/T Both the state breeding population and the migratory or winter population are Threatened.
T/S The state breeding population is threatened and the migratory or winter population is Stable.

Table 12
Other Species of Concern

Common Name	Scientific Name	Fed. Status	State Status	Habitat
Black-throated Green Warbler	*Dendroica virens*		SOC	FW & F
Eastern Box Turtle	*Terrapene carolina*		SOC	F & G
Fowler's Toad	*Bufo woodhousii fowleri*		SOC	EM & FW
Northern Parula	*Parula americana*		SOC	FW & F
Spotted Turtle	*Clemmys guttata*		SOC	EM & FW
Yellow-breasted Chat	*Icteria virens*		SOC	FW & F
American Kestrel	*Falco sparverius*		INC/S	G

Status Codes: SOC Species of Special Concern
INC/S State breeding population is increasing and the migratory or winter population is Stable.

There have been several sightings of State endangered or threatened species in Millstone Township that are not included on the NHP database results. Sightings of a Northern Goshawk were reported by a former member of the Millstone Township Environmental Commission (Rick Brody, personal communication, 2005). Additionally, the Natural Resource Inventory prepared by Amy S. Greene Environmental Consultants, Inc. in 1991 reported sightings of Northern Harriers (reported by Herpetological Associates in 1988).

The breeding populations of both the Northern Harrier, *Circus cyaneus*, and the Northern Goshawk, *Accipiter gentiles*, are endangered.

Habitats and Identifying Characteristics

Bog Turtle – The State Endangered and Federally Threatened bog turtle is a small, dark turtle with a distinct orange patch behind the tympanum (ear membrane) on both sides of the head. The bog turtle is known to be one of the smallest and secretive of North American turtles, measuring between 3.0-3.9 inches long as adults. Bog turtles occupy emergent and scrub/shrub habitats including calcareous (limestone) fens, sphagnum bogs, and wet, grassy pastures that are characterized by soft, muddy substrates and perennial groundwater seepage. The depth of water in this habitat is rarely greater than four inches from the surface. The dominant vegetation associated with bog turtle habitat includes: sedges (*Carex spp.*), rushes (*Juncus spp.*), mosses, and grasses. Some of the other vegetative species found within bog turtle habitat include: skunk cabbage (*Symplocarpus foetidus*), cattail (*Typha spp.*), jewelweed (*Impatiens capensis*), red maple (*Acer rubrum*), alder (*Alnus spp.*), rice-cut grass (*Leersia oryzoides*), cinnamon fern (*Osmunda cinnamomea*) and sensitive fern (*Onoclea sensibilis*). Due to the loss of suitable habitat, declining population, restricted habitat preference and collecting, the bog turtle was listed as an endangered species in New Jersey. In 1977, the US Fish and Wildlife Service included the bog turtle on the federally threatened species list.

Timber Rattlesnake – The State Endangered timber rattlesnake is one of only two venomous reptiles found within New Jersey; the other being the Northern Copperhead. The timber rattlesnake has dark brown to black bands on the body section just behind the head. The bands are typically outlined with a lighter color. The timber rattlesnake is a member of the pit viper subfamily. Pit vipers have two facial pits located between the nostril and the eye on each side of the head. The pits are utilized to sense body heat. The rattlesnake has a broad, triangular shaped head. The most definitive characteristic of the timber rattlesnake is the rattle which is located at the end of its black-colored tail. Timber rattlesnake habitat in this portion of New Jersey include pineland habitats consisting of

pitch pine (*Pinus rigida*), shortleaf pine (*Pinus echinata*), scrub oak (*Quercus ilicifolia*), blackjack oak (*Quercus marilandica*) and blueberry (*Vaccinium spp.*). Timber rattlesnake dens are typically found in cedar swamps and along streambanks. The summer range of gravid (pregnant) females includes a roughly 25% canopy cover with nearly equivalent vegetative groundcover, leaf litter and fallen logs. The summer range of male and non-gravid females generally consists of forested habitats with 50% canopy cover and 75% vegetative ground cover. The species hibernates in communal dens referred to as hibernaculas with other species, including black rat snakes. The timber rattlesnake once thrived in New Jersey, however the loss of habitat and wanton killings have limited the population. The timber rattlesnake was listed as an endangered species in New Jersey in 1979.

Vesper Sparrow – The State Endangered vesper sparrow is a grayish-brown bird with a streaked breast and a short tail. This species has a brown cheek patch which is adjacent to a white stripe that extends down from the beak and a white ring around its eye. The tail is notched and black with white outer tail feathers. The vesper sparrow habitat includes cultivated fields, grasslands, dry shrublands, woodland clearings, fallow fields and pastures. The vesper sparrow may occupy agricultural fields containing crops of corn, soybean, alfalfa, hay, timothy, wheat or strawberry. They tend to favor farmed areas that are adjacent to fallow fields or contain strips of uncultivated land along fence rows. These areas provide nesting habitat as well as protection, foraging site and perches. Active farmlands with human disturbance can threaten nesting sparrows. The vesper sparrow has been reported as a year round breeding resident of Monmouth County. Due to its dependence on habitat which is created by farming, the vesper sparrow population has declined significantly due to the loss of agricultural areas in New Jersey. The vesper sparrow was listed as a threatened species in NJ in 1979, however due to continuing decline was reclassified as endangered in 1984.

Pine Barrens Treefrog – The State Endangered Pine Barrens treefrog is bright green with a purple stripe outlined by a yellowish white border extending from the snout through the eye and down each side of the body. There is a vibrant orange patch beneath

each leg which is seen when the frog jumps. The adult Pine Barrens treefrog is 1.13 to 1.75 inches in length. This species requires specialized acidic habitats which include Atlantic white-cedar (*Chamaecyparis thyoides*) swamps and pitch pine (*Pinus rigida*) lowlands that contain dense mats of sphagnum moss (*Sphagnum spp.*). Vernal ponds, white cedar or cranberry bogs and seepage areas along tributaries to major rivers and streams serve as breeding ponds for the treefrog. Due to declining population, habitat loss, its restricted range and pollution of breeding ponds, the Pine Barrens treefrog was listed as an endangered species in New Jersey in 1979.

Northern Pine Snake – The State Threatened northern pine snake is black and dull to yellowish white with a whitish underbelly. This species burrows underground where it can easily be undetected even in locations where it is known to exist. Pine snake habitat includes dry pine-oak forest types which grow in infertile, sandy soils such as Lakehurst or Lakewood sands (Burger and Zappalorti 1988-1989). Sandy, infertile soil is especially important because the pine snakes dig hibernaculas and summer dens. The pine snake is very secretive which has led to some uncertainty regarding its overall status in the northeastern United States. The New Jersey Pinelands may contain some of the largest Northern Pine Snake populations, however even in the Pinelands the species is at risk and therefore it is listed as a threatened species in New Jersey.

Wood Turtle – The State Threatened wood turtle is identified by the sculpted or grooved appearance of its carapace, or upper shell and by the reddish-orange legs and throat. The wood turtle resides in both aquatic and terrestrial environments. They require aquatic habitats for feeding, mating and hibernation. They forage and deposit their eggs in terrestrial areas. The wood turtle requires somewhat remote freshwater streams, rivers, creeks or brooks that are relatively clean, free of litter and pollutants. Wood turtles may also be found in agricultural fields, pastures or on abandoned railroad beds. Habitat loss and stream degradation have led to the decline of the species and therefore the wood turtle was listed as a threatened species in New Jersey in 1979.

Frosted Elfin – The State Threatened frosted elfin range from 1-1.25 inches in size and are a drab brown color. The frosted elfin can be distinguished from other elfins by a small "tail" like feature extends from the hind wings. There are also distinctive markings on the under side of the hind wing which help to positively identify the species as well as a black spot near the tail on the hind wing. The frosted elfin habitat includes dry clearings and open areas that are natural or manmade. The presence of food plants is also necessary. The frosted elfin occurs in small isolated populations and is considered locally rare which led to its classification as threatened in the state of New Jersey.

Barred Owl – The State Threatened barred owl is a large owl which can be visually identified by brown barring on the chest and brown streaks on the lower breast and stomach. The owl has a distinct call which resembles the words "who cooks for you, who cooks for you allllll" and is often accompanied by a loud "hoo-ah." The barred owl was traditionally known as the "swamp owl," which exemplifies its habitat preference of remote, contiguous, old-growth wetland forests. This owl species requires mature wet woods that contain large trees with cavities for nesting. In this area of New Jersey, the barred owl inhabits both deciduous wetland forests and Atlantic white cedar swamps associated with stream corridors. Habitat loss, population decline and poaching led to the classification of the barred owl as a threatened species in New Jersey in 1979. Current development and fragmentation of large tracts of private forested lands has led to a continued decline of the species.

Bobolink- The State Threatened bobolink exhibits dimorphism in plumage during the breeding season. The male is black overall with a creamy nape and hind neck, a white rump and white scapulars (feathers at the base of the wing). The female is buff color with dark brown streaking on the back, sides and rump and dark stripes on the head. Male plumage resembles the female when not in breeding season. During the breeding season Bobolinks occupy low-intensity agricultural areas such as hayfields and pastures. Other habitats include lush fallow fields, grasslands and meadows. Due to habitat loss and population decline, the bobolink was listed as a threatened species in New Jersey in 1979.

Cooper's Hawk – The State Threatened Cooper's hawk is relatively the size of a crow, with short, rounded wings and a long narrow tail. The adult has a dark cap, bluish-gray back and rusty, barred underparts. The tail is rounded with a white edge along the tip. Cooper's Hawks occupy deciduous, coniferous and mixed riparian or wetland forests during the breeding season. The hawk territory commonly contains forest edges and small openings along streams or roads which are utilized for hunting. Although Cooper's Hawks occupy many of the same habitats in winter as during the breeding season, they forage within a variety of forest types as well as woodland edges due to limited prey availability. Until the 1930's, Cooper's hawks were often shot in large numbers because they were suspected of poultry and game predation. In addition, the use of the pesticide DDT led to impaired reproduction and population decline. The Cooper's hawk was listed as an endangered species in New Jersey in 1974. Following the ban of DDT in 1972 and reforestation within the state, the hawk populations began to recover. The Cooper's hawk was reclassified as a threatened species in New Jersey in 1999. The loss of large, contiguous forests still threatens the population of the species and therefore the state feels protection is warranted.

Savannah Sparrow – The State Threatened savannah sparrow is a small sparrow that is brown above, white below with brown streaks on the breast and sides, nape, back and crown. The savannah sparrow nests in hay and alfalfa fields, fallow fields, grasslands, upland meadows, pastures and vegetated landfills. Suitable land must offer a mix of short and tall grasses, a thick litter layer, dense ground vegetation and scattered shrubs, saplings or forbs. A decline in agriculture has led to a decline in breeding populations of savannah sparrows. Habitat loss and population decline led to inclusion of the savannah sparrow to the list of threatened species in New Jersey in 1979.

Grasshopper Sparrow – The State Threatened grasshopper sparrow is brown above with buff colored streaks with a white belly. The crown is dark brown with light stripes on the head and orange to golden stripes between the eyes and bill. The sparrow breeds in grasslands, upland meadows, pastures, hayfields, old fields and agricultural lands. They favor areas of over 100 acres containing short to medium height grasses interspersed with

patches of bare ground, a shallow leaf litter, scattered forbs and few shrubs. Expanding development and loss of agricultural lands led to a sever habitat loss and population decline. In 1979 the grasshopper sparrow was listed as a threatened species in New Jersey.

Northern Harrier – The State Endangered northern harrier is listed as a Federal Migratory Nongame Bird of Management Concern. The northern harrier is a medium to large sized hawk with a characteristic white "rump patch." Adults are sexually dimorphic in size and plumage. The smaller male is slate gray above and white below with contrasting black wing tips and a black edge on the wing. The larger females are brown above and buff colored below with brown vertical streaks on the chest and belly. Another identifying feature is the wing position in flight is a shallow "V" shaped dihedral. Formerly known as the "marsh hawk," the harrier inhabits tidal marshes, emergent wetlands, grasslands, meadows, fallow fields and agricultural areas. Many nests occur in brackish or saline marshes. In the early twentieth century, Northern Harriers, like many raptors, were often shot in large numbers because they were suspected of poultry and game predation. Bird counts from 1952 to 1971 indicated a decline of the harrier which coincided with extensive dredging and filling of coastal wetlands from mid-1950 to the mid-1970. In addition, the use of the pesticide DDT led to impaired reproduction and population decline. The Northern Harrier was listed as a threatened breeding species in New Jersey in 1979. However, a continued loss of suitable nesting habitat, limited population, restricted range and sensitivity to disturbance led the species to decline further. The Northern Harrier was reclassified as an endangered species in New Jersey in 1984.

Northern Goshawk – The State Endangered northern goshawk has short, rounded wings and a long, broad tail. The adult northern goshawk is pale blue-gray on the back and whitish underneath with fine charcoal colored barring. This species nests in mature, contiguous forests that are sheltered from human activity and development. Breeding habitat includes areas with large trees, a closed canopy and an open understory. They sometimes nest in wooded swamps, lower gentle slopes or flat areas at elevation and

nesting territories may contain small, unfrequented roads or trails within a forest. Northern goshawks may inhabit coniferous, deciduous or mixed forests. Northern goshawks were historically shot in large numbers by farmers and hunters because they consumed chickens and game birds. In 1929, Pennsylvania passes a law offering a $5 bounty for each dead goshawk. Due to its rarity as a breeder and its need for large contiguous old growth forest, which is a limited resource within New Jersey, the northern goshawk was listed as a threatened species in New Jersey in 1987.

The loss of suitable habitat is the major factor that resulted in the decline of all the above listed species. Identification and preservation of potential prime habitat should be a consideration in preserving open space and planning development within Millstone Township. All proposed development sites should be surveyed for the presence or absence of threatened and endangered species and their habitat. Surveys should be performed during the time of year that is most suitable for observing the individual species for which habitat may be present. A Natural Heritage Program database search should be requested from the NJDEP Natural Heritage Program for current records of sightings of threatened and endangered species on or adjacent to the site proposed for development. If a rare species exists on the site, the development application should include a methodology and plan to ensure protection of the species.

The Millstone Township Land Use Ordinance requires a Statement of Environmental Impact and Assessment (SEIA) be submitted with applications for development for all major subdivisions of land and site plans as well as other applications for development or land uses on sites within the Township that contain the following: a 100 year floodplain; wetlands or wetlands transition areas; areas of slopes 15% or greater; and/or lakes ponds or other open waters. An inventory of existing conditions including wildlife is a requirement of the SEIA.

Landscape Project

The NJDEP adopted a landscape level approach to imperiled species in 1994. The objective is to protect the diversity of wildlife within the State by maintaining and improving rare animal populations within healthy, functional ecosystems. The Division of Fish & Wildlife, Endangered and Nongame Species Program (ENSP) developed the Landscape Project to assist in the identification of threatened and endangered species habitat throughout the State of New Jersey. The Landscape Project consists of five habitat types: 1) Emergent Wetland; 2) Forested Wetland; 3) Forest; 4) Grassland; and 5) Beach. Millstone Township contains four of these habitat types. Figures 4-8 represent the Landscape habitats throughout Millstone Township.

The ENSP has developed maps that identify critical areas for imperiled species based on land use classifications and imperiled species locations. The maps are designed to identify important habitat areas and protect them in several ways.

Critical area maps can be utilized to prioritize land acquisition through Township Open Space, Farmland Preservation, Green Acres and the US Fish and Wildlife Service's refuge system. Critical area maps provide land use regulators and planners with the tools needed to enhance protection through the regulatory and planning process. The combination of critical area maps with other GIS data layers such as roads and development areas that are in need of protection are easily identified. Critical area maps identify important imperiled species habitats on open space land and therefore ENSP biologists and land owners can work together to develop best management practices for the protection and long term conservation of these species.

The method for delineating critical areas includes using boundaries between habitat types and major roads and delineating contiguous patches for each habitat. Habitat patches are classified based on the status of the species present as follows:

- Rank 5 – Habitat patches that contain one or more occurrences of at least one wildlife species listed as endangered or threatened on the Federal list of endangered and threatened species.
- Rank 4 – Habitat patches with one or more occurrences of at least one State endangered species.
- Rank 3 – Habitat patches with one or more occurrences of at least one State threatened species.
- Rank 2 – Habitat patches containing one or more occurrences of at least one non-listed State priority species.
- Rank 1 – Habitat patches that meet habitat-specific-suitability requirements such as minimum size criteria for endangered, threatened or priority wildlife species, however do not intersect with any confirmed occurrences of such species.

Figures 12-13 represents the Landscape Project Critical Area Ranking system throughout Millstone Township.

Endangered Species Legislation

The NJDEP maintains a listing of species and subspecies of wildlife that are indigenous to the State which were determined to be endangered, threatened or a species of special concern. The protection of these species is regulated by the Endangered and Nongame Species Act of New Jersey. Nongame species are those which have not been classified as endangered and for which a legal hunting season has not been established. The Act prohibits the possession, harassing, killing, transportation, and exportation of any nongame or endangered species.

Some threatened and endangered species habitats are protected by the NJ Freshwater Wetlands Protection Act. This Act requires a transition area or "buffer" around wetlands of intermediate or exceptional resource value. The presence of or documented habitat of a threatened or endangered species would require an increased transition area.

The Endangered Species Act of 1973 (P.L. 93-205) is a federal legislation that protects rare species. The US Department of Interior determines which species are considered endangered or threatened throughout their range within the United States and includes them on the Federal Endangered Species listing. No federal permits are issued for activities proposed within documented endangered species documented habitat. Within Millstone Township, one (1) wildlife species, the Bog Turtle, is listed as a federally threatened species and one (1) plant species, Swamp Pink is listed as a federally threatened species.

Natural Heritage Priority Site

The NJDEP Office of Natural Lands Management (ONLM) has identified critically important areas in an effort to conserve biological diversity within the State. Utilizing the Natural Heritage Database, ONLM has identified Natural Heritage Priority Sites which "represent some of the best remaining habitat for rare species and exemplary natural communities in the state." These priority site designations should be strongly considered when analyzing the area for planning and/or potential development.

The Natural Heritage Program has identified the 'JCP&L Swamp' as a Natural Heritage Priority Site which is partially located within Millstone Township. The boundaries of the JCP&L Swamp site were established in order to protect the wetland habitat that contains the Federally threatened and State endangered species, Swamp Pink (*Helonias bullata*). The JCP&L Swamp has a biological diversity ranking of B4 having a scattered, but widespread occurrence of a federally listed threatened plant species. As of 2005, the JCP&L Swamp is the only Natural Heritage Priority Site within Millstone Township and is within the North Branch of the Metedeconk River watershed, located along the eastern border of the Township. (Figures 9 & 10)

Summary

Protection of critical habitat for endangered and threatened wildlife is vital to preserving the species. The NJDEP will require intensive field surveys to determine the absence or presence of these species if they are thought to exist based on site suitability, the Landscape Project data and the NHP database. However the NJDEP will only require these surveys if the applicant has approached the NJDEP with an application for a permit. In some cases, a NJDEP permit is not required and therefore the Department will not review the databases. It is essential that the Township along with the Environmental Commission require all applicants to obtain an updated NHP database and Landscape Project habitat review of proposed development areas. Additionally, if suitable habitat for these species exists on site, the Township should require the applicant to perform the intensive surveys. All sites that are proposed for development should include a comprehensive wildlife survey performed by a qualified individual to ensure rare species do not exist on site, regardless of NHP results. As previously discussed, the NHP can not provide a 'definitive' statement on the absence or presence of threatened or endangered species in any area since many areas have never been surveyed. Wildlife surveys should be performed when wildlife is present on the site, not during hibernation of species such as reptiles and amphibians.

OPEN SPACE/CONSERVATION EASEMENTS/ HORSE TRAIL NETWORKS

As indicated within the Master Plan, "Millstone Township is committed to preserving its important open spaces, farms, and natural features." The Township established an open space trust fund that can be used in addition to available State and County funding in order to preserve the maximum amount of open space, farmland and natural features within the Township. The 'Open Space and Farmland Preservation Council of the Township of Millstone' was established by ordinance in 1994 under the General Ordinance 94-22. The Council is comprised of up to eleven members who are appointed by the Township Committee. The council was created in an effort to acquire and preserve open space areas for passive and active recreation and to ensure the protection of farmland through preservation.

Open space lands are often acquired with the assistance of State Funding. The NJDEP created the Green Acres Program in 1961 in an effort to meet the States growing need for recreation and conservation areas. Nine bond issues were approved from 1961 through 1995 resulting in more than $1.4 billion for the purpose of land acquisition and park development within the State. On November 3, 1998, New Jersey voters approved a referendum which created a stable source of funding for open space, farmland, historic preservation and recreation development. On June 30, 1999, the Garden State Preservation Trust Act was signed into law. This bill created a stable source of funding to acquire and preserve open space, farmland and historic sites around the State.

Millstone Township officials and the Open Space and Farmland Preservation Council have been very active in the acquisition of open space lands and farmland preservation over the last several years.

As detailed within the Land Use section of this report, Millstone Township adopted two new planning areas into ordinance in 2003, the RU-P and the RU-C. A cluster option is

offered within both planning areas. As an incentive for the developer to utilize the cluster provision of the ordinance, bonus lots are offered in exchange for dedicating a portion (70% in RU-P and 75% in RU-C) of the land area to farmland and/or open space. In an effort to ensure that buildable land is preserved, a condition is placed that a minimum of 50% of the open space area can not contain freshwater wetlands, wetland buffers, 100-year flood plains, areas of topographic slopes 15% or greater and/or stream corridor buffers required by Delaware & Raritan Canal Commission, Millstone Township, Monmouth County and/or the State of NJ.

Millstone Township adopted three additional ordinances that contribute to the preservation of open space: Conservation Easements, Horse Trail Easements and Wildlife Corridors.

The Township adopted a Wildlife Corridor ordinance prior to 1996. At their discretion, the Planning Board may require the dedication of a strip or strips of land, a minimum of fifteen feet in width, around the interior perimeter of all or portions of a subdivision tract as a wildlife corridor. The wildlife corridor must be shown on the development plans and must be dedicated to the Township of Millstone.

In June 2005, the Township adopted a Conservation Ordinance. The Planning Board can require a conservation easement to be dedicated to the Township in areas that are deemed valuable with regard to scenic vistas; open space; historical areas; soil type; steep slopes; tree preservation; protection of watercourses; protection of wildlife; and to eliminate excessive noise. All conservation easements must be dedicated to the Township and shown on the development Plans. Conservation easements also must be delineated in the field with a marker stating "Conservation Easement" attached to a permanent post. Conservation markers must be located at the intersection of property lines as well as a midway point between property lines. The removal of vegetation within a conservation easement is prohibited except for the following: removal of dead or diseased trees; removal of hazardous trees; limited thinning of trees and growth to encourage the most desirable growth; removal of trees to allow for structures that are designed to impound

water or in areas to be flooded for the creation of a waterbody; or based on approved conservation plan by the Soil Conservation District.

In November 2005, the Township adopted a Horse Trail Network ordinance. The Horse Trail Network ordinance was created with the intent of promoting and developing a series of horse trails within the Township. The Planning Board may require a dedication of certain strip(s) of land, each a minimum of fifteen feet in width, around the perimeter of all or portions of a subdivision or a site plan tract. All horse trail easements must be dedicated to the Township of Millstone and shown on the development plans. Horse trail easements must be delineated in the field with a marker stating "Trail" attached to a permanent post. The specific locations of the markers are determined by the Planning Board during the development review process in consultation with the Planning Board Engineer and the Open Space and Farmland Preservation Council.

The Open Space Council maintains a Recreation and Open Space Inventory (ROSI) report which details all lands that are held for recreation or conservation purposes. The primary purpose of the ROSI report is to document all restricted lands and to provide notice of the restrictions (including horse trail easements and wildlife corridors) to title searchers. The current ROSI report, dated February 1, 2006 indicates the following:

- The total area of developed and partially developed land is 305.83 acres.
- The total area of wholly undeveloped land is 423.701 acres.
- The total area of preserved trails is 13.579 acres.

The preserved land areas within Millstone Township as of February 2006 are shown in Figure 14.

CRITICALLY SENSITIVE AREAS

Critically Sensitive Areas include freshwater wetlands; wetland transition areas; 100-year flood plains; steep slopes, and areas known to contain threatened or endangered species habitat.

Freshwater wetland and wetland transition areas are regulated by the New Jersey Department of Environmental Protection (NJDEP) as detailed within the 'Wetlands' section of this report. One hundred year floodplains are either defined by the NJDEP, by the Federal Emergency Management Agency (FEMA), or from a study conducted by a qualified consultant and approved by the NJDEP. One hundred year floodplains are also regulated by the NJDEP.

As discussed within the 'Threatened and Endangered Wildlife Species and Wildlife Species of Special Concern' section of this report, the Natural Heritage Program contains a database of documented occurrences of rare species within the State. The NJDEP Endangered and Non-game Species program also developed the Landscape Project mapping which identifies areas of known and areas of suitable habitat for imperiled species. Threatened and endangered species are protected by the Endangered and Nongame Species Act of New Jersey and by the federal legislation known as the Endangered Species Act of 1973.

Millstone Township developed an ordinance regarding steep slopes which is addressed within the Land Use Ordinance Section 11-24. Any property which is the subject of a major subdivision application and which contains slope areas in excess of five vertical feet and 15 % or greater, shall comply with the requirements of the ordinance. Steep slopes are to be contained in conservation easements. A slope buffer area of fifty feet must be provided at the top and bottom of the steep slope. If the slope has previously been disturbed, eroded or is poorly stabilized, the Board may require the re-stabilization of the slope.

In January 2005, Millstone Township adopted an ordinance effecting critically sensitive areas on all undersized vacant lots within the R-20, R-80, R-130, R-170, RU-C and RU-P zoning districts. The proposed development area must be equal to at least one (1) contiguous acre in accordance with the following:

"The contiguous one (1) acres must not contain any freshwater wetlands, wetland transition buffers, 100-year flood plains, detention or retention basins, topographic slopes 15% or greater and/or any stream corridor buffers required by the Delaware & Raritan Canal Commission, Millstone Township, Monmouth County and/or by the State of New Jersey."

EXISTING CONTAMINATED SITES

The New Jersey Department of Environmental Protection regulates known contaminated sites within the state through two programs: the Site Remediation and Waste Management Program and the Solid and Hazardous Waste Program.

There are two departments within the Solid and Hazardous Waste Program: the Bureau of Hazardous Waste and the Bureau of Solid Waste. The Bureau of Hazardous Waste is responsible for ensuring that hazardous waste is properly identified, collected, transported and disposed of in an environmentally safe manner. The Bureau of Solid Waste is responsible for ensuring that solid waste is collected, transported and disposed on in an environmentally acceptable manner. Both bureaus perform the following tasks: investigate complaints, conduct inspections; provide compliance assistance; issue enforcement documents; assist the Attorney General in developing enforcement cases and testifying in court; and negotiating compliance schedule and penalty settlements.

The Bureau of Site Remediation and Waste Management (SRWM) has two major functions: site remediation including activities related to environmental site cleanups and restoration of sites. The SRWM maintains a record of all known contaminated sites that are active within all municipalities of the state. Additional information can be found for each site through an Open Public Records Act (OPRA) request which can be obtained on the state website at www.nj.gov/dep/opra. The following is a listing of existing contaminated sites that are active within Millstone Township per a meeting with representatives of the SRWM program in late 2005:

Table 13 - SRWM Site Report
Active Sites within Millstone Twp

Case Name	PI Number	Case Manager/ Contact	Bureau	Phone #
454 Stage Coach Road	G000061343	NFA-A /OPRA		
718 Perrineville Road	G000034323	Linda Jordan	BFO-S	609-584-4159
Accredited Movers	019087	Raphael Rivera	BFO-IN	609-633-1435
Amoco Service Station	021853	Joe Eaker	BSCM	609-633-1406
Benton Fibre Drum	026092	Frank Sorce	BEMSA	609-584-4287
Lakeside Gourmet Deli	G000033269	Fuman Stoop	BFO-S	609-584-4153
McNeill William	223290	NFA-E/OPRA		
Millstone Twp. Bd. of Ed.	021712	Jeff Spera	BSCM	609-292-7311
Mustang Service Station	009246	Joe Eaker	BSCM	609-633-1406
Nurko Property	191133	Mark Gruzlovic	BFO-S	609-584-4150
Perl Acres	196674	Mike Tomkins	BFO-S	609-584-4166
Raceway Service Station	022303	Dan Goetz	BSCM	609-984-9481
Sahara Sand	G000011571	Ralph Downs	CAS	609-292-2015
Scotto Farm	208437	Mark Gruzlovic	BFO-S	609-584-4150
Soon Hing Farms	243805	Chris Dwyer	BFO-S	609-584-4156
The Riverbrook Co.	232647	Mike Tomkins	BFO-S	609-584-4166

NFA-A – No Further Action-Area of Concern
OPRA – To get info. perform OPRA request at www.nj.gov/dep/opra
BFO-S – Bureau of Southern Field Operations
BFO-IN –Bureau of Field Operations-Initial Notice
BSCM – Bureau of Southern Case Management (formerly Bureau of Underground Storage Tanks)
BEMSA – Bureau of Environmental Measurements and Site Assessment
NFA-E – No Further Action-Entire
CAS – Case Assignment Section

SURFACE WATER

Watersheds

A watershed is an area of land that drains into a body of water such as a lake, river, stream or bay. A watershed includes the waterway as well as the entire area of land that drains to it. The New Jersey Department of Environmental Protection has designated a total of twenty (20) watershed management areas (WMAs) within the state. These WMAs, which are comprised of several watersheds and sub-watersheds, differentiate the main bodies of water throughout the state. Millstone Township lies within five (5) different WMAs: WMA 9, WMA 10, WMA 11, WMA 13 and WMA 20 (See Figure 15).

WMA 9 – Lower Raritan, South River, Lawrence Management Area

WMA 9 includes most of Middlesex County as well as some parts of Monmouth, Somerset and Union counties. This watershed consists of the mainstem Raritan River downstream from the north and south branch convergence; its tributaries including Lawrence Brook, Manalapan Brook, Matchaponix Brook, Green Brook, and South River; and all the surrounding land that drains into these waterways. The upper portions of the Manalapan River and Matchaponix Brook are located within Millstone Township. Both the Manalapan River and Matchaponix Brook have a surface water classification of neither freshwater non-trout production nor trout maintenance water (FW2-NT). The dominant land uses surrounding the upper sub watersheds of the Manalapan River and Matchaponix Brook are agricultural and forested lands.

WMA 10 – Millstone Management Area

WMA 10 lies in portions of Monmouth, Mercer, Middlesex, Somerset and Hunterdon counties. This watershed area includes the Millstone River and its tributaries. The Millstone River is a tributary to the Raritan River. The Millstone River upper watershed lies within Millstone Township and has a surface water classification of

FW2-NT. The Millstone River, Bently Brook and Rocky Brook flow to the north and northwest prior to joining further north within the Millstone Watershed. Land use in this portion of the Millstone Watershed area is primarily agricultural areas and recent residential developments.

WMA 11- Central Delaware Tributaries Management Area

WMA 11 affects the drainage of twenty four (24) municipalities within the counties of Monmouth, Mercer and Hunterdon counties. The predominant drainage area funnels to the Delaware River or the Delaware and Raritan Canal. This watershed is dominated by Assunpink Creek and its tributaries. This management area has been profoundly impacted by suburban development which has stressed its water resources and impacted water quality. The City of Trenton lies within this watershed management area. A portion of Assunpink Creek and its tributaries are located within Millstone Township. The sections of Assunpink Creek with the Assunpink Wildlife Management Area are classified as FW2-NT (C1) and all other segments within the Township are classified as FW2-NT.

WMA 13 – Barnegat Bay Management Area

WMA 13 lies mostly in Ocean County and includes the Barnegat Bay as well as the Metedeconk River, Toms River, Forked River and Cedar Creek sub watersheds. Millstone Township contains headwaters of the Toms River, which flows to the southwest in Millstone before taking a southeasterly route towards Barnegat Bay. This portion of the Toms River is classified as FW2-NT. Dominant land uses within the Toms River sub watershed include forested land and residential areas.

WMA 20 –Crosswicks Creek Management Area

WMA 20 encompasses 253 square miles with twenty seven (27) municipalities within Monmouth, Ocean, Burlington and Mercer counties. This watershed management

area includes Crosswicks Creek, Doctors Creek, the Assiscunk River and other smaller Inner Coastal Plain watersheds that eventually drain to the Delaware Estuary south of Trenton. Two tributaries of Crosswicks Creek are located within Millstone Township: Doctors Creek and Ivanhoe Brook. Ivanhoe Brook drains into Lahaway Creek which is a tributary to Crosswicks Creek. The surface waters within this drainage area are classified as FW2-NT.

N.J.A.C. 7:9B "Surface Water Quality Standards" defines FW2 waters as general classification freshwaters. The NT designation indicates non-trout waters or waters that are incapable of sustaining a trout population. These waters may be capable of sustaining other species. Trout are highly susceptible to changes in water quality and therefore are used as an indicator of stream quality.

The Category 1 (C1) classification indicates that the waters are designated for protection from measurable changes in water quality in NJAC 7:9B because of "...clarity, color, scenic setting, other characteristics of aesthetic value, exceptional ecological significance, exceptional recreational significance, exceptional water supply significance, or exceptional fisheries resource(s)." Waters not designated as C1 in Millstone Township are considered Category 2 (C2) waters and therefore discharges to these streams may be less constrained than they would be for C1 waters.

The USGS has calculated the drainage areas of each of the following streams within Millstone Township. The drainage areas for the streams are as follows:

Assunpink Creek	11.4 square miles
Millstone River	7.57 square miles
Rocky Brook	7.14 square miles
Doctors Creek	3.83 square miles
Ivanhoe Brook	3.49 square miles
Toms River	3.29 square miles
Manalapan Brook	2.87 square miles

Stormwater runoff is a leading source of pollutants in our waters. According the NJDEP, approximately 60 percent of existing water pollution is attributed to nonpoint source pollution. In a natural environment, native vegetation intercepts precipitation either directly or by absorption of runoff that has infiltrated the ground surface and releases it into the atmosphere through evapotranspiration. A portion of the precipitation will replenish surface water and some rainfall will infiltrate the ground surface and recharge the groundwater. This process, known as the hydrologic cycle, is extremely susceptible to impacts resulting from development.

The zoning changes that are addressed within the Land Use section of this document have resulted in the preservation of more open space land. The conservation of these natural areas creates less density, less septic to groundwater discharge and less impervious surface.

Development will typically alter natural vegetation through placement of impervious cover and lawn, which thereby reduces the evaporation, transpiration and infiltration rates of the watershed. Construction activity can cause soil compaction reducing infiltration and increasing volume and rate of stormwater runoff from a site.

Another way humans affect a watershed is by adding potential pollution sources to the watershed. The type of pollutants rain collects while traveling through a watershed depends in part on how the land it travels through is utilized. The land use in a watershed whether agricultural, residential or commercial, has a direct impact on the water quality of the watershed. When it rains, stormwater carries with it the effects of human activities as it drains off the land into the local waterway. Rain may pick up litter, road salt and motor oil from a parking lot and carry the pollutants to a local stream. On a farm, rain may carry fertilizers and soil into a water body. Melting snow may wash fertilizers and pesticides from a suburban lawn.

To reduce this pollution of stormwater, it is important to prevent pollution at the source. Some examples include: recycling motor oil instead of pouring it onto the street; cleaning

up after pets; putting trash into containers rather than littering; or reducing our use of fertilizers, pesticides and deicers.

Millstone Township has adopted the Stormwater Management Regulations for both residential and non-residential developed that are required by State Statute, set forth in N.J.A.C. 7:8-4. The NJDEP has issued a New Jersey Pollutant Discharge Elimination System (NJPDES) Permit (NJ0141852) to the Township of Millstone. There are several statewide basic requirements within the NJPDES permit including: public notification, post-construction stormwater management in new development and redevelopment; local public education; proper/improper disposal of waste; illicit connection elimination and MS4 outfall pipe mapping; controls for solids and floatables; maintenance yard operations; employee training; and construction site stormwater runoff control. Some of the ordinances that are being created apply to existing residents including: a pet waste ordinance; litter ordinance; improper disposal of waste ordinance; wildlife feeding ordinance and yard waste ordinance. For more information regarding the new stormwater regulations, refer to the "Stormwater Management Plan, Township of Millstone, Monmouth County" prepared by Leon S. Avakian, Inc. on April 1, 2005.

According to the New Jersey State Water Quality Report, samples were taken from locations throughout Millstone Township from each of the five Watershed Management Areas within the Township and assigned a biological impairment rating. The results from the State testing are as follows:

Table 14

Biological Assessment Table

Management Area	Water Body	Location	Sample Date	Biological Impairment Rating
WMA 9	Manalapan Brook	Rt. 524, Millstone	09/29/93 12/16/93 03/15/94 06/08/94 03/24/95	Non-impaired Non-impaired Non-impaired Moderately impaired Non-impaired
WMA 10	Millstone River	Baird Road, Millstone	07/25/90 10/07/92 01/21/93 04/08/93	Non-impaired Moderately impaired Severely impaired Moderately impaired
WMA 11	Assunpink Creek Tributary	Near Assunpink WMA office	05/22/91	Severely impaired
WMA 13	Toms River	Paint Island Springs Road, Millstone	10/29/90 02/22/91 05/17/91 07/10/91	Non-impaired Moderately impaired Non-impaired Moderately impaired
WMA 20	Doctors Creek	Spring Road, Millstone	10/29/90	Moderately impaired

In 2002, Millstone Township contracted an environmental company, Shaw Environmental & Infrastructure, Inc. (Shaw) to perform a watershed assessment within the Township. The Township watershed council and Shaw selected twenty (20) sites for assessment. The sites were equally distributed throughout the Township and represented seven different brooks and rivers: Doctors Creek, Ivanhoe Brook, Manalapan Brook, Millstone River, Rocky Brook, Toms River and Bently Brook. In order to identify the health of the surface water, each site was evaluated for general physical measurements; Rosgen classification and observations (a method for identifying channel type based on general geomorphic characterizations); general soil classifications; surrounding land use; plant communities; observance of wildlife including benthic macroinverebrates; erosion observations; and chemical measurements including: dissolved oxygen, pH, temperature, conductivity and turbidity. Dissolved oxygen ranged from 4.12 to 9.07 mg/l. The pH at the twenty sites ranged from acidic 3.65pH to the more neutral 6.57pH.

Additionally, seven of the sites were further analyzed based on observed erosion/bank stabilization, high value habitat and presence of suitable habitat for endangered or threatened species. The Monmouth County Health Department (MCHD) collected samples from three of the sites for rapid bioassessments (RBA's). Two of those sites were located within WMA 10, Millstone Watershed Management Area and the third was located within WMA 20, Crosswicks Creek Management Area. One testing location on Bently Brook received a RBA score of 15, moderately impaired water quality, based upon biological criteria. A second testing location along Baird Road in Rocky Brook received a RBA score of 12, moderately impaired water quality based upon biological criteria. The third testing location located on Ivanhoe Brook received a RBA score of 9, moderately impaired water quality based upon biological criteria.

Various stages of erosion were observed throughout the Township on all streams that were part of the watershed assessment. A historic review of the area ascertained that the streams had been modified, straightened and dredged for agriculture, development and flood control. Stream restoration was not recommended for most sites due to the presence of heavily vegetated buffers.

The watershed assessment study indicated that the overall health and quality of the streams and their associated wetlands is good. Most of the streams that were visited were well buffered with well functioning, high quality wetlands. Throughout the study, several assessment areas were found to contain suitable habitat for threatened or endangered species: bog turtle, wood turtle and/or swamp pink. Shaw did not observe any of these species during the assessment nor has the NJDEP identified any of the investigated sites as containing threatened or endangered species, however some species were identified by the NJDEP in relatively close proximity.

Several management practices were recommended including stabilization of a portion of Rocky Brook; yearly inspection of stormwater detention basins; providing buffers and "no mow zones" along streams; limit the removal of vegetation on parcels; restricting

excessive use of pesticides and herbicides within riparian corridors. Buffer strips can enhance wildlife habitat and protect species biodiversity by providing food and shelter as well as enhance water quality by intercepting contaminants and lowering water temperature. The National Resource Conservation Service (NRCS) recommends the following buffer widths:

- >15 feet for shade and temperature regulation
- >20 feet for increased water quality
- >30 feet for small streams
- >30% of floodplain or 100 feet for large streams

These practices should be implemented during the planning phase of development. For more detailed information regarding the watershed assessment study, please refer to the "Watershed Assessment Report" prepared by Shaw Environmental & Infrastructure, Inc. dated October 2002.

GROUNDWATER

Millstone Township serves as a recharge area and headwaters for one of the fastest growing regions in New Jersey. Additionally, the source of all drinking water within the Township is groundwater. There is no public water supply within Millstone Township; all water supply to residents is from individual wells. Therefore, the protection of groundwater resources is especially important to the Township.

Groundwater is the "subsurface water that occurs beneath the water table in soils and geologic formations that are fully saturated" (Freeze & Cherry 1979). Water enters a saturated zone also known as an aquifer system and becomes available as a water resource which can be utilized via a well system. In New Jersey water must be capable of infiltrating to a minimum depth of 50 feet below the ground surface to be captured by a residential well.

In June of 2002, the Township contracted M² Associates to conduct an evaluation of the groundwater resources of the Millstone Township. The study was requested based on the following:

- Individual wells which provide all drinking water to residents of the Township are completed in unconsolidated Coastal Plain aquifers. These aquifers are dependent on the size of particles and void spaces between the particles; the interconnection of the void spaces; and the sorting and layering of particles. These characteristics limit recharge rates, sustained yields, interference effects, quality of groundwater and contaminant removal or dilution rates.
- The Township is located entirely within the "Coastal Plain Sole Source Aquifer." As defined by the US Environmental Protection Agency (USEPA) "Sole source aquifers (SSAs) are those aquifers which contribute more than 50% of the drinking water to a specific area and the water would be impossible to replace if the aquifer were contaminated."

- Four aquifers beneath Monmouth, Middlesex and Ocean Counties have been adversely impacted as a result of over pumping: the Mt. Laurel-Wenonah, Englishtown, Old Bridge, and Farrington. A "depleted zone" was defined for each of the aquifers in which the NJDEP mandated that major water diversions reduce pumping of groundwater.
- The increased density of housing and surface/subsurface improvements can impact aquifers which may lead to reduced recharge, lower yields, increased interference, and the degradation of groundwater quality.

According to the M² report, Millstone Township residents consumed approximately 0.9 million gallons per day or 327 million gallons per year of groundwater through their wells (based on 2000 US Census data). The M² report also stated that Millstone Township "could sustain the water supply demands of a population of approximately 9800 persons or approximately 800 more than resided within the Township during the 2000 census".

Millstone Township utilizes septic systems to discharge wastewater. Groundwater is taken from an aquifer via a well system and returned to an aquifer system through the septic system. Based on the M² report, groundwater is withdrawn from a confined/semi-confined aquifer system and disposed into an overlying unconfined system throughout most of the Township. Therefore according to M² at least 84 percent of the Township, waste water is not returned to the aquifer that from which it was originally withdrawn. This results in a depletion of the confined/semi-confined aquifer. In 16 percent of the Township discharges from the septic system could be returned to the originating aquifer. However the wastewater from a septic system does not meet Federal or State Drinking Water Quality Standards and would require dilution within the aquifer to adequately reduce the concentrations of contaminants.

The M² report found that there are aquifer systems within Millstone Township that are capable of meeting most or possibly all of the water supply needs and there are aquicludes or confining units that are essentially incapable of yielding adequate

groundwater supply demands. Of the five aquifers within Millstone Township (Englishtown, Wenonah-Mount Laurel, Shrewsbury, Vincentown and Kirkwood-Cohansey) only the Kirkwood-Cohansey system does not meet NJDEP regulatory requirements and therefore can not be utilized for resident well systems.

For additional information, please refer to the report entitled "Evaluation of Groundwater Resources of Millstone Township, Monmouth County, New Jersey" prepared by M^2 Associates Inc. on October 24, 2003 which is available at the Township Clerks office.

SOILS

Soils consist of unconsolidated, natural material that supports, or is capable of supporting plant life. The upper limit is air and the lower limit is either bedrock or the limit of biological activity. Mineral soils have very little organic matter; while histosols are composed primarily of organic matter. The relative proportions of particles (sand, silt, clay, and organic matter) within a soil are affected by many interacting environmental factors. As normally defined, a soil must support plant life. The concept is expanded to include substrates that could support plant life. For various reasons, plants may be absent from areas that have well-defined soils.

Soils are very significant with regard to the land use of an area. The knowledge of soil types in a location is essential to natural land uses such as agricultural areas, forests, and in the determination of wetland areas. Additionally, soil is a key factor in planning for development. Some of the factors that are necessary in determining development suitability are: can the soil type support subsurface sewage disposal system; are the soils acceptable for the proposed stormwater management systems, especially due to the new stormwater management regulations where groundwater recharge is a requirement; does the soil have the proper structural design for future roadways; and would the soil type require mitigation of acid producing soils during construction activity.

The United States Department of Agriculture (USDA) Soil Conservation Service prepared a survey of soil types throughout the country. In April 1989 the USDA published the "Soil Survey of Monmouth County, New Jersey." Within this publication, all soil types throughout Monmouth County were mapped to provide a reference tool for planners, community officials, engineers, farmers, foresters and many other individuals. Soils are broken down into several different categories.

Soils are characterized by 'mapping units'. Mapping units represent an area dominated by either one major kind of soil or several kinds of soil. Soils that have similar profiles make up a 'soil series'. All soils of a series have major horizons that are similar in composition,

thickness and arrangement. A 'soil complex' consists of two or more soils, or one soil along with a miscellaneous area, that are located in an intricate pattern or small area where they can not be shown separately.

The USDA National Resource Conservation Service (NRCS) mapped the soils of New Jersey and included them in the New Jersey Geological Survey (NJGS) Geographic Information System (GIS). Based on this mapping, Millstone Township contains a total of twenty nine (29) soil series:

Adelphia	Atsion	Colemantown	Collington
Colts Neck	Downer	Elkton	Evesboro
Fallsington	Fluvaquents	Freehold	Galloway
Hammonton	Holmdel	Humaquepts	Keyport
Kresson	Lakehurst	Lakewood	Manahawkin
Marlton	Pemberton	Phalanx	Pits, Sand & Gravel
Sassafras	Shrewsbury	Tinton	Udorthents
Woodstown			

These soil classifications are further subdivided based on texture and slope gradients.

The soils beneath Millstone represent all gradations from clays to gravel; however the majority of the soils are sand or sandy loam. Per a review of soil mapping by Maser Sosinski & Associates (NRI, 1992), coarse grained, gravelly soils occur in some areas within the central and eastern-central areas of the Township. Loam soils are located in the southwestern, northern and eastern portions of the Township. Sand, sandy loams and loamy sands cover the majority of the Township.

Based on the NRCS mapping of soils within Millstone Township, approximately 23 percent of the soils have low runoff rates and high infiltration rates; approximately 45 percent of the soils have moderate runoff and infiltration rates; approximately 31 percent of the soils have high to very high runoff rates and low to very low infiltration rates; and

the remaining 1 percent of the Township is underlain with unclassified urban soils or are covered with water.

The 1989 Federal Manual for Identifying and Delineating Jurisdictional Wetlands identify hydric soils as being saturated, flooded, or ponded for usually one week or more during the growing season. These soils often support hydrophytic vegetation. Hydrophytic vegetation is defined as the "sum total of macrophytic plant life that occurs in areas where the frequency and duration of inundation or soil saturation produce permanently or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present." Per the NRCS soil mapping, approximately 20 percent of the soils beneath Millstone Township are classified as hydric, which could support wetlands. Additional information on the hydric soils is addressed within the Wetlands section of this report.

A study by the Soil Conservation Service in Monmouth County prior to 1992 identified low-ph or acid soils in fifteen locations within Millstone Township. Thirteen of those sites were located in the northwestern half of the Township. The acid soils were found in outcrop zones of the Englishtown, Wenonah, Marshalltown and Navesink formations and ranged in depth from 4-16 feet. The Monmouth County Soil Conservation District provides a detailed method of mitigation for acid producing soils.

Based on its large agricultural use both currently and in the past, historic pesticide contamination is a concern within Millstone Township. The Land Development Ordinance requires site investigation and soil sampling for all development applications prior to Board approval to ensure that contamination levels do not exceed the New Jersey Department of Environmental Protection Soil Cleanup Criteria.

A listing of all soil types located within Millstone Township per NRCS mapping and a mapping of soil types throughout the Township is included in the Appendix C of this report.

INDIVIDUAL SUBSURFACE SEWAGE DISPOSAL SYSTEMS (SEPTIC SYSTEMS)

Millstone Township has no sanitary sewer. All residential, commercial and industrial development is dependent upon well and septic systems. Based strictly on the soil types that have been mapped by the NRCS, approximately 65 percent of the soils within the Township would have slight to few operational limitations for septic systems; approximately 34 percent of the soils would have moderate to severe limitations for septic systems; and the remaining 1 percent of the Township is covered with unclassified urban soils or water (M^2Associates, 2003).

During the planning process of new developments, the county health department requires soil test pits to be excavated in the area of proposed septic systems. A representative from the health department is on site to determine the suitability of the soils. In the case where soils are not suitable for septic, the developer has the option to try to relocate the proposed septic system in a suitable area or to continue the excavation in order to find a proper zone of disposal. The soils within the test pit must be witnessed and approved by the health department. Additionally, soil samples are taken in the area proposed for septic systems and tested for permeability. The soils must be acceptable based on the permeability criteria as delineated in the NJ septic regulations (NJAC 7:9A).

The bulk of restaurants and stores located in the southern portion of the township, along Route 537 have had septic failure in the recent past. Per conversations with a representative of the Monmouth County Health Department, these failures are predominantly caused by an overload of congealed fat from food preparation and a lack of continued maintenance and/or removal of the congealed fat from the grease trap septic tanks on a regular basis. Other failures can be traced to a high volume of effluent experienced during the peak months of operation of nearby Six Flags Great Adventure Amusement Park. The Wawa convenience store and McDonalds are examples of septic failures due to high usage. Septic design is governed by State statute and enforced by the local county health department or the NJDEP.

WELLS

Approximately fifteen percent of all New Jersey residents have private wells to supply their drinking water. As previously discussed, there is no public water supply within Millstone Township; therefore all water supply to residents is from individual wells. Wells tap into the local groundwater and are designed to provide clean, safe drinking water. An improperly constructed or poorly maintained well can allow a variety of contaminants into the water supply such as bacteria, viruses, pesticides, fertilizers or other harmful chemicals. These contaminants can go undetected because they are often odorless, colorless and tasteless. Proper well construction and maintenance is essential for your health and the environment.

In New Jersey water must be capable of infiltrating to a minimum depth of 50 feet below the ground surface to be captured by a residential well. Shallow wells draw water from groundwater close to the land surface which is most likely to be affected by local sources of contamination. Wells should be located as far from a potential pollution source as possible. New Jersey requires that all new wells be located at a minimum distance of 50 feet from a septic tank, 100 feet from a septic system disposal field, and 150 feet from a cesspool. Additionally, a new well should be located where surface water such as stormwater runoff drains away from the well. A well that is located downhill from a leaking fuel storage tank, septic system, or over-fertilized farm field has a greater risk of contamination than a well on the uphill side of these pollution sources. However, the slope of land does not always dictate the direction a pollutant might flow once it is in the groundwater. In order to protect your water supply, any condition which is likely to cause groundwater contamination should be eliminated, regardless of the proximity to the well.

Water testing is essential to monitor water quality and to identify potential health risks. It is recommended that water be tested each year at a minimum for the three most common contaminants: bacteria, lead and nitrates. A full-spectrum comprehensive water test will provide information about hardness, pH, corrosivity, radioactivity, iron, manganese,

mercury, sodium and chloride content. Additionally, a broad scan test of water quality will test for contaminants such as pesticides and volatile organic chemicals.

Water should be tested more than once a year if: 1) someone is pregnant or nursing; 2) there are unexplained illnesses in the family; 3) there are dangerous contaminant in a neighbor's water; 4) there is a change the taste, odor, clarity or color of your water; or 5) there has been a spill or back-siphonage of chemicals or fuels into or near your well. Further advice on testing can be found at the Monmouth County Health Department or the Monmouth County Rutgers Cooperative Extension. A listing of state certified water testing laboratories can be found in Fact Sheet 343, *Where to Get Your Drinking Water Tested in New Jersey* provided by the Monmouth County Cooperative Extension Office. A listing of federal and state drinking water standards can be found in Fact Sheet 433 *Drinking Water Standards*. Keep a record of testing results to monitor water quality over time.

Well equipment will require mechanical attention from a qualified well driller or pump installer every 10 to 20 years. A record of all well maintenance and inspections should be retained as well.

For more information, Millstone Township has a well publication which includes the 'Home*A*Syst' worksheet available at the Clerk's Office. The 'Farm*A*Syst' and 'Home*A*Syst' information can also be found their website: www.uwex.edu/farmasyst. The EPA has published a pamphlet entitled *Drinking Water From Household Wells*, which is available at: www.epa.gov/OGWDW/consumer/wells/household_wells.pdf.

CLIMATE

The climate of Millstone Township is classified as temperate humid and is distinguished by warm summers, moderate winters and noticeable changes in season. The Atlantic Ocean has a moderating influence on temperature and generally limits the wide variation of climatic fluctuation that is associated with more interior locations. However, there are often large variations in temperature within Millstone Township and the surrounding areas. According to the National Weather Service, the highest recorded temperature within Millstone Township (recorded in Clarksburg) was 105° F in 1936. The lowest recorded temperature was -16° F in 1935. On average, the warmest month in Millstone Township is July and the average coolest month is January. On average, the most precipitation occurs in July.

The National Oceanic and Atmospheric Administration (NOAA) lists the average annual temperature for this area from 1895-2005 as 52.13 ° F and the average annual precipitation from that time period is 44.90 inches.

There are presently no permanent weather stations located within Millstone Township. The New Jersey Department of Transportation has a monitoring station in Freehold Township. Based on information obtained in Freehold, Monmouth County has the following climatic conditions:

Mean Annual Temperature	53° F
Highest recorded Temperature	106° F in July of 1936 (Freehold)
Coldest recorded Temperature	-20° F in February 1934 (Freehold)
Temperatures recorded ≥ 32° F	as late as May 17th and as early as September 24th
Average Growing Season	178 days (from April 23rd to October 18th)
Average Precipitation	45-47 inches per year
Average Countywide Snowfall	25-26" per season
Maximum Snowfall	66.9" during 1957-1958 season
Occurrence of Snowfall	typically between December and March however snow has fallen October through May

Table 15 – Average Weather Conditions in Millstone Township (Recorded in Clarksburg)

Month	Avg. High	Avg. Low	Mean	Avg. Precip	Record High	Record Low
Jan	39°F	21°F	30°F	3.75 in	73°F (1932)	-16°F (1935)
Feb	41°F	24°F	32°F	2.75 in	75°F (1985)	-8°F (1996)
Mar	50°F	31°F	41°F	3.95 in	88°F (1998)	2°F (1967)
Apr	61°F	39°F	50°F	3.94 in	93°F (1990)	18°F (1982)
May	72°F	49°F	60°F	4.42 in	96°F (1962)	28°F (1978)
Jun	80°F	58°F	69°F	3.95 in	100°F (1952)	35°F (1938)
Jul	85°F	63°F	74°F	4.96 in	105°F (1936)	45°F (1986)
Aug	83°F	62°F	72°F	4.85 in	102°F (1955)	40°F (1986)
Sep	76°F	54°F	65°F	4.28 in	103°F (1953)	31°F (1963)
Oct	65°F	42°F	54°F	3.44 in	95°F (1941)	22°F (1969)
Nov	54°F	35°F	44°F	3.66 in	82°F (1950)	0°F (1938)
Dec	43°F	27°F	35°F	3.73 in	76°F (1998)	-6°F (1948)

Source: The Weather Channel 2006

AIR QUALITY

The quality of our air is monitored by the NJ Department of Environmental Protection, Bureau of Air Monitoring. The state is categorized into nine regions: Northern Metropolitan Region, Southern Metropolitan Region, Suburban Region, Northern Delaware Valley Region, Central Delaware Valley Region, Northern Coastal Region, Southern Coastal Region, Southern Delaware Valley Region and Delaware Bay Region. All of Monmouth and Ocean Counties are located within the Northern Coastal Region.

There are three monitoring sites within the Northern Coastal Region: Colliers Mills, Monmouth University and Freehold. Hourly air quality readings are taken at the monitoring sites which are based on a national system known as the Air Quality Index (AQI). The AQI compares pollutant levels to health standards, taking into account multiple pollutants and assigns an air quality rating such as "good" or "unhealthy."

Five pollutants are utilized in the AQI: carbon monoxide, nitrogen dioxide, ground-level ozone, particulates and sulfur dioxide. There are national health standards for all five of these pollutants. A brief overview of the health standards per pollutant is provided in the table below:

Table 16

Pollutant Health Effects

Pollutant	Health Effects	Source of Pollution
Carbon Monoxide	Weakens the heart contractions and lowers amount of oxygen carried by the blood. It can cause nausea, dizziness, headaches and in extreme concentration can cause death.	Primarily comes from motor vehicles. Also comes from the incomplete burning of any fuel.
Nitrogen Dioxide	Irritates the nose and throat, especially to asthma sufferers. Appears to increase susceptibility to respiratory infections.	Power plants, large industrial facilities and motor vehicles.
Ozone	Irritates the lungs and breathing passages, causing coughing and pain in chest and throat. Increases susceptibility to respiratory infections. Most severe in people with asthma or other respiratory ailments.	Forms in the air from other pollutants – volatile organic compounds (VOCs) and nitrogen oxides).
Particulates	Aggravates existing heart and lung diseases, changes the body's defense against inhaled materials and damages lung tissue.	Diesel cars, trucks and buses, power plants, industry and many other sources.
Sulfur Dioxide	Aggravates existing lung diseases, especially bronchitis. Constricts breathing passages, causes wheezing, shortness of breath and coughing.	Power plants, large industrial facilities, diesel vehicles, and even oil-burning home heaters.

Not every monitoring station or air monitoring region tests for all five pollutants. At this time, the three monitoring stations within the Northern Coastal Region do not test for nitrogen dioxide or sulfur dioxide. These pollutants are typically tested in more urban city areas.

Colliers Mills and Monmouth University monitoring stations test solely for Ozone. The Freehold monitoring station tests for carbon monoxide and particulates. There is a standard for each pollutant. The ozone health standard is 0.08 parts per million (ppm) based on an 8-hour average. For concentrations to be considered an 'exceedance,' they must be 0.085 ppm or greater. The ozone standard based on a 1-hour average is 0.12 ppm. For concentrations to be considered an exceedance, they must be 0.125 ppm or

greater. The following table provides the number of occurrences that ozone levels exceeded the standard in both monitoring stations, over the time period 1998-2004.

Table 17
Ozone 8-Hour Exceedance Summary

Year	Monitoring Station	Number of Days Exceeding the Ozone 8 Hr. Standard
2004	Colliers Mills	8
	Monmouth University	2
2003	Colliers Mills	9
	Monmouth University	10
2002	Colliers Mills	30
	Monmouth University	17
2001	Colliers Mills	21
	Monmouth University	8
2000	Colliers Mills	11
	Monmouth University	5
1999	Colliers Mills	23
	Monmouth University	12
1998	Colliers Mills	28
	Monmouth University	20

Table 18
Ozone 1-Hour Exceedance Summary

Year	Monitoring Station	Number of Days Exceeding the Ozone 1 Hr. Standard
2004	Colliers Mills	0
	Monmouth University	0
2003	Colliers Mills	1
	Monmouth University	4
2002	Colliers Mills	7
	Monmouth University	2
2001	Colliers Mills	4
	Monmouth University	1
2000	Colliers Mills	4
	Monmouth University	2
1999	Colliers Mills	3
	Monmouth University	0
1998	Colliers Mills	3
	Monmouth University	2

The national carbon monoxide health standard is 9 parts per million (ppm) based on an 8-hour average. For concentrations to be considered exceedances, they must be at 9.5 ppm or above. The carbon monoxide standard is 35 ppm based on a 1-hour average. The Freehold monitoring station had no exceedances based on an 8 hour average from 1985 through 2004. The maximum level based on an 8 hour average was 2.3 ppm. The maximum level based on a 1 hour average was 8.6 ppm, with a second highest level of 3.6 ppm.

Weather can affect air quality through high temperature and bright sunlight. Ground-level ozone forms in the air from other pollutants: volatile organic compounds (VOCs) and nitrogen oxides (NOx). The higher the temperature and the more direct the sunlight, the more ozone is produced. Unhealthy levels of ozone often occur in the summer months. As previously addressed, there were two days that the ozone level exceeded the standard at the Monmouth University monitoring station and eight days that the ozone level exceeded the standard at Colliers Mills during 2004. The two unhealthy reporting days at Monmouth University occurred in June and August. The eight days reported as unhealthy at Colliers Mills were in April through July.

Proper land planning and preservation of open space is helpful in maintaining air quality within the Township. The preservation of trees, through the regulation of tree removal during development; the requirements of conservation easements and horse trail easements; the acquisition of open space; and preservation of farmland ensures that natural areas will be preserved throughout the Township. These efforts help to limit the overdevelopment of the Township thereby minimizing the associated increase in pollutants.

BIBLIOGRAPHY

Amy S. Green Environmental Consultants, Inc. Natural Resource Inventory Phase I, Township of Millstone, Monmouth County, New Jersey. January 18, 1991.

Cobb, Farnsworth and Lowe. Peterson Field Guides: Ferns of Northeastern and Central North America. Houghton Mifflin. 2005.

Conant, Roger and Collins, Joseph. Peterson Field Guides: Reptiles and Amphibians of Eastern and Central North America. Houghton Mifflin. 1998.

Environmental Protection Agency. Drinking Water From Household Wells. www.epa.gov/OGWDW/consumer/wells/household_wells.pdf.

Farm*A*Syst & Home*A*Syst. Drinking Water Protection. www.uwex.edu/farmasyst.

Freeze & Cherry. Groundwater. 1979.

Leon S. Avakian, Inc. Stormwater Management Plan, Township of Millstone, Monmouth County. April 1, 2005.

M² Associates Inc. Evaluation of Groundwater Resources of Millstone Township, Monmouth County, New Jersey. October 24, 2003.

Maser, Sosinski & Associates, PA. Natural Resource Inventory Update Phase II, Millstone Township, Monmouth County, New Jersey. November, 1992.

Monmouth County GIS. GIS Mapping of Millstone Township. 2003.

National Oceanic and Atmospheric Administration. Climate Data. www.ncdc.noaa.gov

New Jersey Department of Environmental Protection. Various. www.state.nj.us/dep

New Jersey Department of Environmental Protection, GIS. I-Map NJ. www.state.nj.us/dep/gis/imapnj

Newcomb, Lawrence. Newcomb's Wildflower Guide. Little, Brown and Company. 1977.

Peterson, Roger Tory. Peterson Field Guides: Eastern Birds. Houghton Mifflin. 1984.

Peterson, Roger Tory & McKenny, Margaret. Peterson Field Guides: Wildflowers of Northeastern and Northcentral North America. Houghton Mifflin. 1998.

Shaw Environmental & Infrastructure, Inc. Watershed Assessment Report, Millstone Township, Monmouth County, New Jersey. October, 2002.

The Weather Channel. Average Weather Conditions in Clarksburg, NJ. www.weather.com

US Department of Agriculture. Soil Survey of Monmouth County, New Jersey. April, 1989.

US Department of Agriculture. Various. www.nrcs.usda.gov

USFWS. National List of Plant Species That Occur in Wetlands: Northeast Region" May, 1988.

FIGURES

FIGURE 1

MILLSTONE TOWNSHIP

Monmouth County, New Jersey

ZONING MAP

2000 0 2000 4000 6000 Feet

MAY 21, 2003

RU-P	Rural Preservation
RU-C	Rural Conservation
R-170	Rural Environmental
R-130	Rural Residential
R-80	Rural Residential
R-20	Residential
NC	Neighborhood Commercial
HC	Highway Commercial
HC-1	Highway Commercial
PCD	Planned Commercial Development
BP	Business Park
RC	Recreation Camp
FHSC	Flood Hazard and Stream Corridor Overlay

(Boundaries shown are generalized and based on FEMA GIS data for 100 year flood. The Actual location of the flood hazard and stream corridor overlay area for any stream shall be determined in accordance with the Land Use and Development Regulations of Millstone Township)

For Information Purposes Only

- Preserved Farmland
- Streams
- State or County Open Space
- Township Public Lands *
  (Parks, Open Space, Community Facilities, Public Property)

*Includes Homeowner Association Open Space

SP State Park	E.S. Elementary School	F.S. Fire Station
CP County Park	M.S. Middle School	F.A. First Aid
PR Private Open Space	Municipal Building	

ZONE MAP
TOWNSHIP OF MILLSTONE
MONMOUTH COUNTY, NEW JERSEY
MAY 21, 2003 REV. ORD. SUPP. 6/03

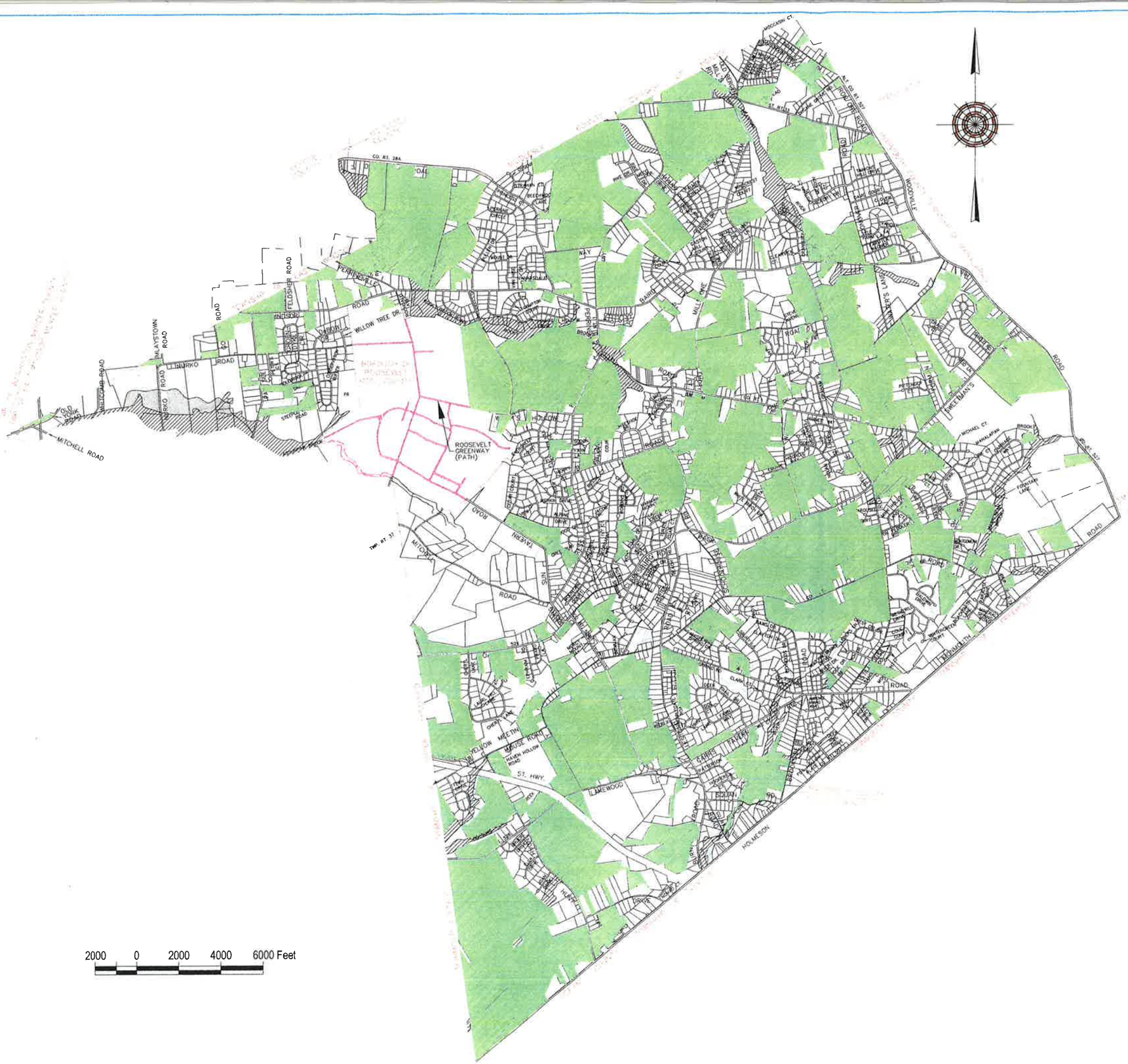
PREPARED BY
LEON S. AVAKIAN, INC.
788 WAYSIDE ROAD, NEPTUNE, NEW JERSEY

BASE MAP PREPARED BY
T & M ASSOCIATES
MAY 21, 2003 ORD. SUPP. 6/03

REF. MSZONEFIG1_11x17

FIGURE 2
MILLSTONE TOWNSHIP
Monmouth County, New Jersey
FARMLAND PARCEL MAP

FARMLAND PARCEL



FARMLAND PARCEL MAP
TOWNSHIP OF MILLSTONE
MONMOUTH COUNTY, NEW JERSEY
FEB. 6, 2006

PREPARED BY
LEON S. AVAKIAN, INC.
788 WAYSIDE ROAD, NEPTUNE, NEW JERSEY

BASE MAP PREPARED BY
T & M ASSOCIATES
MAY 21, 2003 ORD. SUPP. 6/03

REF. MS0514FARMLANDIIX17

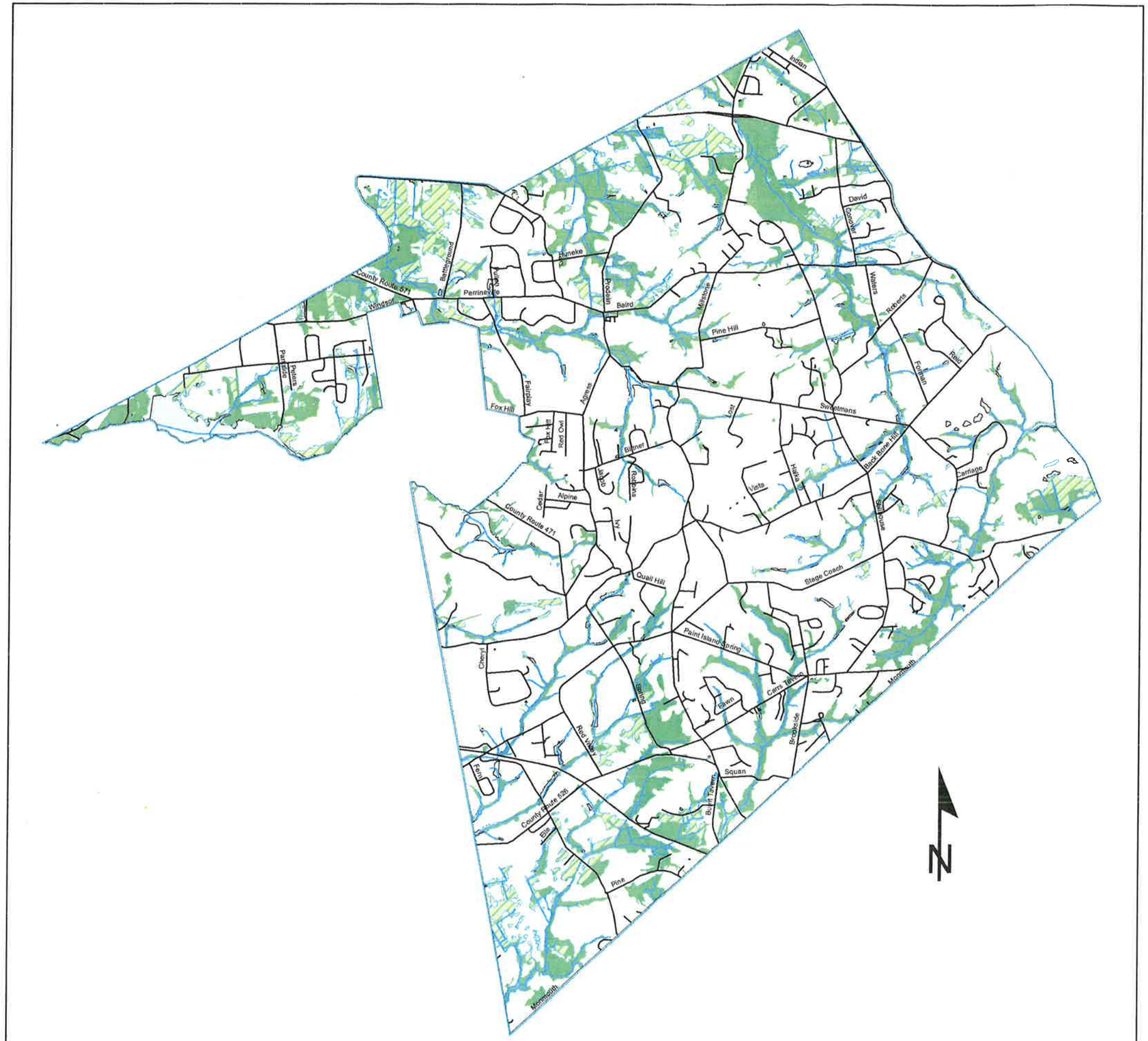


Figure No. 3
Millstone Township Wetlands

Legend

- Streams
- Roads
- Lakes
- Forested Wetlands
- Emergent Wetlands

1:62,000

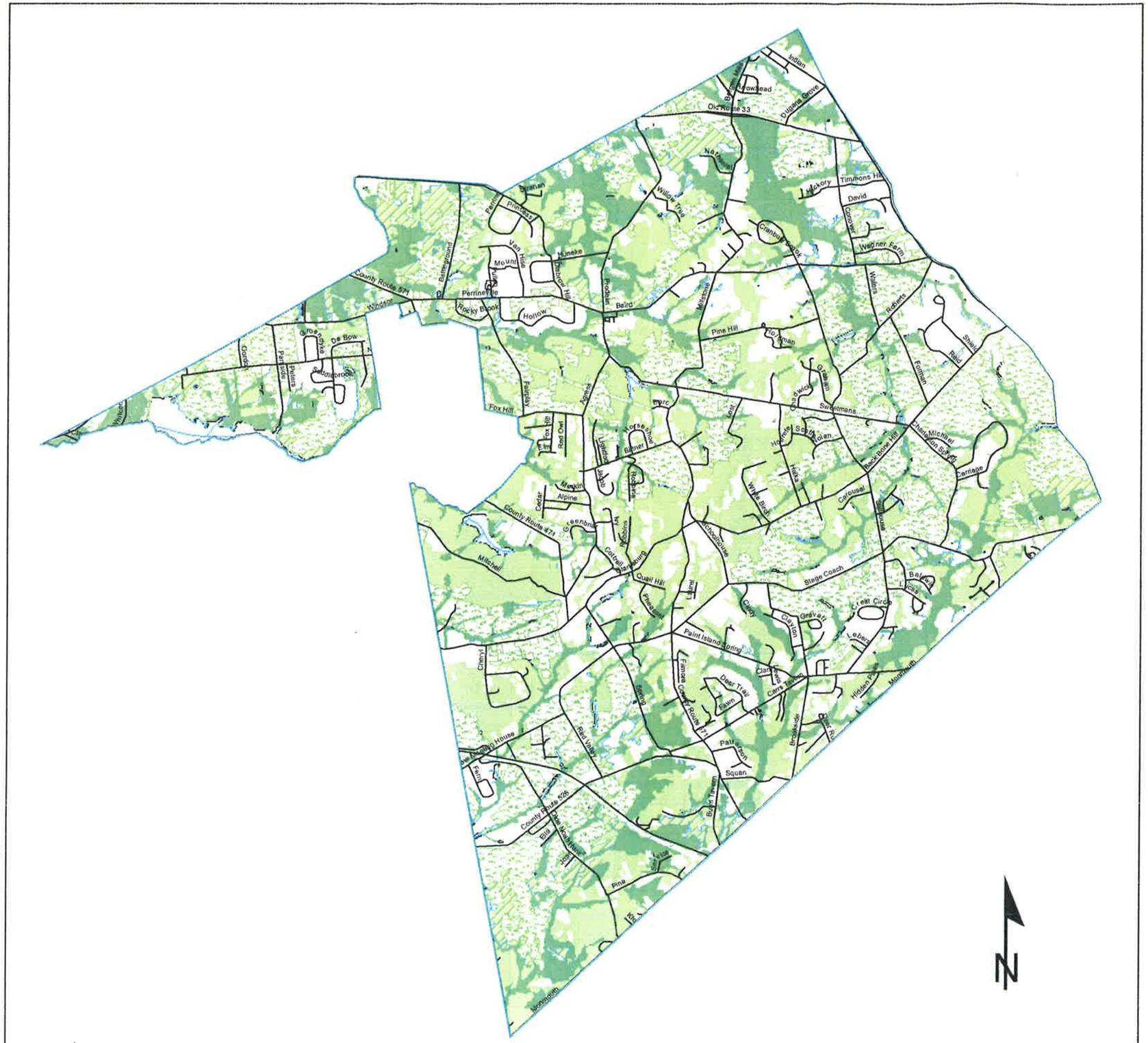
Sources: NJDEP Landscape Project Version 2.0
Monmouth County GIS (2003)

Not intended as a substitution for a wetland delineation. All wetlands must be verified by the NJDEP Land Use Department with a Wetlands Letter of Interpretation.

"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."

Prepared by Leon S. Avakian, Inc.
March 2006

Figure No. 4
Millstone Township
Landscape Habitats



Legend

- Streams
- Roads
- Lakes
- Forested Wetlands
- Forest
- grassland
- Emergent Wetlands

1:62,000

Sources: NJDEP Landscape Project Version 2.0
Monmouth County GIS (2003)

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Prepared by Leon S. Avakian, Inc.
March 2006

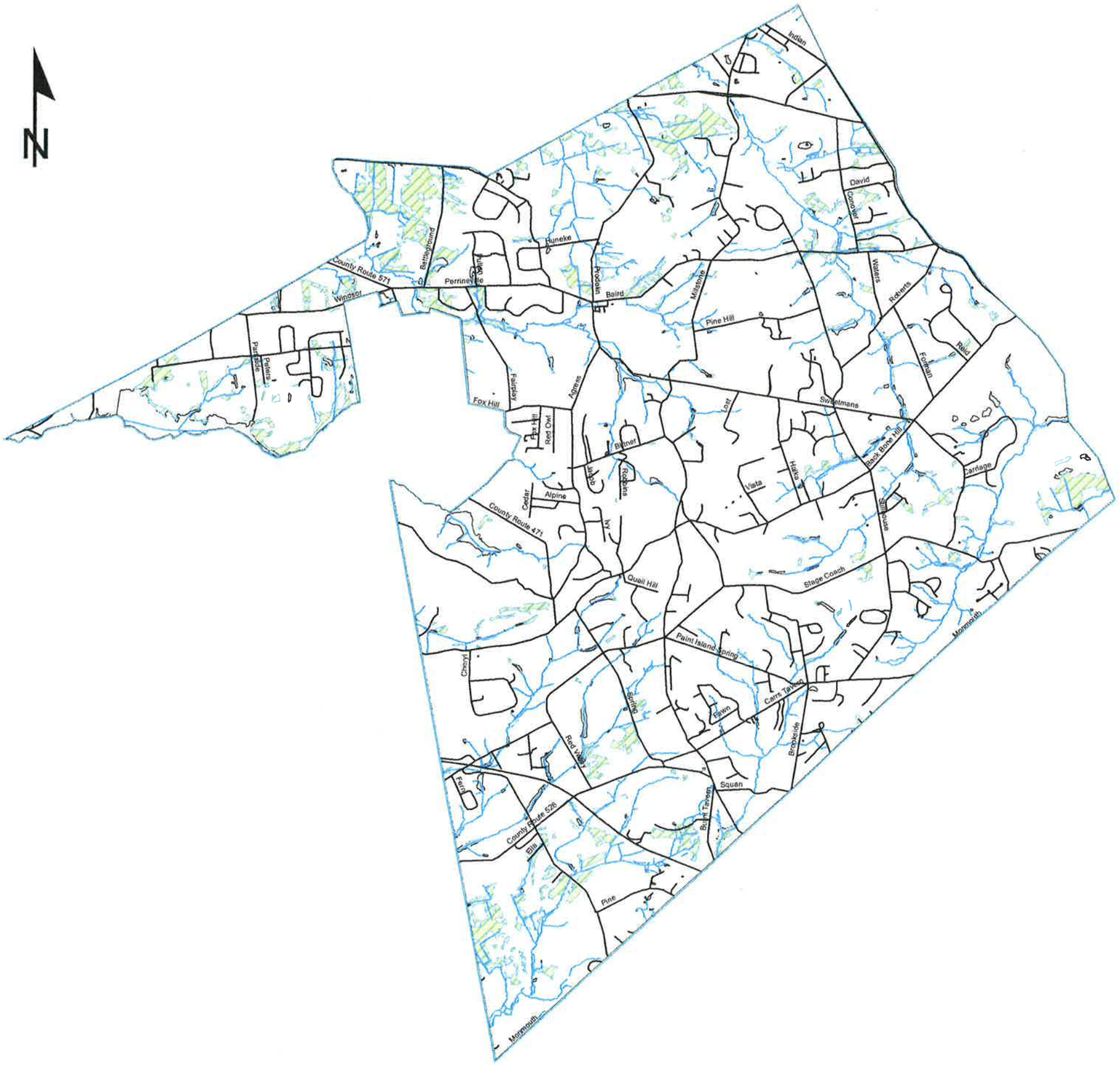

Figure No. 5
Millstone Township
Emergent Wetlands

Legend

- Streams
- Roads
- Lakes
- Emergent Wetlands

1:63,000

Sources: NJDEP Landscape Project Version 2.0
Monmouth County GIS (2003)

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Prepared by Leon S. Avakian, Inc.
March 2006

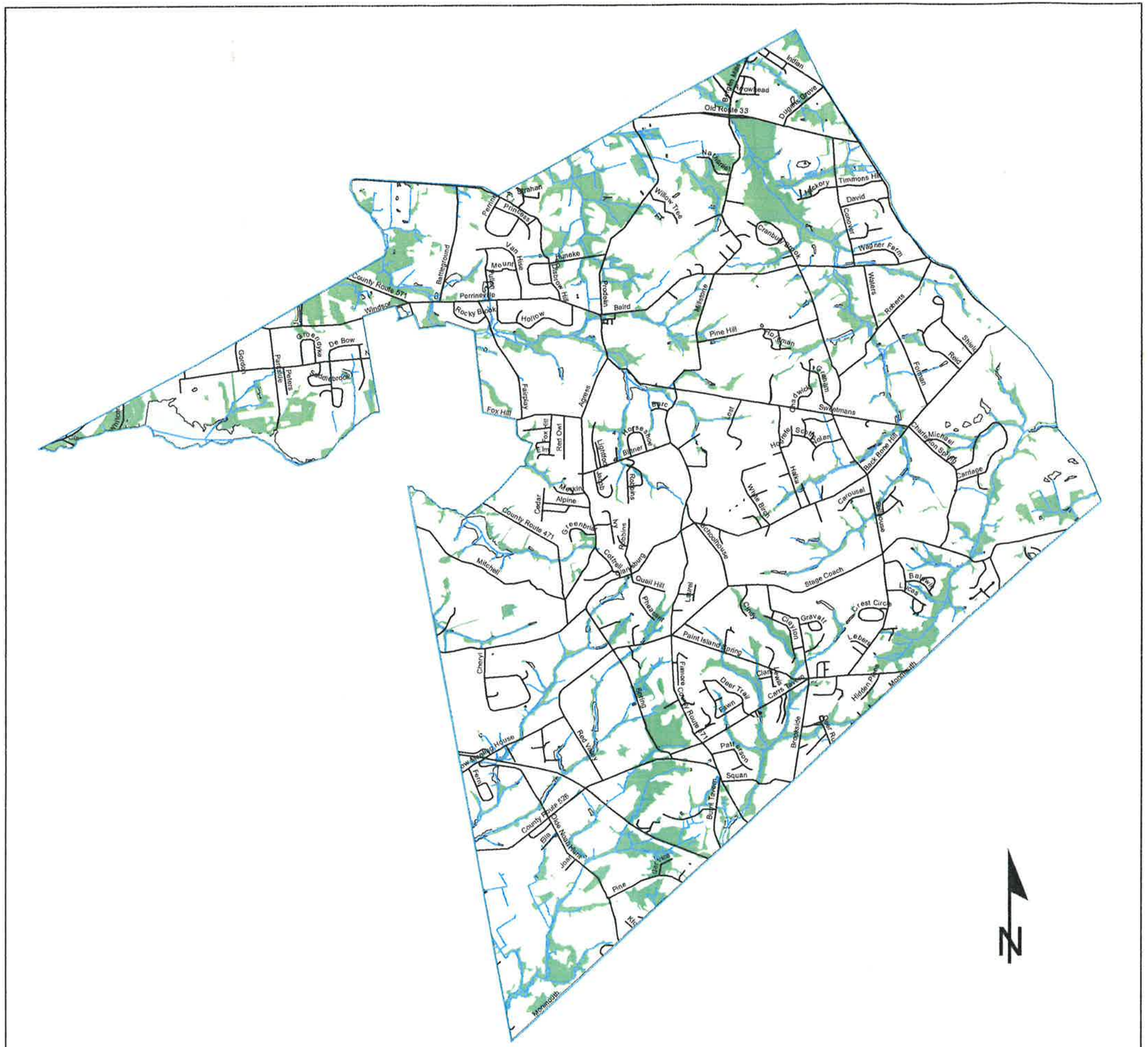

Figure No. 6

Millstone Township Forested Wetlands

Legend

- Streams
- Roads
- Lakes
- Forested Wetlands

1:62,000

Sources: NJDEP Landscape Project Version 2.0
Monmouth County GIS (2003)

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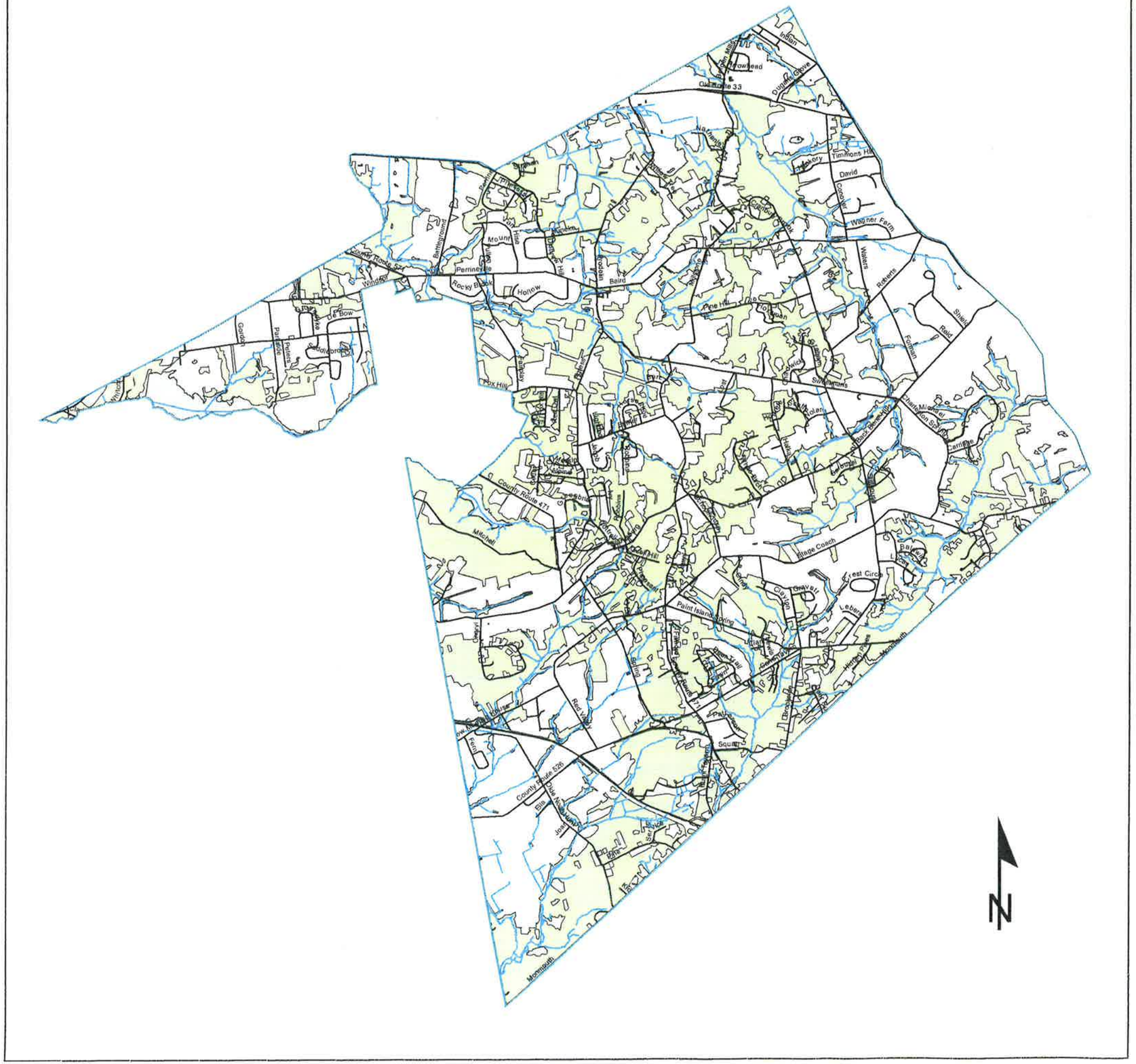

Figure No. 7

Millstone Township Forested Uplands

Legend

- Streams
- Roads
- Lakes
- Forest

1:62,000

Sources: NJDEP Landscape Project Version 2.0
Monmouth County GIS (2003)

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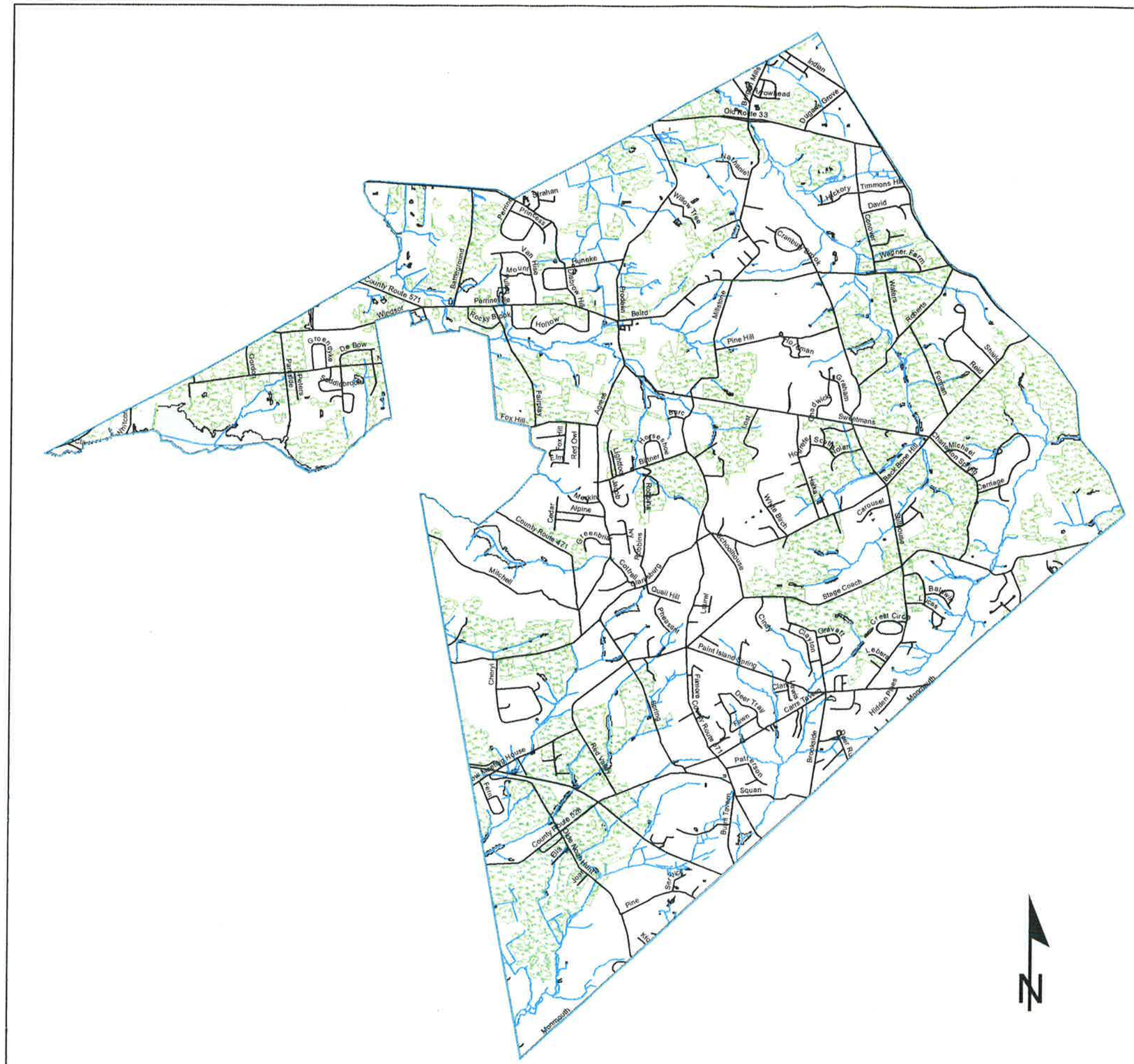
Prepared by Leon S. Avakian, Inc.
March 2006

Figure No. 8

Millstone Township
Grassland Habitat



Legend

- Streams
- Roads
- Lakes
- Grassland

1:62,000

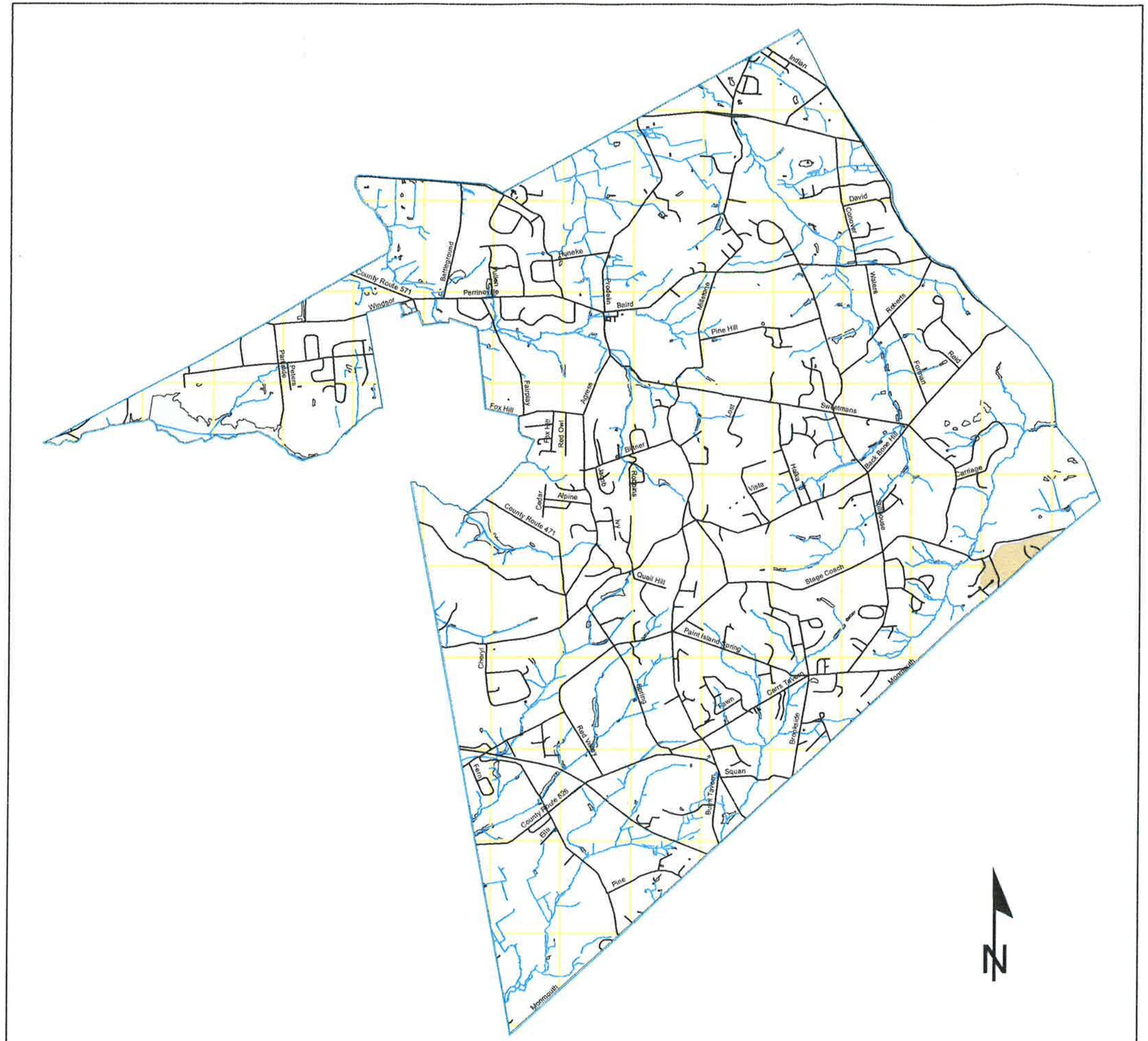
Sources: NJDEP Landscape Project Version 2.0
Monmouth County GIS (2003)

This map was developed using NJDEP GIS System digital data, but this secondary product has not been verified by NJDEP and is not state authorized.

Prepared by Leon S. Avakian, Inc.
March 2006

Figure No. 9

Millstone Township Natural Heritage Program (NHP) Priority Sites



Legend

- Streams
- Roads
- Lakes
- NHP Priority Sites
- NHP Grid Map

1:62,000

Sources: NJDEP Landscape Project Version 2.0
Monmouth County GIS (2003)

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Prepared by Leon S. Avakian, Inc.
March 2006

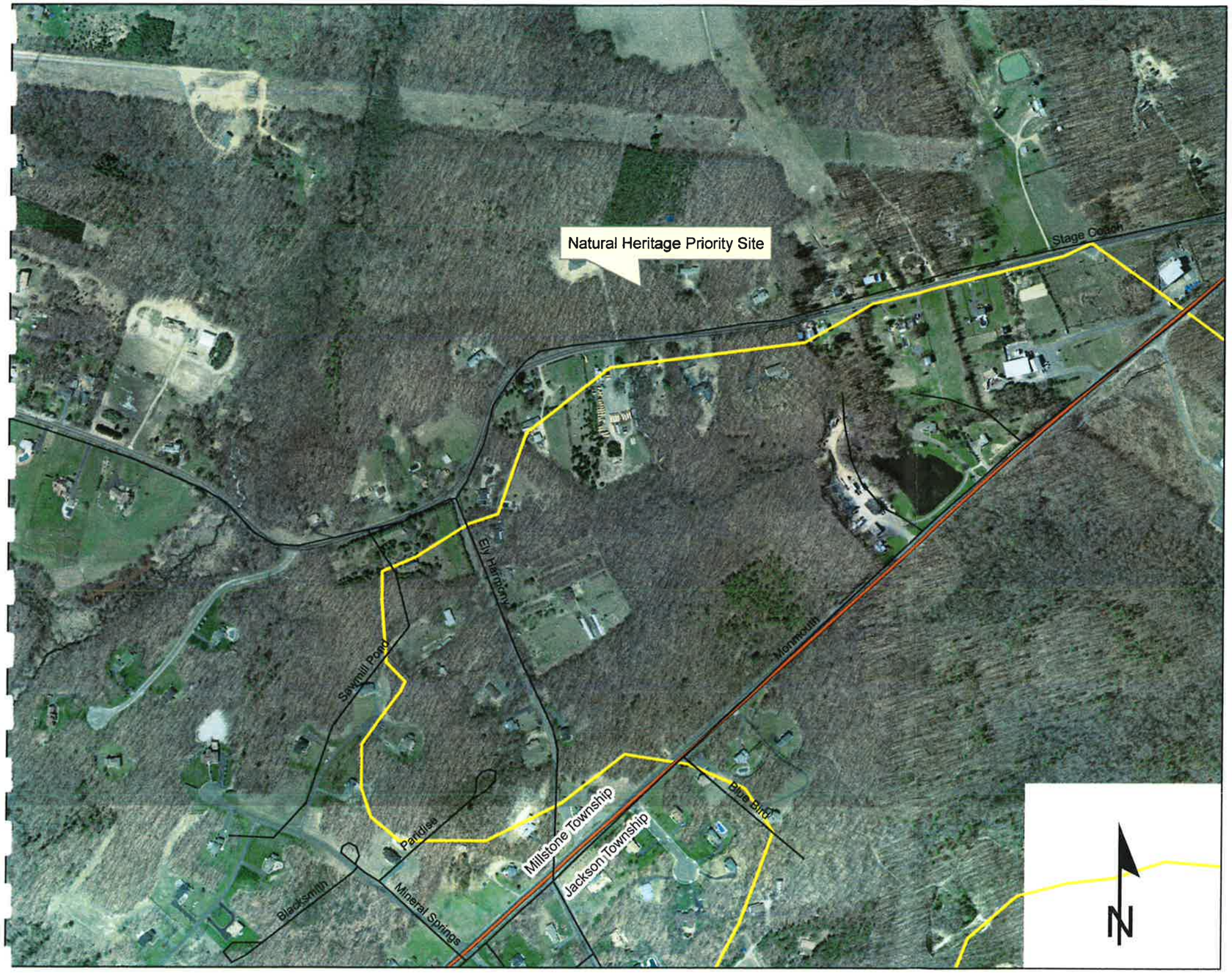


Figure No. 10
Millstone Township Natural Heritage Program (NHP) Priority Sites

Legend

- NHP Priority Sites
- Roads
- Municipal Boundary Lines

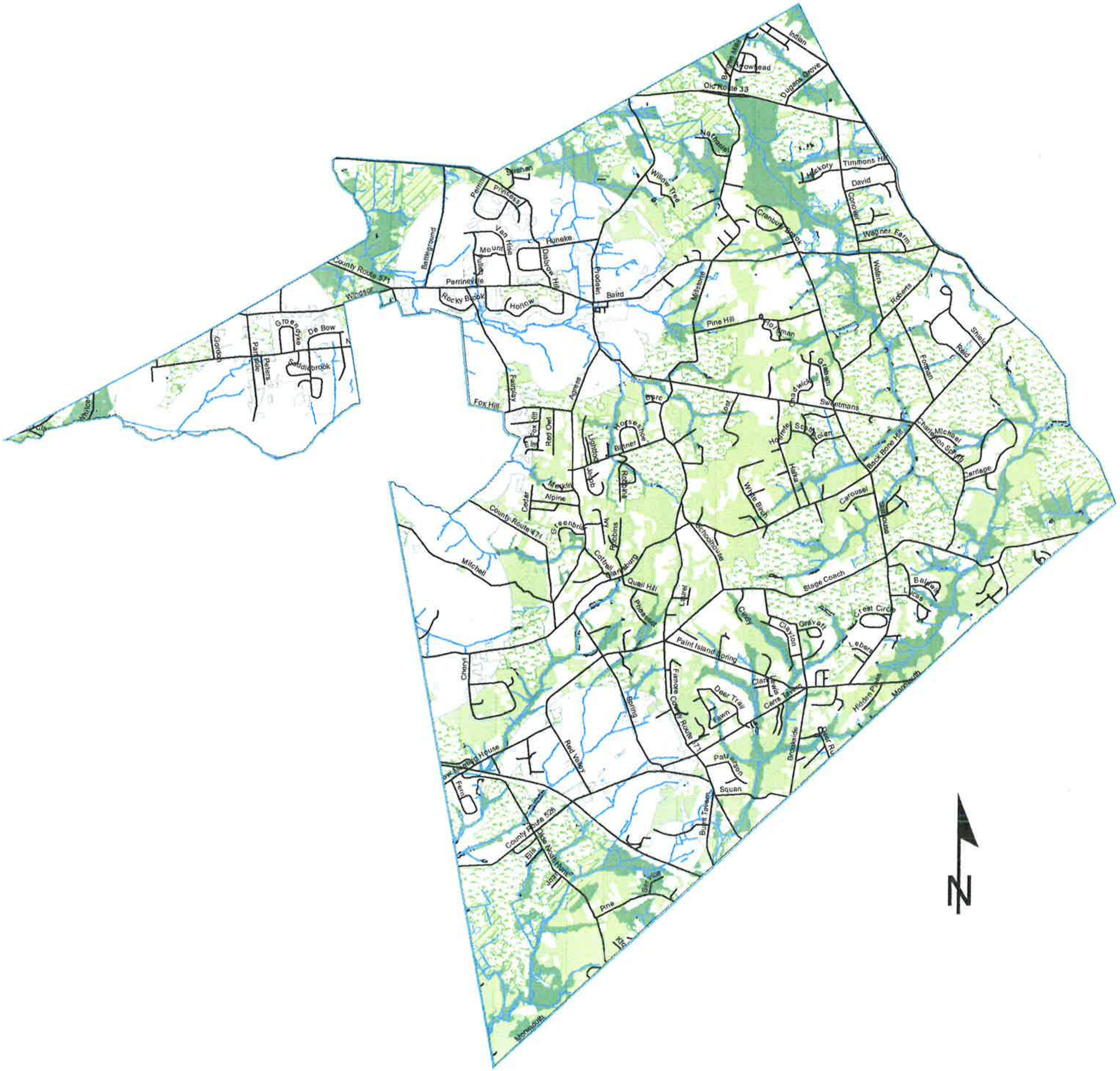
1:6,000

Sources: NJDEP GIS (2005)
NJDEP Natural Heritage Program
Monmouth County GIS (2003)

"This map was developed using New Jersey Department of EnvironmentalProtection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state authorized."

Prepared by Leon S. Avakian, Inc.
March 2006

Figure No. 11
Millstone Township
Wood Turtle Habitat



Legend

- Streams
- Roads
- Lakes
- Wood Turtle Habitat
- Forest
- Forested Wetlands
- Emergent Wetlands
- Grassland

1:62,000

Sources: NJDEP Landscape Project Version 2.0
Monmouth County GIS (2003)

Not intended as a substitution for a wetland delineation. All wetlands must be verified by the NJDEP Land Use Department with a Wetlands Letter of Interpretation.

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Prepared by Leon S. Avakian, Inc.
March 2006

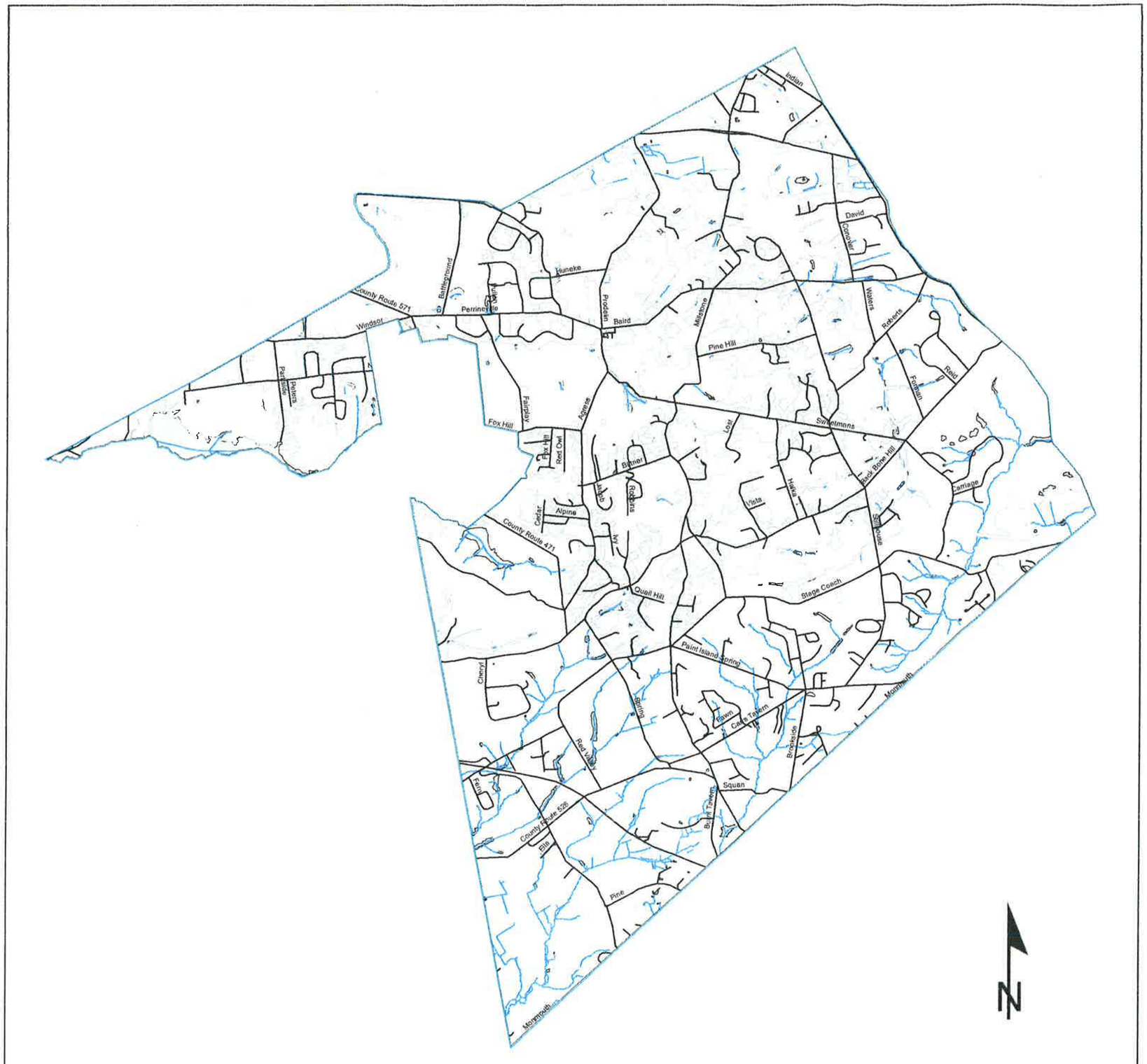


Figure No. 12

Millstone Township Landscape Project Endangered Species Habitat Rank 2 Cross Acceptance

Legend

- Streams
- Lakes
- Roads
- Endang. Spp. Habitat Rank 2

1:64,000

Sources: NJDEP Landscape Project Version 2.0
Monmouth County GIS (2003)

This map was developed using NJDEP GIS System digital data, but this secondary product has not been verified by NJDEP and is not state authorized.

Prepared by Leon S. Avakian, Inc.
March 2006

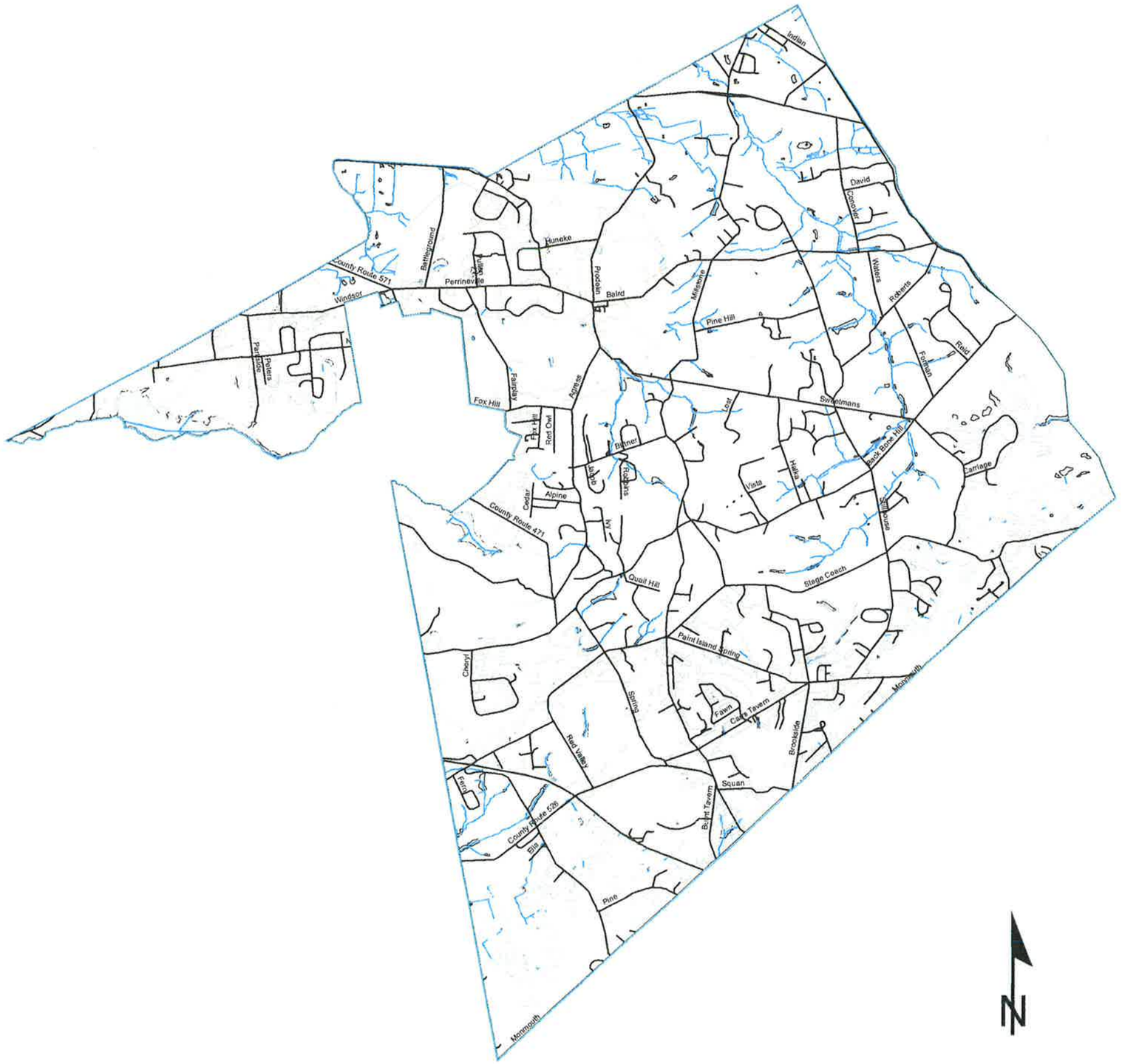


Figure No. 13

Millstone Township Landscape Project Endangered Species Habitat Combined Ranks 3, 4 & 5 Cross Acceptance

Legend

- Streams
- Lakes
- T/E Spp. Habitat Ranks 3, 4 & 5
- Roads

1:64,000

Sources: NJDEP Landscape Project Version 2.0
Monmouth County GIS (2003)

This map was developed using NJDEP GIS System digital data, but this secondary product has not been verified by NJDEP and is not state authorized.

Prepared by Leon S. Avakian, Inc.
March 2006

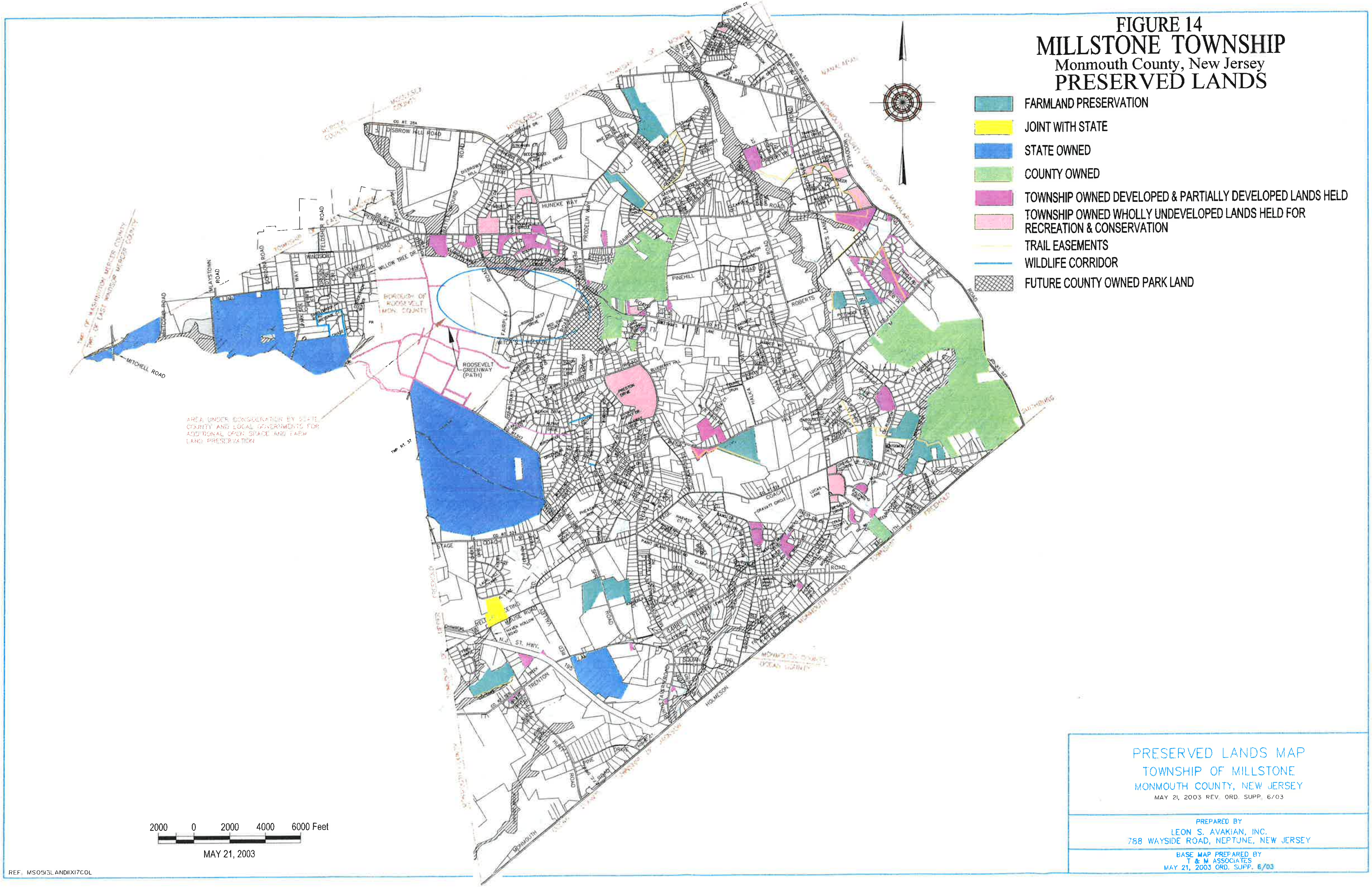


FIGURE 14
MILLSTONE TOWNSHIP
Monmouth County, New Jersey
PRESERVED LANDS
FARMLAND PRESERVATION
JOINT WITH STATE
STATE OWNED
COUNTY OWNED
TOWNSHIP OWNED DEVELOPED & PARTIALLY DEVELOPED LANDS HELD
TOWNSHIP OWNED WHOLLY UNDEVELOPED LANDS HELD FOR RECREATION & CONSERVATION
TRAIL EASEMENTS
WILDLIFE CORRIDOR
FUTURE COUNTY OWNED PARK LAND
AREA UNDER CONSIDERATION BY STATE, COUNTY AND LOCAL GOVERNMENTS FOR ADDITIONAL OPEN SPACE AND FARM LAND PRESERVATION
BOROUGH OF ROOSEVELT (MON. COUNTY)
ROOSEVELT GREENWAY (PATH)
MITCHELL ROAD
DISBROW HILL ROAD
HUNEKE WAY
PRODELIN WAY
PINEHILL
ROBERTS
WOODVILLE
MONMOUTH COUNTY
TOWNSHIP OF MANALAPAN
TOWNSHIP OF FREEHOLD
HOLMESON
TRENTON
N.J. ST. HWY.
195
2000 0 2000 4000 6000 Feet
MAY 21, 2003
REF. MS05I3LANDIIXI7COL
PRESERVED LANDS MAP
TOWNSHIP OF MILLSTONE
MONMOUTH COUNTY, NEW JERSEY
MAY 21, 2003 REV. ORD. SUPP. 6/03
PREPARED BY
LEON S. AVAKIAN, INC.
788 WAYSIDE ROAD, NEPTUNE, NEW JERSEY
BASE MAP PREPARED BY
T & M ASSOCIATES
MAY 21, 2003 ORD. SUPP. 6/03

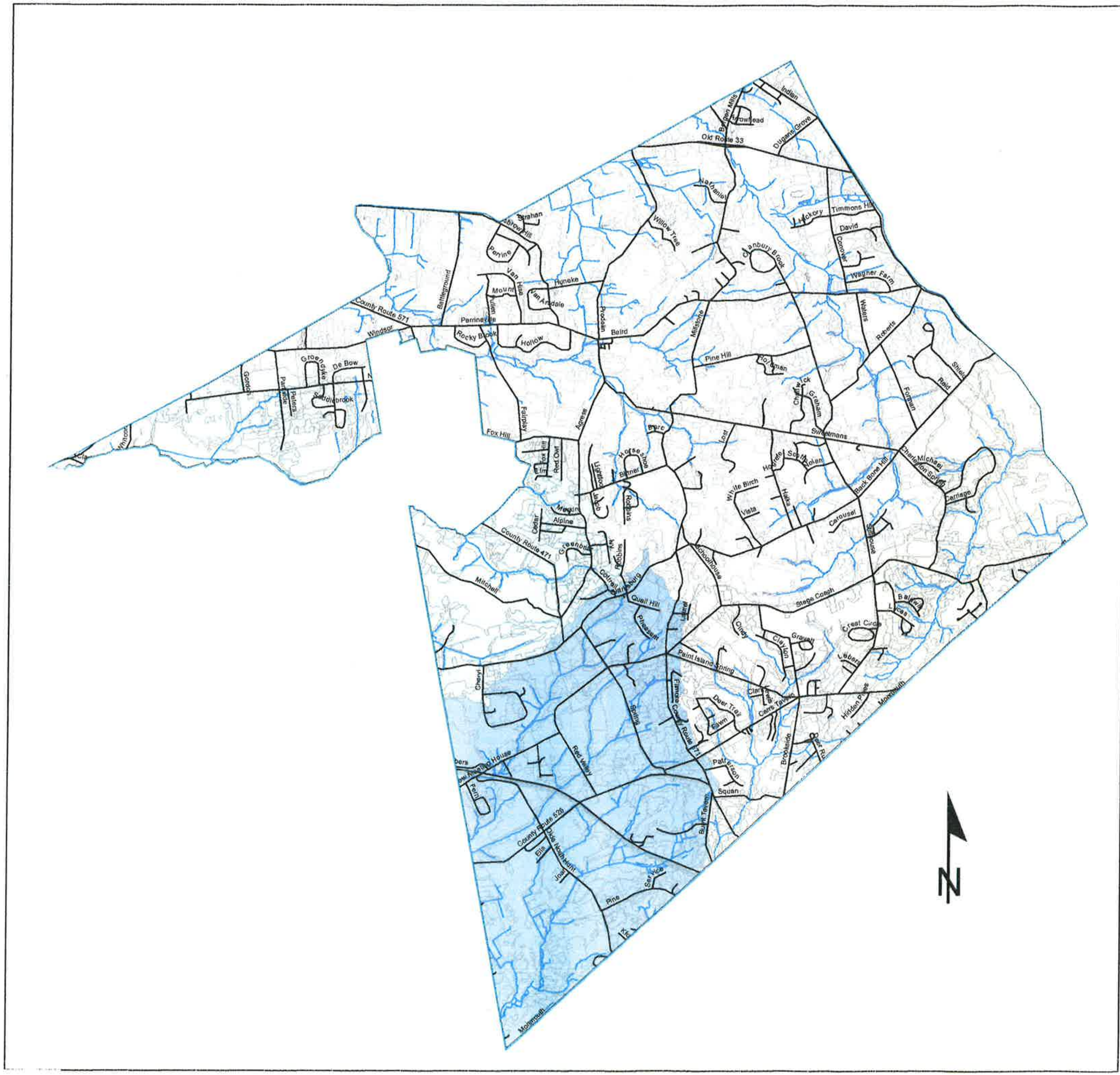


Figure No. 15
Millstone Township Watershed Management Areas

Legend

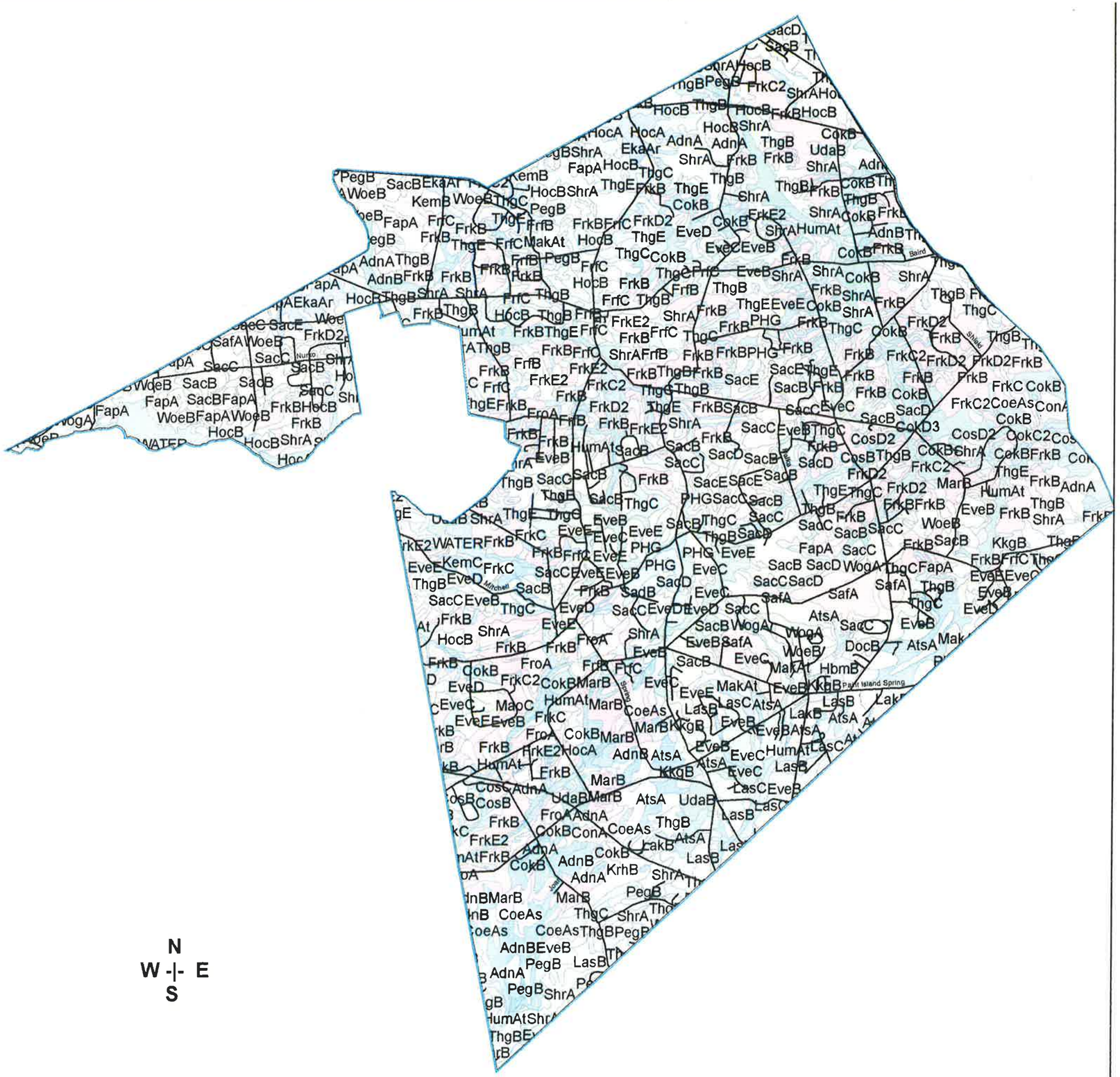
- Roads
- Streams
- Lakes
- Crosswicks Creek WMA
- Barnegat Bay WMA
- Central Delaware Tributaries WMA
- Lower Raritan, So. River, Lawrence WMA
- Millstone River WMA

1:62,000

Sources: NJDEP Landscape Project Version 2.0
Monmouth County GIS (2003)

Not intended as a substitution for a wetland delineation. All wetlands must be verified by the NJDEP Land Use Department with a Wetlands Letter of Interpretation.

Prepared by Leon S. Avakian, Inc.
March 2006



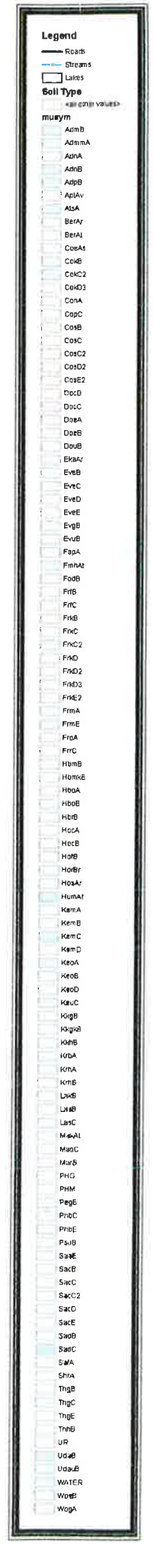


Figure No. 16

Soils of Millstone Township

Sources: NJDEP Landscape Project Version 2.0
Monmouth County GIS (2003)
USDA NRCS (2005)

This map was developed using NJDEP GIS System digital data, but this secondary product has not been verified by NJDEP and is not state authorized.

Prepared by Leon S. Avakian, Inc.
October 2005

APPENDIX A

View of the Millstone River

View of the Rocky Brook

Rocky Brook Creek

Swans on Perrineville Lake

Wagner Farm Park Recreation Center

Football Game at Wagner Park

Sandra at Breezy Acres

Duke at Breezy Acres

The Old Clarksburg School Was Renovated to Become the New Millstone Township Municipal Building

Millstone Township Veterans Memorial

London Planetree Dedicated by Halka Nursery to Commemorate the 2006 Millstone Township NRI/ERI

Spring in Millstone Township

Grassland Habitat within Millstone Township

Wetlands at Bittner Creek

New Jersey Equine Clinic Preserved as Farmland within Millstone Township

Forested Wetland within Millstone Township

Open Space Land Preserved Within Millstone Township

APPENDIX B

State of New Jersey
Richard J. Codey
Acting
Department of Environmental Protection
Bradley M. Campbel
Commissioner
Division of Parks and Forestry
Office of Natural Lands Management
Natural Heritage Program
P.O. Box 404
Trenton, NJ 08625-0404
Tel. #609-984-1339
Fax. #609-984-1427

September 8,

2005 Lisa Spaziano Leon S. Avakian, Inc. 788 Wayside Road
Neptune, NJ 07753

Re: Millstown Township Natural Resources Inventory

Dear Ms. Spaziano:

Thank you for your data request regarding rare species information for Millstone Township, Monmouth County.

We have checked the Natural Heritage Database and the Landscape Project habitat mapping for occurrences of any rare wildlife species or wildlife habitat on the referenced site. Please see Table 1 for species list and conservation status.

Table I (on referenced site).

Common Name	Scientific Name	Federal Status	State Status	Grank	Srank
American kestrel	*Falco sparverius*		INC/S	G5	S3B,S?N
barred owl	*Strix varia*		T/T	G5	S3B
black-throated green warbler	*Dendmica wrens*		Special Concern	G5	S3B
bobolink	*Dolichonyx oryzivorus*		T/T	G5	S2B
bog turtle	*Clemmys muhlenbergii*	LT	E	G3	S2
Cooper's hawk	*Accipiter cooper/7*		T/T	G5	S3B.S4N
eastern box turtle	*Terrapene Carolina*		Special Concern	G5	S5B
Fowler's toad	*Bufo woodhousii fowleri*		Special Concern	G5	S4
frosted elfin	*Callophrys irus*		T	G3	S2S3
grasshopper sparrow	*Ammodramus savannarum*		T/S	G5	S2B
northern parula	*Parula americana*		Special Concern	G5	S3B
northern pine snake	*Pituophis m. melanoleucus*		T	G4T4	S3
pine barrens treefrog	*Hyla andersonii*		T	G4	S3
savannah sparrow	*Passerculus sandwichensis*		T/T	G5	S2B.S4N
spotted turtle	*Clemmys guttata*		Special Concern	G5	S4
timber rattlesnake	*Crotalus n. horridus*		E	G4T4	S2
vesper sparrow	*Pooecetes gramineus*		E	G5	S1B.S2N
wood turtle	*Clemmys insculpta*		T	G4	S3
yellow-breasted chat	*Icteria wrens*		Special Concern	G5	S3B

We have also checked the Natural Heritage Database for occurrences of rare plant species or natural communities. The Natural Heritage Database has records for occurrences of *Helonias bullata* and *Platanthera peramoena* that may be on the site. The attached list provides more information about these occurrences.

Also attached is a list of rare species and natural communities that have been documented from Monmouth County. If suitable habitat is present at the project site, these species have potential to be present.

Status and rank codes used in the tables and lists are defined in the attached EXPLANATION OF CODES USED IN NATURAE HERITAGE REPORTS.

In order to red flag the general locations of occurrences of rare and endangered plant species and natural communities, we have prepared computer generated Natural Heritage Index Maps. Enclosed please find these maps for the Jamesburg, Allentown, Roosevelt and Adelphia USGS quadrangles. If individual projects are to be located in the areas of these maps that contain letter codes, the Natural Heritage Program can be contacted for additional information.

If you have questions concerning the wildlife records or wildlife species mentioned in this response, we recommend that you visit the interactive I-Map-NJ website at the following URL, http://www.state.nj.us/dep/gis/depsplash.htm or contact the Division of Fish and Wildlife, Endangered and Nongame Species Program.

PLEASE SEE THE ATTACHED 'CAUTIONS AND RESTRICTIONS ON NHP DATA'.

Thank you for consulting the Natural Heritage Program. The attached invoice details the payment due for processing this data request. Feel free to contact us again regarding any future data requests.

Sincerely,

Herbert A. Lord
Data Request Specialist

cc: Robert J. Cartica
Lawrence Niles
NHP File No. 05-4007424

Millstone Township
Rare Plant Species and Ecological Communities Presently Recorded in the New Jersey Natural Heritage Database

Scientific Name	*Common Name*	*Federal Status*	*State Status*	*Regional Status*	*G Rank*	*S Rank*	*Last Observed*	*Ident*
Vascular Plant								
Helonias bullata	**Swamp-pink**	**LT**	**E**	**LP, HL**	**G3**	**S3**	**2002-09-??**	
Helonias bullata	**Swamp-pink**	**LT**	**E**	**LP, HL**	**G3**	**S3**	**2000-08-23**	**Y**
Platantheraperamoena	**Purple Fringeless Orchid**	**E**	**LP, HL**	**G5**	**SI**		**1954-07-24**	**Y**

3 Records Selected

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 in order to map critical habitat for rare animal species. Natural Heritage Database response letters will also list all species (if any) found during a search of the Landscape Project. However, 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

EXPLANATIONS OF CODES USED IN NATURAL HERITAGE

REPORTS

FEDERAL STATUS CODES

The following U.S. Fish and Wildlife Service categories and their definitions of endangered and threatened plants and animals have been modified from the U.S. Fish and Wildlife Service (F.R. Vol. 50 No. 1 88; Vol. 61, No. 40; F.R. 50 CFR Part 1 7). Federal Status codes reported for species follow the most recent listing.

LE	Taxa formally listed as endangered.
LT	Taxa formally listed as threatened.
PE	Taxa already proposed to be formally listed as endangered.
PT	Taxa already proposed to be formally listed as threatened.
C	Taxa for which the Service currently has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species.
S/A	Similarity of appearance species.

STATE STATUS CODES

Two animal lists provide state status codes after the Endangered and Nongame Species Conservation Act of 1 973 (NSSA 23:2A-1 3 et. seq.): the list of endangered species (N.J.A.C. 7:25-4.1 3) and the list defining status of indigenous, nongame wildlife species of New Jersey (N.J.A.C. 7:25-4.1 7(a)). The status of animal species is determined by the Nongame and Endangered Species Program (ENSP). The state status codes and definitions provided reflect the most recent lists that were revised in the New Jersey Register, Monday, June 3, 1 991.

D	Declining species-a species which has exhibited a continued decline in population numbers over the years.
E	Endangered species-an endangered species is one whose prospects for survival within the state are in immediate danger due to one or many factors - a loss of habitat, over exploitation, predation, competition, disease. An endangered species requires immediate assistance or extinction will probably follow.
EX -	Extirpated species-a species that formerly occurred in New Jersey, but is not now known to exist within the state.
I	Introduced species-a species not native to New Jersey that could not have established itself here without the assistance of man.
INC	Increasing species-a species whose population has exhibited a significant increase, beyond the normal range of its life cycle, over a long term period.
T	Threatened species-a species that may become endangered if conditions surrounding the species begin to or continue to deteriorate.
P	Peripheral species-a species whose occurrence in New Jersey is at the extreme edge of its present natural range.
S	Stable species-a species whose population is not undergoing any long-term increase/decrease within its natural cycle.
U	Undetermined species-a species about which there is not enough information available to determine the status.

Status for animals separated by a slash(/) indicate a duel status. First status refers to the state breeding population, and the second status refers to the migratory or winter population.

Special Concern applies to animal species that warrant special attention because of some evidence of decline, inherent vulnerability to environmental deterioration, or habitat modification that would result in their becoming a Threatened species. This category would also be applied to species that meet the foregoing criteria and for which there is little understanding of their current population status in the state.

Plant taxa listed as endangered are from New Jersey's official Endangered Plant Species List N.J.S.A. 1 31 B-l 5.1 51 et seq.

E Native New Jersey plant species whose survival in the State or nation is in jeopardy.

REGIONAL STATUS CODES FOR PLANTS AND ECOLOGICAL COMMUNITIES

LP Indicates taxa listed by the Pinelands Commission as endangered or threatened within their legal jurisdiction. Not all species currently tracked by the Pinelands Commission are tracked by the Natural Heritage Program. A complete list of endangered and threatened Pineland species is included in the New Jersey Pinelands Comprehensive Management Plan.

HL Indicates taxa or ecological communities protected by the Highlands Water Protection and Planning Act within the jurisdiction of the Highlands Preservation Area.

EXPLANATION OF GLOBAL AND STATE ELEMENT RANKS

The Nature Conservancy has developed a ranking system for use in identifying elements (rare species and natural communities) of natural diversity most endangered with extinction. Each element is ranked according to its global, national, and state (or subnational in other countries) rarity. These ranks are used to prioritize conservation work so that the most endangered elements receive attention first. Definitions for element ranks are after The Nature Conservancy (1982: Chapter 4, 4.1-1 through 4.4.1.3-3).

GLOBAL ELEMENT RANKS

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

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

C3 Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g., a single western state, a physiographic region in the East) or because of other factors making it vulnerable to extinction throughout it's range; with the number of occurrences in the range of 21 to 1 00.

C4 Apparently secure globally; although it may be quite rare in parts of its range, especially at the periphery.

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

GH Of historical occurrence throughout its range i.e., formerly part of the established biota, with the expectation that it may be rediscovered.

CD Possibly in peril range-wide but status uncertain; more information needed.

GX Believed to be extinct throughout range (e.g., passenger pigeon) with virtually no likelihood that it will be rediscovered.

G? Species has not yet been ranked.

GNR Species has not yet been ranked.

STATE ELEMENT RANKS

51 Critically imperiled in New Jersey because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres). Elements so ranked are often restricted to very specialized conditions or habitats and/or restricted to an extremely small geographical area of the state. Also included are elements which were formerly more abundant, but because of habitat destruction or some other critical factor of its biology, they have been demonstrably reduced in abundance. In essence, these are elements for which, even with intensive searching, sizable additional occurrences are unlikely to be discovered.

52 Imperiled in New Jersey because of rarity (6 to 20 occurrences). Historically many of these elements may have been more frequent but are now known from very few extant occurrences, primarily because of habitat destruction. Diligent searching may yield additional occurrences.

53 Rare in state with 21 to 1 00 occurrences (plant species and ecological communities in this category have only 21 to 50 occurrences). Includes elements which are widely distributed in the state but with small populations/acreage or elements with restricted distribution, but locally abundant. Not yet imperiled in state but may soon be if current trends continue. Searching often yields additional occurrences.

54 Apparently secure in state, with many occurrences.

55 Demonstrably secure in state and essentially ineradicable under present conditions.

.SA Accidental in state, including species (usually birds or butterflies) recorded once or twice or only at very great intervals, hundreds or even thousands of miles outside their usual range; a few of these species may even have bred on the one or two occasions they were recorded; examples include European strays or western birds on the East Coast and vice-versa.

SE Elements that are clearly exotic in New Jersey including those taxa not native to North America (introduced taxa) or taxa deliberately or accidentally introduced into the State from other parts of North America (adventive taxa). Taxa ranked SE are not a conservation priority (viable introduced occurrences of GI or C2 elements may be exceptions).

SH Elements of historical occurrence in New Jersey. Despite some searching of historical occurrences and/or potential habitat, no extant occurrences are known. Since not all of the historical occurrences have been field surveyed, and unsearched potential habitat remains, historically ranked taxa are considered possibly extant, and remain a conservation priority for continued field work.

SP Element has potential to occur in New Jersey, but no occurrences have been reported.

SR Elements reported from New Jersey, but without persuasive documentation which would provide a basis for either accepting or rejecting the report. In some instances documentation may exist, but as of yet, its source or location has not been determined.

SRF Elements erroneously reported from New Jersey, but this error persists in the literature.

SU Elements believed to be in peril but the degree of rarity uncertain. Also included are rare taxa of uncertain taxonomical standing. More information is needed to resolve rank.

SX Elements that have been determined or are presumed to be extirpated from New Jersey. All historical occurrences have been searched *and a reasonable search of potential habitat has been completed. Extirpated taxa are not a current conservation priority.*

SXC Elements presumed extirpated from New Jersey, but native populations collected from the wild exist in cultivation.

SZ Not of practical conservation concern in New Jersey, because there are no definable occurrences, although the taxon is native and appears regularly in the state. An SZ rank will generally be used for long distance migrants whose occurrences during their migrations are too irregular (in terms of repeated visitation to the same locations), transitory, and dispersed to be reliably identified, mapped and protected. In other words, the migrant regularly passes through the state, but enduring, mappable element occurrences cannot be defined.

Typically, the SZ rank applies to a non-breeding population (N) in the state - for example, birds on migration. An SZ rank may in a few instances also apply to a breeding population (B), for example certain lepidoptera which regularly die out every year with no significant return migration.

Although the SZ rank typically applies to migrants, it should not be used indiscriminately. Just because a species is on migration does not mean it receives an SZ rank. SZ will only apply when the migrants occur in an irregular, transitory and dispersed manner.

B Refers to the breeding population of the element in the state.

N Refers to the non-breeding population of the element in the state.

T Element ranks containing a "T" indicate that the infraspecific taxon is being ranked differently than the full species. For example Stachys palustris var. homotricha is ranked "G5T? SH" meaning the full species is globally secure but the global rarity of the var. homotricha has not been determined; in New Jersey the variety is ranked historic.

Q Elements containing a "Q" in the global portion of its rank indicates that the taxon is of questionable, or uncertain taxonomical standing, e.g., some authors regard it as a full species, while others treat it at the subspecific level.

.1 Elements documented from a single location.

Note: To express uncertainty, the most likely rank is assigned and a question mark added (e.g., C2?). A range is indicated by combining two ranks (e.g., C1C2.S1S3).

IDENTIFICATION CODES

These codes refer to whether the identification of the species or community has been checked by a reliable individual and is indicative of significant habitat.

Y Identification has been verified and is indicative of significant habitat.

BLANK Identification has not been verified but there is no reason to believe it is not indicative of significant habitat.

? Either it has not been determined if the record is indicative of significant habitat or the identification of the species or community may be confusing or disputed.

Revised May 2005

APPENDIX C

Soils of Millstone Township

SOIL TYPE	Map Label (See Figure 5)	APPROXIMATE AREA (Acres)	N.J.A.C. 7:9A Septic System Soil Suitability Classification	Hydrologic Group	Drainage
Adelphia loam, 0 to 2 percent slopes	AdnA	232.311	IIWr	C	MW
Adelphia loam, 2 to 5 percent slopes	AdnB	330.013	IIWr	C	MW
Atsion sand	Ats	379.221	IIIWr	C/D	P
Colemantown loam, occasionally flooded	Coes	408.668	IIIHrWp	C/D	P
Collington sandy loam, 2 to 5 percent slopes	CokB	939.294	I	B	W
Collington sandy loam, 5 to 10 percent slopes	CokC2	267.303	I	B	W
Collington sandy loam, 10 to 15 percent slopes	CokD3	112.261	I	B	W
Collington loam, 0 to 2 percent slopes	ConA	120.829	I	B	W
Colts Neck sandy loam, 2 to 5 percent slopes	CosB	91.982	I,IIHr	B	W
Colts Neck sandy loam, 5 to 10 percent slopes	CosC	21.11	I,IIHr	B	W
Colts Neck sandy loam, 5 to 10 percent slopes	CosC2	41.865	I,IIHr	B	W
Colts Neck sandy loam, 10 to 15 percent slopes	CosD2	56.104	I,IIHr	B	W
Colts Neck sandy loam, 15 to 20 percent slopes	CosE2	25.113	I,IIHr	B	W
Downer loamy sand, 0 to 5 percent slopes	DocB	30.945	I	B	W
Downer loamy sand, 5 to 10 percent slopes	DocC	22.197	I	B	W
Downer sandy loam, 0 to 2 percent slopes	DoeA	6.457	I	B	W
Elkton loam	EkaA	239.51	IIISrWr	C/D	P
Evesboro sand, 0 to 5 percent slopes	EveB	867.567	I	A	E
Evesboro sand, 5 to 10 percent slopes	EveC	416.524	I	A	E
Evesboro sand, 10 to 15 percent.slopes	EveD	248.755	I	A	E
Evesboro sand, 15 to 25 percent slopes	EveE	398.422	I	A	E
Fallsington loam	Fap	459.321	IIIWr	B/D	P
Fluvaquents, loamy, frequently flooded	Fmht	0.717	Frequently flooded	C	P
Freehold loamy sand, 0 to 5 percent slopes	FrfB	172.238	I	B	W
Freehold loamy sand, 5 to 10 percent slopes	FrfC	218.312	I	B	W
Freehold sandy loam, 2 to 5 percent slopes	FrkB	3087.758	I	B	W

Freehold sandy loam, 5 to 10 percent slopes	FrkC	217.095	I	B	W
Freehold sandy loam, 5 to 10 percent slopes, eroded	FrkC2	527.932	I	B	W
Freehold sandy loam, 10 to 15 percent slopes	FrkD	18.708	I	B	W

SOIL TYPE	Map Label (See Figure 5)	APPROXIMATE AREA (Acres)	N.J.A.C. 7:9A Septic System Soil Suitability Classification	Hydrologic Group	Drainage
Freehold sandy loam, 10 to 15 percent slopes, eroded	FrkD2	332.077	I	B	W
Freehold sandy loam, 15 to 25 percent slopes, eroded	FrkE2	330.299	I	B	W
Freehold loam, 0 to 2 percent slopes	FroA	240.198	I	B	W
Galloway loamy sand, 0 to 5 percent slopes	GamB	134.024		B/D	SP/P
Galloway loamy sand, clayey substratum, 0 to 5 percent slopes	GamkB	4.428		B	SP
Hammonton loamy sand, 0 to 5 percent slopes	HbmB	30.25	IIWr	B	MW
Holmdel sandy loam, 0 to 2 percent slopes	HocA	144.836	IIIWr,IIWr	C	MW
Holmdel sandy loam, 2 to 5 percent slopes	HocB	840.96	IIIWr,IIWr	C	MW
Humaquepts, frequently flooded	Humt	926.667		C	P
Keyport sandy loam, 0 to 2 percent slopes	KemA	1.35	IIISr(IIWp)	C	MW
Keyport sandy loam, 2 to 5 percent slopes	KemB	127.722	IIISr(IIWp)	C	MW
Keyport sandy loam, 5 to 10 percent slopes	KemC	52.796	IIISr(IIWp)	C	MW
Keyport sandy loam, 10 to 15 percent slopes	KemD	21.469	IIISr(IIWp)	C	MW
Kresson loam, 2 to 5 percent slopes	KrhB	40.761	IIIHrWp(IIWr)	C	SP/P
Lakehurst sand, 0 to 5 percent slopes	LakB	150.816	IIWr,IIIWr	A	MW
Lakewood sand, 0 to 5 percent slopes	LasB	474.504	I	A	E
Lakewood sand, 5 to 10 percent slopes	LasC	92.591	I	A	E
Manahawkin muck, frequently flooded	Makt	244.83	Wetland	D	VP
Marlton sandy loam, 5 to 10 percent slopes	MaoC	135.773	IIIHr(IIWp);IIIHr	C	W
Marlton loam, 2 to 5 percent slopes	MarB	430.507	IIIHr(IIWp);IIIHr	C	W
Pemberton loamy sand, 0 to 5 percent slopes	PegB	330.143	IIWr, IIIWr	B	MW
Phalanx loamy sand, 5 to 10 percent slopes	PhbC	69.008	IISc	B	W
Phalanx loamy sand, 10 to 25 percent slopes	PhbE	11.905	IISc	B	W
Pits, sand and	PHG	148.986		A	W

gravel					
Sassafras sandy loam, 2 to 5 percent slopes	SacB	1860.555	I	B	W
Sassafras sandy loam, 5 to 10 percent slopes	SacC	569.568	I	B	W
Sassafras sandy loam, 10 to 15 percent slopes	SacD	261.292	I	B	W
Sassafras sandy loam, 15 to 25 percent slopes	SacE	209.453	I	B	W
Sassafras gravelly sandy loam, 2 to 5 percent slopes	SadB	33.321	I	B	W

SOIL TYPE	Map Label (See Figure 5)	APPROXIMATE AREA (Acres)	N.J.A.C. 7:9A Septic System Soil Suitability Classification	Hydrologic Group	Drainage
Sassafras gravelly sandy loam, 5 to 10 percent slopes	SadC	9.107	I	B	W
Sassafras loam, 0 to 2 percent slopes	SafA	359.191	I	B	W
Shrewsbury sandy loam	Shr	1656.857	IIIWr	C/D	P
Tinton loamy sand, 0 to 5 percent slopes	ThgB	1450.149	I	A	W
Tinton loamy sand, 5 to 10 percent slopes	ThgC	743.337	I	A	W
Tinton loamy sand, 10 to 25 percent slopes	the	413.337	I	A	W
Udorthents-Urban land complex, 0 to 5 percent slopes	Uda	16.291			MW
Udorthents, smoothed	Uds	96.677			MW
Water	Water	320.99			
Woodstown sandy loam, 2 to 5 percent slopes	WoeB	473.75	IIIWr, IIWr	C	MW
Woodstown loam, 2 to 5 percent slopes	WogA	138.155	IIIWr, IIWr	C	MW

Notes:

Soils ranked on restrictions from I, least restrictive to III, most restrictive
Wr refers to regional zone of saturation with IIWr indicating 2 to 5 feet and IIIWr indicating 0 to 2 feet below ground surface.
Wp refers to perched zone of saturation with IIWp indicating 2 to 5 feet and IIIWp indicating 0 to 2 feet below ground surface.
Hr refers to hydraulically restrictive zone with IIHr indicating 4 to 9 feet and IIIHr indicating 0 to 4 feet below ground surface.
Sr refers to hydraulically restrictive substrata with IISr indicating 4 to 9 feet and IIISr indicating 0 to 4 feet below ground surface.

IISc refers to excessively coarse substrata from 0 to 5 feet below ground surface.
Hydrologic classification with A soils having high infiltration rates and D soils having very slow infiltration rates and/or shallow water table.
Drainage codes: MW= moderately well, P= poorly, E= excessively, W= well, SP= somewhat poorly, and VP= very poorly.
Hydric codes: Y=soils are considered hydric and N= soils are not considered hydric.

APPENDIX D

gure No. 17

ɔne Township
ial Photograph

1:45,000

P Landscape Project Version 2.0
uth County GIS (2003)

s developed using NJDEP
m digital data, but this
duct has not been verified
ınd is not state authorized."

y Leon S. Avakian, Inc.
March 2006

Figure No. 18

stone Township
3 Aerial View

1:45,000

Monmouth County GIS (2003)
NJDEP GIS

epared by Leon S. Avakian, Inc.
March 2006