Environmental Resource Inventory

Cranbury Township

Middlesex County, New Jersey

March 2016

This document was updated with a Sustainable Jersey Small Grant funded by the PSEG Foundation.*

**The initial Cranbury Township Environmental Resource Inventory was prepared by Amy S. Greene Environmental Consultants in June 2006. In 2015 / 2016, using the Sustainable Jersey Small Grant the maps and data were updated by Johnny Quispe. Members of the Environmental Commission revised the original text to reflect the updated maps and revised data.*

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EXECTUTIVE SUMMARY

The purpose of the Environmental Resource Inventory (ERI) for Cranbury Township is to objectively identify and describe the natural resources, cultural conditions, and environmental features within the Township. The ERI provides both visual depictions of natural resources, in the form of mapping information and text that describes these resources, their sensitivity and limitations for development, and suggested measures for protecting sensitive resources. The text has been gathered from existing resources such as the Cranbury Township Master Plan, and reports and studies provided by County, State, and Federal Agencies, and non-government organizations.

The updating of the original 2006 Cranbury Township ERI has produced a much more comprehensive document for use as a planning tool to assist Cranbury Township balance the ongoing development within the Township while protecting and enhancing the sensitive environmental resources in the Township. The updated ERI provides 37 maps (as opposed to 19 in the original 2006 ERI) depicting key geologic, soils, water resources, wetlands, air quality, land use, and wildlife information on the resources in the Township. All of the existing data and text in the original ERI has been updated as required and new data and text has been provided for the additional maps included in the updated ERI.

The Cranbury Township Environmental Commission took the opportunity in updating the ERI to expand on the key characteristics of the Township that make Cranbury a special community. Discussions on the Village Historic District, as well as the open space within the Township have been expanded in the updated ERI. Additional mapping, data, and text on the parks, wildlife preserves, and farmland preservation have been included on the updated ERI.

In updating the ERI, the Environmental Commission has also provided links to other key documents and information that are important in the planning process. Links to the Cranbury Township Open Space component of the Master Plan are provided in the applicable sections of the updated ERI. The link to the Parks Committee's web site provides useful information on all of the parks and wildlife preserves within the Township.

1.0 INTRODUCTION

The purpose of the Environmental Resource Inventory (ERI) for Cranbury Township is to objectively identify and describe the natural resources, cultural conditions, and environmental features within the Township. The ERI provides both visual depictions of natural resources, in the form of mapping information and text that describes these resources, their sensitivity and limitations for development, and suggested measures for protecting sensitive resources. The text has been gathered from existing resources such as the Cranbury Township Master Plan, and reports and studies provided by County, State, and Federal Agencies, and non-government organizations.

Existing map sources provided the basis for establishing the location of natural resources presented in the ERI. Since the maps were not field verified, the resource mapping presented herein is intended for general planning purpose and should not substitute for site-specific surveys.

The Township of Cranbury is a 13.42 square mile mostly rural community located at the southern end of Middlesex County, adjacent to Mercer County (Figure 1). The Township is bordered by four other municipalities: Plainsboro Township to the west, South Brunswick Township to the north, Monroe Township to the east and East Windsor Township to the south.

State Highway Route 130 traverses Cranbury Township (Figures 2 & 3) and provides regional access to the other central New Jersey Municipalities. The New Jersey Turnpike also travels through the Township and provides interstate access to New York City and Philadelphia. Land to the east of Route 130 is developed for industrial warehouse and other highway commercial uses. Land to the west of Route 130 is made up of mostly residential uses, as well as active farms and woodlands. A state and nationally recognized historic downtown area, Cranbury Village, runs along Main Street and consists of small retail and service establishments and densely developed residential lots surrounding the commercial core. The historic ambiance of the Village center is augmented by preserved farmland along its edges, which denotes the historic, agricultural character. Cranbury is characterized by relatively flat terrain. Several watercourses pass through the Township, including Cranbury Brook (which drains to Brainerd Lake), Cedar Brook, and the Millstone River. In 2015, the estimated

population of Cranbury was estimated to be 3,857, an increase over the 2000 population of 3,227.

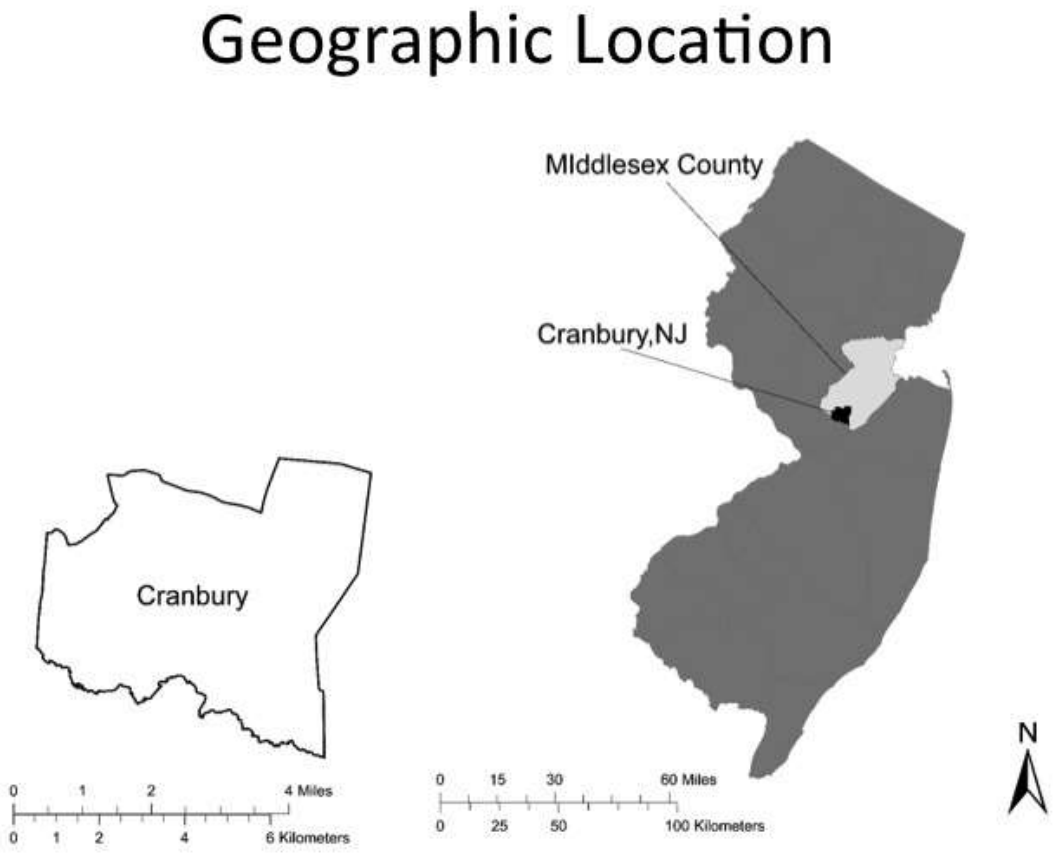


Fig 1. Cranbury Location Map – Middlesex County / State of New Jersey

As stated in the Cranbury Township Master Plan (2010), the overriding goal in Cranbury Township is preservation of the Township's rural characteristics. Cranbury's rural character is defined by a variety of elements, including scenic views, county roads, open space, farmland, hedgerows and tree lines, barns, streams and ponds, and historic structures. Historic Cranbury Village is also an important element in preserving the rural character. The preservation of the unique features of the historic Cranbury Village is integral to maintaining the character and quality of life that identifies Cranbury Township. A secondary goal is to provide Cranbury with sufficient ratable base to sustain Cranbury's fiscal and

community needs in the long term, but to focus such efforts on the Route 130 Corridor and areas east of Route 130.

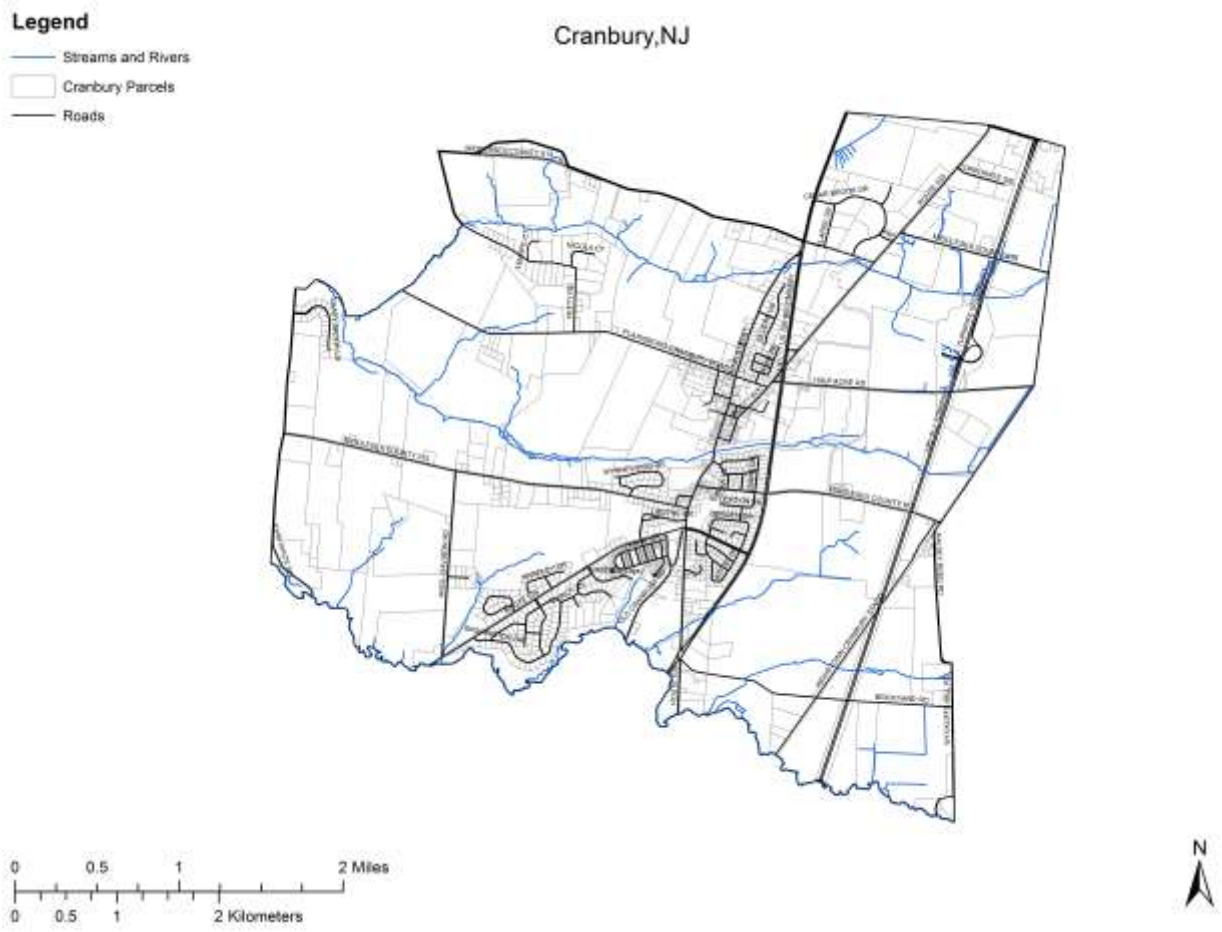


Figure 2 – Cranbury Parcels, Roads, and Rivers

The Master Plan establishes a set of Conservation / Environmental Objectives to help accomplish this major goal, as follows:

- Provide a continuous network of open spaces along streams, scenic areas and critical environmental areas and connect with the open space network in Plainsboro.
- Minimize the impact of development on environmentally sensitive areas including wetlands; stream corridors, and aquifer recharge areas.

- Limit or prohibit development in critical environmental areas such as wetlands and stream corridors.
- Encourage lot averaging or cluster development techniques which preserve natural amenities, farms, woodlands, scenic views, and open space.
- Require replacement plantings in areas of disturbance that reflect the natural vegetation in the area.

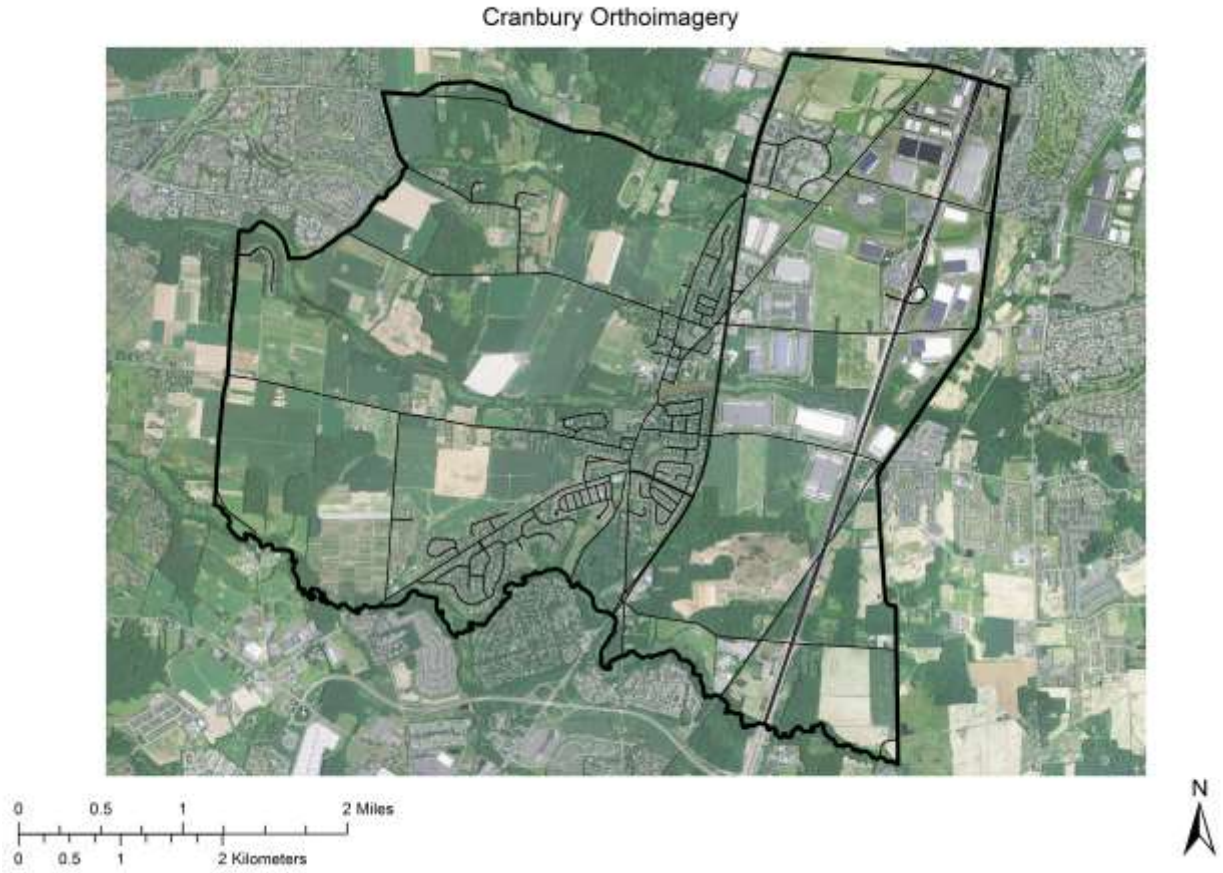


Figure 3 – Cranbury Orthoimagery Map

- Preserve and protect open space areas having scenic views and/or important historical, cultural, or agriculture significance.
- To preserve stands of mature trees to the extent possible.

While working with organizations including the Stony Brook-Millstone Watershed Association, the Natural Resource Conservation Service, and the Association of Environmental Commissions, the Township of Cranbury has actively pursued

many of these environmental objectives with regard to planning, open space preservation, and the development of ordinances. By utilizing data and information provided herein to identify and best protect sensitive environmental resources, Cranbury may better pursue the Master Plan objectives stated above and better execute environmentally and culturally responsible land use with regard to future development in the Township.

The ERI is part of the Township's Master Plan. Revisions to the ERI will be necessary as the Master Plan is updated and priorities and conditions in the Township change. The ERI must be reviewed and updated with regard to changes in and use, the quality of environmental resources, and local, State, and Federal laws. Reviews of the ERI content are necessary to accurately document the progression of the Township over time and to keep the ERI functioning as a legitimate planning tool. The Townships' Environmental Commission is responsible for updating the ERI.

2.0 History / Historic Preservation

2.1 History

Cranbury, one of the oldest towns in New Jersey, was settled in 1697 on land formerly home to the Lenape Indians, a native American Delaware tribe. The Village of Cranbury developed as a result of early transportation routes, which followed the trails of the Lenape. Located between the two major colonial cities of New York and Philadelphia, Cranbury was a convenient stop for stagecoaches where food and lodging could be found.

In 1737, Thomas Grubbs erected the Cranberry Mill on the south side of Cranbury Brook, which formed the nucleus of the Village. The name may have derived from Cranberries growing in a marshland near the mill. On 18th century maps, the name appears as Cranberry and Cranberry Town. A Presbyterian Church was built in 1740, and by 1789; the village contained approximately twenty-five houses, an inn, a blacksmith shop, and a store.

During the American Revolution Cranbury (then Cranbury Town), saw armies rest and past on. Here, the Marquis de Lafayette and Colonel Alexander Hamilton with their troops quartered on June 25, 1778, and here George Washington and his staff established headquarters on June 1778, issuing dispatches, orders and plans

that shaped the Battle of Monmouth. Cranbury is now in the Crossroads of the American Revolution National Heritage Area. Later, Aaron Burr passed through Cranbury as he fled Philadelphia after his dual with Alexander Hamilton.

By 1834, Cranbury contained an academy, a gristmill, two tanneries, three taverns, two stores, and 60 to 80 dwellings. A second Presbyterian Church was established on 1838, followed by a Methodist Church in 1845. An African Methodist Church was formed in Cranbury in 1855 to serve a community of both slaves and free blacks.

The opening of the Camden and Amboy Railroad in 1832, which ran east of the Village, led to some industrial growth in the area. The community of Cranbury Station was developed around the railroad stop. In December of 1869, the Towns' name was changed from Cranberry to Cranbury. On March 7,1872, Cranbury was recognized as a political subdivision of Middlesex County. The area included the Village of Cranbury and the areas within South Brunswick and Monroe Townships at the time.

Beginning in the latter half of the nineteenth century, Cranbury was expanded considerably as the first 1896 Old School building (current Town Hall) was built and was followed by a growth of business and commercial enterprises developed in Cranbury.

Once a center of a potato-growing district, Cranbury retains much of the charm of a farming community's village center. From its early history, Cranbury has consisted of mixed residential and commercial areas. Farmers used the village to sell produce and relied on the Village for services. Many historic residences and farm buildings are located on the farm tracts outside the Village boundaries. The surrounding rural community was dependent of the Village for provisions, while the Village was dependent on the economic support of the farmers. The surrounding rural landscape defines the Village and is a necessary part of the historic integrity of both the Village and the historic structures outside the Village area.

The land development pattern in the Township grew around Cranbury Village. Small retail and service establishments form the core of the Village, with smaller, more densely populated residential lots surrounding the commercial center. Larger lot development, more typical of post World War II suburban

development, occurred outside of the older Village center. New residential development has occurred largely around Cranbury Village, on the west side of Route 130. Highway commercial uses, intended not to compete with commercial establishments in the Village, are located along Route 130.

Beginning in the 1980s, due to its proximity to Exit 8A of the New Jersey Turnpike and its accessibility to the New York and Philadelphia metropolitan regions, industrial warehouses/distribution, office, research and development uses developed to the east side of Route 130. These land development patterns are the result of deliberate land use policy decisions begun in the 1960s and continue to the present.

In the face of significant development pressure, beginning in the 1980s, Cranbury's leadership recognized that the preservation of farmland and other agricultural activity was essential to preserving the rural character of Cranbury Township. Through the use of sound land management regulations as well as revenue from both State and local sources, including tax revenue from its warehouse and distribution district east of Route 130, considerable farmland was saved. Such resources were used to purchase both farmland and open space and to continue further participation in the Farmland Preservation program.

2.2 Historic Preservation

Two organizations in Cranbury, the Historic Preservation Commission and the Cranbury Historical and Preservation Society, are responsible for enhancing, perpetuating the historic nature of the Village, and communication to the public the history of Cranbury.

The Historic Preservation Advisory Committee (HPAC) was established in 1988 for the purposes of protecting, enhancing and perpetuating historical resources within the Township. On February 27, 2006, the HPAC Ordinance Chapter 93 was repealed and replaced with the new Chapter 21 entitled the Historic Preservation Commission (HPC) and a new Chapter 93 entitled "Historic Preservation" pursuant to the N.J.S.A. 40:55D-107 *et seq.* and which is intended to perform all of the functions of a historic preservation commission pursuant to N.J.S.A. 40:55D-109. The HPC still identifies and designates historic landmarks and districts. One of their duties is to advise the Planning and Zoning Boards on the inclusion of

historic sites and landmarks in the recommended capital improvement program. The HPAC web page can be accessed at: http://www.cranburytownship.org/historic_preservation_main.html

The Cranbury Historical and Preservation Society was organized in 1967 and incorporated on November 17, 1970. An Executive Board, composed of officers, trustees and committee chairpersons, governs the Society.

The Society is committed to the furthering of interest and knowledge in the history of Cranbury; the promotion, support and encouragement of the beautification of the land and buildings located in Cranbury; and the restoration and preservation of Cranbury's old and historic buildings and sites. The Society operates a museum and history center, and sponsors biennial house and garden tours; tours of its Museum, and walking tours of the village; periodic exhibits in the Museum; a series of programs in local history at the Cranbury School; and cultural programs and events for the entire community. The Cranbury Historical and Preservation Society web site can be accessed at: http://www.cranburyhistory.org/

3.0 Climatology / Climate Change

3.1 Climatology

New Jersey experiences a significant variation in temperature between the summer and winter months and large daily and day-to-day fluctuations. In the winter, the semi-permanent high-pressures that forms over Canada and the northern Great Plains influences New Jersey's climate. Prevailing winds drag cold polar air masses to the southeast over the eastern United States. Storm centers often accompany these cold polar masses of air. In spring, the high pressure over Canada weakens and a Bermuda high develops over the Atlantic Ocean. The clockwise flow around this high-pressure system results in prevailing winds from the south and southwest, carrying moist tropical and maritime air from the Gulf of Mexico and the Caribbean. In autumn, the Bermuda high weakens and retreats to the south. During this transition period, New Jersey often experiences mild and tranquil weather as weak high pressure moves slowly southeast from Canada.

The winter circulation pattern slowly becomes reestablished by December, ushering in our winter weather.

In spite of New Jersey's small size (7,836 square miles), the Office of the State Climatologist identifies five distinct climate zones in the state: The Northern; Central; Pine Barrens; Southwest; and Coastal. The region's geology, distance from the Atlantic Ocean, and prevailing atmospheric flow patterns produce distinct variations in the daily weather between each of these zones. Cranbury is located within the Central Climate Zone.

The Central Zone has a northeast to southwest orientation, running from New York Harbor and the Lower Hudson River to the great bend of the Delaware River in the vicinity of Trenton. The region is marked by higher levels of pollutants associated with industry and increased automobile traffic as compared to rural areas within the state. Concentrations of buildings and paved areas within these areas tend to retain heat, creating slightly warmer ambient temperatures than surrounding rural areas. Referred to as "heat islands," these warm zones occur frequently within the urbanized parts of the Central Climate Zone.

The northern edge of the Central Climate Zone often serves as a boundary between freezing precipitation and rain during the winter. The Central Zone tends to have 15-20 days above 90 degrees Fahrenheit in the summertime; generally half as many as in areas south of this zone.

The National Weather Service's Cooperative Observer Program (COOP) provides weather and climate data through weather stations nationwide. The data provided is from a sampling station in Hightstown (COOP id # 283951). Data provided here includes normal taken between 1971 and 2000 from the Hightstown station, just south of Cranbury. Precipitation within the region is fairly uniform with an average of 3.97 inches per month. Precipitation levels are around 47.7 inches per year.

Average annual temperature for the region is 52.3 degrees Fahrenheit, which as expected by its location, is an intermediate average temperature compared to northern and southern regions within the state. Generally northern areas of the state have the lowest mean temperature at around 46 degrees Fahrenheit (High Point). Southern portions of the state including Cumberland and Cape May Counties have mean annual temperatures at around 54 degrees Fahrenheit.

Cranbury's coolest month is January with an average temperature of approximately 39 degrees Fahrenheit; and the warmest month is July at 86 degrees Fahrenheit. Snowfall at the Hightstown station averaged 23 inches between 1981 and 2010 (OSC, 2016). The Office of the State Climatologist (http://climate.rutgers.edu/stateclim/) provides additional information on the Hightstown Station and weather and climate trends throughout the state.

3.1 Climate Change

Climate change refers to fluctuations in the Earth's climate over a long period of time. Defined as the average of global or of a locale's weather patterns over an extended period of time, climate is different from normal variations in weather, which can change on a regional scale, hour-to-hour, day-to-day, season – to - season.

Current estimates geologically date the Earth to about 4.5 billion years, and it is important to note that the Earth's climate has changed over time. In more recent history, the northern hemisphere experienced above average temperatures from the eleventh century through the fifteenth century, while the seventeenth through mid-nineteenth century experienced temperatures that were colder than normal. Climate can also vary on a short-term basis due to volcanic eruptions or certain shifts in the Earth's system, for example, El Niño, La Niña, or North Atlantic oscillation patterns.

It is common knowledge that greenhouse gases, such as carbon dioxide, methane, ozone, and water vapor, absorb radiation in the atmosphere, naturally heating the Earth's surface. Without this greenhouse effect, the Earth would be inhabitable for most forms of life. However, scientists are attributing the record rate of warming of the twentieth century and present day to a human activity-enhanced greenhouse effect. As humans create and release more man-made greenhouse gases into the atmosphere, the natural greenhouse effect is magnified, trapping more heat than is released into space and causing more warming of the Earth's surface.

This amplified level of warming is a concern. Scientists all over the world are studying the occurrence of climate change over the past century and the impacts it will have on the Earth in the future. Calls for adaptation at all levels - internationally, nationally, and locally - are being sounded.

The New Jersey Climate Adaptation Alliance is a network of policymakers, public and private sector practitioners, academics, and NGO and business leaders designed to build climate change preparedness capacity in New Jersey. The Alliance is facilitated by Rutgers University, which provides science and technical support, facilitates the Alliance's operations and advances its recommendations. The Climate Adaption Alliance findings are presented in the "State of Climate Change in New Jersey", which can be accessed at: http://njadapt.rutgers.edu/

4.0 Geology

4.1 Physiography

Physiography is the relationship between a location and its underlying geology. New Jersey includes four major physiographic provinces, the Ridge and Valley, Highlands, Piedmont and the Atlantic Coastal Plain. The Coastal Plain area is the most easterly and southerly area of New Jersey and constitutes about 60% of the total land area of the State. It belongs to a larger geologic province of the eastern United States that extends northward through Long Island to Cape Cod and southwestward along the coast into Mexico. The Coastal Plain province is separated into the Inner and Outer Coastal Plain. Cranbury lies entirely within the Inner Coastal Plain. The Inner Coastal Plain is comprised of Cretaceous sands, clays and glauconitic marl and tends have to a lower sand and higher clay content than the soils of the Outer Coastal Plain. As a result, Inner Coastal Plain soils tend to be less porous and retain more nutrients than the sandier soils of the Outer Coastal Plain. Differences between the vegetative communities may reflect these soil differences including the increased dominance of coniferous (pitch pine) forests in the Outer Coastal Plain.

The Coastal Plain is the youngest of the physiographic provinces, having been formed beginning about 140 million years before present day (MYBP). The Coastal Plain is almost entirely of Cretaceous (136-65 MYBP) and Tertiary (65-1.8 MYBP) ages. The Coastal Plain began to form as the continental deposits on older metamorphosed rocks subsided below sea level. Subsequently, marine and marginal marine materials and sediments were deposited. As a result, the Coastal Plain is composed of a sequence of unconsolidated highly permeable to relatively impermeable quartz gravel, sand, silt, glauconitic sand (greensand) and clay strata that dip and thicken southeastward, thickening to about 6000 feet at Cape May

and extending seaward onto the submerged continental shelf. During the Cretaceous and Tertiary periods the Atlantic Ocean alternately advanced and retreated across the landscape, retreating for the final time about 5 MYBP.

4.2 Stratigraphy and Surficial Formations

The sediments of various geologic strata that comprise the Inner Coastal Plain physiographic province were laid down in a sequential process, one atop the next, as the ocean advanced and retreated over millions of years. Alternating layers of gravelly and sandy marine materials and continental, fluvial sediments and clays were deposited forming a highly stratified geologic condition. The gravelly and sandy marine deposits contain substantial pore spaces while the silt and clay deposits create confining layers, or "aquicludes." The sediment deposits that form the Coastal Plain are underlain by crystalline metamorphic and igneous bedrock of Paleozoic and/or Precambrian Age.

The Township of Cranbury contains three surficial formations (geologic units that outcrop within the Township). These three Upper Cretaceous deposits include Magothy, Merchantville and Woodbury formations. The Magothy formation is the deepest formation in Cranbury. It is overlain by the Merchantville formation to the south and east in Cranbury. The Merchantville formation is overlain by the Woodbury formation in the southernmost corner of Cranbury (Figure 4).

The southernmost outcropping formation in Cranbury is the Woodbury formation. This formation outcrops in the southern most portions of Cranbury west of the New Jersey Turnpike. This approximate 50 foot thick layer is comprised of clay silts containing mica and pyrite, glauconite clay, carbonized materials and quartz sands near the lower portions.

Below the Woodbury formation is the Merchantville Formation. The Merchantville Formation extends in a band from the eastern portion of the Millstone River in Cranbury to the eastern boundary in the northeastern corner of the municipality. Within Cranbury, it is over 7000 feet wide at its widest, encompassing the southern portion of Cranbury Village. The outcropping portion is considerably narrower (approximately 3000-4000 feet wide) in northeastern Cranbury. The formation ranges from approximately 20-65 feet deep and is

composed of clayey and silty glauconite and glauconite-quartz sands containing mica, feldspar and pyrite, particularly in the lowest portions.

The Magothy Formation lies below the Merchantville Formation and outcrops throughout northern and western Cranbury. It is overlain by the Merchantville and Woodbury formations in the rest of Cranbury. The Magothy formation under Cranbury contains fine to coarse-grained quartz sand and gravel interbedded with thin layers of clays and silt in the upper portions. Depths of the Magothy Formation within the Inner Coastal Plain range from about 80 to over 250 feet. The sands of this formation, in conjunction with those of the underlying Raritan and Potomac formations form the Potomac Raritan Magothy Aquifer (PRM) - a vital source of water for the New Jersey Coastal Plain. The PRM is discussed in greater detail in the next section.

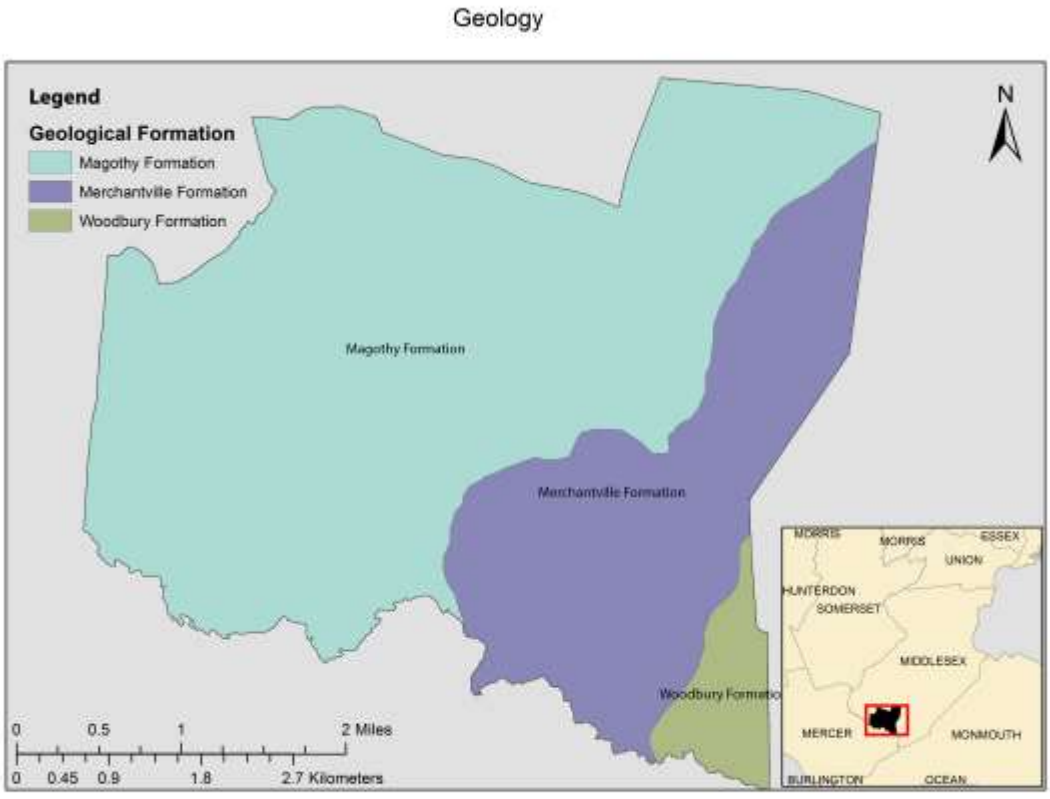


Fig 4. Geological Formations

Just South of Cranbury, additional Upper Cretaceous geologic units overlay the formations mentioned above. These younger formations outcrop in narrow bands, following the general northeast/southwest outcrop pattern found throughout the Inner Coastal Plain. They include (in ascending order) Englishtown Formation, which overlies the Woodbury Formation, the Marshalltown Formation, Wenonah Formation, Mount Laurel Formation and the Navesink Formation.

4.3 Aquifers and Recharge Areas

An aquifer is a saturated permeable geologic unit that can transmit significant quantities of water under ordinary hydraulic gradients. More than 75% of the freshwater supply in the Coastal Plain is groundwater drawn from aquifers (USEPA, 1988). The most common aquifers are those geologic formations that have relatively high hydraulic conductivity values, such as unconsolidated sands and gravels, permeable sedimentary rocks such as sandstone and limestone, and heavily fractured sedimentary, volcanic and crystalline rocks. The aquifers of the Coastal Plain consist primarily of unconsolidated sands and gravels and are therefore sometimes capable of transmitting large quantities of water.

The groundwater that comprises an aquifer is derived from that part of precipitation that does not run off the surface of the land to streams or return to the atmosphere through evaporation and transpiration. Factors, which determine the amount of water that infiltrates to the groundwater aquifer, include the porosity and permeability of the surficial material, the slope of the land, the amount and kind of natural and artificial cover, and the intensity and amount of precipitation. Water infiltrating a groundwater aquifer, and the process itself is referred to as “recharge.” Coastal Plain aquifers are recharged primarily by precipitation, which enters through outcrops or via the overlying unconsolidated material. Some additional water may enter the aquifer from vertical leakage through adjacent semi-confining units or recharge where the hydraulic gradient is from a stream or lake to the aquifer. NJDEP Mapping indicates that recharge of the aquifers in Cranbury is typically 9-14 inches per year, with the exception of areas containing hydric soils and large impervious surfaces (Figures 5 & 6).

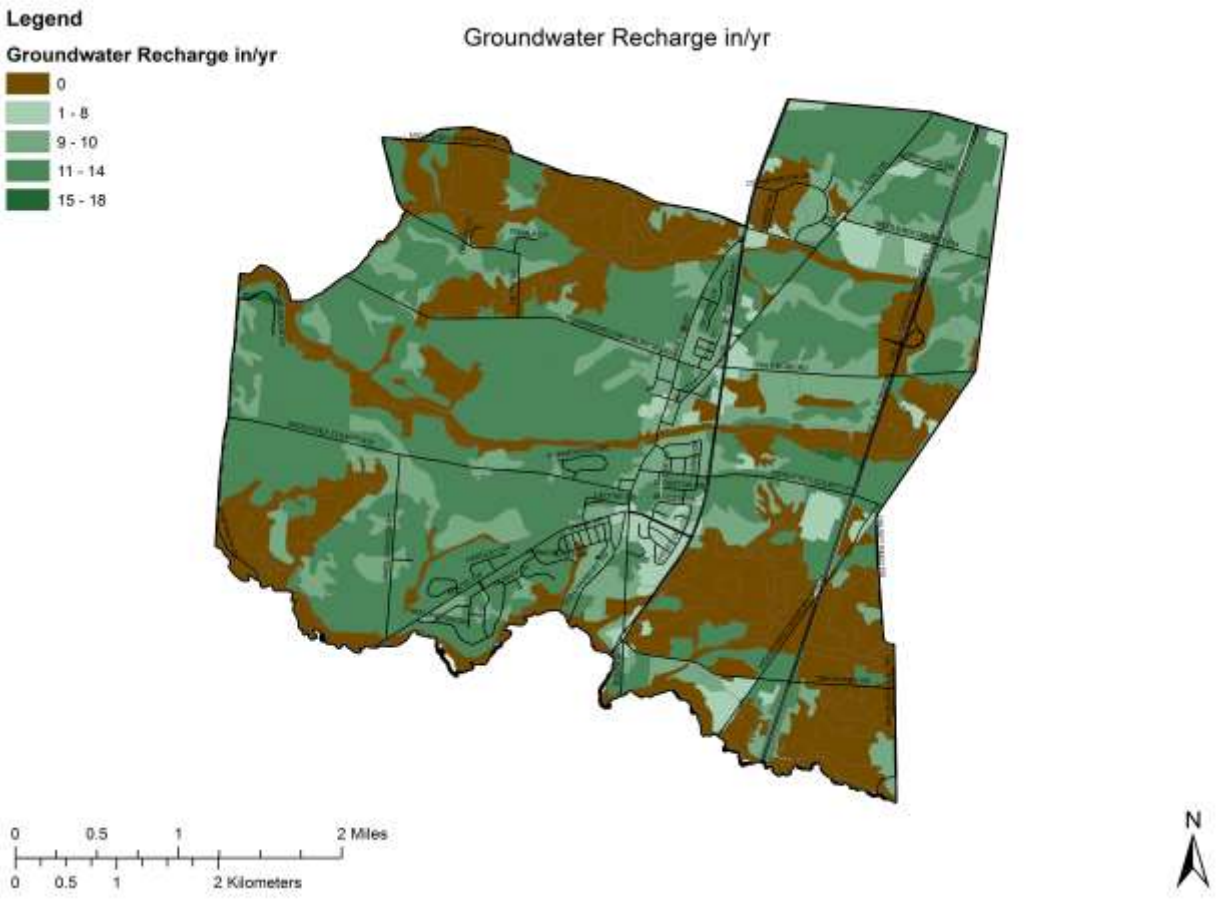


Fig. 5 – Ground-water Recharge – inches / year

Aquifers are generally equated to the name of the geologic formation in which they exist, but in actuality do not necessarily correspond to the defined boundary of the mapped geologic formation. NJDEP Mapping indicates that the primary bedrock aquifer associated with the Magothy (Kmg) formation in Cranbury is the Potomac-Raritan-Magothy aquifer system (PRM). The PRM is one of five major New Jersey Coastal Plain aquifers. The Englishtown aquifer, Wenonah-Mount Laurel aquifer, the “800 Foot Sand” aquifer and the Kirkwood-Cohansey aquifer are the other four major Coastal Plain aquifers.

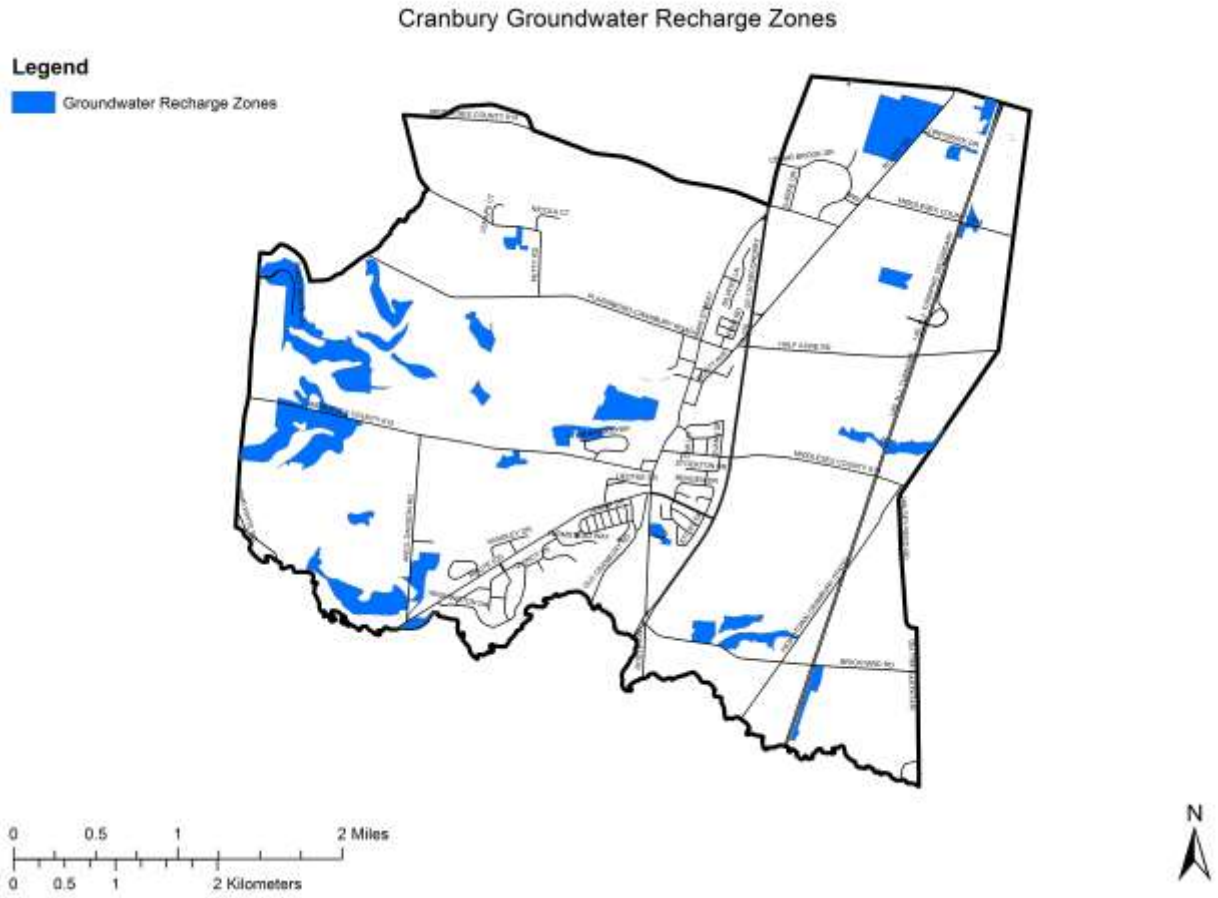


Figure 6 – Cranbury Groundwater Recharge Zones

The PRM aquifer is a wedge-shaped formation consisting of Cretaceous age sediments deposited in alternating layers of clay, silt, sand, and gravel. The aquifer thickens throughout the outer coastal plain from a very thin layer in the near the outcrop to more than 4,100 feet beneath Cape May County (USEPA, 1988). The Potomac-Raritan-Magothy aquifer system is divided into two aquifers: The Farrington aquifer (mainly Raritan age) and the Old Bridge aquifer (Magothy age). The southeastern portion of Cranbury is underlain by a second aquifer, the Merchantville-Woodbury confining unit aquifer (Mewcu). The Merchantville–Woodbury confining unit is found in Cranbury in eastern portions of the Township. The Farrington aquifer's boundaries are defined by the corresponding Merchantville and Woodbury geology (Figure 4). In New Jersey, these aquifers outcrop in narrow northeastern-southwestern bands that run from northeastern Middlesex County, south through Mercer County, paralleling the Delaware River to western Salem County.

4.4 - Water Tables – Maximum and Annual

Figure 7 shows the shallowest distance to the top of a wet soil layer (the water-table) within a soil map unit polygon. The value is the minimum during three critical spring and early summer months (April – June) as well as the annual minimum (Figure 8). Therefore the reported value is the nearest the water table gets to the soil surface of any significant component during the spring and early summer.

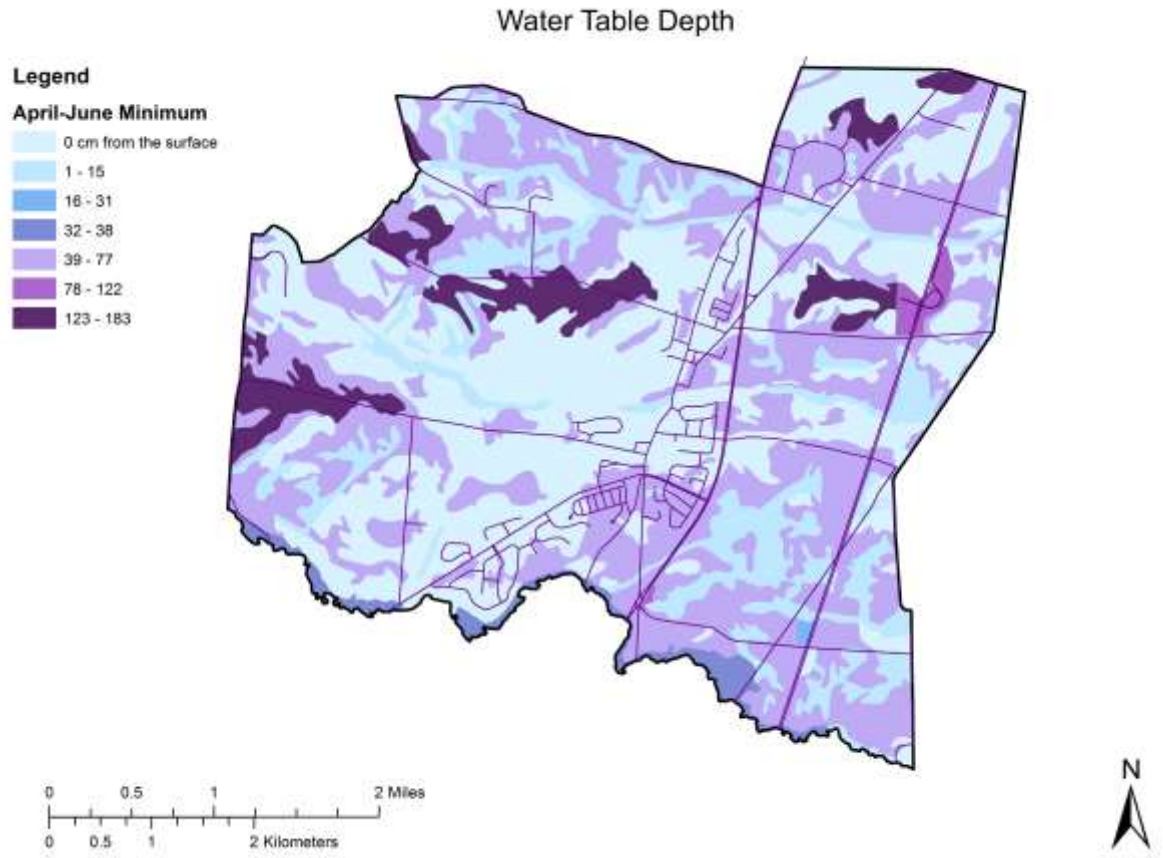


Figure 7 – Water Table Depth – April – June Minimum

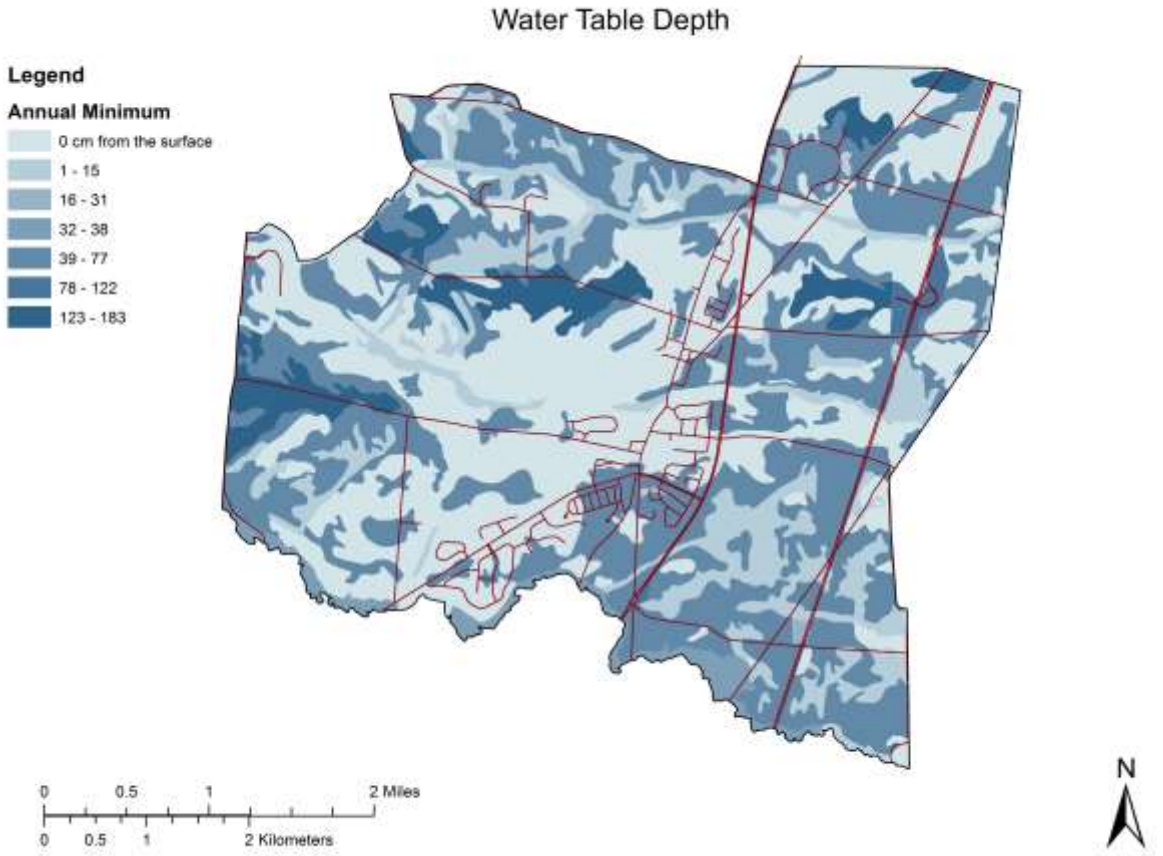


Figure 8 – Water Table Depth – Annual Minimum

In Cranbury, the public wells are associated with the Farrington and Old Bridge sands of the PRM Aquifer, and are in unconfined conditions. Cranbury's public well depths are generally between 100-300 feet and are associated with the Magothy or the underlying Raritan formation. Within the Magothy and Raritan formations, confined conditions exist in some deeper wells (typically 500-900 feet) (NJWSA, 2002).

Inner Coastal Plain aquifers may produce substantial yields. High-capacity wells tapping the PRM aquifer in the northern Coastal Plain have been found to have yields ranging from 140 to 1500 gallons per minute (GPM) (Mulhall, 2004 et al). The public community wells in Cranbury generally yield 100-500 GPM. Public community wells in nearby Inner Coastal Plain municipalities of the Millstone Watershed, including East Windsor, Monroe, and Hightstown, generally yield between 250-1400 GPM (NJWSA, 2002). The PRM has experienced significant declines in the ground water level from overuse. Declines in groundwater may

result in infiltration from adjacent water bodies. The PRM is subject to saline infiltration from the lower Delaware River in Salem and Gloucester Counties (USEPA, 1988). The result is salinity levels within this portion of the aquifer that range from less than 250 to as high as 27,000 mg/L (Luzier 1980 et al.).

4.5 Potable Water Supply

The EPA reports that the natural ground water in the New Jersey Coastal Plain is typically low in dissolved solids (generally less than 150 milligrams per liter (mg/l). Levels of iron and manganese are sometimes found to be objectionable within Coastal Plain aquifers and high levels of iron deposits have occurred in Cranbury's public water supply. Problems associated with high iron levels are not typically health issues. Waters within these systems may have a lower pH and are treated before consumption. Under natural conditions, water within the artesian groundwater system of the Coastal Plain meet or exceed Federal and State water quality standards although water quality in outcrop areas tends to be more variable due to the impact of surficial conditions within the vicinity of the well (USEPA, 1988).

According to the NJDEP Source Water Assessment Report, the Elizabethtown Division of the New Jersey American Water Company provides Cranbury's water supply. Source water for the system comes from 129 regional wells and 7 surface water intakes. Water sources for the Elizabethtown system include the Millstone River, Upper Potomac-Raritan–Magothy aquifer; deposits within igneous and metamorphic rocks, glacial sand and gravel; Delaware & Raritan Canal, Brunswick aquifer and the Stockton Formation. The three public community wells from the Elizabethtown Water System within Cranbury are currently not in use due to the potential for radium contamination.

4.6 Contamination

The chemical quality of ground water is primary concern where it is used for public and domestic supply. The chemical properties are determined by the chemical properties of the precipitation; mineralogy of the substrate through which the water moves; and the length of time the water is in contact with the substrate. The chemical content can be altered by the introduction of contaminants into the environment. Pollutants may enter the environment from

point or nonpoint sources. Point sources are usually discrete sources where concentrations may be elevated, such as leaking pipes, underground storage tanks and accidental spills. Nonpoint sources are usually lower concentrations spread out over larger areas; such as fertilizers and pesticides applied in agricultural area; storm water runoff from pavement and vehicle emissions that settle on the ground and infiltrate with precipitation.

Outcropping portions of the New Jersey Coastal Plain Aquifer system have a fairly high potential for contamination through recharge (USEPA, 1988). A combination of factors including the high water table conditions, high permeability of the soil, and its low attenuation capability allow for the transport of contaminants from the land surface into the aquifers. Leaking septic systems, landfill leaching, chemical spills leaks and illegal dumping, industrial waste lagoons, highway deicing agents and agricultural and lawn maintenance chemicals may all contribute to contamination (USEPA, 1988). These contaminants may have immediate local impacts and long term impacts as the contamination travels deeper into the aquifers.

The New Jersey Department of Environmental Protection produces a Source Water Assessment Report for all Public water systems within the state. This report determines the susceptibility of a water system to various contaminants and does not reflect actual contaminants being consumed by customers of that water supply system. Information on the susceptibility of Cranbury Township's public water system may be found in the NJDEP Source Water Assessment Report (www.nj.gov/dep/watersupply/swap)

Nutrient contamination in the form of nitrate has been detected in some private wells in Cranbury. From September of 2002 to March 2003, NJDEP tested 50 private wells in Middlesex County. Five wells within the county were found to have contaminant levels above the accepted maximum contaminant level (MCL). Of the three private wells tested in Cranbury, two were found to have levels of nitrates above MCL. Neighboring Plainsboro Township was also found to have two of its four tested wells exceeding the MCL for nitrate. Mercury, Arsenic, Volatile Organic Compounds (VOCs) and *E. coli* bacteria were also tested for and found to meet acceptable standards in the Cranbury wells and throughout Middlesex County's well samples.

Aquifers within Coastal Plain have been found to be susceptible to radionuclide contamination due to the presence naturally occurring radioactive decay elements in the soil, particularly radium, which can more easily absorb into groundwater as it comes in contact with soils or sand. Radium 226, 228 and 224 h all have been detected in Coastal Plain aquifers, particularly the Kirkwood-Cohansey (NJDEP, 2005).

Preliminary water testing for radioactive elements involves measuring gross alpha activity. Alpha radiation is product of radioactive decay, a process by which elements emit radiation to reach a more stable form and is measured in units known as picocuries. Additional information related to radionuclide contamination may be obtained at: www.nj.gov/dep/rpp/radwater.htm

4.7 Wellhead Protection

In order to protect New Jersey Groundwater Resources, the New Jersey Department of Environmental Protection (NJDEP) has identified Wellhead Protection Areas (WHPAs) for public community water supply wells. The WHPA is the area from which a well draws its water within a specified timeframe. Once delineated, the WHPA are typically considered priority areas to prevent and clean up groundwater contamination.

Wellhead protection areas from adjacent township public community wells are located along the northern boundary of Cranbury. Four of these wells are owned by the Monroe Township Municipal Utilities Authority including MUA Well 5 on Mystic Lane, MUA Well 11 on Abeel Road, MUA Well 17 on Rossmoor Golf Course and MUA Well 12A on Nassau Road. The South Brunswick Township Water Division owns one well, identified as Well 15 on Broadway Road.

Public community and public non-community wellhead protection areas exist throughout eastern Cranbury including portions of protection areas from adjacent township wells along Cranbury's northern boundary. Land use planning should include an examination of the existing and proposed land uses in the wellhead protection areas. Certain land uses have a greater potential to contaminate groundwater than do others. Consideration should be given to monitoring or restricting certain types of land uses in wellhead protection areas. The Stony-

Brook Millstone Watershed association has developed a document outlining major aspects of wellhead protection and the development of wellhead protection ordinances. The document is available online at: https://www.thewatershed.org/images/uploads/Wellhead_Ordinance_Implementation_Package.pdf

4.8 Known Contaminated Sites

The NJDEP Site Remediation Program currently maintains a list of more than 12,000 New Jersey sites that are confirmed to be contaminated and are undergoing a remedial investigation or a cleanup or are awaiting assignment to a NJDEP case manager. Known contaminated sites are sites that contain contaminants above a regulatory action level. According to the NJDEP, Cranbury contains a total of 10 active Known Contaminated Sites (Figure 9) as listed in the Table 1 below.

Table 1: Cranbury Township Known Contaminated Sites 2016

Site ID	Name	Address	Status	Contamination
68837	Amoco	Rt. 130	Active – LSRP	AOCs / GW
6083	Amoco	Rt. 130	Active – LSRP	AOCs / GW
6089	Molly Pitcher Service Area	NJ Turnpike -	Active – LSRP	AOCs / GW
6084	Hapco	2731 Rt. 130	LSRP	AOCs
93416	Millstone Park	Old Trenton Rd.	NFA	NA
143950	Sharma	61 Station Rd.	NFA	NA
6094	Cranbury Service Center	2734 Rt. 130	Active – LSRP	AOCs / GW
50169	APCO	2736 Rt. 130	LSRP	AOCs
20098	Lebanon	190 Plainsboro Rd.	LSRP	AOCs / GW
87852	Cranbury	Brickyard Rd.	LSRP	AOCs / GW

Notes for Table 1:

LSRP – Licensed Site Remediation Professional Oversight
GW – Groundwater Contamination
AOCs – Areas of Concern

Source: http://www.nj.gov/dep/srp/kcsnj/

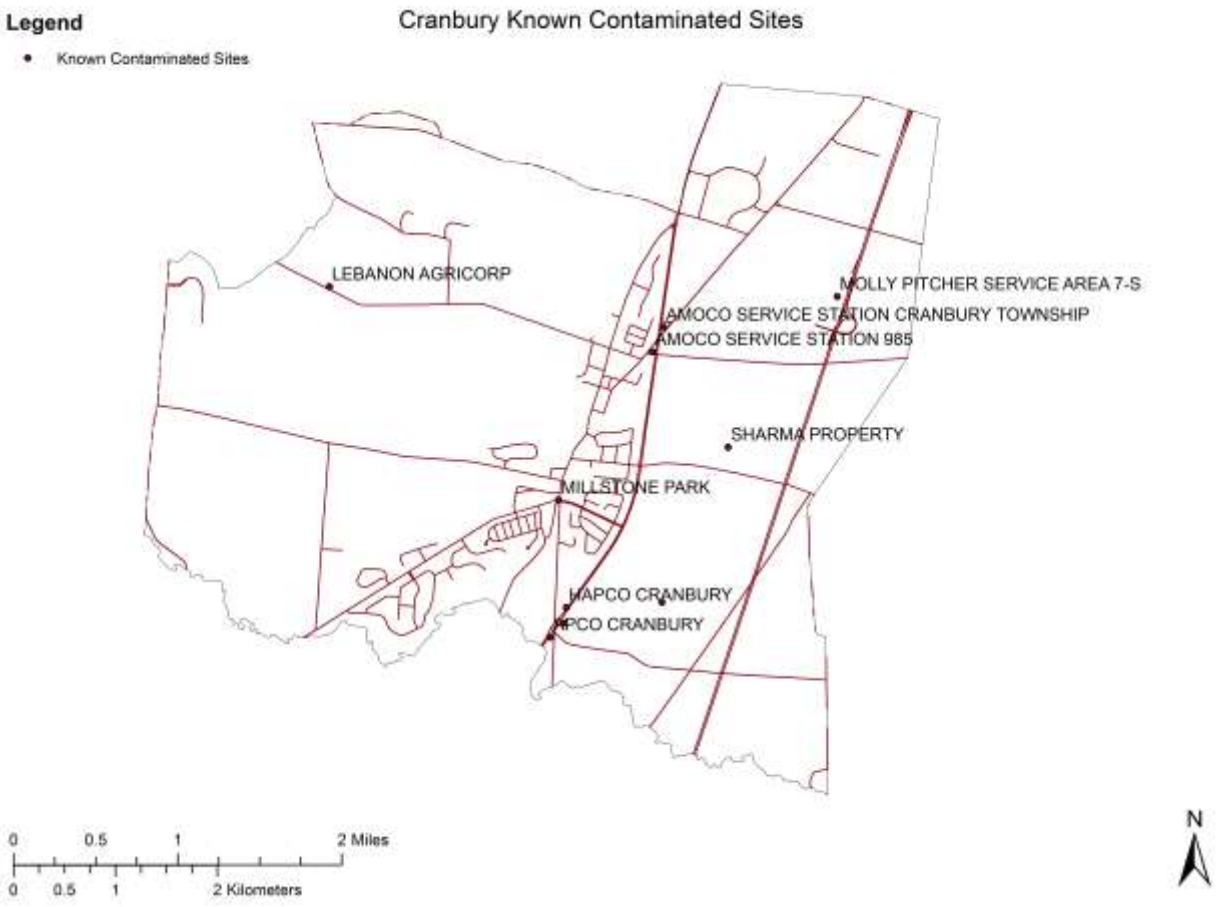


Figure 9 – Cranbury Known Contaminated Sites

For additional information regarding these sites, the type of remediation, or other general information about Known Contaminated Sites, access the NJDEP website at: http://www.state.nj.us/dep/srp/kcs-nj/1overview.htm

Currently there are over 220 sites in Cranbury that are regulated by NJDEP. These sites include those that have been determined to not be contaminated, receive

inspections, have discharge permits or have completed remediation and have received letters from NJDEP determining that "No Further Action" (NFA) is needed. To review the full list of sites, visit the NJDEP data-miner site at http://www.nj.gov/dep/opra/online.html . The data-mine site contains an archive of inspections, enforcement actions and violations on file for each of these sites. Sites that may not be closed may not have data available.

Section 5 - Soils

4.1 Soil Types

Soils provide the basis for the potential land uses within the community. They determine the types of vegetation or crops that can be grown and influence the development activities and design of structures that can be constructed. Soils represent a non-renewable resource and must be appropriately managed. In addition to the cultural and aesthetic losses typically associated with the loss of farms to residential development, the loss of quality soil typically occurs. Residential and commercial development results in the conversion of soils from their historic agricultural or open space uses and into permanent non-use. Considering significant soils in the planning process is vital to maintaining the Township's rural character and meeting objectives set forth in the Master Plan.

Soils are formed by forces of the environment acting on soil material deposited or accumulated by geologic processes. The characteristics of a soil at any given location are determined by the climate in which the soils material has accumulated and has existed since accumulation; the physical and mineralogical composition of the parent material; the relief or slope of the land which influences drainage, moisture content, aeration, susceptibility to erosion, and exposure to the sun and elements; the biological forces (plants and animals) acting upon the soil material; and the length of time the climate and biological forces have had to act on the soil.

The parent material of Cranbury's soils consists of the water deposited clays, silts, sands and gravels typical of the Coastal Plain. The major soil series in Cranbury generally tend to be acidic to extremely acidic, well-drained loams, and sandy loams. Organic content and permeability in Cranbury's major soil series tend to be

moderate to low. Erosion problems may be of particular concern with reference to particle properties. The erodability of a soil type is determined by the soil infiltration capacity and the ease with which particles dislodge in precipitation or under flow conditions. Silty and fine sandy soil particles tend to detach easily resulting in highly erodible conditions. These soils are less erodible when particles with binding properties such as clay or organic matter increase in the soil's composition.

Although coarse sandy or gravelly soils may easily detach, these soils are not typically erodible because they are highly permeable and tend to be easily infiltrated by surface water, which in turn slows runoff. Soils considered to have low erodability may however show significant signs of erosion when occurring on steep slopes.

A model known as K factor Soil Erodability is commonly used to determine the erodability of a soil. This erodability index measures the susceptibility of a soil type to erosion and the rate of runoff where the soil occurs. Although Cranbury lacks large areas of slopes in excess of 10% (Figure 10), Natural Resources Conservation Service (NRCS) data indicates that Cranbury's soil erodability levels considered medium to high (17 to .32+) K factors (Yergeau 2004 et al).

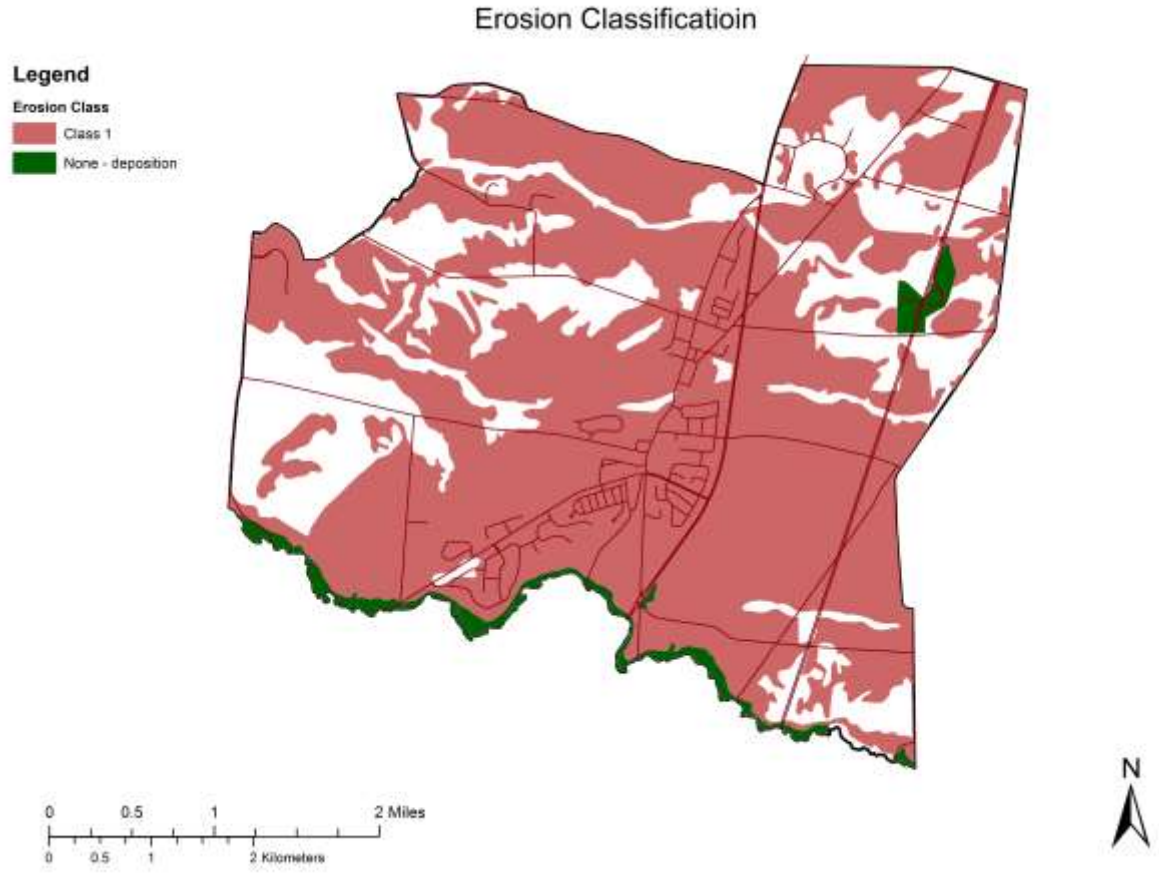


Figure 10 – Erosion Classification – Class 1 = short term

Soil loss tolerance factor is the maximum rate of soil loss that will permit crop productivity to be sustained economically and indefinitely on a given soil. Soil loss tolerance factor considers the maintenance of adequate soil depth, the value of nutrients lost, prevention of gullies, crop yield reduction due to erosion, and losses to water holding capacity. Soil loss is expressed as tons per acre per year. T values range from 1 to 5 tons per acre per year.

Figure 11 presents the soil loss tolerance factor for the soils within Cranbury Township. Soil loss tolerance factor is defined as the maximum rate of annual soil erosion that will permit a high level of crop productivity to be obtained economically and indefinitely. The primary use for soil loss tolerance factor is evaluating the effectiveness of erosion control measures on farmland. Soil loss tolerance factor serves as a quantitative standard to compare to erosion rate estimates from models such as the Revised Universal Soil Loss Equation. Farmlands where soil loss tolerance factor is less than modeled erosion rates are considered unsustainable.

Soil loss is the result of a number of factors including climate, soil characteristics, and topography and cropping practices. The economic impact of mitigating soil erosion significantly burdens the agri-business sector and the Nation as a whole. Dust contributions to the atmosphere and delivery of sediment, nutrients, and chemicals to water resources are primary environmental concerns addressed by public policy makers and the stewards of our working lands. Understanding and managing these processes has important long-term implications for cropland sustainability, natural resource condition and health, and environmental quality. According to the United States Department of Agriculture in 2007 in the US, 99 million acres (28% of all cropland) were eroding above soil loss tolerance (T) rates. This was compared to 169 million acres (40% of cropland) in 1982.

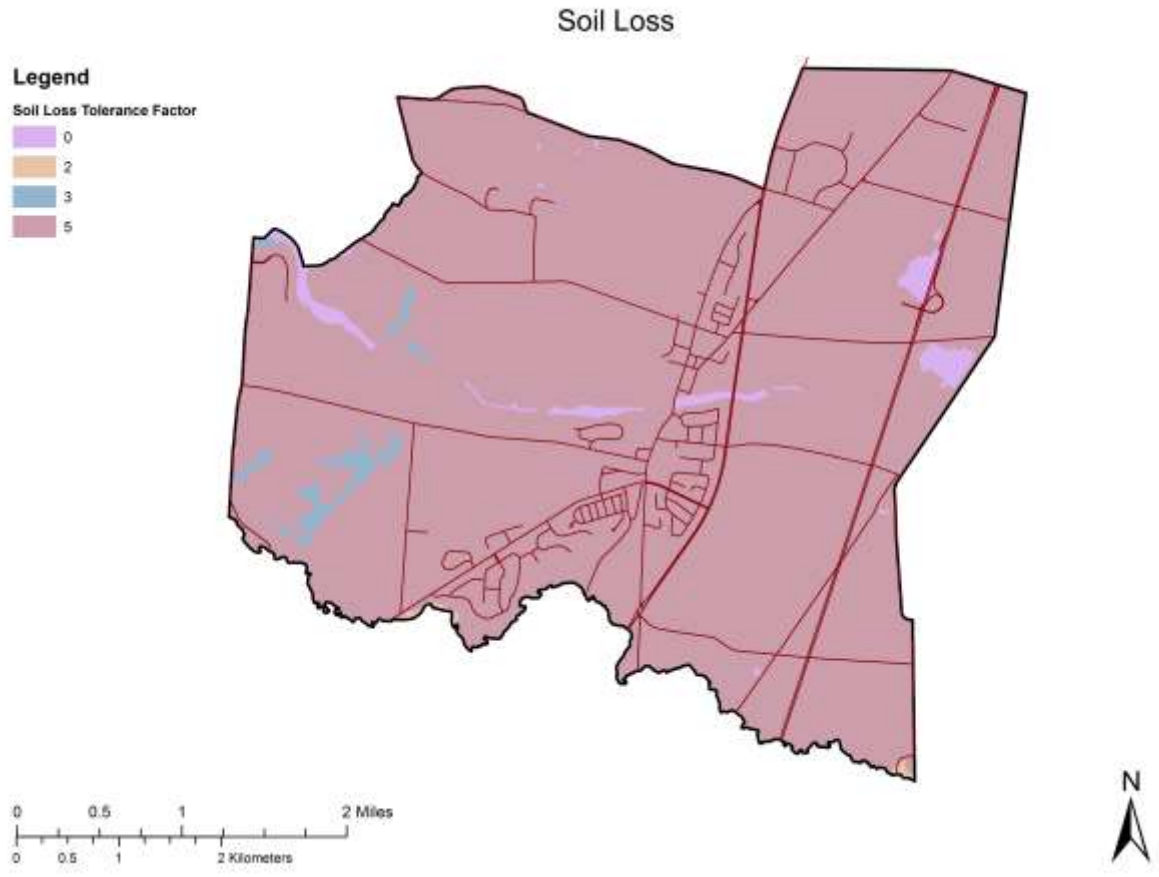


Figure 11 – Soil Loss

The NRCS has also prepared soil mapping from the Soil Survey Geographic (SSURGO) database that is available from NJDEP GIS data. SSURGO is mapped throughout the State of New Jersey. Mapping was prepared on a detailed scale that provides individual soil mapping units for Middlesex County. The soil map (Figure 12) is based on the mapping provided by the NRCS. Cranbury includes a total of 31 individual soil-mapping units, excluding sand pits and gravel pits. The 31 mapping units occur in 17 different soil series (excluding water; urban land; or

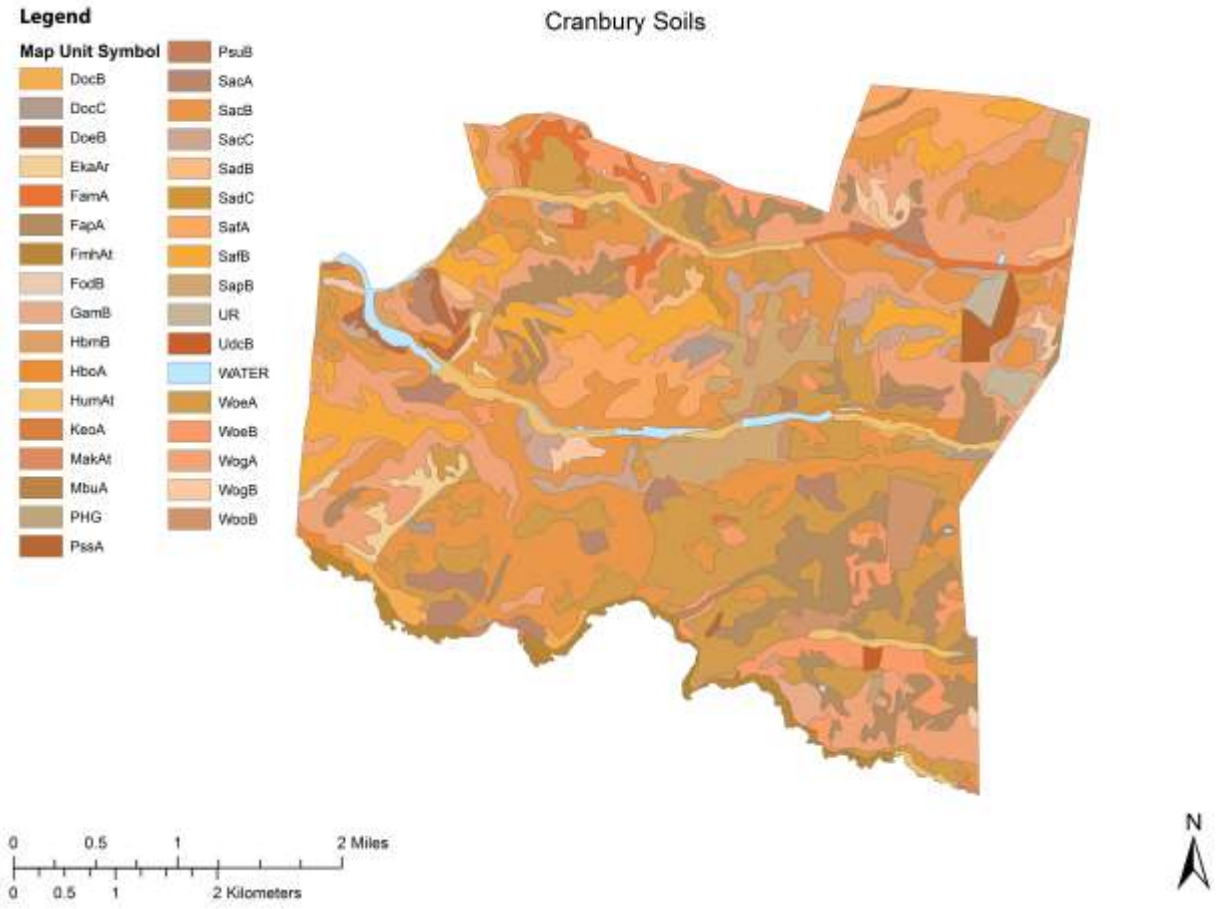


Fig 12. - Soil Classifications

pits, sand and gravel). The various units and their amounts within Cranbury as mapped by SSURGO (Figure 12) are in the Table 2.

Table 2

Cranbury Soil Mapping Units and their Characteristics

Label	Name	Acres	Hydric	Status	Depth to Seasonal High Water Table	Depth to Bedrock
DocB	Downer loamy sand, 0-5% slopes	68.96	NL	SI	Greater than 72”	Greater than 72”
DocC	Downer loamy sand, 5-10% slopes	44.37	NL	SI	Greater than 72”	Greater than 72”
DoeB	Downer sand loam, 2-5% slopes	49.00	NL	P	Greater than 72”	Greater than 72”
EkaAr	Elkton loam, 0-2% slopes, rarely flooded	87.19	H	SI	0 to 12”	Greater than 60”
FamA	Fallsington sandy loam, 0-2% slopes	135.20	H	SI	0 to 12”	Greater than 60”
FapA	Fallsington loam, 0-2% slopes	715.79	H	SI	0 to 12”	Greater than 60”
FmhAt	Fluvaquents, loamy, 0-3% slopes, frequently flooded	141.70	H		NA	NA
FodB	Fort Mott loamy sand, 0-5% slopes	8.49	NL	SI	Greater than 72”	Greater than 72”
GamB	Galloway loamy sand, 0-5% slopes	32.10	HI	SI	24 to 48”	Greater than 60”
HbmB	Hammonton loamy sand, 0-5% slopes	37.95	NL	SI	18 to 42”	Greater than 72”
HboA	Hammonton sandy loam, 0-2% slopes	59.02	HI	P	18 to 42”	Greater than 72”
HumAt	Humaquepts, 0-3% slopes, frequently flooded	208.19	H		NA	NA
KeoA	Keyport loam, 0-2% slopes	3.72	HI	P		Greater than 60”
MakAt	Manahawkin muck, 0-2% slopes, frequently flooded	11.03	H	UI	+12 to 0”	Greater than 60”
MbuA	Mattapex silt loam, 0-2% slopes	6.90	HI	P	18 to 36”	Greater than 60”
PHG	Pits, sand and gravel	17.67	NL		NA	NA
PssA	Psamments, 0-3% slopes	61.09	HI		NA	NA

PsuB	Psamments, waste substratum, 0-8% slopes	13.00	NL		NA	NA
SacA	Sassafras sandy loam, 0-2% slopes	211.13	NL	P	Greater than 72”	Greater than 60”
SacB	Sassafras sandy loam, 2-5% slopes	1826.32	NL	P	Greater than 72”	Greater than 60”
SacC	Sassafras sandy loam, 5-10% slopes	243.43	NL	SI	Greater than 72”	Greater than 60”
SadB	Sassafras gravelly sandy loam, 2-5% slopes	61.49	NL	P	Greater than 72”	Greater than 60”
SadC	Sassafras gravelly sandy loam, 5-10% slopes	17.40	NL	SI	Greater than 72”	Greater than 60”
SafA	Sassafras loam, 0-2% slopes	325.88	HI	P	Greater than 72”	Greater than 60”
SafB	Sassafras loam, 2-5% slopes	532.85	NL	P	Greater than 72”	Greater than 60”
SapB	Sassafras - Urban land complex, 0-5% slopes	295.53	NL		NA	NA
UdcB	Udorthents, clayer substratum, 0-8% slopes	9.38	NL		NA	NA
UR	Urban land	65.99	NL		NA	NA
WATER	Water	84.73	NL		NA	NA
WoeA	Woodstown sandy loam, 0-2% slopes	1296.20	HI	P	18 to 42”	Greater than 60”
WoeB	Woodstown sandy loam, 2-5% slopes	385.12	NL	P	18 to 42”	Greater than 60”
WogA	Woodstown loam, 0-2% slopes	1300.40	HI	P	18 to 42”	Greater than 60”
WogB	Woodstown loam, 2-5% slopes	75.66	NL	P	18 to 42”	Greater than 60”
WooB	Woodstown - Urban land complex, 0-5% slopes	153.97	NL		18 to 42”	Greater than 60”
TOTAL		8586.88				

Notes for Table 2

NA – Not applicable/available: P =Prime Farmland: SI =Soils of Statewide Importance: H =Hydric Soils

HI =Hydric Inclusions: NL =Not listed as Hydric

5.2 Prime Farmland

The NRCS has identified soils based on their agricultural significance, or Land Capability Classification. The best quality soils are termed "Prime Farmlands" which are followed by "Soils of Statewide Importance." Prime Farmlands include all those soils in Land Capability Class I and selected soils from land Capability Class II. Prime Farmlands is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops and is also available for these uses. It has the soils quality, growing season, and moisture supply needed to economically produce a sustained high yield of crops when treated and managed according to acceptable farming methods. Prime farmlands are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding. Soils of Statewide Importance include those soils in land capability Class II and III that do not meet the criteria as Prime Farmlands, but nonetheless support agricultural production, with some limitations. These soils may be suited to certain crops or require special conservation practices to maintain their productivity. The table identifies the soil-mapping units that are considered Prime Farmland or Soils of Statewide Importance as well as depth to the seasonal high water table and depth to bedrock.

Areas of Prime Farmland and Soils of Statewide Significance occur throughout Cranbury and occupy approximately 6500 acres or nearly 76% of Cranbury Township's surface area. Sassafras (2957.67 acres of Prime Farmland) and the Woodstown (3057.38 acres of Prime Farmland) are the series that comprise most of the Prime Farmland Soils in Cranbury. Other soil series represented with Prime Farmland in the Township include the Downer, Hammonton, Keyport and Mattapex. An additional 1391.18 acres of mapped soils are considered of Statewide Significance. The soils that are identified as Prime Farmland and Soils of Statewide Significance represent areas that are most suitable for retention as agricultural lands. The preservation of these high quality agricultural lands is generally considered vital to keeping an agricultural component to a municipality's identity.

Available water storage (AWS) is the portion of a soil's potential water storage that plants can use. Available water storage is calculated from the difference between soil water content at field capacity and the permanent wilting point

adjusted for salinity and fragments. AWS for Cranbury Township is shown on Figures 13 (0-25cm), Figure 14 0-50cm), and Figure 15 (0-100cm)

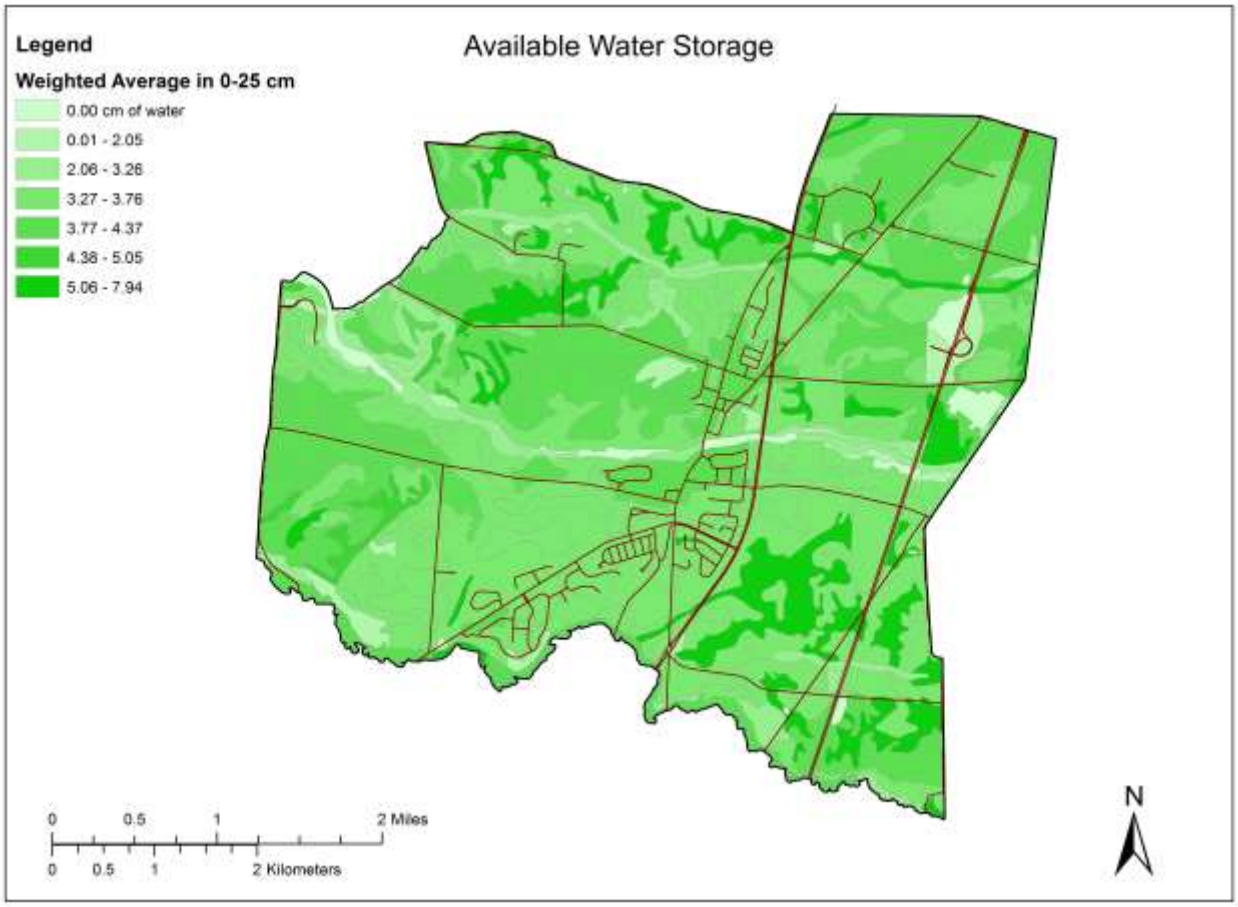
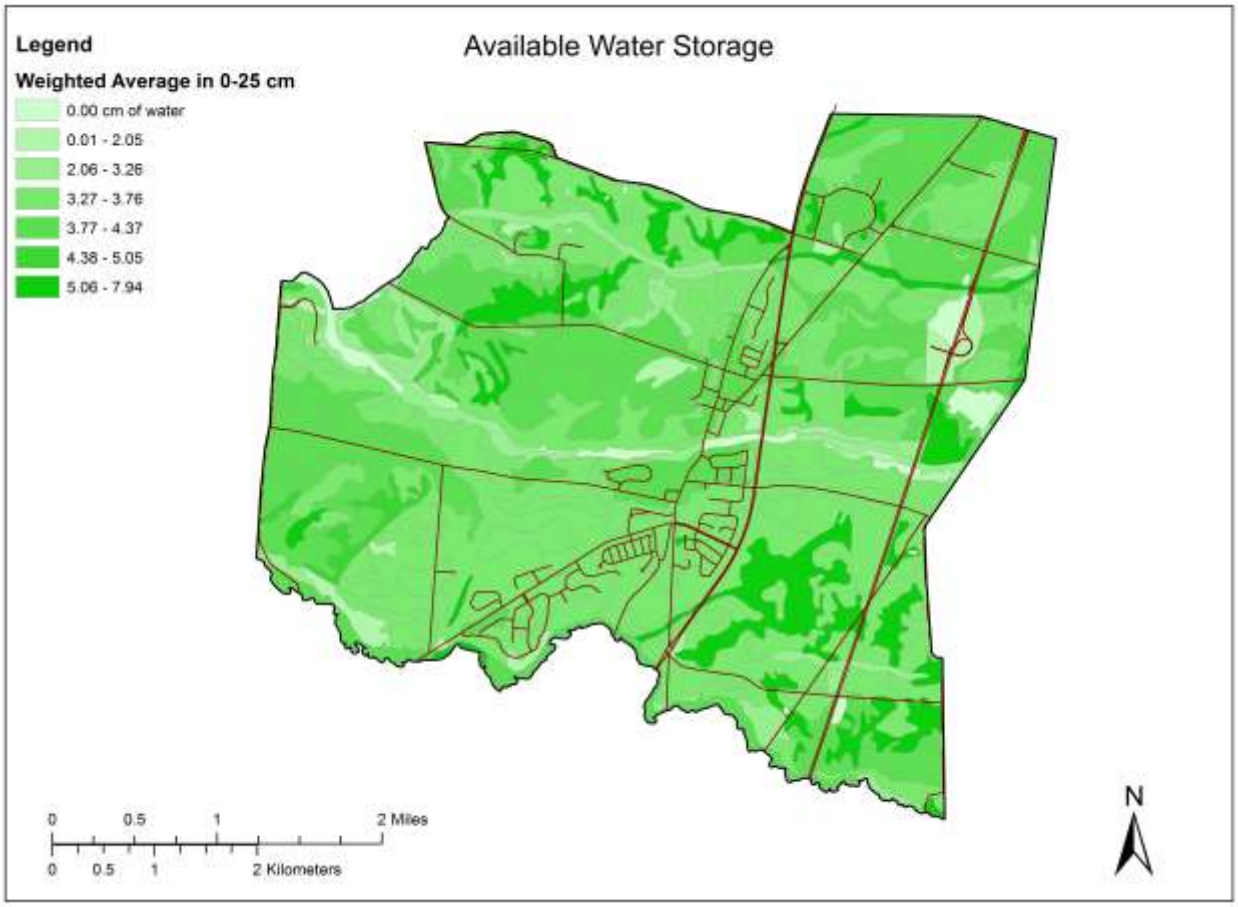


Figure 13 – Available Water Storage – 0 – 25 cm

5.3 Hydric Soils

Approximately 1300 acres of hydric soils are mapped in Cranbury. Many other soil units within the township have hydric inclusions. Hydric soils are the soils that typically characterize the soil substrate found in wetlands. They are soils that have low permeability, are poorly to very poorly drained and that have a water table at or near the ground surface during the growing season; or are soils that are frequently ponded or flooded for a long duration or very long duration during the growing season. The major hydric soil series in Cranbury are identified as the Falsington (850.99 acres), Humaquepts (208.19 acres), and Fluvaquents (141.70

acres). NJDEP mapping (Figure 16) indicates that these soils occupy about 15.3% of the Township.



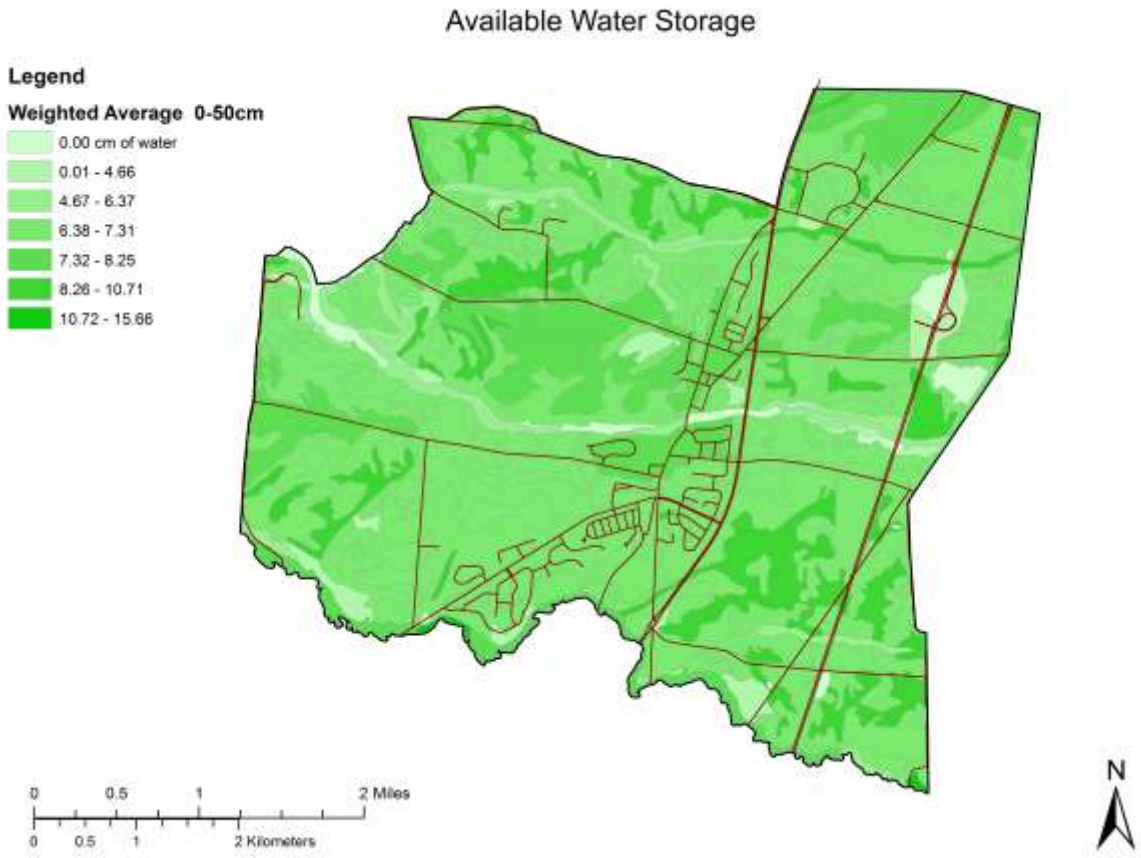


Figure 14– Available Water Storage – 0-50cm

Hydrologic soil group (HSG – Figure 17) is a measure of a soil's runoff potential. In accordance with NRCS recommendations, HSG is typically determined through information available in the NRCS Web Soil Survey. However, at certain locations, it is unable to provide sufficient information to determine a soil's HSG. At other locations, direct soil observations and tests may indicate that a soil's HSG is different than the one provided by the Soil Surveys.

5.4 Major Soil Series Descriptions

A brief description of Cranbury's major soils series is provided below. Descriptions are as provided by the Natural Resource Conservation Service's (NRCS) (Official Soil Series Descriptions) and the SSURGO Database. Official Soil Series Descriptions are not given for some hydric soils such as Humaquepts or urban land complexes.

SASSAFRAS SERIES

Approximately 3200 acres of soils in the Sassafras series are mapped in Cranbury. The Sassafras Series consist of well drained, extremely to strongly acidic soils that that are typically found in upland environments. Parent materials consist of sandy marine and old alluvial sediments. The Sassafras soil typically has a brownish surface layer 9 inches thick and depth to the bedrock is greater than 60 inches. Organic matter is generally low with average clay contents of about 21 percent.

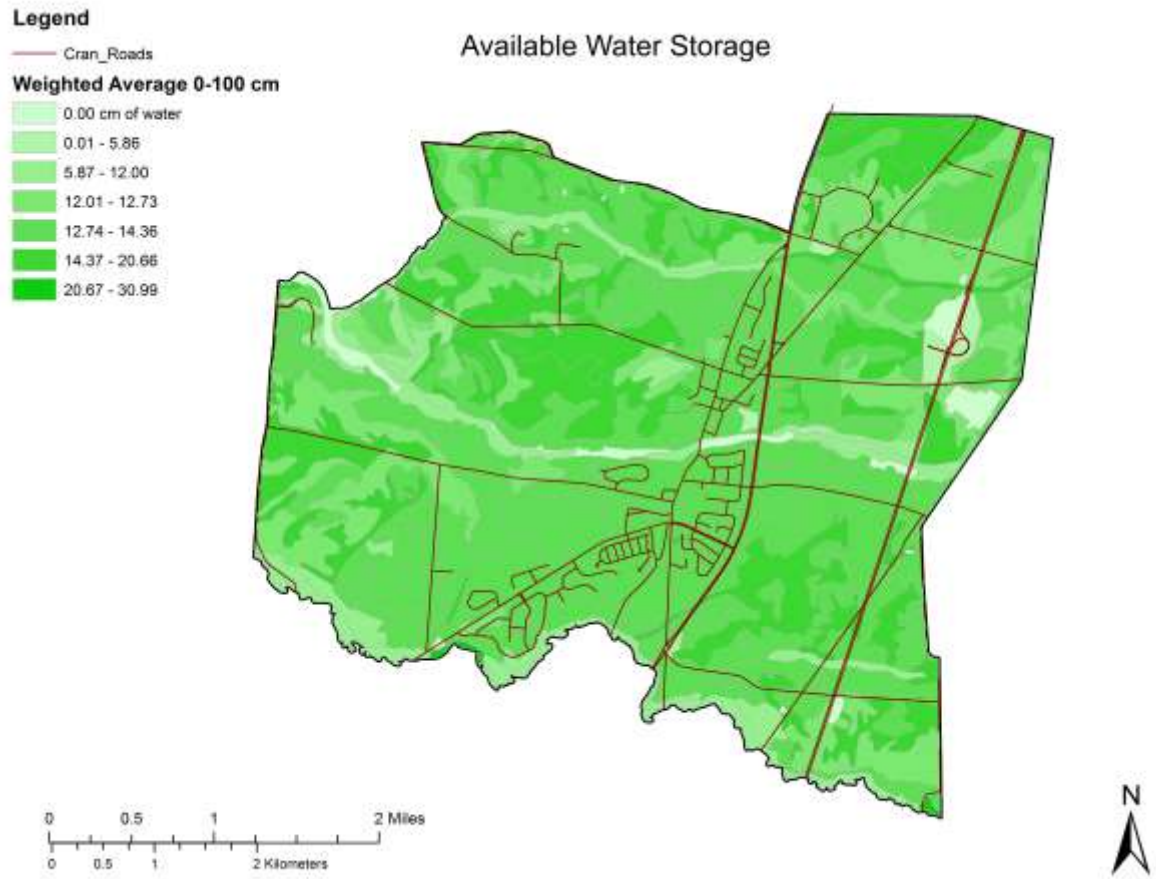


Figure 15 – Available Water Storage – 0 – 100cm

These soils tend to have a fine-loamy texture. Associated vegetation is typically mixed upland hardwoods, with some pines. Agricultural uses are for general crops, truck crops, pastures and fruits. These soils generally have a Capability Class of II and III.

WOODSTOWN SERIES

Approximately 3100 acres of soils in the Woodstown series are mapped in Cranbury. Woodstown soils are located on intermediate positions in the landscape. They consist of moderately well drained soils that developed from sandy marine and old alluvial sediments. A typical Woodstown soil has a plow layer of brown to yellowish-brown sandy loam and a subsoil of strong-brown or yellowish-brown sandy loam. In a natural condition, these soils have a water table that rises to within about 2 feet of the surface in the late fall through the early spring. The organic matter content and fertility range from moderate to low and the soils are acidic. Water holding capacity is moderate. The native communities typically associated with the Woodstown series are oak forests. If adequately drained, agricultural crops including orchard trees or vegetables may be planted. However, if the soil becomes saturated, orchard trees can be blown over by high wind. These soils are thought to make suitable sites for dug out ponds if the water table is suitably high. Capability Class units are II and III, with limitations due to wetness.

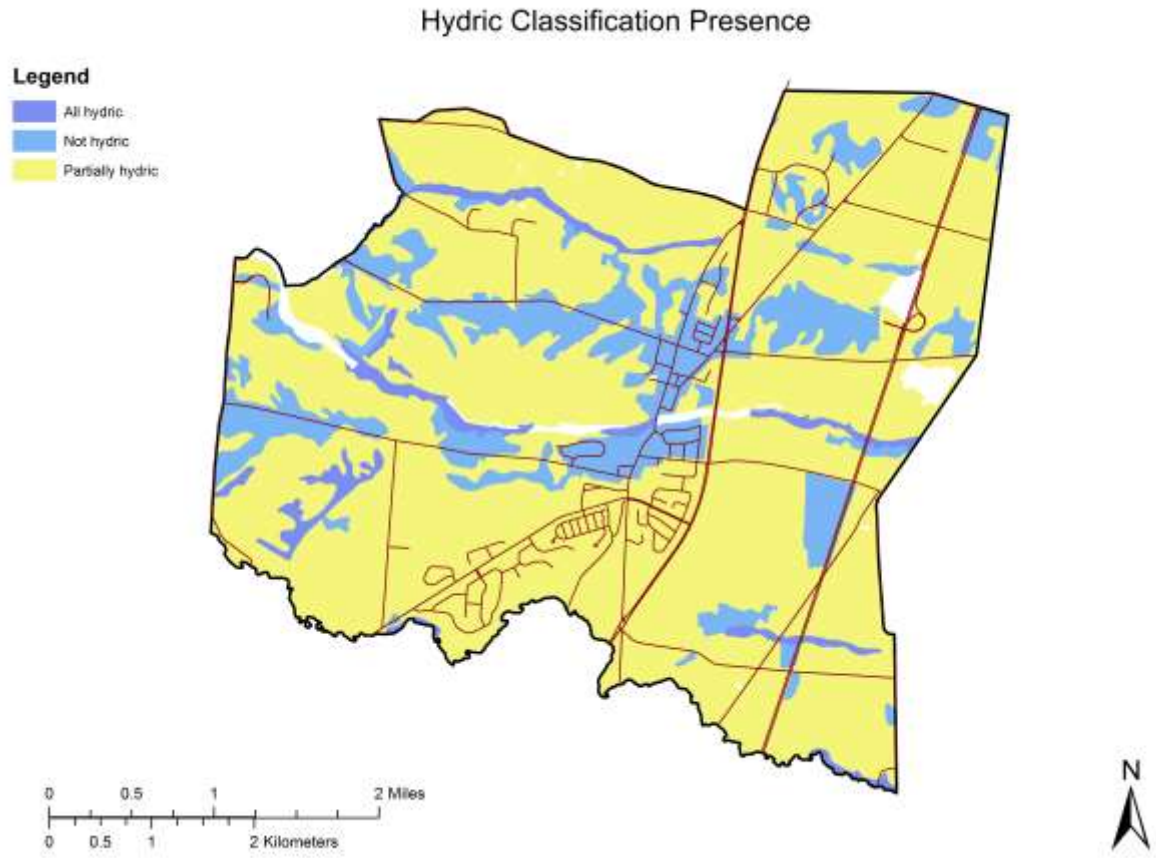


Figure 16 – Hydric Classification Presence

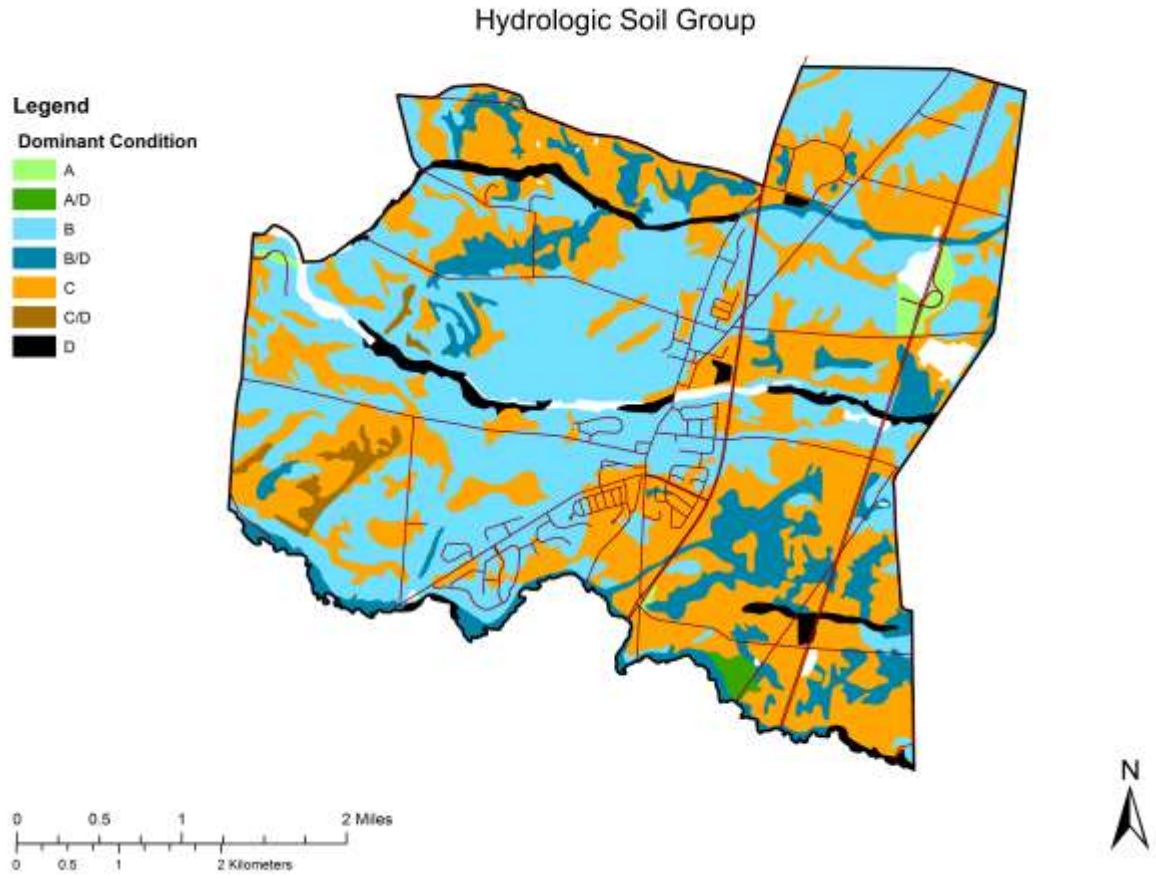


Figure 17 – Hydrologic Soil Group

FALLSINGTON SERIES

Approximately of 850 acres of the Fallsington series soils are mapped in Cranbury. These very deep soils are generally found on flats and depressions of the landscape at elevations of 5 to 120 feet. They are poorly drained soils with moderate to slow permeability and were formed from alluvial and loamy marine sediment parent materials. Soil acidity ranges from extremely strong to very strong. The A horizon is a 10 inch layer of dark gray sandy loam. This layer overlay the B-horizon of gray sandy clay loam, sandy loam or loamy sand to 46 inches. The C-horizon extends to approximately 46 to 65 inches of light gray sand. Adequately drained areas may be used for crops including soybeans, corn and small grains. Wooded areas associated with the soils may include white oak, willow oak, red maple, sweet gum and holly.

DOWNER SERIES

A total of 160 acres of soils in the Downer series are mapped in Cranbury. Downer soils are typically found on lower slopes in the landscape. They consist of nearly level, deep, well-drained soils that formed on deposits of sand and gravel that contain small amounts of silt and clay. A typical cultivated Downer soil has a brownish-yellow loamy sand about 19 inches thick over a similar thickness of yellowish-brown sandy loam. In a natural condition, these soils have a water table that rises to within about 2 feet of the surface in the late fall through the early spring. The organic matter content is low to moderate, fertility is low, and the soils are acidic. Water holding capacity is low to moderately low. The natural vegetation is usually oak but may contain pine. Sassafras and pine usually colonize abandoned fields. Downer soils are suitable for most crops although high value crops will require irrigation. Wind erosion and sandblasting of crops are serious problems in places where Downer soils are cultivated or left bare. Capability Class units are II and III, with limitations due to the potential for erosion and drought.

5.5 Steep Slopes

Cranbury's relatively flat to gently sloping topography is typical of the Coastal Plain physiographic region. Elevations within the Township range from under 80 above sea level along the Millstone River and points along the Cranbury Brook to areas over 120 feet above sea level in multiple locations typically near Route 130 in the eastern portion of the Township.

NJDEP mapping does not map slopes in excess of 10% in Cranbury. The majority of 5-10 % slopes in the Township are found near the division of the Cranbury and Cedar Brook HUC –14 watersheds north of Plainsboro-Cranbury and Half Acre Roads. Additional slopes ranging from 5-10% may be found along Cranbury Neck Road primarily west of its intersection with Ancil Davison Road. Most other areas within the Township are mapped as sloping between 0 and 5% (Figure 18).

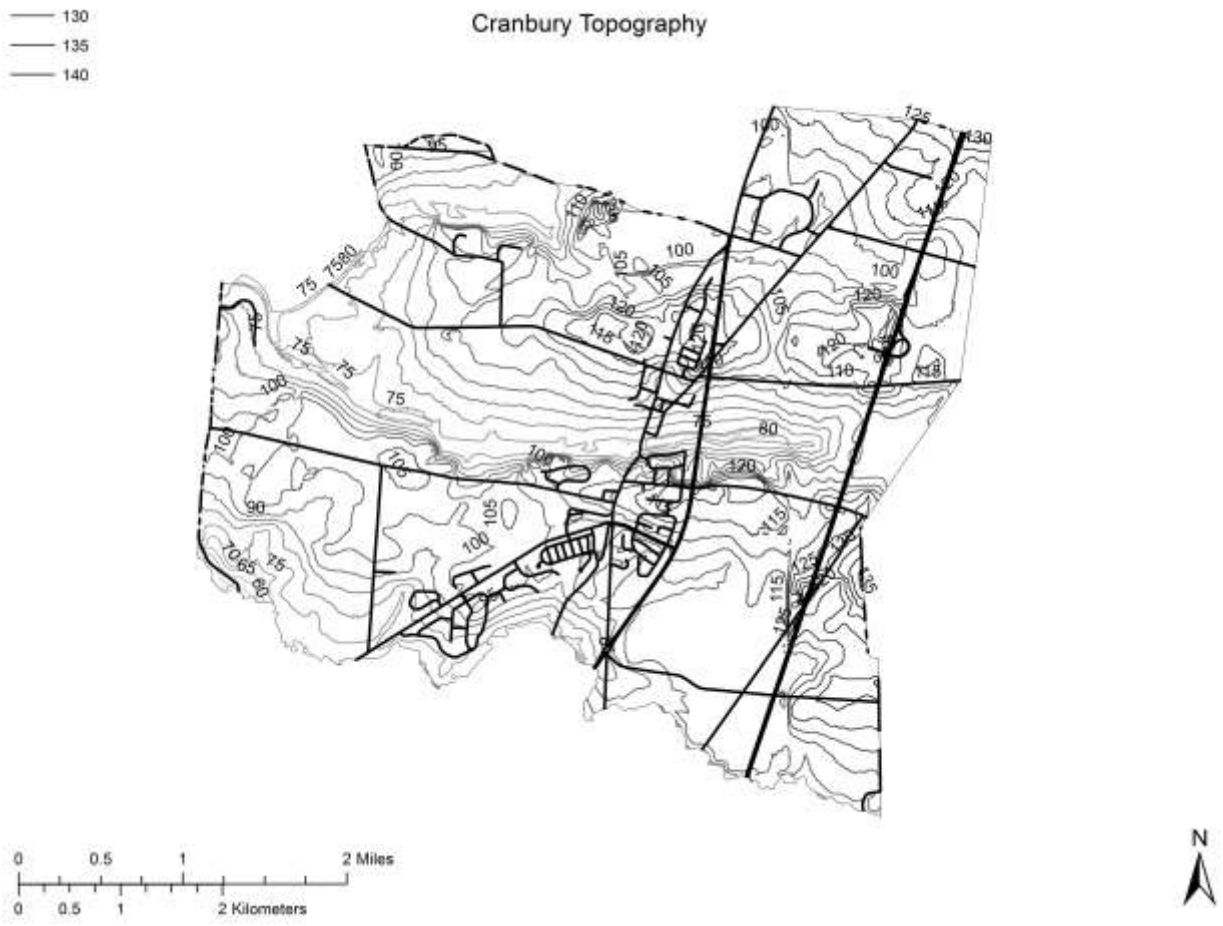


Figure 18 – Cranbury Topography

In general, development of slopes in excess of 10% is not recommended due to the increased risk of erosion, storm water runoff and flooding potential. The additional runoff results in sedimentation of down slope surface waters, which damages habitat and has the potential to damage property. The sloping land increases the rate of runoff, which reduces the rate of groundwater infiltration. This is exacerbated when vegetation is unnecessarily stripped from the slope.

5.6 Soil Erosion and Sediment Control

The NJDEP Soil Erosion and Sediment Control Act (N.J.S.A. 4-24-42 et seq.), requires that a Soil Erosion and Sediment Control Plan be prepared for any clearing or disturbance of 5000 square feet or more. The plan must be prepared in accordance with the Standards for Soil Erosion and Sediment Control in N.J.A.C

2:90. Soil disturbance of one acre or more during construction also requires a New Jersey Pollutant Discharge Elimination System (NJPDES) permit and a Request for Authorization (RFA) from NJDEP's Bureau of Nonpoint pollution. These documents and information can be obtained through the County's Soil Conservation District. The SCD monitors compliance with the SESC plan during construction. The Freehold Soil Conservation District represents Middlesex and Monmouth Counties. Information about Soil Erosion and Sediment Control may be obtained from the Freehold SCD at (732) 683 –8500 or at www.freeholdscd.org. Soil Erosion and Sediment Control standards are also included in the Flood Fringe (Chapter 88) and Land Use (Chapter 150) sections of the Cranbury Township Code.

5.7 Acid Producing Soils

NJDEP defines acid producing soils as "Soils that contain geologic deposits of iron sulfide minerals (pyrite or marcasite) which, when exposed to oxygen from the air or from surface waters, oxidize to produce sulfuric acid. Acid producing soils, upon excavation, generally have a pH of 4.0 or lower. After exposure to oxygen, these soils generally have a pH of 3.0 or lower."

The formations of the New Jersey Inner Coastal Plain are commonly associated with acid producing soils including the Woodbury, Merchantville and the Magothy.

Because of the ability of acid producing soils to impact water quality and alter natural communities, Soil Erosion and Sediment Control Standards specific to acid producing soils were developed by NJDEP. Stream buffers are typically required to be 50 feet along streams and open waters where acid-producing soils will be exposed. Guidelines for the additional information on the location and handling of acid producing soils in the region may be obtained through the Freehold SCD (see Section 5.6).

5.8 Historic Fill

The "Brownfield and Contaminated Site Remediation Act" (N.J.S.A. 58:10B-1 et seq.) requires the Department of Environmental Protection to map regions of the

state where large areas of historic fill exist and make this information available to the public. These maps show areas of historic fill covering more than approximately 5 acres. For the purposes of these maps, historic fill is non-indigenous material placed on a site in order to raise the topographic elevation of the site. No representation is made as to the composition of the fill or presence of contamination in the fill. Some areas mapped as fill may contain chemical-production waste or ore processing waste that exclude them from the legislative definition of historic fill. Figure 19 shows the historic fill map for Cranbury.

Fill was mapped from stereo aerial photography taken in March 1979, supplemented in places by planimetric aerial photography taken in the spring of 1991 and 1992. Additional areas of fill were mapped by comparing areas of swamp, marsh, and floodplain shown on archival topographic and geologic maps on file at the N. J. Geological Survey, dated between 1840 and 1910, to their modern extent. In a few places, fill was mapped from field observations and from drillers' logs of wells and borings.

Most urban and suburban areas are underlain by a discontinuous layer of excavated indigenous soil mixed with varying amounts of non-indigenous material. This material generally does not meet the definition of historic fill and is not depicted on these maps. Also, there may be historic fills that are not detectable on aerial photography or by archival map interpretation and so are not shown on these maps, particularly along streams in urban and suburban areas.

6.0 Water Resources

6.1 Drainage Basins and Major Surface Water Features

A watershed is an area of land that drains into a body of water such as a stream, lake, river or bay. This includes surface water features and surrounding land itself. Topographic features such as hills and slopes define the boundaries of watershed management areas. These watershed management areas are comprised of Drainage Basins; large watersheds that encompass multiple small watersheds. NJDEP manages watersheds by dividing the state into 20 large watershed management areas (WMAS). Cranbury is located entirely within Watershed Management Area 10, the Millstone Watershed (Above Carnegie Lake).

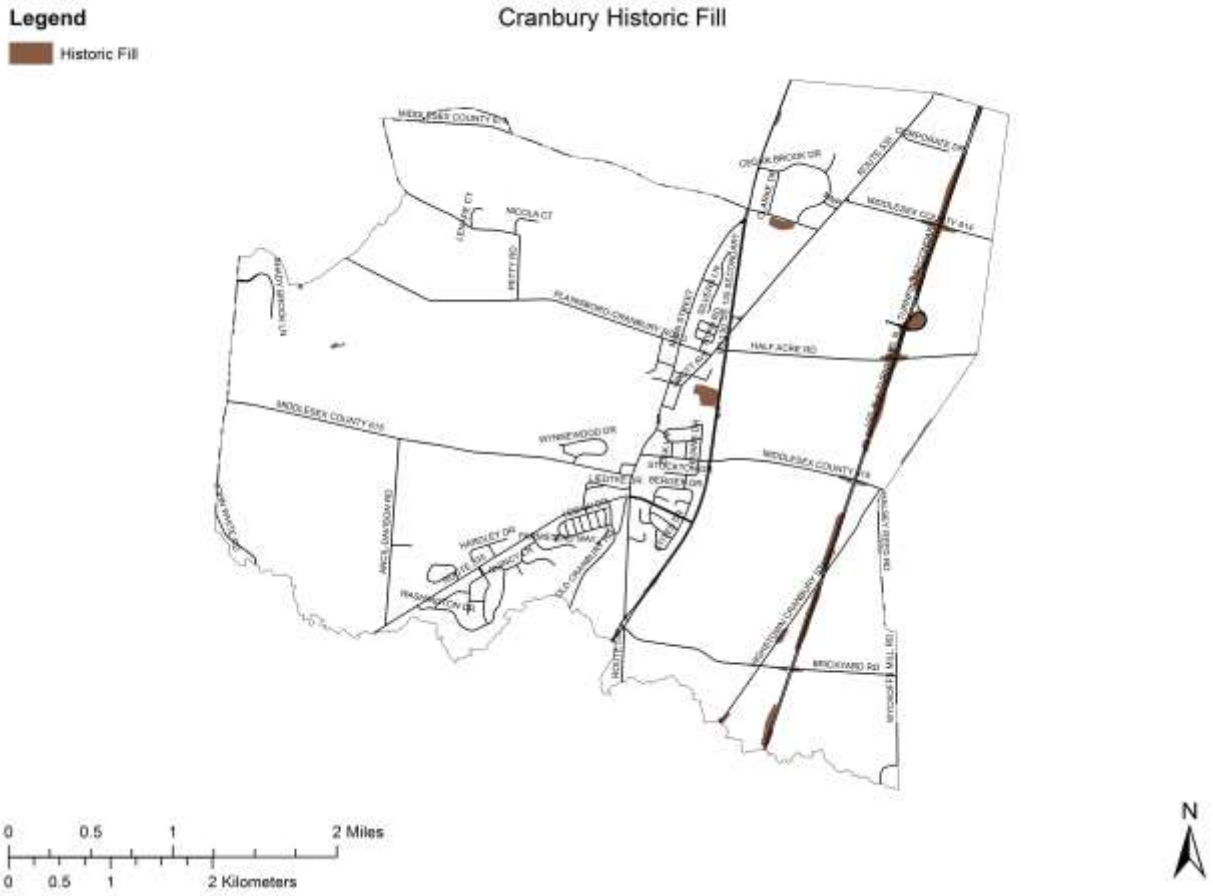


Figure 19 – Cranbury Historic Fill

The entire Millstone Watershed incorporates the 38-mile Millstone River and its tributaries. Areas within the watershed are generally defined as being upstream or downstream from Carnegie Lake, the river's largest impoundment. The watershed drains approximately 184,320 acres within the Piedmont Plateau and Inner Coastal Plain physiographic provinces in Central New Jersey. The Millstone River generally flows in a northwesterly direction from Millstone Township in Monmouth County, forming the southern border of Middlesex County including Cranbury Township before turning more northerly near Princeton Junction, and eventually flowing into the Raritan River near Bound Brook. Stony Brook, Cranbury Brook, Bear Brook, Ten Mile River, Six Mile River, Rocky Brook and Beden Brook are all major tributaries of the Millstone River. Land use in the Millstone Watershed is primarily a mix of agricultural and suburban with

increasing levels of development occurring in areas, particularly within the upper portion of the watershed.

In addition to the Millstone River, one of its major tributaries, Cranbury Brook and Cranbury Brook's major tributary Cedar Brook are within Cranbury (See Figure 20). Each of these waterways contains multiple small tributaries within the Township. All of Cranbury's surface waters are classified as Freshwater Non-trout Category 2- FW2-NT C2 (See Figure 21).

The Cranbury Brook is a 13-mile tributary of the Millstone River that has its headwaters in Millstone Township, flows through the middle of Cranbury Township and converges with the Millstone River in Plainsboro near Plainsboro Pond. The Cranbury Brook drainage is an area paralleling the brook and encompassing the northern portion of Cranbury including the Cedar Brook.

The Cedar Brook's headwaters are near Prospect Plains–Cranbury Road at the Township's eastern boundary. Cedar brook flows west and parallels the Cranbury Brook through the most of the northern portion of the Township before turning southwesterly near Petty Road, forming a portion of the Township's western boundary before converging with Cranbury Brook.

The US Geological Survey has mapped and identified watersheds using a hierarchical numbering system. Each watershed or "hydrologic unit" is identified by a unique hydrologic unit code (HUC) consisting of up to 14 digits, for the smallest mapped watersheds. There are 921 HUC 14 sub-watersheds in New Jersey, ranging in size from 0.1 to 42 square miles, with an average size of 8.5 square miles. There are 150 HUC -11 watersheds ranging in size from 0.1 to 143 square miles, with an average size of 51.9 square miles.

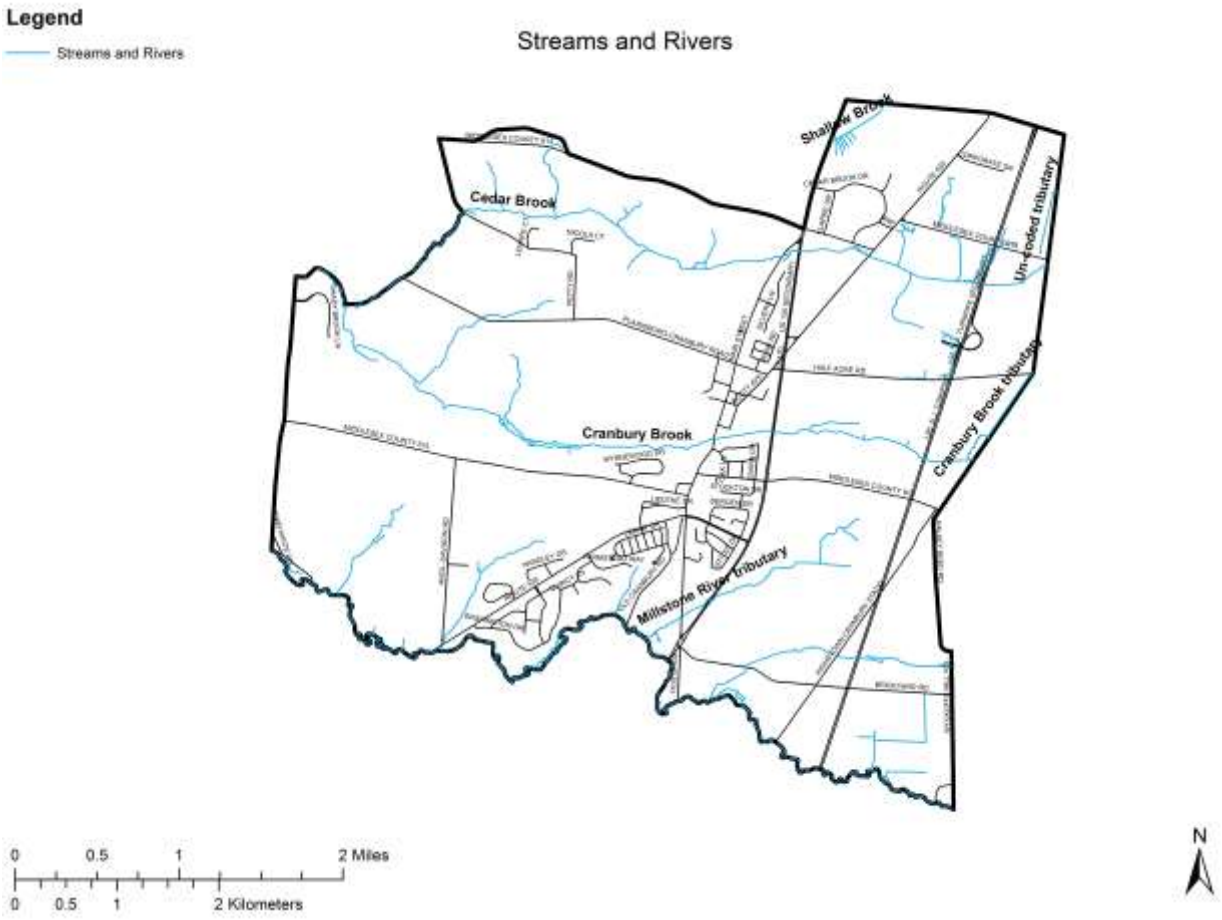


Figure 20 – Cranbury – Streams and Rivers

Seven HUC 14 sub-watersheds are situated in Cranbury. (See Figure 22 and Table 3). The sub-watersheds are identified as the Shallow Brook (Devils Brook), Cedar Brook (Cranbury Brook), Cranbury Brook (below NJ Turnpike), Millstone River (Rocky Brook to Applegarth Road), and Millstone River (Cranbury Brook to Rocky Brook). Brainerd Lake is the one major impoundment within Cranbury. All of Cranbury's HUC14 sub-watersheds drain into the Millstone River (above Carnegie Lake) HUC 11. The Millstone River (above Carnegie Lake) is one of 16 HUC 11s that make up the Raritan Basin HUC 8 (02030105). Most of Cranbury's lakes are impoundments along the Cranbury Brook. The most significant of these is Brainerd Lake.

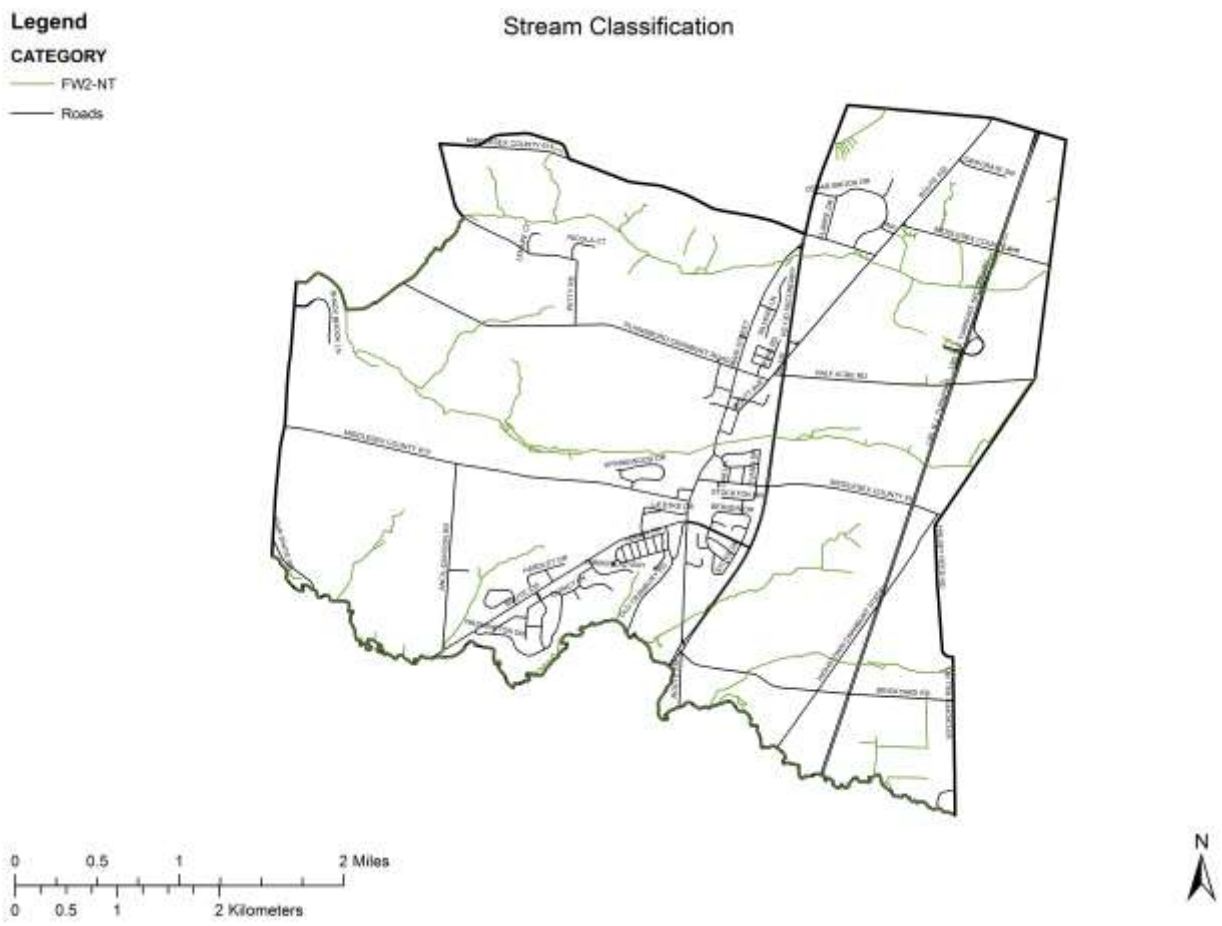


Figure 21 – Steam Classification

A few areas of the watershed are critical and responsible for high amount of soil and nutrient losses. Implementation of best management practices is required in those critical erosion prone areas of the watershed for controlling the soil and nutrient losses. Identification of these critical areas is essential for the effective and efficient implementation of watershed management programs. The critical watershed areas in Cranbury Township are shown of Figure 23.

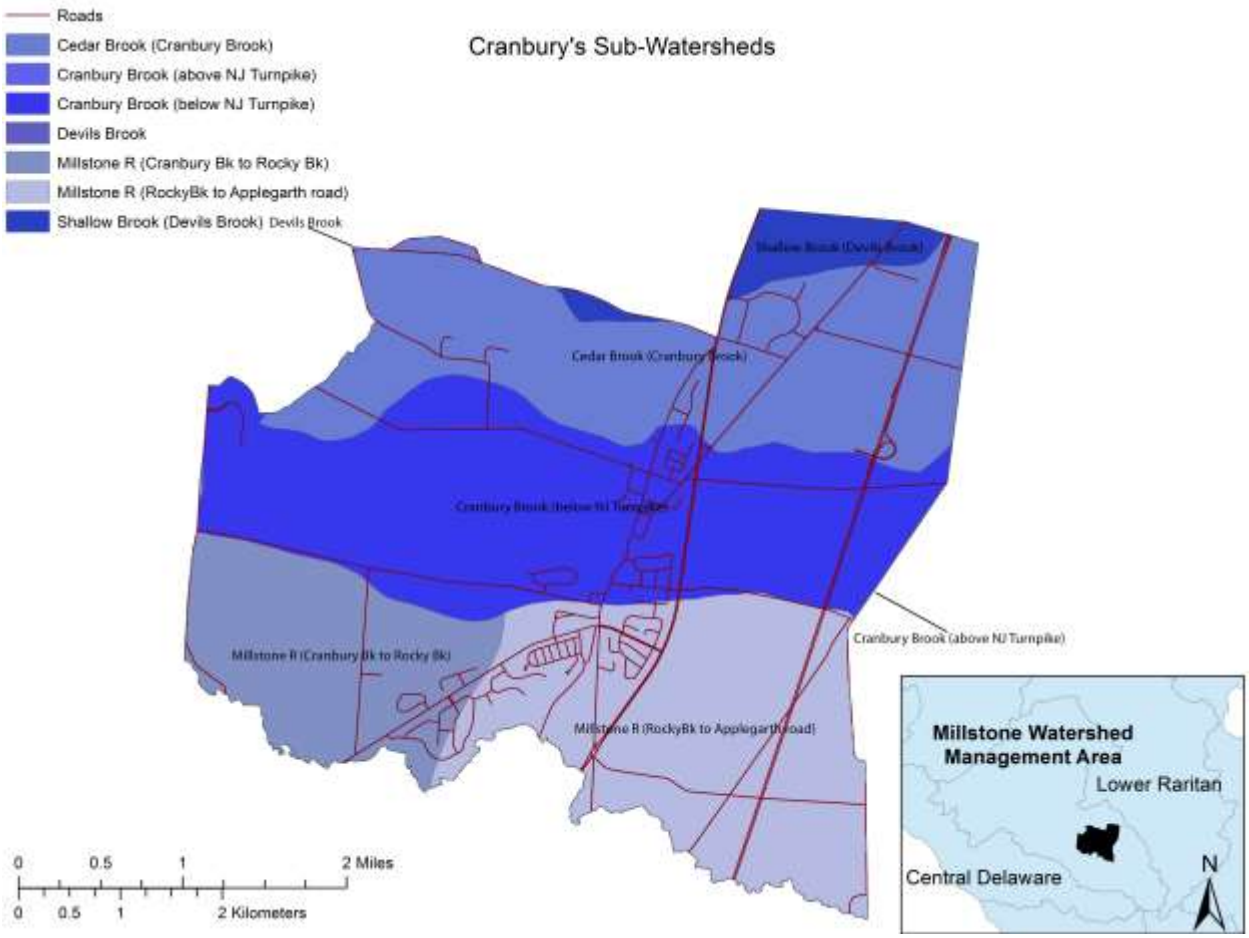


Figure 22– Cranbury Sub-Watersheds

Table 3

Cranbury Township Watersheds

HUC-14 Watershed Name	*HUC-14 Number*	*Surface Water Classification*	*Ac. Within Cranbury*	*% of Cranbury Acreage*	*Associated Named streams or Major Lakes Within Twp.*
Cedar Brook (Cranbury Brook)	02030105110080	FW2 –NT C2	2243.857	26.13	2 Unnamed
Cranbury Brook Above NJ Turnpike	0203010510070	FW2-NT C2	4.402	.051	None

Cranbury Brook (Below NJ Turnpike)	02030105110090	FW2 –NT C2	2822.708	32.96	Brainerd Lake Cedar Brook Horse Run Brook Unnamed Trib.
Millstone River (Rocky Brook to Applegarth Road)	02030105110030	FW2 –NT C2	2076.141	24.18	Indian Run 4 Unnamed
Millstone River (Cranbury Brook to Rocky Brook	02030105110060	FW2 –NT C2	1160.854	13.52	Cranbury Brook
Shallow Brook (Devils Brook)	02030105110100	FW2 –NT C2	278.330	3.24	None
Devils Brook	02030105110110	FW2 –NT C2	.673	.008	None

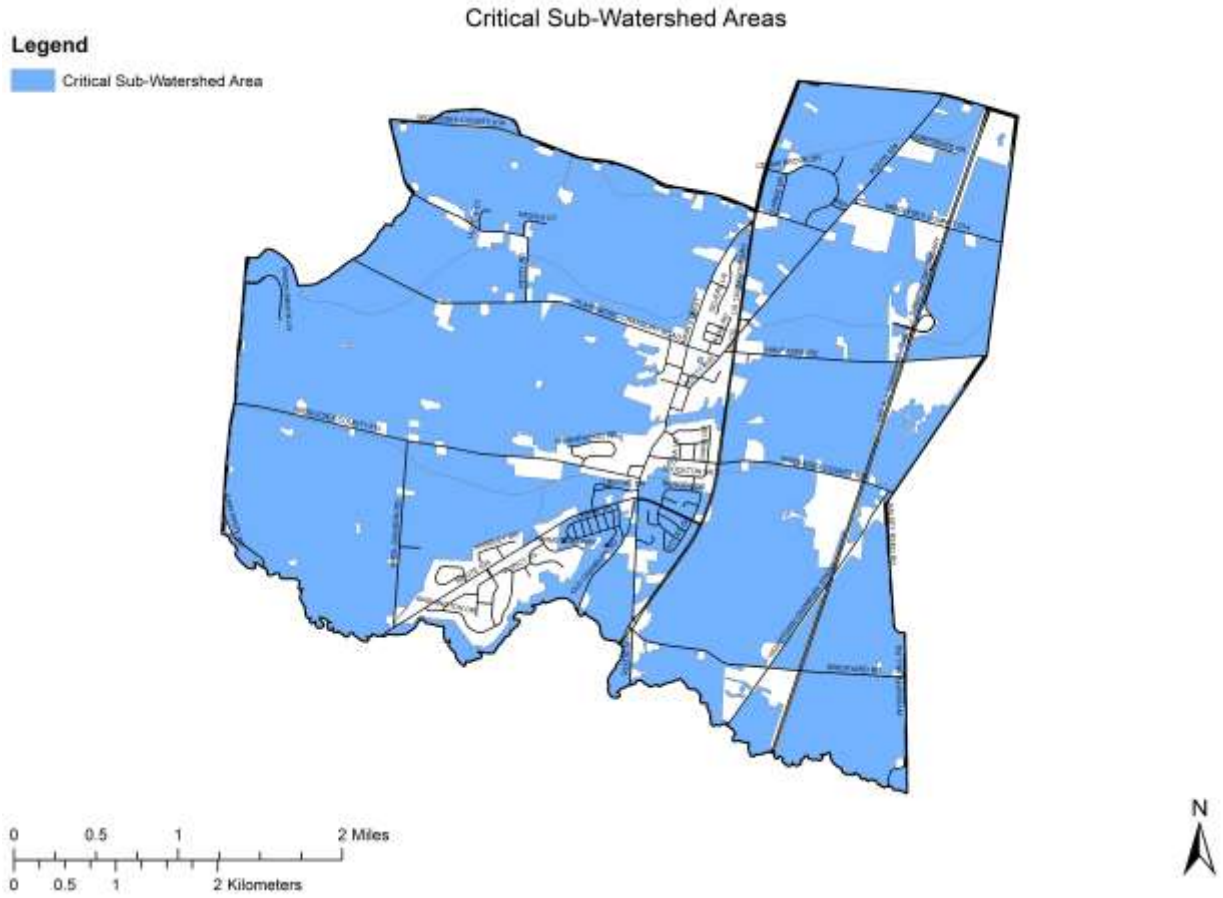


Figure 23. – Critical Watershed Areas

6.2 Surface Water Quality Classification

In New Jersey, it is the policy of the State to restore, maintain, and enhance the chemical, physical, and biological integrity of its waters, to protect the public health, to safeguard aquatic biota, protect scenic and ecological values and to enhance the domestic, municipal, recreational, industrial, agricultural and other reasonable uses of the State's waters. Water quality is evaluated with respect to Surface Water Quality Standards (SWQS) and water quality concerns occur when SWQS are not met or are threatened. New Jersey's Surface Water Quality standards (NJAC 7:9B, et seq.) establish the water quality goals and policies underlying the management of the State's water quality.

All of the surface water bodies that are located in Cranbury Township are classified as freshwater non-trout (FW2-NT) – (Figure 21). Non-Trout waters are

not associated with trout production or trout maintenance and are generally unsuitable for trout because of their physical, chemical, or biological attributes. These waters may be suitable for wide variety of other fish species.

The designated use for FW2-NT waters are identified as:

- Maintenance, migration and propagation of the natural and established biota;
- Primary and secondary contact recreation;
- Industrial and agricultural water supply;
- Public potable water supply after conventional filtration, treatment and disinfection; and,
- Any other reasonable uses.

Category 1 and 2 waters

In addition to the standard water quality classifications, waters are also classified as either Category 1 or Category 2 waters. Category 1 waters are those waters designated for additional protection due to their "color, clarity, scenic setting other aesthetic value, exceptional ecological significance, recreational significance, water supply significance or fisheries resources." All other waters are considered Category 2 waters. Under the NJ Storm-water Management Rules (N.J.A.C. 7:8) Category 1 waters are afforded a designated special waters resource protection area (SWRPA). The SWRPA areas are those areas within 300 feet of the top of each bank of C1 waters. In addition, the 300-foot width SWRPA is required adjacent to those waters that drain to C1 waters within the limits of the associated sub-watershed (HUC-14). The SWRPA is intended as a buffer between development and these special waters in order to further protect water quality. The 300-foot width buffer is based on an NJDEP review of existing scientific literature. Existing development within the SWRPA is not regulated. Consequently, maintenance of existing features, such as tree pruning; cultivation and mowing are also not regulated. However, new construction or expansion of existing facilities that would disturb up to one acre of land or create one-quarter acre of new impervious surfaces is considered major development and would be regulated under the NJDEP Storm-water Management Rules (N.J.A.C. 7:8). Although there are currently no C1 waters in Cranbury, NJDEP (2004) indicated

some of the tributaries of the Cranbury Brook have been considered for C1 classification (Yergeau and Sankalia, 2004).

6.3 Surface Water Quality

The surface water quality for rivers and creeks of has been evaluated in Middlesex County using various methods; in particular, the NJDEP uses a protocol termed Ambient Biological Monitoring Network (AMNET) for rapidly assessing water quality. In addition, under the Federal Clean Water Act Section 303 (d) States are required to list the status of their streams. The 303(d) list is generated using the AMNET and other stream monitoring data such as that generated by the NJDEP Clean Lakes Program, NJDEP Shellfish Monitoring Program, Fish Tissue Monitoring and NJDEP/USGS chemical and physical water quality monitoring.

6.3.1 AMNET Monitoring

In order to determine the health of the streams that comprise the watersheds, the NJDEP performs monitoring of benthic macro invertebrate populations using the Environmental Protection Agencies Rapid Bio assessment Protocols – Level II procedure. Using this method, aquatic communities are examined for pollution tolerant and intolerant life forms and the results are used to compute a New Jersey Impairment Score and Biological Condition. Biological condition of a stream sample is based 100 organism samples taken at the AMNET site. The benthic macro invertebrate samples examined include representatives of various taxonomic families of insects and insect larvae, mollusks such as mussels, clams and snails, and crustaceans such as crayfish. Ratings of the stream condition are based on the level of pollution tolerance of the families collected, the ratio of pollution tolerant to pollution intolerant families, and the biodiversity of the system (percentage of single species dominance). The program is termed the Ambient Biological Monitoring Network (AMNET). In New Jersey, over 800 locations are sampled on a five-year rotating schedule. Biological impairment of streams may be caused by several major factors including nonpoint source pollution, point source pollution and/or a lack of stream corridor (riparian) buffers.

Although no AMNET stations are established in Cranbury, several are located in adjacent townships. The stations included are the closest upstream and downstream stations and one across the Millstone River in East Windsor, Mercer County. Sampling stations near Cranbury are included in the table below.

Table 4

Biological Condition of Streams Impacting Cranbury

Stream Name	Location	AMNET Station	Biological Condition 1998 / 2004 /2009	Location Notes
Millstone River	Grover's Mills Road	AN0382	Good/ Fair / Fair	Plainsboro Twp. (Down stream)
Cranbury Brook	Edgemere Avenue	AN0386	NS / NS / Fair	Plainsboro Twp. (Down stream)
Millstone River	Route 535	AN0382B	Fair / Fair / Fair	East Windsor Twp. (opposite)
Cranbury Brook	Applegarth Road	AN0385	Fair / Poor / Good	Monroe Twp. (Upstream)
Millstone River	Applegarth Road	AN0382D	Fair / NS / Poor	Monroe Twp. (Upstream)

Source: http://waterqualitydata.u

No AMNET stations are currently located within the Township's Cedar Brook.

Using the most up to date protocols, AMNET testing has been completed three times at the above stations since 1999. The water quality ratings for the three rounds of sampling are summarized in the above table. A detail explanation of the ratings is provided below:

Multimetric Indices and Regulatory Thresholds For Benthic Macro invertebrate Data In Wadeable Streams

AMNET Site Assessment Attributes

Excellent: Minimal changes in structure of biological community and minimal changes in ecosystem function. Virtually all-native taxa are maintained with some changes to biomass and/or abundance; ecosystem functions are fully maintained within the range of natural variability.

Good: Some evident changes in structure of the biotic community and minimal changes in ecosystem function. Some changes in structure due to loss of some rare native taxa; shifts in relative abundance of taxa but sensitive-ubiquitous taxa are common and abundant; ecosystem functions are fully maintained.

Fair: Moderate to major changes in structure of biological community and moderate changes in ecosystem function. Sensitive taxa are markedly diminished; conspicuously unbalanced distribution of major groups from that expected; organism condition shows signs of physiological stress; system function shows reduced complexity.

Poor: Extreme changes in structure of biological community and major loss of ecosystem function. Extreme changes in structure; wholesale changes in taxonomic composition; extreme alterations from normal densities and distributions; organism condition is often poor; ecosystem functions are severely altered**.**

NS – No sample

6.3.2 Federal Clean Water Act Section 303 (d)

Under the Federal *Clean Water Act* Section 303(d), each State is required to list impaired water-bodies. New Jersey uses chemical and biological stream monitoring to determine these impaired waters. Water-bodies cannot be removed from the 303(d) list until the water quality standards are met. A review of the 303(d) listings finds that the following water bodies in or near Cranbury are included. This list represents the most recently available data from NJDEP. The 303(d) list is divided into 5 sub-lists or categories depending on the condition of the water body. The categories defined by NJDEP are as follows:

Water Supply: All New Jersey freshwater streams and lakes are designated for potential use as drinking water supply; however, most of the waters that do not support this use are not used for drinking water purposes.

Recreation: All waters of the State are designated for recreational use (e.g., swimming, boating). Twenty-four percent of all New Jersey waters, including lakes, ponds, rivers, and streams fully

support the recreational use, 41 percent do not support the use, and 35 percent have insufficient information.

Aquatic Life: All waters of the State are designated for general aquatic life use and 80 percent have been assessed for this use. Sixteen percent of State waters fully support the general aquatic life use, 64 percent do not support the use, and 20 percent have insufficient information to assess the use. Ten percent of waters designated for the trout aquatic life use fully support this use, 57 percent do not support this use, and 33 percent have insufficient information.

Shellfish Harvest for Consumption: Almost ninety percent of shellfish waters are classified as harvestable. Harvestable waters include: approved with no restrictions, seasonal harvest, and special restrictions. Only shellfish waters approved with no restrictions are considered to be fully supporting the designated use.

Fish Consumption: All New Jersey waters are designated for fish consumption. A very small percentage (<.05 percent) of waters fully support the fish consumption use, 36 percent do not support the use, and sixty-four percent have insufficient information.

Table 5

2014 Impaired Waters Listed on the 303(d) in or Near Cranbury Township

Water Body	Water Supply	Recreation	Aquatic Life	Shellfish Consumption	Fish Consumption
Cranbury Brook – above NJ Turnpike	Fully supports	Not supportive	Fully supports	NA	Insufficient data
Cranbury Brook – below NJ Turnpike	Fully supports	Not supportive	Not supportive	NA	Insufficient data
Millstone River – Cranbury Brook to Rocky Brook	Not supportive	Fully supportive	Not supportive	NA	Not supportive
Millstone River – Rocky Brook to Applegarth Rd.	Not supportive	Not supportive	Not supportive	NA	Insufficient data

Source: http://www.nj.gov/dep/wms/bears/2014_integrated_report.htm

Cedar Brook (Cranbury Brook) is on the list, but there is insufficient data for all categories.

6.3.3 Non-source Pollution

The major source of stream pollution in Cranbury is the result of storm-water runoff and other nonpoint sources. These sources of pollution are somewhat difficult to identify since they do not discharge directly from a pipe, or a "point source." The major form of nonpoint source pollution is from storm-water that runs off of developed, impervious surfaces and from agricultural areas that are subject to erosion.

Nonpoint source storm-water runoff affects the quantity and quality of the receiving waters. The increase in quantity causes downstream areas to peak faster and higher than under natural or predevelopment conditions. This results in downstream flooding and erosion problems. Sedimentation disrupts the naturally occurring substrate in a stream bottom and may literally smother benthic (bottom dwelling) invertebrate communities. When water runs quickly over the land surface or is directed via a pipe to a stream, the opportunity for the water to infiltrate and recharge groundwater is lost. Groundwater supplies the stream base flow for many streams. Reduced stream base flows can negatively impact the hydrology of adjacent wetlands. The reduced base flow and increased peak flows cause streams to erode at a faster than normal rate which introduces excess sediment. The increased sedimentation fills channels and causes streams to broaden and become increasingly shallow. Sediment is the most common and easily recognized of the nonpoint source pollutants. Visual assessments of the Cranbury Brook drainage taken by the Stony Brook Millstone Watershed Association indicate that sedimentation may be the major contributor to macro-invertebrate populations and indicate that the severe impairment of the Cranbury Brook Applegarth Road macro-invertebrate populations (AMNET, AN0385 – immediately upstream from Cranbury Township) during the 1999 sampling may have been the result of erosion/sedimentation associated with concrete bank retention and other activities occurring upstream (Yergeau 2004 et al). The 2004 sampling condition for this location was poor, while the 2009 sampling condition was good.

Cropland erosion accounts for about 38% of the approximately 1.5 billion tons of sediment that reach the nations waters each year. In addition to increased runoff, developed areas also accumulate pollutants on the land surface from atmospheric deposition. These pollutants are mobilized and transported to streams during storm events. The most common pollutants associated with storm-water include solid waste/floatables; sediment; nutrients; pesticides; metals, road salts; petroleum hydrocarbons and pathogens. Storm water that runs off of pavement or is stored in detention basins is also often heated, which raises the temperature of the receiving waters. The consequences of nonpoint source pollution result in significant stream and habitat degradation.

The Environmental Commission completed water quality testing studies in 2002 / 2003 funded by an NJDEP grant. The result of these studies is presented in Appendix A.

6.3.4 Point Source Pollution

Point source pollution comes from a defined "point" in the landscape such as an industrial or storm-water discharge pipe. Point source discharges to surface and ground water are regulated by the NJDEP under the New Jersey Pollution Elimination Discharge System (NJPDES). The Federal Clean Water Act created much of this program in 1972. To accomplish the goals of the program, permits are issued that limit the mass and or concentration of pollutants, which may be discharged into the ground or surface water. These types of permits often require monitoring and include maintenance and best management practices to ensure that they are functioning properly. The types of permitted facilities range from campgrounds, schools and shopping centers to large industrial and municipal wastewater facilities. In Cranbury there are currently 18 NJPDES permits currently on file with the NJDEP on the Active Permit List, most of which are storm-water discharges.

Table 6
NJPDES Permitted Facilities within Cranbury Township

NJPDES Permit Number	PI Number	Facility Name	Effective Start Date	Expiration Date	Discharge Category code	Discharge Category Description
NJ0020079	46569	66 STATION RD WTP	09/01/11	08/31/16	GW	Basic Industrial Storm-water GP - NJ0088315 (5G2)
NJG0126829	49165	PLANT FOOD COMPANY INC	02/01/13	01/31/18	5G2	Basic Industrial Storm-water GP - NJ0088315 (5G2)
NJG0127493	49219	CHAMBERLIN & BARCLAY INC	02/01/13	01/31/18	5G2	Basic Industrial Storm-water GP - NJ0088315 (5G2)
NJG0144487	196480	BROWN & PERKINS INC	02/01/13	01/31/18	5G2	Basic Industrial Storm-water GP - NJ0088315 (5G2)
NJG0153737	223061	ITW COVID INC	02/01/13	01/31/18	5G2	Basic Industrial Storm-water GP - NJ0088315 (5G2)
NJG0164143	286092	NEW WORLD VAN LINES	02/01/13	01/31/18	5G2	Sanitary Subsurface Disposal (GP)

NJG0167045	295774	CRANBURY SWIM CLUB	11/01/13	10/31/18	T1	Basic Industrial Storm-water GP - NJ0088315 (5G2)
NJG0168009	423032	MAIN TAPE CO INC	02/01/13	01/31/18	5G2	Basic Industrial Storm-water GP - NJ0088315 (5G2)
NJG0173932	216767	FEDEX GROUND HOME DELIVERY	02/01/13	01/31/18	5G2	Construction Activity Storm-water (GP)
NJG0215058	604548	Cranbury Brick Yard	04/11/13	02/28/17	5G3	Construction Activity Storm-water (GP)
NJG0217719	610638	Rahway Steel Drum	06/26/13	02/28/17	5G3	Construction Activity Storm-water (GP)
NJG0218774	613430	Richard J. Abrams Residence	07/30/13	02/28/17	5G3	Construction Activity Storm-water (GP)
NJG0232793	658932	CRANBURY WETLAND MITIGATION BANK	09/22/14	02/28/17	5G3	Sludge Quality Exempt (GP)

NJG0235911	46569	66 STATION RD WTP	01/01/16	12/31/20	SXG	Basic Industrial Storm-water GP - NJ0088315 (5G2)
NJG0238210	669070	SHAW INDUSTRIES PLANT #48	01/28/15	01/31/18	5G2	Construction Activity Storm-water (GP)
NJG0245411	702442	IMPROVEMENTS TO HCSR	08/17/15	02/28/17	5G3	Construction Activity Storm-water (GP)
NJG0245992	703940	CORPORATE PARK - 1 FARRVIEW DRIVE	09/01/15	02/28/17	5G3	Construction Activity Storm-water (GP)
NJG0249360	713119	HAMPTON INN/DAY CARE ADDITION	12/11/15	02/28/17	5G3	Construction Activity Storm-water (GP)
NJG0249556	713269	CRANBURY HALF ACRE	12/16/15	02/16/15	SG3	Construction Activity Storm-water (GP)

Source: http://datamine2.state.nj.us/dep/DEP_OPRA/NJDEPexcel.htm

6.4 Surface Water Quality Protection

6.4.1 Riparian Corridors

Riparian corridors are natural areas along river systems that typically connect larger patches of habitat and provide the stream or river with a buffer to disturbance. The riparian corridors in which streams and rivers are located serve many functions in protecting these sensitive resources. They are

complex ecosystems that provide food and shade and are effective in removing excess nutrients and sediment from surface runoff and shallow groundwater. Streamside vegetation also buffers the impacts of some pesticides and provides dissolved and particulate organic food needed to maintain high biological productivity and diversity by facilitating the movement /recruitment of wildlife between larger habitat patches. Streamside forests improve water quality and biological diversity by filtering out sediments and suspended solids; transforming excess nitrogen and phosphorus; storing nutrients for extended periods; and provide energy to the stream in the form of dissolved carbon compounds and particulate organic detritus (dead plant matter). This detritus forms the basis for the aquatic food chain. In New Jersey, deforestation associated with agriculture and urban and residential development has drastically reduced the extent of stream corridor protected by forest

The protection of riparian corridors is one of the most effective methods for protecting the streams in Cranbury and this is recognized at both the Municipal and Regional watershed level.

The Cranbury Township Master Plan (2010) states the importance of minimizing impacts to stream corridors and suggests open space planning that links areas through a greenway system. The Plan emphasizes the importance of "maintaining stream channels for their natural functions, including drainage and ecological purposes." The "Conservation and Environment" objectives of the plan include the protection and restoration of habitat along streams and other sensitive habitat areas by various means including planting of native vegetation. The effort to protect and preserve stream corridors should be priority for any land acquisition projects and when reviewing development proposals.

The Municipal Assessment for Cranbury created by The Stony Brook-Millstone Watershed Association (SBMWA) (SBMWA, February 2004) recommended the creation of a comprehensive stream corridor ordinance with language that specifically protects water quality and ecosystems. As such, and with the guidance of the Cranbury Environmental Commission, the Cranbury Township Committee adopted a Riparian Zone ordinance on June 22, 2015 (Chapter 150-39.1 of the Township Code), which provides a uniform 150-foot riparian buffer for all surface water bodies in Cranbury.

A total of 5650 acres of the Cranbury Brook watershed are corridor areas. This number was determined by looking at multiple factors including 100-year flood areas, wetland hydrology and hydric soils and appropriate wildlife buffer areas. It was determined that 4,023 acres of the riparian corridors are wetland, forest or open water. Land distribution figures in 1995 show that the large (61%) proportion of Cranbury's 150-foot riparian corridor areas were wetlands; 13 % were agricultural; eight percent were urban; seven percent were forest; and the remaining 11% was open water.

6.4.2 Flood Hazard Area Control Act Rules

Under the NJDEP *Flood Hazard Area Control Act* rules (N.J.A.C. 7:7), the NJDEP regulates development within the vicinity of stream corridors and within floodplains. However, under this regulation, the protection of vegetation only extends for a distance of 25 feet (50 feet for trout production water or endangered or threatened species habitat) from the top of bank along streams. A corridor of this width may provide some limited stream corridor functions, such as shade and bank stabilization, but will provide little in the way of filtering sediment or pollutants or the uptake of nutrients. Enacting local ordinances that provide more stringent requirements than those enforced by NJDEP can provide further protection of these resources. The greater the width of the buffer, the more effective will be the functions provided for protection of the stream corridor. Cranbury regulates Flood Hazard Areas under the Cranbury Township Code, Chapter 87- Flood Damage Prevention, Chapter 88 –Flood Fringe Areas, and Chapter 150 – Land Use.

6.4.3 Storm-water Management Rules

On February 2, 2005, New Jersey adopted two sets of rules that affect storm-water management in New Jersey. The first set of rules is the Phase II New Jersey Pollutant Discharge Elimination System (NJPDES) Storm-water Regulation Program Rule (N.J.A.C. 7:14A-1 *et seq*.). These rules address pollutants associated with existing storm-water runoff, as required under the Federal Clean Water Act. These rules govern the issuance of permits to certain public entities, including municipalities, which own or operate small municipal storm sewer systems (MS4s). The permit program establishes the Statewide Basic Requirements that

must be implemented to reduce nonpoint source pollutant loads from these sources. The Statewide requirements include measures such as: the adoption of ordinances (litter control, pet waste, wildlife feeding, proper waste disposal, etc.,) the development of a municipal storm-water management plan and implementing ordinances; requiring certain maintenance activities (such as street sweeping and catch basin cleaning); implementing solids and floatables controls, locating discharge points and stenciling catch basins, and a public education component.

The second set of rules are the Stormwater Management Rules (N.J.A.C. 7:8-1 *et seq*.), which apply to storm-water systems associated with new (proposed) development. The design and performance standards established in these rules have replaced the storm-water management rules that apply to residential development under the Residential Site Improvement Standards (RSIS), and include residential subdivisions, site plan and building permit approvals. For non-residential development, the Storm-water Management Rules will not be applied at a local level until a municipal ordinance is passed adopting the standards. However, if the non-residential development requires one of the Land Use Regulation Program permits listed at N.J.A.C. 7:8-1.6(c), the new rules will be applied under that review.

The Storm-water Management Rules apply to new development that will ultimately result in the disturbance of one or more acres of land, or in an increase in impervious surface by one-quarter of an acre or more (*i.e.*, "major development").

6.4.4 Public Participation

Cranbury and the Stony Brook Millstone Watershed Association have been instrumental in involving the public in the preservation of open space and watershed quality. It is vital to establish a connection between riparian preservation and water quality among the public as the association between buffer quantity and quality and its impact on open waters is not always understood. This can be done by involving the public in projects such as a stream monitoring program, implementing stream cleanup projects, and riparian planting projects in order to improving the condition of the stream corridor. Stream walks can be organized to involve the citizens in observing the stream and floodplains,

and also to identify any potential problem areas (*i.e.*, erosion, illegal dumping, unauthorized storm-water discharges, etc.). Schoolteachers, particularly those with backgrounds in botany, ecology or aquatic biology, could incorporate a water chemistry/stream biology section into their curriculum, and plan field trips to local parks where waterways can easily be observed.

6.5 Floodplains

Activities in floodplains are regulated by the NJDEP under the *NJ Flood Hazard Area Control Act* (N.J.S.A. 58:16A-50 et seq.).

A floodplain is defined in N.J.A.C. 7:13-1.1 et. seq. as the area inundated by the regulatory flood including the watercourse that creates it. For regulatory purposes, the floodplain is calculated as the area inundated by the 100 year storm, plus 25% flow in order to account for the affects of future development in the watershed. The floodplain area includes both the floodway and flood fringe. The floodway is the channel and portions of the floodplain adjoining the channel, which are reasonably required to carry and discharge the regulatory flood. The floodway is subject to high velocity flows during flooding events. The flood fringe is the portion of the flood plain contiguous with the floodway. The flood fringe experiences flooding, but is inundated to a lesser degree than the floodway.

Delineated floodplains have been established and officially adopted by the State of New Jersey. Flood profiles, mapping and corresponding computer models for delineated watercourses may be obtained from the NJDEP. The Flood Insurance Program, administered by the US Flood Emergency Management Agency (FEMA) has also prepared mapping and classifies flood plain areas in a manner similar to the State of New Jersey. Their mapping may be utilized if it can be demonstrated that the mapping reflects full development of the drainage area. Figure 24 shows the areas of Cranbury that frequently flood and Figure 25 shows the Flood Zones. This mapping was derived from digital coverage provided by FEMA.

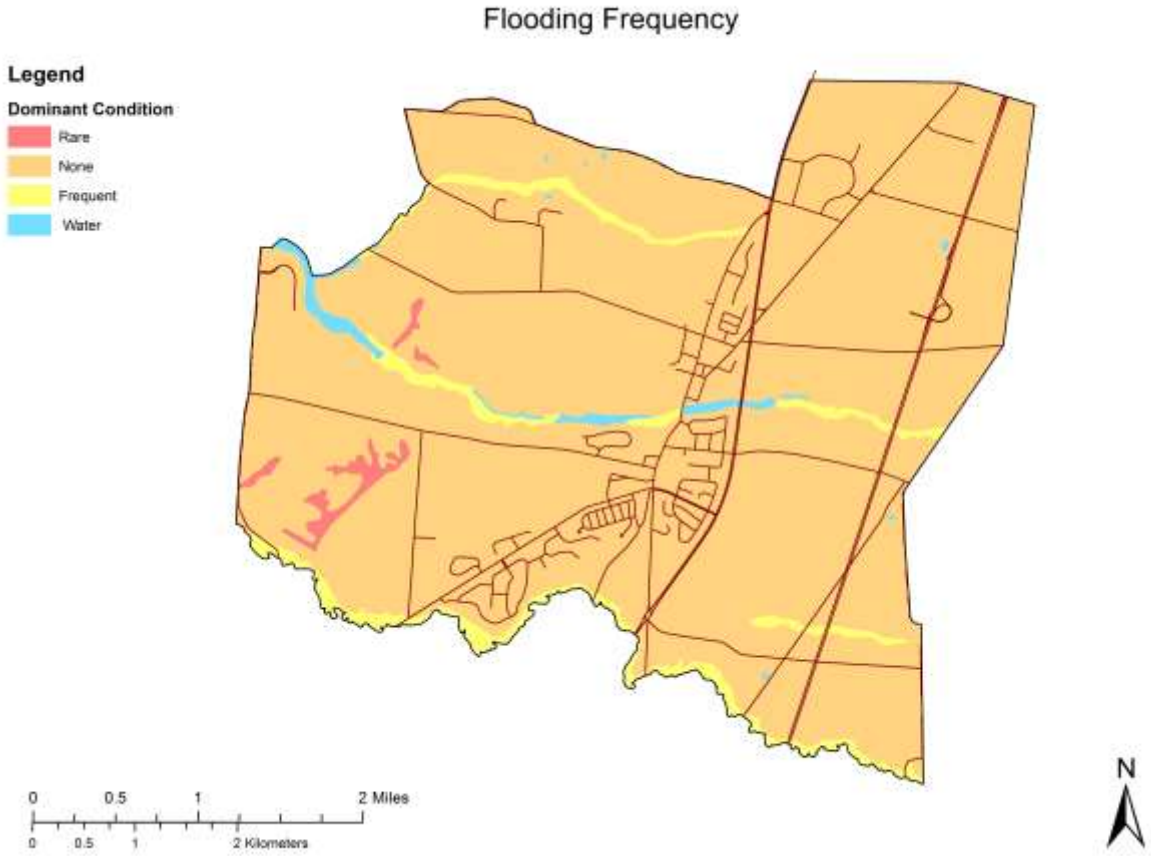


Figure 24 – Flooding Frequency

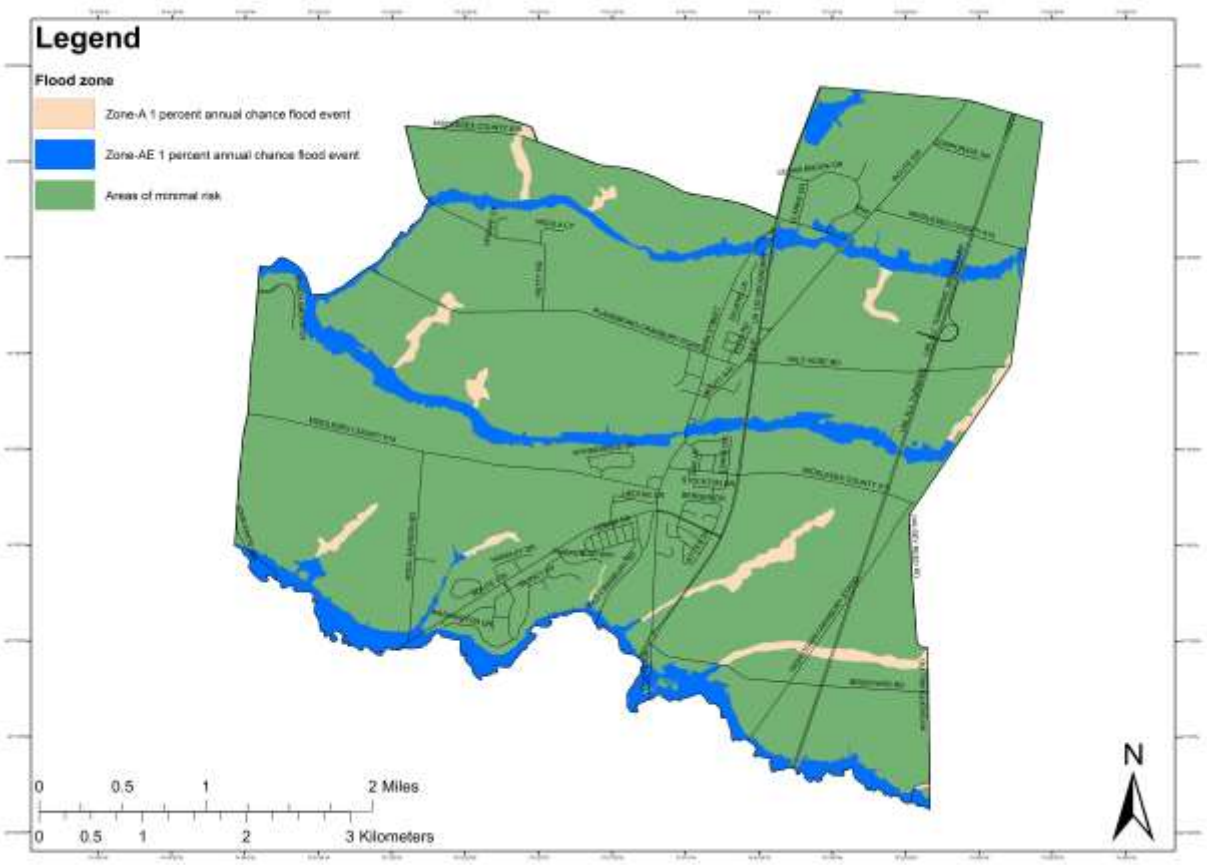


Figure 25 – Flood Zone

In accordance with the *NJ Flood Hazard Area Control Act* (FHACA) rules, NJDEP must issue a stream encroachment permit for certain types of development activities. By regulating and limiting development in the flood hazard area, not only is the floodplain protected as a resource, but potential property loss is minimized as well. Filling and development of floodplains removes the capacity of the floodplain to provide flood storage benefits, which increase the likelihood of increased upstream and downstream flooding. Vegetated floodplains reduce the velocity of storm-water, thereby reducing erosion and increasing flood storage. Floodplains also provide habitat and travel corridors for wildlife. Cranbury also regulates activities in floodplains. Floodplains are governed under the Flood Fringe (Chapter 88) and under Land use (Chapter 150) in the Cranbury Township Code. These codes may be accessed on the Township website.

The FHACA rules currently provide for stream buffers of 25 or 50 feet from the top of bank, depending on several factors. The 50 foot buffers are intended for

waters that are designated as Trout Maintenance (FW2-TM) or Trout Production (TP); areas where acid-producing soils are present; and areas where endangered and threatened species are known to, or historically have been known to, utilize habitat. In Cranbury, all surface waters are non- trout, however it is likely that acid-producing soils are present in many areas. Wood turtle habitat is mapped in Cranbury along a portion of the Millstone River floodplain. For non-wetland floodplains that may be associated with their habitat, the NJDEP may impose a 50-foot buffer. Stream floodplains containing wetland habitat may be considered exceptional resource value and receive a 150-foot transition area buffer. Within this buffer area, NJDEP requires that vegetation not be disturbed unless it is demonstrated that there is no alternative when constructing a project. Any Major Development that requires a Stream Encroachment Permit is also subject to the Storm-water Management Rules at N.J.A.C. 7:8, which require a stream buffer, or Special Resource Protection Area, of 300 feet adjacent to Category 1 waters (see discussion in water resources, above).

7.0 WETLANDS

7.1 Definition and Identifying Factors

The NJDEP regulates activities in wetlands and their adjacent transition areas under the *New Jersey Freshwater Wetlands Protection Act* (NJSA 13:9A-1 et seq.), which 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 under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation."

In other words, a wetland is an area with a specific hydrologic regime that supports the growth of plants adapted to living in saturated soil conditions. Wetlands serve many important functions. They minimize flooding by absorbing water during storm events and releasing it slowly over time. They improve water quality by filtering sediments and adsorbing nutrients and pollutants and reducing them to their elemental forms. Wetlands provide habitat for many species of wildlife including Federal and State-listed endangered and/or threatened species.

In order to accurately define and delineate wetlands, a methodology was developed by the Federal Interagency Committee for Wetland Delineation (FICWD) and is presented in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands (FICWD 1989). NJDEP has adopted this manual as the technical basis for identifying and delineating freshwater wetlands in New Jersey. The location and extent of wetlands is established using a three-parameter approach: 1) dominance of hydrophytic vegetation, 2) presence of hydric soils, and 3) evidence of long-term wetland hydrology.

7.2 Wetland Locations

The general distribution of freshwater wetlands in Cranbury is depicted on the Wetlands Map (Figure 26). The mapped wetlands are based on photo interpretation of 1986 color infrared aerial photos that were integrated with other sources (i.e. hydric soils, USGS flood-prone areas and 1906 atlas sheet geology) based on coincident features. The extent of wetlands as depicted are intended to be used as a general planning tool. The specific location, extent and resource value classification of wetlands is subject to case-by-case detailed field delineations, surveys and analysis. The presence, absence, extent and resource value classification of wetlands are subject to verification by the NJDEP Land Use Regulation Program through the Letter of Interpretation application process.

According to the NJDEP wetlands mapping, Cranbury has extensive forested wetland areas in the north central, southeastern and southwestern portions of the Township. Wetland areas are also associated with the floodplains of surface waters throughout the Township. Most wetlands within the township are associated with Woodstown and Fallsington soils. Humaquepts and fluvaquents are the dominant hydric soils associated with wetland floodplains in Cranbury.

While the Township may not adopt ordinances specifically regulating activities in wetlands and wetland transition areas, the Township may adopt an ordinance requiring that an applicant for subdivision, site plan or building permit approval obtain a Letter of Interpretation from NJDEP establishing the limit of wetlands and wetlands transition areas on a property.

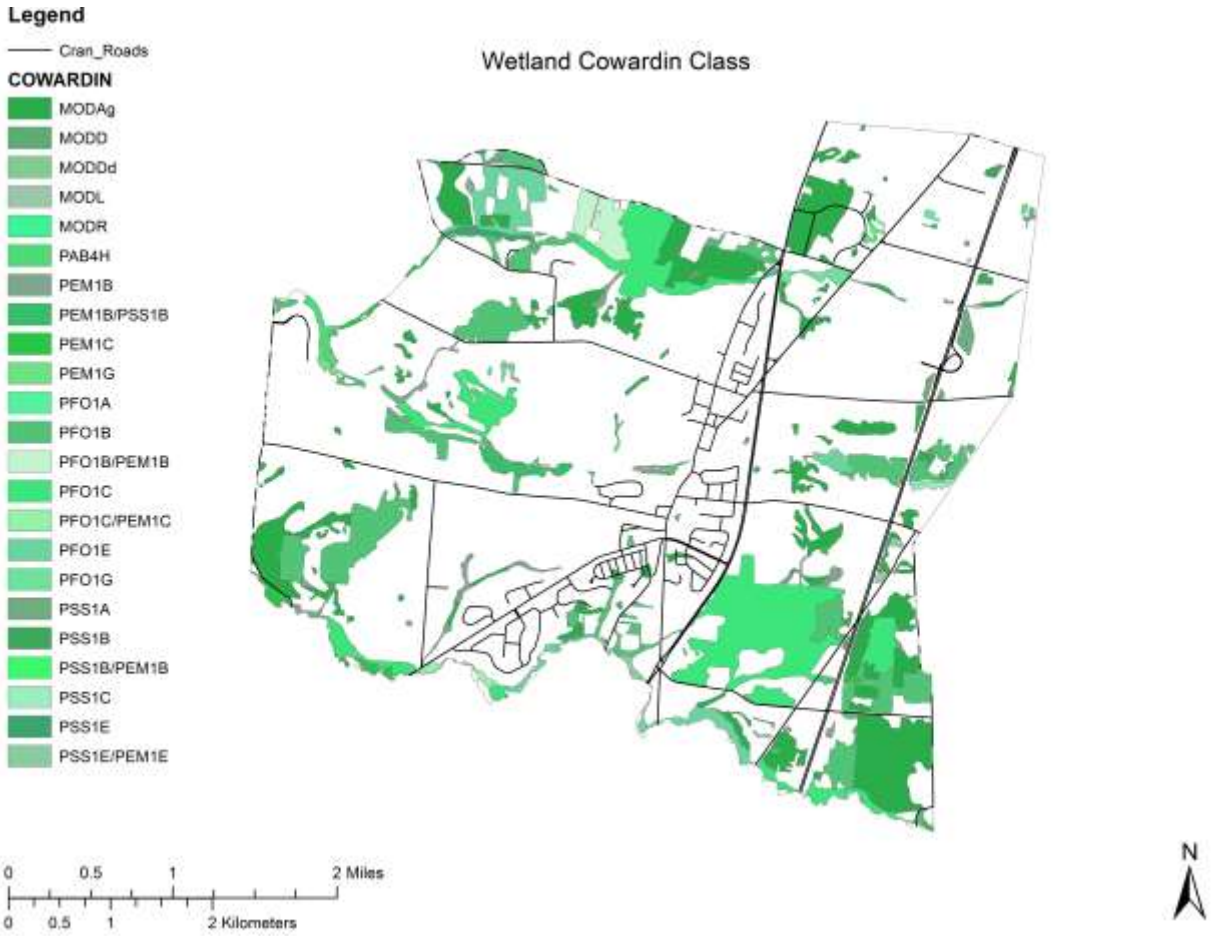


Figure 26 - Wetlands

7.3 Wetland Resource Value Classification

The Freshwater Wetlands Protection Act classifies wetlands according to resource value. Each wetland resource value classification has a corresponding transition area, or upland buffer, that must be maintained between the wetland and adjacent development to protect the integrity and viability of the wetland ecosystem. There are three different resource value classifications; exceptional, ordinary and intermediate as described below:

Exceptional resource value wetlands are the highest quality wetlands and require a 150-foot transition area. Exceptional resource value wetlands are those that drain to FW-1 waters, FW-2 trout production waters or their tributaries, or are present or documented habitat for threatened or endangered species.

Ordinary resource value wetlands are typically viewed as the lowest quality wetlands and do not require a transition area. Ordinary resource value wetlands do not exhibit the characteristics of exceptional resource value wetlands and include isolated wetlands that are surrounded by development by more than 50% and are less than 5,000 square feet in size. These wetlands include drainage ditches, swales, or detention basins.

Intermediate resource value wetlands include all freshwater wetlands not defined as exceptional or ordinary and require a 50-foot transition area.

NJDEP has the final authority to determine the resource value classification of wetlands. This is established when the NJDEP issues a "Letter of Interpretation" (LOI) for a site. A LOI is obtained by submitting an application to the NJDEP Land Use Regulation Program in accordance with the requirements found at N.J.A.C. 7:7A-3. The Township of Cranbury currently does require that an LOI on all sites where action is requested by the by the Planning Board or Zoning Board.

All of the surface waters within Cranbury are classified as non-trout Category 2 by NJDEP. Landscape mapping of Endangered and threatened wetland species within the town indicates the presence of wood turtle habitat along a small section of the Millstone River in Cranbury. The presence of this state-threatened species will affect the resource value of wetlands with which it is associated. The NJ Landscape Project Mapping, which is another tool used to identify the potential presence of endangered or threatened species habitat, identifies most of the large wetland complexes as providing habitat for State-listed threatened or endangered species. Based on a review of NJDEP Natural Heritage information and the NJ Landscape Project Forest and Grassland Habitat mapping (Figure 28) in, it appears that the majority of the wetlands in Cranbury would be likely to be classified as intermediate resource value wetlands and would have an associated

50-foot width wetland transition area (buffer). Wetlands within the NJDEP Landscape Mapping mapped wood turtle habitat would most likely receive a 150-foot buffer (Figure 27). The documentation of additional threatened or endangered species or individuals in Cranbury may change the potential resource value of wetlands within the Township. The resources value, or width of the transition area, is established by the NJDEP on a case-by-case basis when a Letter of Interpretation application is submitted for NJDEP review and verification. Figure 27 shows the buffer zones for the wetlands in Cranbury.

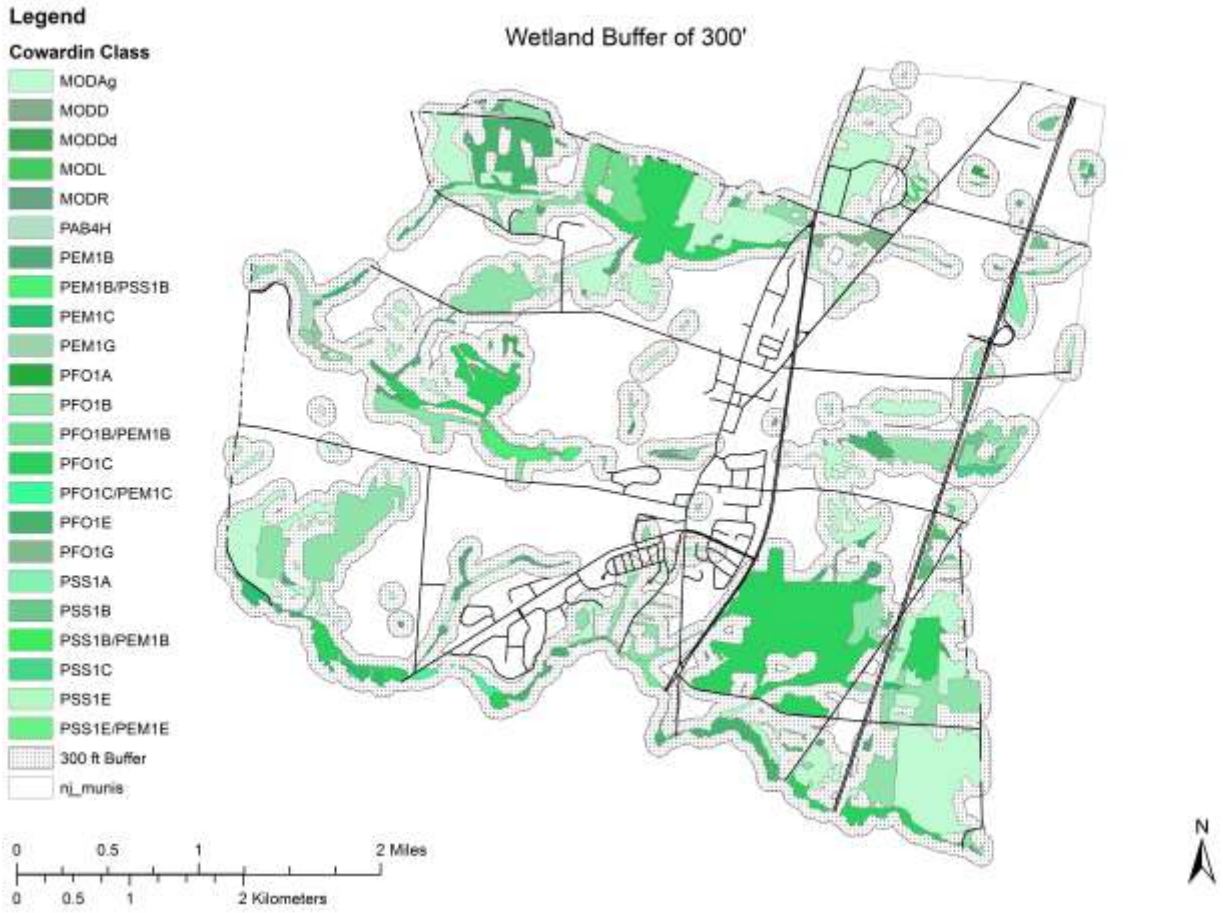


Figure 27– Wetland Buffers

7.4 Wetland Communities

According, to 1995 Land Use data, Cranbury's NJDEP mapped wetland includes a total of 2146 acres of the Township's total land (Figure 26). The wetland

communities are classified following a system identified by Cowardin (1979), which separates wetlands into one of five basic ecological systems: Marine, Estuarine, Riverine, Palustrine, and Lacustrine. Most of Cranbury's wetlands are considered palustrine (Figure 29). A table providing the approximate percentage of the major types of palustrine wetlands is included in Table 7.

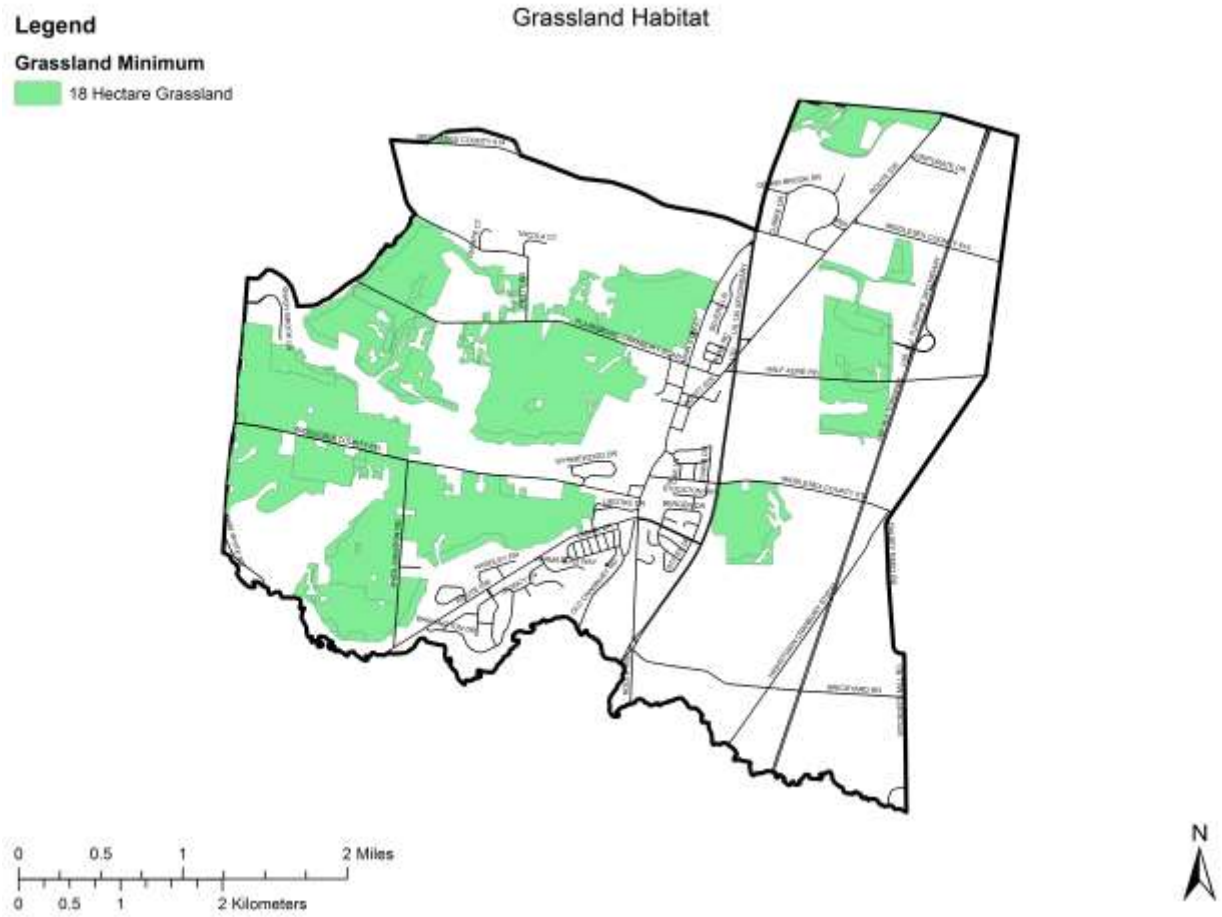


Figure 28 – Grassland Habitats

Table 7

Distribution of Wetland Communities in Cranbury Township

Wetland Type	Acreage	% Of Total
Modified (MOD)	718.94	33.51
Palustrine Aquatic Bed (PAB)	14.16	.66
Emergent (PEM)	124.56	5.81

Palustrine Deciduous (PFO1)	1206.55	56.23
Palustrine Scrub / Shrub (PSS)	81.41	3.79
Total	2145.62	100%

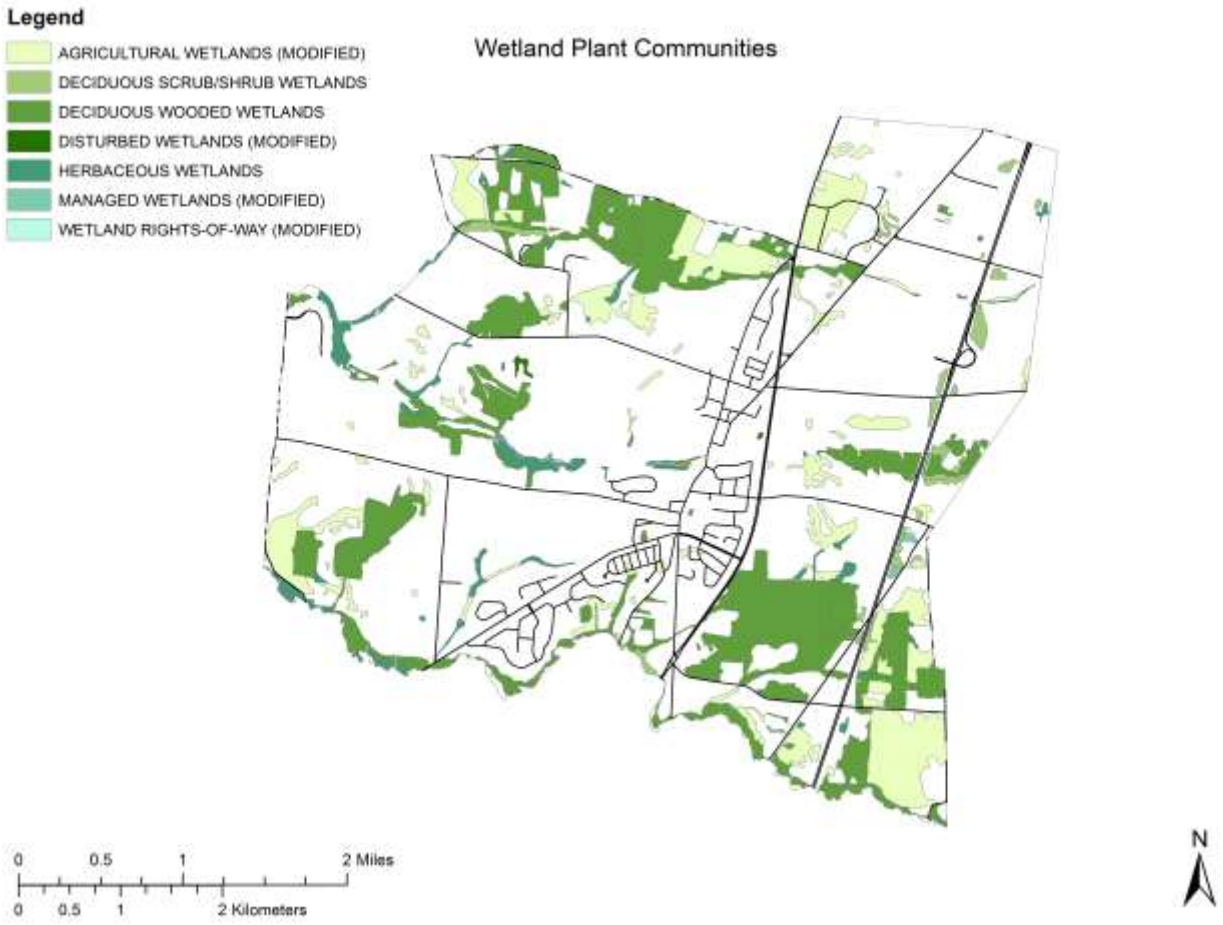


Figure 29 – Wetland Plant Communities

Palustrine wetlands include all non-tidal wetlands dominated by trees, shrubs and persistent emergent vegetation. These wetlands are usually bordered by uplands and shoreward of lakes and river channels and typically include all wetlands termed marsh, bogs, swamps, and fens. Palustrine wetlands may include small, shallow intermittent or permanent ponds, such as vernal pools.

Sources of hydrology for Cranbury's wetlands include surface water runoff, in the form of overland flow or flooding from adjacent open waters; or groundwater discharge to the wetland. Water tables are usually highest in the late winter and into early spring. During this period, water may pond or flood the wetlands for variable periods. In May or June the water table usually begins to drop. Water tables reach their lowest levels in September or October. Fluctuations relate mainly to rainfall patterns, temperatures, and rates of evapotranspiration.

The major palustrine wetlands in Cranbury include palustrine deciduous forested, palustrine scrub-shrub, palustrine emergent, and palustrine aquatic bed, which generally refer to shallow ponds. Some of Cranbury's wetlands may show characteristics of two different vegetation communities. These include emergent with a scrub/shrub component (approx. 26 acres in Cranbury), scrub/shrub with an emergent component (approx. 13 acres in Cranbury), or forested wetlands with pockets of emergent wetland (approx. 63 acres in Cranbury). The dominant community categorizes these wetlands in the above table.

7.4.1 Palustrine Deciduous Forested Wetlands

Deciduous forested wetlands are the most abundant type of wetland in New Jersey and occupy the majority of the wetlands mapped in Cranbury occupying over 1206 acres. Forested wetlands help to filter and purify water by absorbing and filtering pollutants and sediments. They also stabilize stream flows by temporarily storing floodwater and mitigating the effects of drought. Forested wetlands include vegetation that is greater than six meters tall and may have a variety of water regimes ranging from permanently inundated to intermittently flooded. In Cranbury, the forested canopy will typically include red maple (*Acer rubrum*), black gum *(Nyssa sylvatica*), and sweet gum (*Liquidambar styraciflua*). Other trees occurring in the forested wetlands include pin oak (*Quercus palustris*) and swamp white oak (*Quercus bicolor*). Common understory plants will include highbush blueberry (*Vaccinium corymbosum*), southern arrowwood (*Viburnum dentatum*), swamp azalea (*Rhododendron viscosum*) and sweet pepperbush (*Clethra alnifolia*). Other species include winterberry (*Ilex verticillata*), witch-hazel (*Hamamelis virginana*) and spicebush (*Lindera benzoin*). Poison ivy

(*Toxicodendron radicans*) and Japanese honeysuckle (*Lonicera japonica*) may form thickets along with common greenbrier (*Smilax rotundifolia*) within the forested Inner Coastal Plain wetlands.

7.4.2 Palustrine Scrub Shrub Wetlands

In Cranbury, about 80 acres are currently mapped as scrub-shrub wetland. Scrub/shrub wetlands include vegetation that is less than 6 meters tall and includes true shrubs or young trees and may represent a stage of succession, which may occur following logging and other clearing or in some cases inundation from beaver activity or other hydrological impacts. These wetlands include a variety of water regimes ranging from permanently inundated to intermittently flooded. As with upland old-field communities, the first species to colonize disturbed wetland areas such as sediment filled ponds are typically herbaceous species. These may include a wide variety of sedges, grasses and rushes and sometimes Sphagnum mosses. Typical shrub wetlands may include young sweet gum (Liquidambar styraciflua) and red maple (Acer rubrum), swamp azalea (Rhododendron viscosum) southern arrowwood (Vibernum dentatum), and highbush blueberry (Vaccinium corymbosum), buttonbush (Cephalanthus occidentalis), swamp rose (Rosa palustris) and sweet pepperbush. Other wetland shrub species documented in Cranbury (Wolgast, 1974) include silky dogwood (Cornus amomum), common alder (Alnus serrulata) and speckled alder (Alnus rugosa).

7.4.3 Palustrine Emergent Wetlands

In Cranbury, approximately 125 acres of palustrine emergent wetlands are mapped by NJDEP. Emergent wetlands in Cranbury may be wet meadows or freshwater marshes dominated by persistent and non-persistent grasses, rushes sedges, forbs and other herbaceous or grass like plants. Common plants include cattails (*Typha* spp.), tussock sedge (*Carex stricta*) and other *Carex* sedges, water willow (*Decodon verticillatus*), soft rush (*Juncus effusus*), rice cutgrass (*Leersia oryzoides*), burreeds (*Sparganium* spp.), arrow arum (*Peltandra virginica*), pickerelweed (*Pontederia cordata*) and broad-leaved arrowhead (*Sagittaria latifolia*).

Invasive plants typically found in these systems include common reed (*Phragmites australis*) and purple loosestrife (*Lythrum salicaria*). These Eurasian plants that commonly colonize disturbed, emergent wetlands, river and stream banks, pond edges and ditches. Under favorable conditions, it can rapidly replace the native plant community with a dense, monotypic stand and reduce habitat value and biodiversity of the wetland.

7.4.4 Modified Wetlands

Modified wetlands are those wetlands that have been altered by human activities, typically for agriculture. Modified wetlands may also be wetlands in roadside ditches, ball fields, power-line easements, etc. In Cranbury, 707 of the approximate 719 acres of modified wetland mapped by NJDEP are associated with agriculture. Ditching, diking or the installation of subsurface drainage tiles usually alters these wetlands. Modified agricultural wetlands are used for pasturage or crops such as corn, soybeans, hay, small grains, summer vegetables and sod. Modified wetlands may lack a strong hydrophytic vegetation community but contain evidence of hydrology and remnant hydric soils characterized by dark colorization and mottling. Modified wetland will often revert back to the natural hydrophytic plant community if the drainage features are abandoned. These areas can also be actively converted back to wetland with minimal effort by plugging ditches and drains or removing dikes and, as a result are often considered as an option in wetland remediation programs.

7.4.5 Vernal Pools

Vernal pools are ephemeral wetlands that fill annually in the winter and early spring from precipitation runoff or rising groundwater tables. They may be located within a forested, scrub-shrub or emergent wetland. Most years they dry out during the summer and late fall, losing water through evapotranspiration or as the groundwater table drops. This wet/dry cycle and the low water oxygen levels prevent the establishment and breeding of fish, yet provide a unique temporary habitat for many species. The time of year that the pool fills and dries out will influence the community of animals that utilizes the pool. Numerous amphibians and invertebrates have evolved life cycles adapted to the exploitation of vernal pools. Some species are completely dependent on these pools (obligate

Species) while others may use vernal pools or other wetlands (facultative Species) for reproduction. Vernal pools are also indispensable for biodiversity, with local populations often entirely dependent on a single pool. Vernal pools also provide an important source of water for a variety of other wildlife. Vernal pools are a unique wildlife resource that have long been ignored or overlooked. They have been filled, drained, and used as road drainage detention ponds. Adjacent areas have been cleared and groundwater wells have lowered water tables. Fertilizers and pesticides have degraded water quality.

Vernal pools are a very valuable natural resource, and although often isolated from adjacent wetlands, are worthy of protection, along with adjacent upland buffers. Amphibian inhabitants of vernal pools may utilize adjacent forested habitat of up to 1,000 feet or more from the breeding pool.

NJDEP uses four basic criteria to determine if a wetland is a certified vernal pool. A wetland certified by the State as a vernal pool must be: 1) a confined basin/depression lacking a permanent outlet, 2) harboring documented obligate or facultative vernal habitat species (as identified in N.J.A.C. 7:7A, Appendix 1), 3) maintaining water for at least two continuous months between March & September of a normal rainfall year, 4) free of fish populations or dries up at some time during a normal rainfall year.

A high density of vernal pool habitat characterizes the Inner Coastal Plain within the vicinity of Cranbury. The Center for Remote Sensing and Spatial Analysis (CRSSA) maps some nearby areas as having a density of 10–14 vernal pools per square mile. Approximately 50 potential vernal pool habitats have been mapped by NJDEP in Cranbury, the majority of which occurring in forested areas in the north-central and southeastern portions of the Township. Three of these pools have been identified as including documented habitat for vernal pool species and are certified by NJDEP, Non Game and Endangered Species Program. The certified pools exist within forested wetlands along Cranbury Brook within the vicinity of the New Jersey Turnpike (Figure 30). The remaining vernal pools are identified as “not surveyed” and are strictly identified by aerial photography. No field investigation has been performed to confirm their status or existence on the ground. Vernal pools identified, as “Yes/Vernal Pool” has been field investigated

and have been found to have the physical features of a vernal pool; however, vernal pool species have not yet been identified. The remaining vernal pools will require field investigation at the appropriate time of year to determine if they will qualify as “certified” vernal pools.

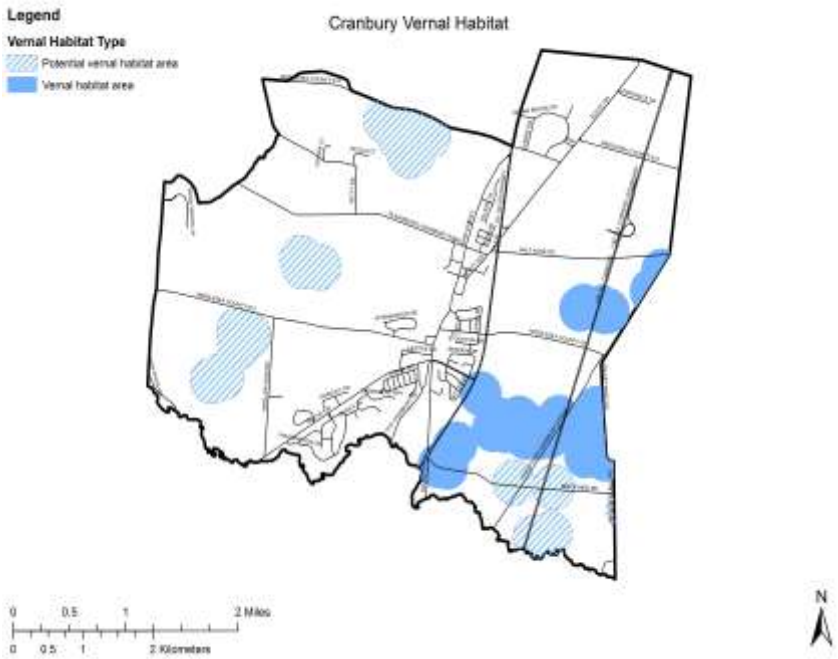


Figure 30– Cranbury Vernal Habitat

Vernal habitats are sometimes relatively small (< .5acre) and may appear as nothing more than an ordinary wooded depression during certain times of the year. Consequently field evaluations for vernal habitat/species within the Township at the appropriate time of year would be required to fully determine the extent of vernal habitat and species.

Within Cranbury, certain obligate vernal pool amphibian species may be targeted during surveys for adults, eggs and larvae. These obligate species must use vernal pools to successfully breed. Wood frogs (*Rana sylvatica*) and the spotted salamander (*Ambystoma maculatum*) would be the most likely obligate vernal species in Cranbury Township and would utilize the pools in the early spring (March-April). Another obligate species mapped within Middlesex County is the marbled salamander (*Ambystoma opacum*). The female marbled salamander utilizes the vernal pools in the fall. Species such as spring peepers (*Pseudacris crucifer*), northern gray tree frogs (*Hyla concolor*), green frogs (*Rana clamitans*),

southern leopard frogs (*Rana utricularia*), pickerel frogs (*Rana palustris*), bullfrogs (*Rana catesbiana*) and the Fowler's toad (*Bufo woodhousii*) are among the numerous facultative amphibian species potentially using these habitats at some point in the year in Cranbury. Facultative species are those species that will utilize a variety of aquatic habitats including vernal pools to breed.

Currently, under the NJDEP *Freshwater Wetlands Protection Act* rules (N.J.A.C. 7:7A), vernal pools and adjacent wetland transition areas are protected from disturbance by prohibition of issuance of most general permits for activities in these vernal habitats [N.J.A.C. 7:7A-4.3(b)16]. However, as of the date of this document, General Permit #6 currently allows the filling of up to one acre of non-tributary or isolated wetlands, (which may be vernal pools) that do not provide documented habitat for State-listed threatened or endangered species. The NJDEP has discretionary authority, however, to require an Individual Permit for a proposed disturbance to an isolated wetland considered a vernal pool.

Individuals that have identified a vernal pool or potential vernal habitat may register the pool at the NJDEP sponsored website listed below. The website, sponsored by the Center for Remote Sensing and Spatial Analysis (CRSSA) at Rutgers University, provides general information about vernal pools and contains a database and mapping of vernal pool locations throughout the state (http://www.nj.gov/dep/opra/online.html)

7.4.6 Wetland Mitigation

Wetlands such as the modified agricultural wetlands mentioned in section 7.4.5 may be converted to their original state as part of a mitigation project. Wetland mitigation is required for certain projects that impact open waters and wetlands in New Jersey. Mitigation is the development, preservation, enhancement or restoration of wetland required (often by NJDEP) as compensation for wetlands impacted or lost during permitted activities such as road development. Mitigation may provide opportunities for landowners to sell wetlands that are otherwise not developable and have less economic value, or sell adjacent uplands they wish not to sell for development. The New Jersey Department of Transportation and other organizations are often required to purchase sites for

mitigation. As mentioned in the Stream Corridors section of the ERI, the NRCS can direct farmers and other landowners to programs and organizations involved with wetland mitigation/restoration.

For those required to do wetland mitigation, it can be performed onsite or offsite or through land donations, monetary contributions, or through the purchase of Wetland Mitigation Bank credits. A wetland mitigation bank is a pre-constructed wetland or an area of wetland/upland that has been preserved. For Watershed Management Area 10, Cranbury's WMA, Wyckoff's Mills Mitigation Bank and Cranbury Wetlands Mitigation Bank are currently listed as approved mitigation banks by the NJDEP. The following descriptions of these mitigation banks are provided by the NJDEP:

- Wyckoff's Mills Wetland Mitigation Bank is operated by Shaw Environmental Infrastructure Inc. and is located on a 146.46-acre parcel in Monroe Township, Middlesex County. The bank received a total of 86.91 mitigation credits for freshwater wetland creation, and wetland/transition area enhancement activities as well as the preservation of upland and wetland areas. This bank is able to sell their mitigation credits. The service area (SA) of the mitigation bank includes watershed management areas (WMAs) 8, 9 and 10 (Raritan Drainage Basin).
  Contact: (609) 588-6491

- Cranbury Wetlands Mitigation Bank - This 138 acre site historically (pre-settlement) was a headwater forested system comprised of riparian/palustrine forested wetlands and uplands. The natural headwater system was significantly altered and impaired by ditching, deforestation, intensive agricultural use and surrounding development including the NJ Turnpike, which forms the sites' western boundary. This fully approved mitigation bank was allotted 38.14 available credits to offset impacts within its approved SA. The bank is comprised of the key ecological elements that may provide compensation for similar impacts. The SAs of this mitigation bank, which is operated by GreenVest, are WMAs 8, 9, and 10.
- Contact: (732) 902 6644

7.4.7 Wetlands Regulations

Since July 1, 1988 the NJDEP Bureau of Freshwater Wetlands has regulated all disturbances in freshwater wetlands under the NJ Freshwater Wetlands Protection Act Rules (NJAC 7:7A-1.1 et seq.). Since July 1, 1989, they have regulated "transition areas," lands adjacent to wetlands. As per the freshwater wetlands regulations, municipalities cannot adopt local wetlands ordinances.

In March 1994 the NJDEP assumed the administration of the federal 404 wetlands program for the majority of freshwater wetlands in the state. The USACOE retained jurisdiction over all tidal wetlands, certain interstate waters and wetlands and freshwater wetlands within 1000 feet of tidal waters. The US Environmental Protection Agency, the National Marine Fisheries Service and the US Fish and Wildlife Service retain some oversight over this program, reviewing permit applications for major discharges to wetlands and reviewing new Statewide General Permits and other changes to the rules for consistency with the federal 404 program.

Between July 1, 1988 and July 1, 1989, only activities in wetlands and open waters themselves were regulated by NJDEP. Since July 1, 1989, buffer or transition areas adjacent to wetlands have also been regulated. Regulated activities in wetlands include draining, flooding, cutting of vegetation, excavation, filling, and erection of structures. Similar activities are regulated in wetland transition areas.

There are two types of permits than can be issued for wetlands disturbance 1) General Permits and 2) Individual Permits. General Permit may also be issued for activities in wetland transition areas. General permits can be granted for certain minor activities in wetlands subject to certain conditions. There are General Permits for wetlands encroachments related to multiple activities including: utility lines; outfalls road crossings; disturbance of isolated wetlands; disturbance of ditches or swales; surveying; soils sampling; house additions; trails and boardwalks; docks and piers; dredging of ponds; fish and wildlife management activities; clean up of hazardous waste; etc. For outfalls and road crossings, no more than 1/4 acre can be disturbed. For isolated wetlands, ditches and swales, no more than one acre can be disturbed. Additions to residential dwellings existing prior to July 1, 1988, are limited to less than 750 SF of fill with no effect to adjacent wetlands. If wetlands filling cannot be avoided, proposed activities

should be limited to those activities authorized under General Permit where at all possible.

Individual Permits are required for all other disturbances in wetlands not authorized under General Permits. These are very difficult to obtain. If the proposed activity is water dependent, and wetlands disturbance is minimized, a permit may be granted. For non-water dependent uses it must be proven that there is no other alternative location or design for the proposed project that would involve less or no wetlands disturbance. An alternative site to be considered can be on property owned by the applicant or on any property that could be obtained in the region. This requirement is very difficult to satisfy. Mitigation, or creation of wetlands from uplands, at a ratio of 2:1 would be a condition of an Individual Permit, but is not required for most General Permits.

Activities in wetland transition areas must be authorized under a Transition Area Waiver. A waiver to disturb the associated transition area accompanies granting of a wetland permit. If activities are limited to within a transition area, they may be approved under a Transition Area Averaging Plan Waiver. Under such a plan the shape of a transition area may be adjusted as long as the total area of the standard transition area is not reduced and other minimum and maximum width requirements of the transition area are maintained. Selected activities within a transition area may be authorized under a Special Activities Waiver. These activities may include construction of road crossings or storm-water outfalls that would be authorized under a General Permit if they were conducted in wetlands. Where certain specific characteristics of slope and vegetative cover are present in the transition area and the development intensity is not high, a straight reduction of the transition area, without compensation, may be authorized under a waiver. Lastly, a Hardship Waiver may be granted under certain circumstances.

8.0 AIR QUALITY

Existing ambient air quality for the Township was obtained from the 2013 Air Quality Report published by the NJDEP, Bureau of Air Monitoring. The 2013 data is the most recent data available. In New Jersey, there are continuous monitoring stations that monitor five specific air pollutants, which are used as indicators of air quality and for which Ambient Air Quality Standards (AAQS) have been

established. These pollutants are listed as carbon monoxide (CO), nitrogen oxide (N02), ozone (O3), sulfur dioxide (SO2), and fine particulate matter (PM).

Cranbury Township is located in the Suburban monitoring reporting region. Monitoring stations in this region are located in Chester, New Brunswick, and at Rutgers University. SO2, O3, and NO2 are monitored at Chester, O3 and NO2 are monitored at Rutgers, and PM is monitored in New Brunswick. On July 18, 2013, O3 exceeded the AQI of 100. This was determined to be Unhealthy for Sensitive Groups (USG).

In general, the air quality in New Jersey has improved significantly since the passage of the Clean Air Act in 1970. New Jersey is now in compliance with all National Ambient Air Quality Standards (NAAQS), except for ozone. Based on a review of the Air Quality data, air quality in the Cranbury region is of intermediate quality compared to other portions of New Jersey. Air quality is poorer in more urbanized areas near New York City and Philadelphia, and better in the more rural portions of the state including the Northern Delaware Valley and the Southern Coastal region. The full NJDEP Bureau of Air Monitoring 2013 Air Quality Report can be reviewed at: http://www.njaqinow.net/

9.0 Land Use / Open Space

9.1 Land Use/Cover Types

Land use cover types according to NJDEP for both 2007 and 2012 digital GIS coverage are presented on the Land Use/Land Cover maps (Figures 31 and 32) where 10 cover types are documented.

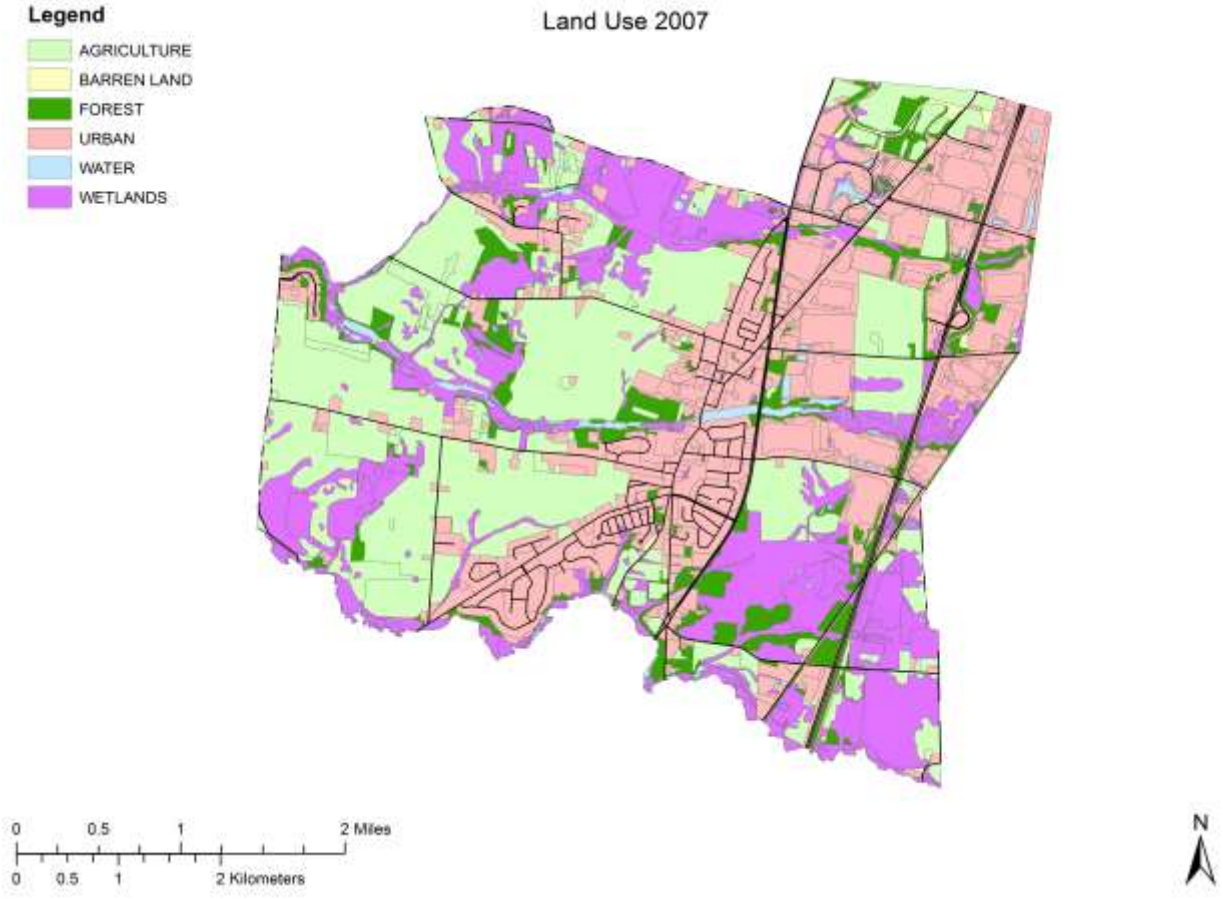


Figure 31– 2007 Land Use

These cover types include Agricultural, Forest (deciduous, coniferous, and scrub shrub), Wetland, Open Water, Recreational, Residential, Urban and Barren Land. The approximate acreages of these various cover types are summarized below in Table 8 and the changes from 2007 to 2012 are shown graphically on Figure 33:

Table 8

Distribution of Land Use/Land Cover Types

	2007		**2012**		
Land Cover Type	Acreage	% of Total	Acreage	% of Total	Ac. Change
Agricultural	4012.87	46.73%	3065.22	35.69%	-947.65

Barren/Altered Lands	122.25	1.42%	353.05	4.12%	+ 230.8
Coniferous			19.13	.22%	+ 2.63
Agricultural	16.50	0.19%			
Deciduous Forest	294.86	3.43%	345.37	4.02%	+ 50.51
Open Water	97.10	1.13%	151.17	1.76%	+ 54.07
Recreational	53.27	0.62%	78.48	.91%	+25.21
Residential	813.12	9.47%	968.23	11.27%	+155.11
Scrub / Shrub Forest	299.96	3.49%	330.50	3.84%	+30.54
Urban	756.13	8.81%	1269.91	14.79%	+513.78
Wetlands	2120.90	24.70%	2005.90	23.35%	- 115.00
TOTAL	8586.97	100%	8586.97	100%	

According to 2012 NJDEP land use data, Cranbury is characterized by a large amount of open space, with wetlands and agriculture comprising approximately 60% of the mapped land cover. Residential and urban land uses occupy about 26% of the land area. Remaining land is predominantly mature and shrub forested upland (just under 8%). Residential land uses are primarily concentrated in the central portion of the Township, west of Route 130. The largest change in land use according to NJDEP data is transitions of agricultural land to urban land in northeastern portions of the Township (see Table 8 and Figure 33)

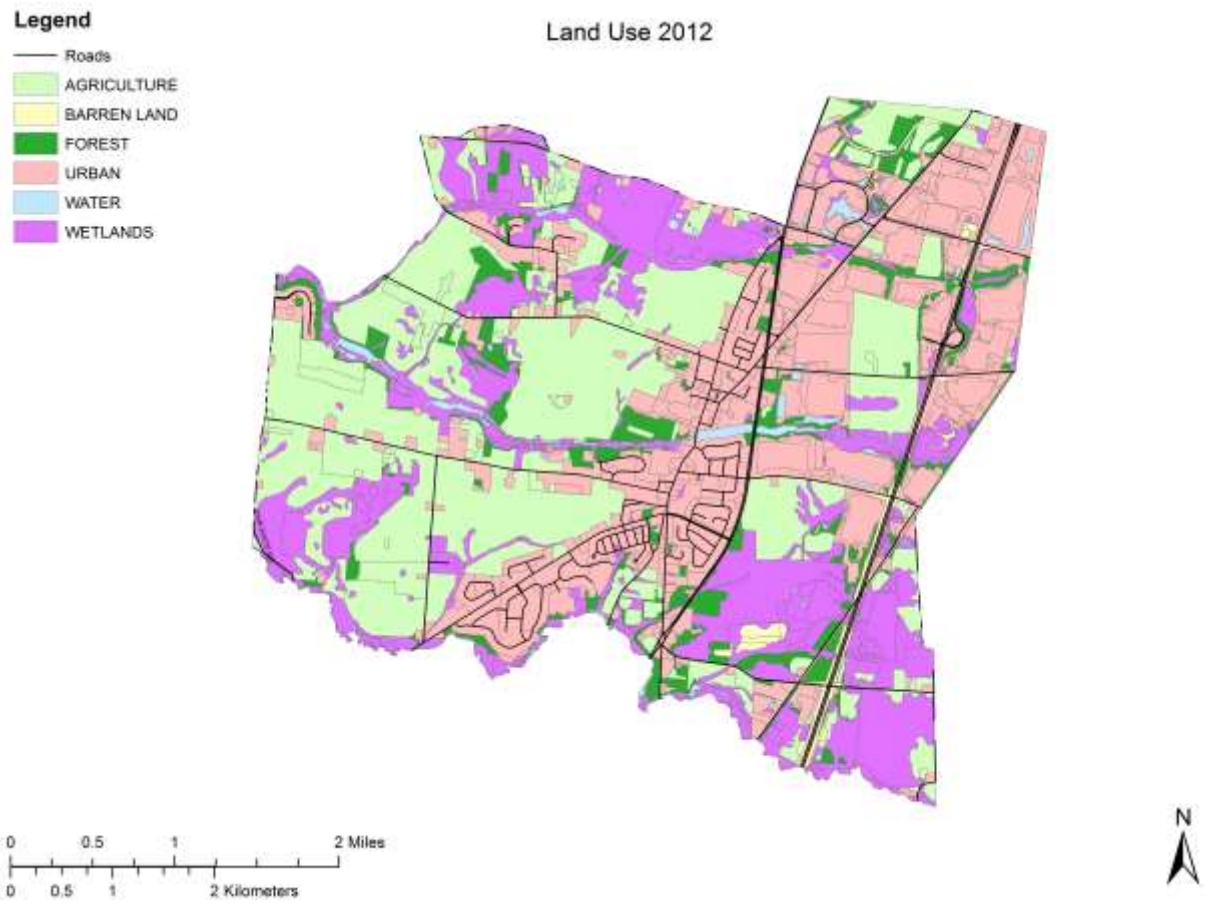


Figure 32 – 2012 Land Use

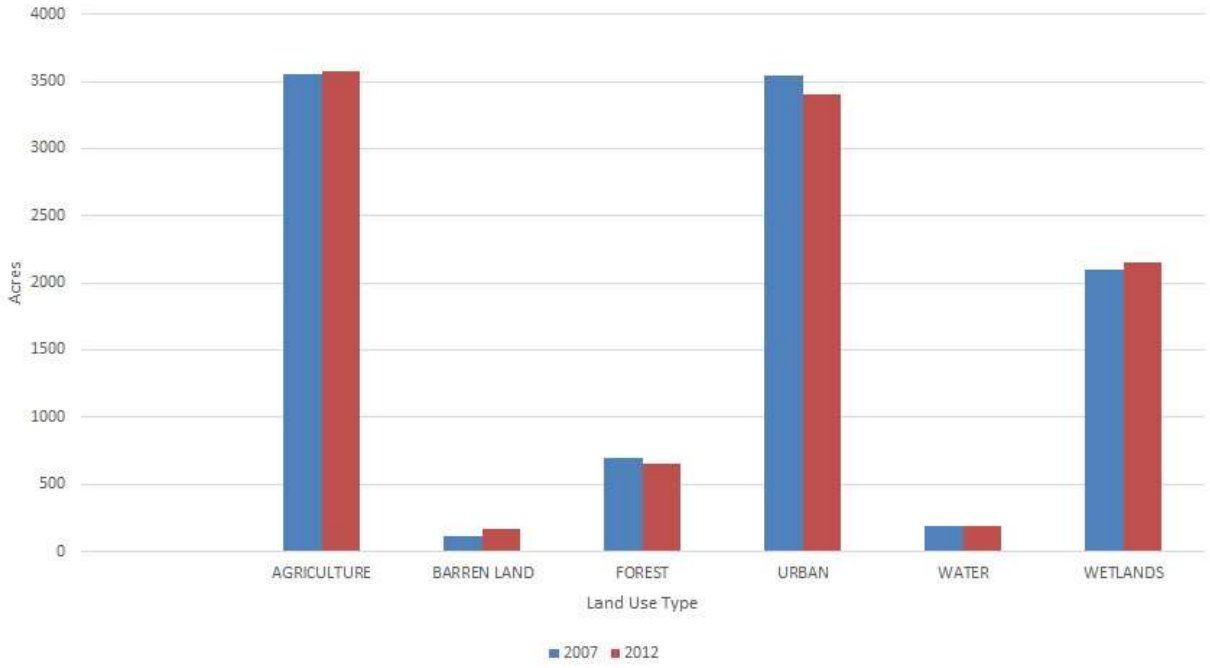


Figure 33– Land Use Changes – 2007 / 2012

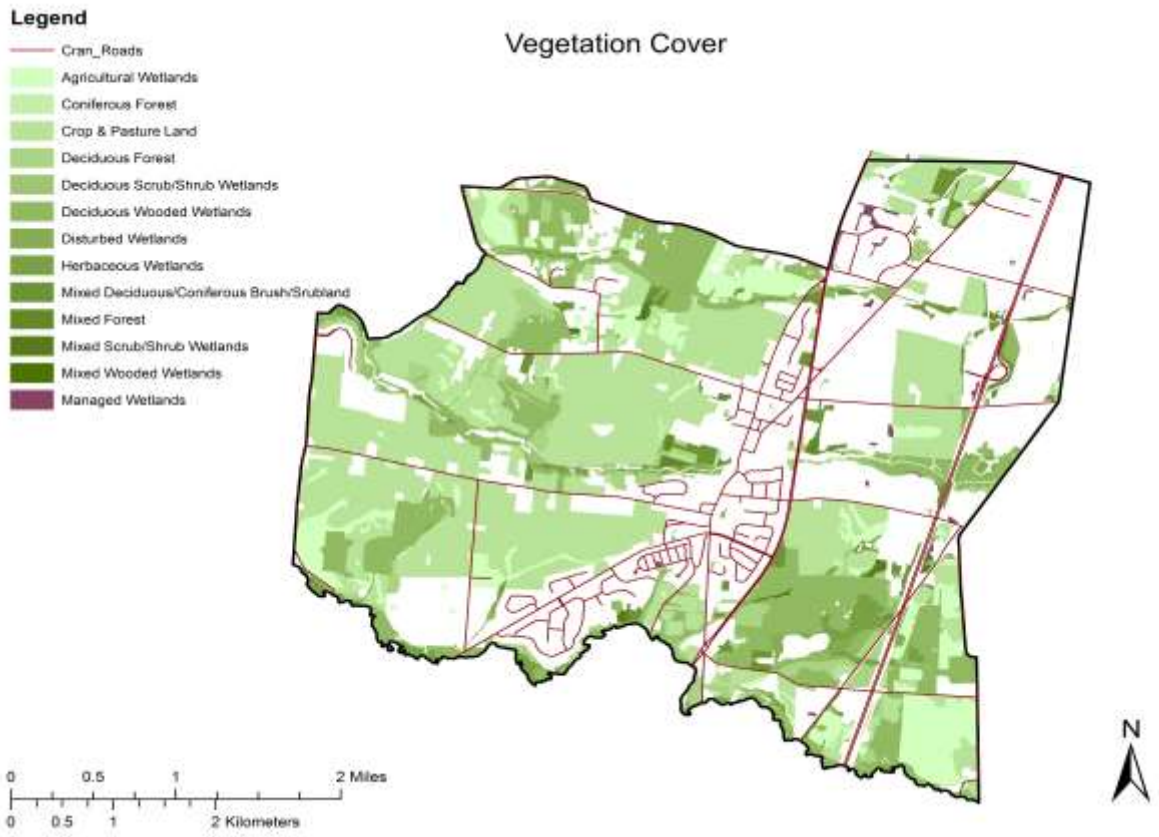


Figure 34– Vegetative Cover

A brief description of the major upland forest cover types shown on Figure 34 is provided below. The description of the wetland communities is provided in Section 7.4 Wetland Communities:

Upland Deciduous Forest

About 345 acres of land in Cranbury are mapped as deciduous upland forest. Most mature forest areas are mapped as wetland forest by NJDEP. The mature deciduous forests of Cranbury are primarily mixed oak forests co-dominated by red oak (*Quercus rubra*), white oak (*Quercus alba*), black oak (*Quercus velutina*), and chestnut oak (*Quercus prinus*). Scarlet oak, (*Quercus coccinea*), red maple (*Acer rubrum*), mockernut hickory (*Carya tomentosa*), shagbark hickory (*Carya ovata*), tulip poplar may also be present in the canopy. (*Liriodendron tulipifera*), sweet gum (*Liquidambar styraciflua*) and white ash (*Fraxinus americana*) may colonize disturbed areas within Cranbury's mixed oak forests (Wolgast, 1974). Arrowwood (*Vibernum dentatum*), maple-leaf vibernum (*Vibernum acerifolium*),

blackhaw vibernum (*Vibernum prunifolium*), spicebush (*Lindera benzoin*), sweet pepperbush (*Clethra alnifolia*), blueberry (*vaccinium corymbosum),* and lowbush blueberry (*Vaccinium vacillans*) are among the typical forest understory species expected in the upland forests of Cranbury.

Scrub/Shrub Forests

About 330 acres of land in Cranbury are mapped as scrub/shrub forest. Successional lots, old fields or other previously disturbed areas would typically represent upland shrub forests mapped within the region. These forests may be old agricultural areas abandoned or left fallow for a period of time or portions of open canopy within a forest. Opportunistic 'pioneer species' initially colonize these areas. In old-field communities, annual, biennial, and eventually perennial herbaceous plants are the pioneer species. Early succession herbaceous plants expected in Cranbury would include goldenrods (*Solidago* spp), ragweed (*Ambrosia artemisiifolia*), foxtails (*Setaria* spp.), wild carrot (*Daucus carota*), horseweed *(Conyza Canadensis*), asters (*Aster* spp.), oxeye daisy (*Chrysanthemum leucanthemum*), wild garlic (*Allium vineale*), thistle (*Cirsium* spp), panic grasses (*Panicum* spp.) broomsedge (*Andropogon* spp) and many others.

As time passes, woody species begin to develop in these areas and become shrub dominated secondary growth forests. Species typically include gray birch (*Betula populifolia*), black cherry (*Prunus serotina*), trembling aspen (*Populus grandedentata*) and Eastern red cedar (*Juniperus virginiana*). Other species may include sassafras (*Sassafras albidum*), black locust (*Robina pseudoacacia*), staghorn sumac (*Rhus typhina*), winged sumac (*Rhus coppalina*) and smooth sumac (*Rhus glabra*), dogwoods (*Cornus* spp.) and autumn olive (*Eleaganus umbellate*). Japanese honeysuckle (*Lonicera japonica*), Virginia creeper (*Parthenocissus quinquefolia*) and poison ivy (*Toxicodendron radicans*) are among the typical vines that may be found in Cranbury's old field/secondary growth communities. Successional forest areas dominated by sweet gum (*Liquidambar styraciflua*) sometimes occur within the Inner Coastal Plain and may account for some mapped shrub forest in Cranbury. These are typically dense stands of sweet gum with less understory and herbaceous vegetation growing. These successional sweet gum communities are often dominant in moist uplands or marginal wetland habitats.

Succession may occur rapidly within the inner Coastal Plain and fields left undisturbed may become colonized with 30-foot trees in as early as 25 years (Collins and Anderson, 1994).

"Coniferous Forest"

NJ Landscape mapping typically identifies pitch pine or pitch pine dominated mixed forest in the state. However, the Christmas tree farms may also be mapped as "coniferous forest" as in the case of Cranbury. Other small planted stands of coniferous species such as Norway spruce (*Picea abes*) or successional areas dominated by Eastern red cedar (*Juniperus virginiana*) may be present within the Township but are not revealed through Landscape Mapping. As discussed in section 10.2, small coniferous stands may be of particular interest as they may be used as roosting areas for owl species in conjunction with farmlands or deciduous forest.

9.2 Open Space

The Township of Cranbury has made the preservation of open space a priority with an emphasis on clustering development in certain areas and acquiring large contiguous agricultural areas, environmentally sensitive areas, and culturally and historically significant areas. Large portions of the Township west of Cranbury Village are under agricultural preservation or are preserved as open space. Areas west of Cranbury Village south of Cedar Brook to the Millstone are zoned as agricultural preservation (A -100). Approximately 3110 acres (91%) of this zone is in agricultural use. Small pockets of urban land uses, which include industries and major roadways, are scattered throughout the Township, but have the heaviest concentrations along the New Jersey Turnpike east of Route 130. Cranbury's land east of Route 130 is zoned as light impact industrial (I-LI), research office-light industrial (RO/LI) or light industrial (LI). Tax revenues from industrial development east of Route 130 have been utilized to preserve open space in the agricultural preservation zones.

9.2.1 Parks / Preserves

Cranbury is proud of its 11 parks and open space properties, which comprise well over 230 acres located west of U.S. Route 130. The first park, Memorial Park, was dedicated over 60 years ago in 1949 to honor our World War I and World War II veterans. Village Park, nestled on 19 acres along Brainerd Lake, was first dedicated in 1964 and provides a wide array of recreational facilities.

Cranbury is also a participant in the State Green Acres program and the Middlesex County open space programs and to date has preserved hundreds of acres of open space for recreation and the preservation of natural resources. Cranbury currently has five unimproved parcels totaling over 175 acres that provide views of nature and/or adjacent farmland linking Cranbury to its agricultural roots and allowing its residents to explore nature along its stream corridors. The 11 parks / open space preserves are shown on the Figure 35 – Cranbury Township Open Space.

The Cranbury Townships Parks Commission web site provides a description of each of these 11 sites, directions, a map, site history and features. The Parks Commission website may be accessed at:
http://www.cranburytownship.org/Parks/Parks_summary.html

The Township has encouraged the public to enjoy the open space provided by the preserves. Over time, various groups have established and maintained hiking trails within the preserves. Highlighted below are descriptions of the trails within the Cranbury Brook preserve, the Unami Woods preserve, the Reinhardt Preserve, and the recently established Pin Oaks trail.

Cranbury Brook Preserve Trail

- The Cranbury Brook Preserve is a 50-acre tract of land that was purchased by Cranbury Township in the 1980's using Green Acres funding. The major purpose of this preserve is to provide this section of the Cranbury Brook with a strong stream corridor. While the preserve has been retained in its heavily wooded and naturally vegetated state, approximately 2.5 miles of unpaved walking trails were created to provide accessibility. These trails are available to the public year-round for such activities as walking, jogging, bird watching, fishing, cross country skiing and the general enjoyment of nature, wildlife and open space. Camping is permitted in designated areas but requires permits from the Cranbury Township Recreation Department and from the Cranbury Fire Official

(if a campfire is desired). Motorized vehicles of any kind are not permitted on these trails. The Preserve and these hiking trails can be accessed via West Property Drive, a gravel road extending west of Main Street and running behind Town Hall and the Cranbury School. A parking area is at the end of this road.

Unami Natural Area Trail

- The Unami Woods Natural Area is a 3-acre, wooded section of the Cranbury Brook Preserve that is located adjacent to Wynnewood Drive, off of Cranbury Neck Road and to the west of South Main Street. It was purchased by the Township in 1966 and received its official name in 1968. The Unami (which means "people down the river") were Native Americans, a subset of the Lenni-Lenape tribe that lived and hunted in the Cranbury area over 300 years ago. This area can be accessed on foot via the Cranbury Brook Preserve (located west of Main Street), by the pump house road behind the Cranbury Firehouse, or by vehicle from Wynnewood Drive. Vehicles may be parked on Wynnewood Drive or on South Main Street. The Unami Woods Natural Area contains a loop trail approximately one-half mile in length that was created in 2015 under the direction of the Cranbury Parks Commission. The main trailhead is located on Wynnewood Drive and is clearly marked by a large wooden sign. Traversing the trail provides hikers with the opportunity for bird watching, nature appreciation and the observation of wildlife. Within this preserve is a ridgeline running parallel to the brook which provides an excellent view of the Cranbury Brook and the extensive preserved farmlands to the north and west.

Reinhardt Preserve Trail

- The Reinhardt Forest Preserve is a 61-acre tract of land that was permanently preserved in May of 2011 under the Middlesex County Open Space Trust Fund. It is located on the north side of Plainsboro Road and approximately 1.5 miles west of Main Street, Cranbury. The Reinhardt family who operated a dairy and vegetable farm across the street, which has been put into farmland preservation, previously owned this property. All of the farms along Plainsboro Road have now been preserved, creating a contiguous vista of more than 500 preserved acres along that roadway from Cranbury to Plainsboro. The Reinhardt Forest Preserve offers open space with extensive wetlands, natural wooded vegetation, vernal pools and wildlife. Approximately 2 miles of unpaved trails have been created in this preserve, providing the public with a unique hiking experience for bird watching, the exploration of local flora and fauna, and the general enjoyment of nature. These trails were developed with the assistance of a grant from ANJEC and are maintained by the Cranbury Department of Public Works and the Cranbury Environmental Commission. Note that seasonal rains and tree fall may render certain sections of these trails temporarily impassable.

Pin Oak Trail

- The Pin Oaks Loop Trail was created in May of 2016 and is a relatively easy short hike (approximately 1 mile) through flat terrain. One half of the loop traverses a wooded area along an unnamed tributary of the Millstone River. The other half of the loop is in a meadow that has been recently reforested. The trail loops around a tract of land that was deeded to Cranbury in 2005 by the developers of Four Seasons as part of a settlement of a lawsuit between the prior owner and the town. Over 2,400 trees were planted on this property in 2011 with reforestation funds provided by the New Jersey Turnpike Authority because of its removal of trees for the turnpike-widening project through Cranbury.

  The loop trail links with another short trail that connects Pin Oaks Drive to Farmstead Way, providing hikers with multiple access points to this preserved Open Space in Cranbury. While parking is available at the Old Cranbury Road trailhead, many Cranbury residents -- particularly those in Shadow Oaks and Four Seasons -- can simply walk to this trail from their homes.

  A full traversal of the Pin Oaks Loop Trail provides hikers with views of flora and fauna in three distinct biomes: streams/wetlands, woods, and meadows. On any given day, hikers may catch a glimpse of fish, frogs, beavers, turtles, deer, woodpeckers, chipmunks, red-tailed hawks, red-winged blackbirds, and a host of wildflowers in the meadow. The Cranbury Department of Public Works and the Cranbury Environmental Commission maintain this trail.

The Cranbury Township Open Space + Recreation Plan Element (2007), prepared as a component of the updated 2010 Cranbury Township Master Plan, analyzed the current and future open space and recreational needs of the Township and presents recommendations to meet those needs. This Plan may be accessed on the Township website at the following: http://www.cranburytownship.org/master-plan/Cranbury_OSRP_Final_complete.pdf

9.2.2 Farmland Preservation

The significance of Cranbury's historic district is inextricably tied to its agricultural setting. The village was built to serve the surrounding farm community and its importance is directly related to that farmland. The sharp edges that remain between farmland and village are very important to the appreciation of both resources. Cranbury is a participant in the New Jersey Farmland Preservation

Program and to date has placed 44 parcels, totaling over 2,800 acres in permanently preserved farmland. The parcels of preserved farmland are shown on the Cranbury Township Open Space Map – Figure 35.

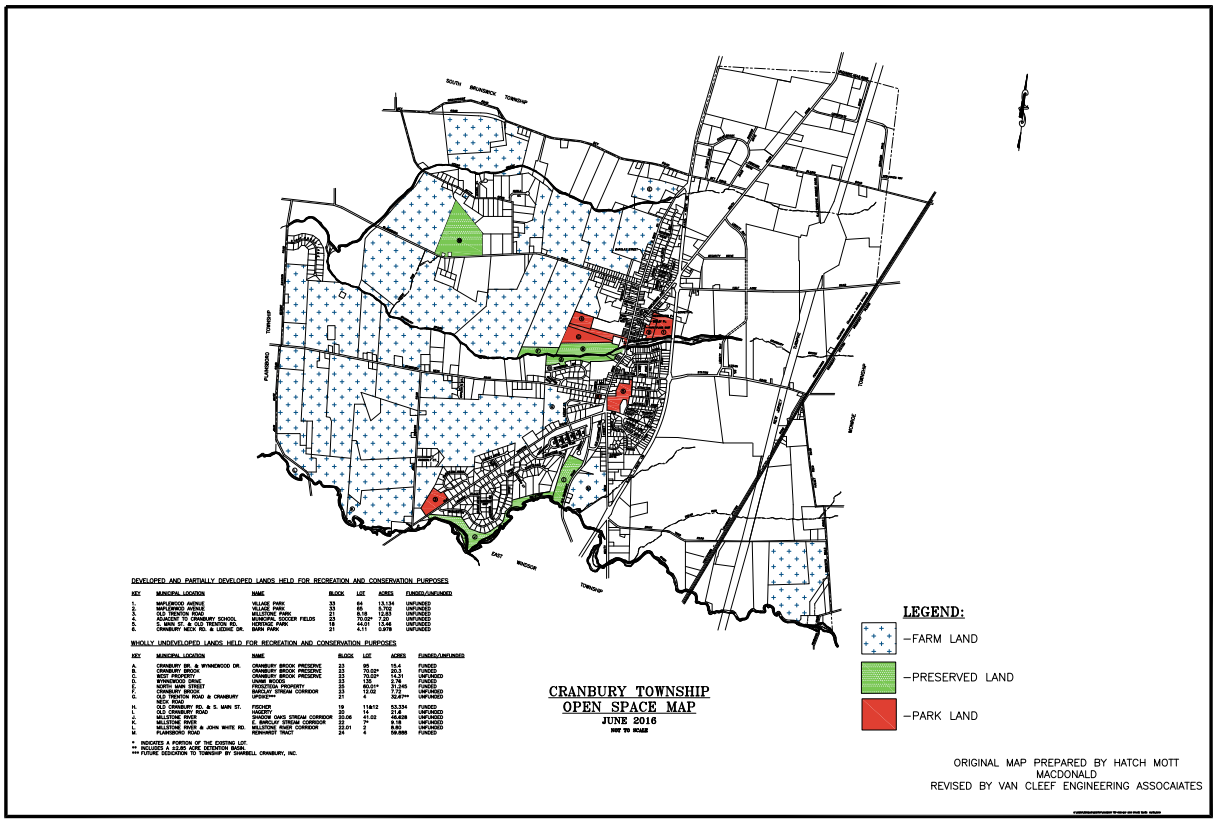


Figure 35 – Cranbury Open Space

10.0 WILDLIFE

10.1 Fisheries

NJDEP Division of Fish and Wildlife's Bureau of Freshwater Fisheries was consulted for inclusion of fisheries data in the ERI. Appendix C presents a list of fishes collected in Brainerd Lake (1963-1996). These fish are common New Jersey species and typically associated with warm-water fisheries. These species are typical of what would be expected in the freshwater fisheries of Central New

Jersey. This list does not preclude the presence of additional species or verify current presence as some of these species may be extirpated from Brainerd Lake. Predatory fish most expected to reside in the lake are identified.

10.2 Endangered and Threatened Wildlife Species

Endangered species are those whose prospects for survival in New Jersey (State-listed), or nationally (Federally-listed), are in immediate danger because of a loss or change in habitat, over-exploitation, predation, competition, disease, disturbance or contamination. Assistance is needed to prevent future extinction. Threatened species are those that may become endangered in New Jersey (State-listed) or nationally (Federally-listed) if conditions surrounding them begin or continue to deteriorate.

The New Jersey Natural Heritage Program (NJNHP), NJ Landscape Project mapping and U.S. Fish and Wildlife Service (FWS) were consulted (Appendix B) as part of the preparation of the ERI. Data from Landscape Mapping and the Natural Heritage Program indicate the records of four State Listed Special Concern species and one Threatened species in Cranbury. One other species, the long-eared owl, is documented within ½ mile of Cranbury. The U.S. Fish and Wildlife Service Indicated that other than an occasional transient bald eagle no federally endangered or threatened flora or fauna are thought to occur in Cranbury Township.

The NJNHP have records of sightings of rare, threatened or endangered species within the vicinity of Cranbury Township are as follows:

Table 9

NJDEP State Listed Species Documented In or Near Cranbury

Common Name	Scientific Name	Status	Documentation
Wood turtle	*Clemmys insculpta*	State Threatened	Cranbury NHP
Great Blue Heron	*Ardea herodias*	State Special Concern	Cranbury NHP
Bald Eagle	*Haliaeetus leucocephalus*	State Endangered	Cranbury NHP

Common Name	Scientific Name	Status	Documentation
Brown thrasher	*Toxostoma rufrum*	State Special Concern	Cranbury Landscape map

A brief description of each of the NJDEP mapped/listed species in or near Cranbury is provided below:

Wood Turtle

Wood turtles are a highly terrestrial turtle and utilize a variety of habitats including open or forested floodplains, wet meadows and forested wetlands with emergent or shrubby vegetation and streams and creeks. Although wood turtle activity often occurs in wooded and marshy stream corridors, turtles may travel well into a variety of atypical upland areas including woodlots, meadows and agricultural fields, particularly after warm spring and summer rains. In addition to berries, mushrooms and green plants, these omnivorous turtles feed on a variety of small animals including fish, frogs, tadpoles, soft bodied invertebrates and carrion.

Wood turtles' wetland habitats are often associated with streams over 10 feet in width and at least one foot deep, which they utilize for mating and hibernating. Hibernacula occur directly within streams, often in an undercut stream bank with a submerged root system. In the spring, wood turtles lay eggs in uplands adjacent to their wetland habitats typically containing loose sand or diorite. Upland habitats required for breeding must be considered when determining the full habitat requirements for this species.

The wood turtle is highly dependent on high quality riparian habitats. Habitat loss and stream degradation from development has significantly reduced wood turtle populations in New Jersey and the species was listed as threatened in by the NJ Division of Fish and Wildlife in 1979. Although considered globally stable, several northeastern states have reported wood turtle population declines and the effects of predation and disturbance on the turtle's reproductive success and juvenile mortality remain a concern in New Jersey.

The forested floodplains along the Millstone River in central Cranbury are documented habitat for wood turtles (see Figure 37). Wood turtle occurrences are extremely rare in the Coastal Plain and the densest populations of the species are in the Highlands and Ridge and Valley portions of the state. The NJDEP mapped habitat in this area may be somewhat degraded for wood turtles and its quality reduced by the presence of residential development adjacent to the wetlands.

Great Blue Heron

Thanks to specially shaped neck vertebrae, Great Blue Herons can quickly strike prey at a distance. Great Blue Herons have specialized feathers on their chest that continually grow and fray. The herons comb this "powder down" with a fringed claw on their middle toes, using the down like a washcloth to remove fish slime and other oils from their feathers as they preen. Applying the powder to their under-parts protects their feathers against the slime and oils of swamps. Great Blue Herons can hunt day and night thanks to a high percentage of rod-type photoreceptors in their eyes that improve their night vision.

Despite their impressive size, Great Blue Herons weigh only 5 to 6 pounds thanks in part to their hollow bones—a feature all birds share.

Great Blue Herons in the northeastern U.S. and southern Canada have benefited from the recovery of beaver populations, which have created a patchwork of

swamps and meadows well suited to foraging and nesting.

Great Blue Herons live in both freshwater and saltwater habitats, and also forage in grasslands and agricultural fields, where they stalk frogs and mammals. Most breeding colonies are located within 2 to 4 miles of feeding areas, often in isolated swamps or on islands, and near lakes and ponds bordered by forests.

Great Blue Herons eat nearly anything within striking distance, including fish, amphibians, reptiles, small mammals, insects, and other birds. They grab smaller prey in their strong mandibles or use their dagger-like bills to impale larger fish, often shaking them to break or relax the sharp spines before gulping them down.

Male Great Blue Herons collect much of the nest material, gathering sticks from the ground and nearby shrubs and trees, and from unguarded and abandoned nests, and presenting them to the female. She weaves a platform and a saucer-

shaped nest cup, lining it with pine needles, moss, reeds, dry grass, mangrove leaves, or small twigs. Nest building can take from 3 days up to 2 weeks; the finished nest can range from a simple platform measuring 20 inches across to more elaborate structures used over multiple years, reaching 4 feet across and nearly 3.5 feet deep. Ground-nesting herons use vegetation such as salt grass to form the nest.

Great Blue Herons nest mainly in trees, but will also nest on the ground, on bushes, in mangroves, and on structures such as duck blinds, channel markers, or artificial nest platforms. Males arrive at the colony and settle on nest sites; from there, they court passing females. Colonies can consist of 500 or more individual nests, with multiple nests per tree built 100 or more feet off the ground.

Bald Eagle

Their full white heads and tails distinguish adult bald eagles, but sub-adult and juvenile birds are brown overall with some white mottling. Both sexes have similar plumage, although the female is slightly larger than the male. With a wing-span of six to seven feet, eagles are larger than most birds, but can be confused with vultures from a distance. While eagles eat mostly fish during the warmer months, they feed on waterfowl, muskrat, and carrion during winter and early spring.

New Jersey bald eagles reside year-round, usually remaining in their nest area. Eagles usually build their large stick nests close to water in trees taller than the forest canopy. They begin courtship and nest building in early January, adding to their existing nest. Pairs lay one to three eggs in mid-January to early March, and incubate for about 35 days. Upon hatching, the chicks are helpless and require close parental care. After about five weeks, the young birds begin to stand up and feed themselves when the adults deliver food. Eaglets fledge the nest at 11-12 weeks in late June to early July. Adults continue to feed young near the nest for a month while the eaglets learn to fly and hunt. In September many young eagles leave the area and may spend the winter in Chesapeake Bay area, where open water and abundant food provide favorable conditions. Recent telemetry studies show NJ eaglets may make long distance flights in nearly any direction before returning to our area.

Brown Thrasher

This relative of the mockingbird is a common breeding bird throughout much of the state. Most breeding individuals occur in the Coastal Plain. Breeding habitat typically includes shrubby areas and dense thickets of multiflora rose and other species, particularly those along the edges of woodlands. Brown thrashers forage on berries, insects and occasionally small vertebrates such as lizards. Forest edges and late succession uplands within Cranbury would be the most commonly expected areas to observe this species. This bird is common in New Jersey from the spring to the fall, but generally moves south and to more coastal areas in the winter. Price (et al 1995) indicated that Brown thrashers have declined substantially on survey routes in the United States from 1966 to 1993.

Many other bird species including a variety of neo-tropical migrants may breed in Cranbury. Appendix D of the ERI lists the bird species potentially occurring within Cranbury and indicates neo-tropical migrant species and others that may breed within township. This list is only reflects the potential for these species and field surveys would be needed to determine which species may occur within the Township. Preservation and expansion of riparian and forest corridors will is vital to the successful reproduction of many forest interior neo-tropical migrants and in Cranbury, will improve the habitat quality for migrating and breeding birds.

US Fish & Wildlife identifies the Indiana Bat (Myotis sodalist) as endangered and the Northern Long-eared Bat and the Bog Turtle as threatened in and around the Township. A brief description of these species are provided below:

Indiana Bat

The scientific name of the Indiana bat is Myotis sodalist and it is an accurate description of the species. Myotis means, “mouse ear” and refers to the relatively small, mouse-like ears of the bats in this group. Sodalist is the Latin word for “companion.” The Indiana bat is a very social species; large numbers cluster together during hibernation. The species is called the Indiana bat because the first specimen described to science in 1928 was based on a specimen found in southern Indiana's Wyandotte Cave in 1904.

The Indiana bat is quite small, weighing only one-quarter of an ounce (about the weight of three pennies). In flight, it has a wingspan of 9 to 11 inches. The fur is dark-brown to black. The Indiana bat is similar in appearance to many other related species. Biologists can distinguish it from similar species by comparing characteristics such as the structure of the foot and color variations in the fur.

Indiana bats hibernate during winter in caves or, occasionally, in abandoned mines. For hibernation, they require cool, humid caves with stable temperatures, under 50° F but above freezing. Very few caves within the range of the species have these conditions.

Hibernation is an adaptation for survival during the cold winter months when no insects are available for bats to eat. Bats must store energy in the form of fat before hibernating. During the six months of hibernation the stored fat is their only source of energy. If bats are disturbed or cave temperatures increase, more energy is needed and hibernating bats may starve.

After hibernation, Indiana bats migrate to their summer habitat in wooded areas where they usually roost under loose tree bark on dead or dying trees. During summer, males roost alone or in small groups, while females roost in larger groups of up to 100 bats or more. Indiana bats also forage in or along the edges of forested areas.

Indiana bats eat a variety of flying insects found along rivers or lakes and in uplands. Like all insect-eating bats, they benefit people by consuming insects that are considered pests or otherwise harmful to humans. Their role in insect control is not insignificant – Indiana bats eat up to half their body weight in insects each night.

Indiana bats are found over most of the eastern half of the United States. Almost half of all Indiana bats (207,000 in 2005) hibernate in caves in southern Indiana. In 2005, other states, which supported populations of over 40,000, included Missouri (65,000), Kentucky (62,000), Illinois (43,000) and New York (42,000). Other states within the current range of the Indiana bat include Alabama, Arkansas, Connecticut, Iowa, Maryland, Michigan, New Jersey, North Carolina, Ohio, Oklahoma, Pennsylvania, Tennessee, Vermont, Virginia, and West Virginia.

The 2005 population estimate is about 457,000 Indiana bats, half as many as when the species was listed as endangered in 1967.

Northern Long-eared Bat

The northern long-eared bat is federally listed as a threatened species under the Endangered Species Act. Endangered species are animals and plants that are in danger of becoming extinct. Threatened species are animals and plants that are likely to become endangered in the foreseeable future. Identifying, protecting, and restoring endangered and threatened species is the primary objective of the U.S. Fish and Wildlife Service's endangered species program.

The northern long-eared bat is a medium-sized bat with a body length of 3 to 3.7 inches but a wingspan of 9 to 10 inches. Their fur color can be medium to dark brown on the back and tawny to pale-brown on the underside. As its name suggests, its long ears, particularly as compared to other bats in its genus, Myotis, distinguish this bat.

Northern long-eared bats spend winter hibernating in caves and mines, called hibernacula. They use areas in various sized caves or mines with constant temperatures, high humidity, and no air currents. Within hibernacula, surveyors find them hibernating most often in small crevices or cracks, often with only the nose and ears visible.

During the summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities or in crevices of both live trees and snags (dead trees). Males and non-reproductive females may also roost in cooler places, like caves and mines. Northern long-eared bats seem to be flexible in selecting roosts, choosing roost trees based on suitability to retain bark or provide cavities or crevices. This bat has also been found rarely roosting in structures, like barns and sheds.

Breeding begins in late summer or early fall when males begin to swarm near hibernacula. After copulation, females store sperm during hibernation until spring. In spring, they emerge from their hibernacula, ovulate and the stored sperm fertilizes an egg. This strategy is called delayed fertilization.

After fertilization, pregnant females migrate to summer areas where they roost in small colonies and give birth to a single pup. Maternity colonies of females and young generally have 30 to 60 bats at the beginning of the summer, although larger maternity colonies have also been seen. Numbers of individuals in roosts, typically decreases from pregnancy to post-lactation. Most bats within a maternity colony give birth around the same time, which may occur from late May or early June to late July, depending where the colony is located within the species' range. Young bats start flying by 18 to 21 days after birth. Maximum lifespan for the northern long-eared bat is estimated to be up to 18.5 years.

Like most bats, northern long-eared bats emerge at dusk to feed. They primarily fly through the understory of forested areas feeding on moths, flies, leafhoppers, caddis flies, and beetles, which they catch while in flight using echolocation or by gleaning motionless insects from vegetation.

The northern long-eared bat's range includes much of the eastern and north central United States, and all Canadian provinces from the Atlantic Ocean west to the southern Yukon Territory and eastern British Columbia. The species' range includes the following 37 States and the District of Columbia: Alabama, Arkansas, Connecticut, Delaware, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, Virginia, West Virginia, Wisconsin, and Wyoming.

Bog Turtle

This is the smallest emydid turtle, and one of the smallest turtles in the world. Adult carapace length is 7.9 to 11.4 cm (3.1 to 4.5 inches). The dark brown or black carapace may be marked with radiating light lines or a light blotch on the vertebral and pleural scutes. Scute annuli are usually prominent in juvenile and young adult specimens, but the carapace may be nearly smooth in old adults. The head, neck, and limbs are typically dark brown with variable reddish to yellow spots and streaks. A large reddish-orange to yellow blotch is visible behind and above each tympanum, sometimes merging into a continuous band on the neck. The upper jaw is weakly notched. (Ernst, Lovich, and Barbour, 1994; Harding, 1997) The plastron is also brown or black, but often with lighter yellow blotches

towards the medial and anterior scute edges. A mature male bog turtle has a concave plastron and a long, thick tail, with the vent posterior to the rear edge of the carapace with tail extended. The female has a flat plastron and a thinner, smaller tail, with the vent at or beneath the rear carapace edge. (Ernst, Lovich, and Barbour, 1994; Harding, 1997)

10.3 Endangered and Threatened Plant Species

Only one historical documentation of a State listed Priority Concern plant (Hyssop Hedge-nettle (Stachys hyssopifolia) exists in Cranbury. No other State or Federal listed plants have been documented in the Township.

A brief description of the Hyssop hedgenettle is provided below.

Hyssop hedgenettle - facultative wetland (FACW+) forb has a typical mint-like appearance and is found in a variety of wetland habitats. It is listed as endangered in Connecticut and a subspecies is listed as threatened in New York.

Swamp Pink (Helonias bullata) is the only US fish and Wildlife Service threatened species listed in Cranbury. Only Federally listed plants are given protection in New Jersey outside of the Pinelands and Highlands regions. However, the diversity and quality of plants within a wetland is often a useful indicator of site biodiversity, impacts and water quality, and therefore can be useful in prioritizing protection of sensitive environmental areas.

A brief description of Swamp Pink is provided below:

Swamp Pink

Swamp pink was federally listed as a threatened species in 1988.

A perennial member of the lily family, swamp pink has smooth, oblong, dark green leaves that form an evergreen rosette. In spring, some rosettes produce a flowering stalk that can grow over 3 feet tall. The stalk is topped by a 1 to 3-inch-long cluster of 30 to 50 small, fragrant, pink flowers dotted with pale blue anthers. The evergreen leaves of swamp pink can be seen year round, and flowering occurs between March and May.

Supporting over half of the known populations, New Jersey is the stronghold for swamp pink. An obligate wetland species, swamp pink occurs in a variety of palustrine forested wetlands including swampy forested wetlands bordering meandering streamlets, headwater wetlands, sphagnous Atlantic white-cedar swamps, and spring seepage areas. Specific hydrologic requirements of swamp pink limit its occurrence within these wetlands to areas that are perennially saturated, but not inundated, by floodwater. The water table must be at or near the surface, fluctuating only slightly during spring and summer months. Groundwater seepage with lateral groundwater movement are common hydrologic characteristics of swamp pink habitat.

Swamp pink is a shade-tolerant plant and has been found in wetlands with canopy closure varying between 20-100%. Sites with minimal canopy closure are less vigorous due in part to competition from other species. Common vegetative associates of swamp pink include Atlantic white-cedar (Chamaecyparis thyoides), red maple (Acer rubrum), pitch pine (Pinus rigida), American larch (Larix laricina), black spruce (Picea mariana), red spruce (P. rubens), sweet pepperbush (Clethra alnifolia), sweetbay magnolia (Magnolia virginiana), sphagnum mosses (Sphagnum spp.), cinnamon fern (Osmunda cinnamomea), skunk cabbage (Symplocarpus foetidus), and laurels (Kalmia spp.). Swamp pink is often found growing on the hummocks formed by trees, shrubs, and sphagnum mosses, and these micro-topographic conditions may be an important component of swamp pink habitat.

The primary threats to swamp pink are the indirect effects of off-site activities and development, such as pollution, introduction of invasive species, and subtle changes in groundwater and surface water hydrology. Hydrologic changes include increased sedimentation from off-site construction, groundwater withdrawals or diversion of surface water, reduced infiltration (recharge) of groundwater, increases in erosion, increases in the frequency, duration, and volume of flooding caused by direct discharges to wetlands (such as storm water outfalls), and increased runoff from upstream development. Other threats to this species include direct destruction of habitat from wetland clearing, draining, and filling; collection; trampling; and climate change.

10.4 The Landscape Project

In 1994, the NJ Division of Fish, Game and Wildlife's Endangered and Nongame Species Program (ENSP) adopted a landscape level approach to rare species protection called the Landscape Project. The Landscape Project has been designed to provide peer reviewed, scientifically sound information that is easily accessible and can be integrated with planning, protection and land management programs at every level of government – State, county and municipal, as well as nongovernmental organizations and private landowners. The ENSP has developed landscape maps that identify critical rare species habitats based on land use classifications, documented rare species locations and habitat models linked to each of the rare, threatened or endangered species. The habitat patches are then assigned a Rank of 1 through 5, based on the status of the species present as follows:

Rank 5: Presence of one or more Federally - listed threatened or endangered species.
Rank 4: Presence of one or more State - listed endangered species.
Rank 3: Presence of one or more State - listed threatened species.
Rank 2: Presence of one or more occurrence of non-listed State priority species.
Rank1: Habitat patches with minimum habitat specific suitability size requirement for threatened or endangered or priority species, but do not intersect with any confirmed occurrence.

These maps and overlays provide a basis for proactive planning, such as the development of local habitat ordinances, zoning to protect critical habitat, management guidelines for rare species protection on public and private lands and prioritizing land acquisition projects. By combining critical area maps with other GIS layers such as roads, development and publicly owned lands, important areas in need of protection can be easily identified. Incorporation of this information early in the planning process results in less conflict, less time wasted, and less money spent attempting to resolve endangered and threatened species issues. See Figure 36 for species based habitat.

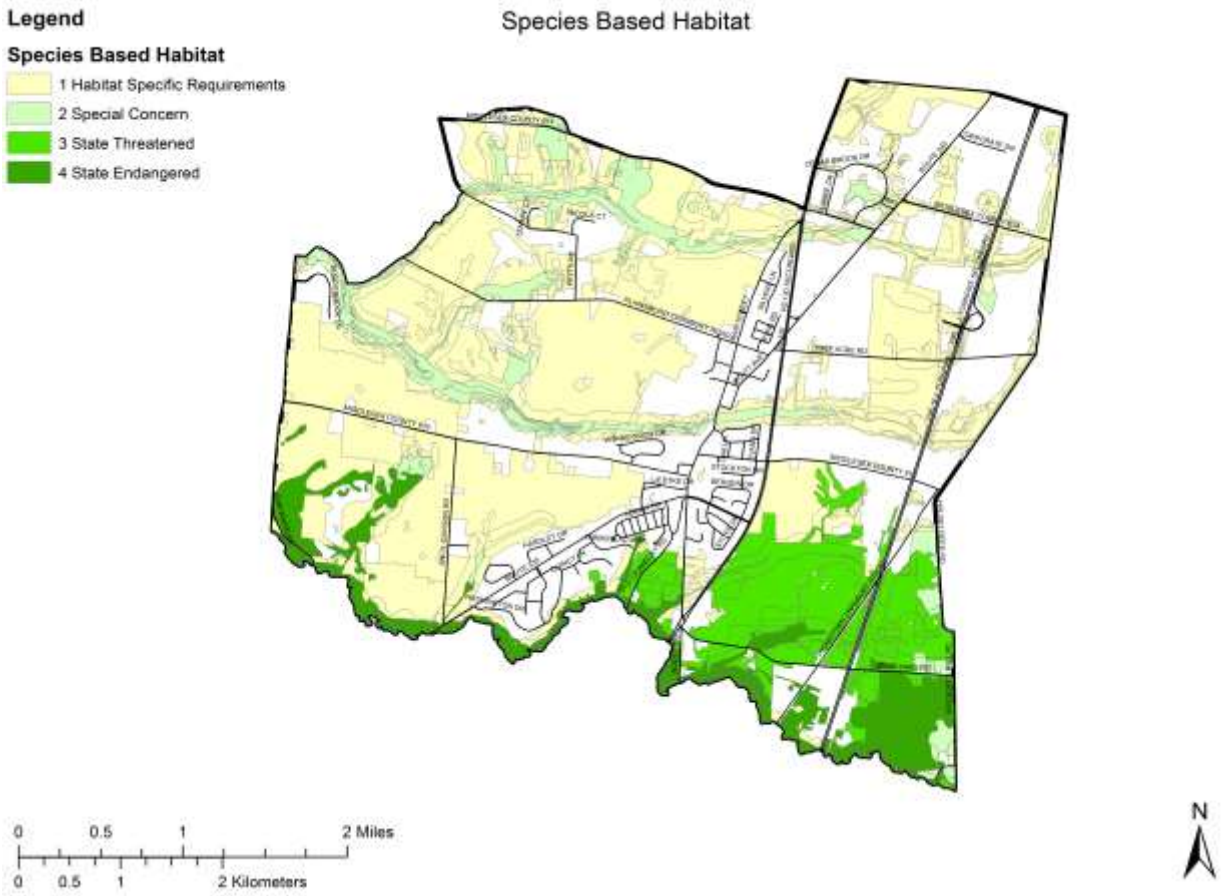


Figure 36 – Species Bases Habitat

The highest priority rank will be the one that appears on the Landscape Project Maps, meaning that a higher ranked area could include additional species that would otherwise be mapped under a lower rank category. In Cranbury, the highest ranking on the Forest and Grassland or the Wetland Landscape Mapping is Rank 2, indicating the documented presence of Species of Special Concern or Priority Species. No State or Federal threatened or endangered species were identified under the general landscape mapping in Cranbury. NJDEP maps the state threatened wood turtle habitat under its own mapping (Figure 37), therefore the documented parcel of wood turtle habitat in Cranbury does not appear as Rank 3 forested wetland. The NJDEP Forest and Grassland Habitat Landscape Project mapping has identified Rank 2 forest and grassland habitat located near CR 535 in the northeastern portion of the Township. Ranked area identifies documented habitat for the eastern box turtle. Forested Rank 2 habitat located east of the New Jersey Turnpike in the southeastern corner of the

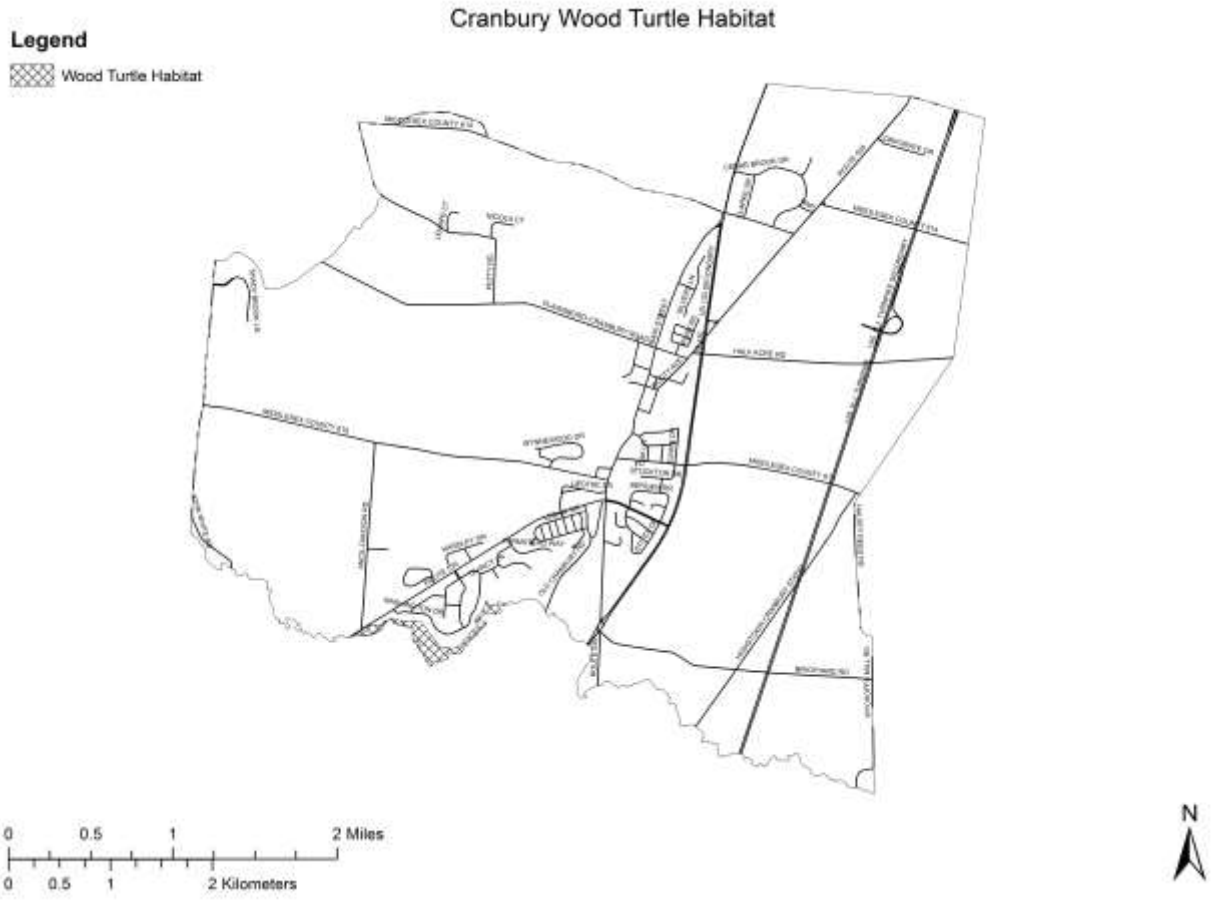


Figure 37 – Wood Turtle Habitat

Township identifies documented habitat for priority birds including the brown thrasher.

The Forested and Emergent Wetland Habitat Landscape Map (Figure 36) also identifies critical habitat for species associated with NJDEP mapped forested wetlands in the same forests east of the New Jersey Turnpike. The mapping identifies Rank 2 forested habitat associated with the brown thrasher. Cranbury's high percentage of farmland, wetland and other open space results in large mapped areas of Rank 1 Grassland and Forest Habitat, and Rank 1 forested and emergent wetland habitat. If threatened, endangered or additional priority concern species were to be documented in any of these areas the mapping would change accordingly. Determining the variety of non-threatened or endangered species that may exist within the Township should not be overlooked when prioritizing areas. Although not officially listed, many common species are becoming increasingly rare and may be good indicators of overall site diversity

and habitat quality. Included in Appendix d of this report are inventory lists of terrestrial vertebrate species potentially within Cranbury.

10.5 Forest Fragmentation and Corridors

Fragmentation of forested areas by means of development isolates stands from the main forest complex, increasing the amount of edge habitat and decreasing the amount of forest interior habitat. Negative effects of forest habitat fragmentation are well documented for breeding birds (Robinson, 1988; Robinson and Wilcove, 1994; Herkert, 1994; Robinson *et al.,* 1995). Large tracts of contiguous forested areas are necessary to support breeding populations of migratory songbirds (Robbins *et al.,* 1989; Robinson *et al*,. 1997) as well as forest dwelling raptors (Thiollay, 1988; Bosakowski *et al.,* 1992; Bosakowski, 1994; Bosakowski and Speiser, 1994). Most forest interior species will only nest within a forest "core" that is at least 90 meters (295 feet) from the nearest forest edge. In addition the forest core must be a minimum of about 10 hectares (25 acres) in size (Dawson et al. 1993). Fragmented forests are characterized by high levels of edge-related nest predation, brood parasitism, or both and prove undesirable for many area sensitive species. In addition, forest fragmentation facilitates the spread of exotic and invasive species, both vegetative and mammalian, that can dramatically change the habitat structure of the forest. Demographic data suggest that populations of many forest-breeding species in severely fragmented landscapes may be "sinks" that produce too few young to compensate for adult mortality. Rates of parasitism and predation are so much lower in large forested landscapes that they may act as "sources" that produce a surplus of young that are able to colonize small tracts in fragmented landscapes (Robinson et al., 1997). Immigration and re-colonization are critical for long-term regional survival of local populations, particularly for imperiled species. The loss of habitat is the primary reason for the decline in species and affects plants, mammals, birds, reptiles, amphibians, fish and invertebrates.

Habitat corridors are linear landscape elements that provide wildlife the ability to move between habitat patches. The best corridors are those that are the widest possible and those that connect the largest patches of habitat. Forest interior and neo tropical migrant birds, although able to disperse effectively, have been found to have a higher probability of using wider corridors (Keller et al 1993). Hodges and Krementz (1996) recommend that the minimum corridor width be no less

than 100 meters (330 feet) in width. This will provide adequate width for forest interior dwellers. Most imperiled species are habitat specialists, meaning that they only survive within a specific type of habitat. In addition, they only occur in limited numbers, so it is critical that areas of suitable habitat are connected via adequate corridors. This allows individuals to migrate between habitats and interbreed with subpopulations. This concept is particularly important for many small mammals, reptiles, amphibians and some invertebrates. Many of these creatures can be entirely prohibited from dispersing if impeded by barriers such as roads or unsuitable habitat. Corridors between natural communities help to mitigate the impacts of habitat fragmentation and species isolation. Corridors allow species with limited dispersal capabilities such as reptiles an effective means to disperse.

Cranbury currently contains several forest patches in the northwest portions of the Township, small-forested areas in the southwestern quadrant of the Township, and large and narrow forested riparian corridors along the Cranbury, Cedar and Millstone waterways. Portions of the Millstone River and Cedar Brook corridors primarily west of Route 130 are preserved as open space or under agricultural protection (Figure 35). Much of the Cranbury Brook forest corridor west of Route 130 is preserved as agricultural preservation. Two partially forested areas, including the Cranbury Brook Preserve, along the Brook are preserved as permanent open space. Many larger forested areas within Cranbury are mapped as wetlands, may limit development potential.

The forested corridor can be broadened or improved by allowing preserved lands to revert to their natural state or through planting of native species to "jump start" the process. Establishing connectivity between the forested patches in the northeastern portion of the Township and where feasible, expanding the width of existing forested riparian corridors may improve the overall habitat quality of the Township's forests. Forest fragmentation and connectivity should always be considered during development review. Projects should be designed to limit forest fragmentation and/or the destruction of forest core area.

10.6 Regulatory Protection for Endangered and Threatened Species

The US Fish and Wildlife Service protects federally listed endangered and threatened wildlife and plant species and their habitat under the 1973

Endangered Species Act. Under Section 7 of this Act Federal agencies are required to consult with the USFWS to ensure that the actions they authorize, fund, or carry out will not jeopardize listed species. In the event that proposed actions are determined to jeopardize a listed species, the USFWS must offer reasonable alternatives that will meet the goals of the proposed action without jeopardizing the listed species.

Under Section 9 of the Act, private landowners are prohibited from the "take" of endangered or threatened species. It is unlawful to endanger the livelihood of a listed species and this provision is extended to the habitat required by the species for its survival. Section 10 of the Act provides for the preparation of Habitat Conservation Plans. This provision is made to protect the rights of private landowners to develop or use their land even though they have endangered species on their property. These landowners can receive an “incidental take permit” provided they develop a Habitat Conservation Plan that provides for the conservation of the species.

The State of New Jersey has its own Endangered Species Act, the *Endangered and Nongame Species Conservation Act* (N.J.S.A. 23:2A-13 *et seq*), which resulted in the listing of State endangered animal species (N.J.A.C. 7:25-4:13) and a Nongame Species list, including threatened species (N.J.A.C. 7:25 4.179(a)). As part of this act, all New Jersey animals appearing on the federal list are also included on this state list.

The Endangered and Nongame Species Program's (ENSP) mission is to actively conserve New Jersey's biological diversity by maintaining and enhancing endangered, threatened and nongame wildlife populations within healthy, functioning ecosystems.

The program is responsible for the protection and management of nearly 500 wildlife species found in the Garden State. These include the 83 species currently listed as endangered or threatened.

Endangered plants in New Jersey have been identified in accordance with the *Endangered Plant Species List Act* (N.J.S.A. 13:1B-15.151 et seq.).

State listed endangered and threatened wildlife species that are dependent upon wetlands can have increased protection to their wetland habitat under the

Freshwater Wetlands Protection Act Rules. Federally listed plant species are also afforded protection under this Act. A freshwater wetland that is habitat for an endangered or threatened species is considered exceptional resource value (N.J.A.C. 7:7A-2.4(b)2.) and is given a standard transition area width of 150 feet (2.4(d)). More stringent review of wetland permit applications is also performed

The *NJ Flood Hazard Area Control Act* rules provide for protection of state listed endangered and threatened animal and plant species that inhabit the floodplain.

Appendix A – Cranbury Environmental Commission Water Quality Study

Cranbury Township has secured grants from the NJDEP to actively track surface water quality within the Township. Samples from the studies were analyzed at NJDEP certified laboratories. The Township of Cranbury Environmental Commission conducted a Surface–Water Sampling and Evaluation Report from 2002-2003. Samples were taken from six locations during the fall, summer and spring. These locations included two locations in Brainerd Lake, two locations in Cranbury Brook upstream and downstream from Brainerd Lake, a location in the Millstone River and one location in the Cedar Brook. Variables tested for included water temperature, pH, total suspended solids, dissolved oxygen, nitrate, sulfate, phosphorous, metals, pesticides and coliform bacteria. This study was designed to develop a baseline for future studies.

Dissolved oxygen standards were over the minimum 4.0mg/L set by NJDEP. Nitrates, sulfates and fecal coliform were all found to be at acceptable levels.

Phosphate levels exceeded the NJDEP standard of .05mg/L in two Brainerd Lake samples in July of 2002. These samples were .053 and .076 mg/L. One stream sample taken in Cedar Brook in July 2002 was .62 mg/L. Other samples were found to be within the standard.

Water temperatures sampled did not exceed 29.4 degrees C (maximum temperature recommendation by the Stony Brook Millstone Watershed Association).

The pH levels were found to be below the state standard of 6.5, however it was determined that the low readings were most likely sampling problems.

There was one sample that exceeded the NJDEP standard for suspended solids (Cedar Brook, July 15, 2002). This sample was found to be at 81mg/L. The NJDEP standard is set at 40 mg/L.

Petroleum hydrocarbons, metals and pesticides were all found to be at acceptable levels.

A second study sponsored by the Township of Cranbury Environmental Commission in December of 2003 specifically monitored contamination from surface runoff within the Township during precipitation events. Samples were

collected from four sites including the warehouse district east of Route 130, from highways, parklands and one residential location.

The wet-weather study found that Brainerd Lake and Cranbury Brook were subject to increased pollution levels from nonpoint source runoff during wet-weather events. Suspended solids, fecal coliform, phosphorous, petroleum hydrocarbons and lead (one sample) were among the perimeters tested that exceeded NJDEP standards during the wet-weather events. Nitrogen, sulfate, 19 pesticides and 7 metals that were tested for were found to occur at acceptable levels during wet-weather flow. Increases in impervious surfaces from development can contribute to long-term impacts in surface water quality as pollutants rapidly enter surface waters during periods of precipitation (Cranbury EC Wet-weather Sampling). Increased levels of development and consequently flow level may contribute to increased sedimentation and contamination within Cranbury's open waters during precipitation. Control and/or reduction of impervious surfaces, vegetation improvements to riparian and lakeside buffers and local reductions in the uses of chemicals such as road salts, fertilizers and solvents may improve the increased nonpoint contamination associated with wet-weather events within the Township.

Appendix B

NJDEP Natural Heritage / Landscape Project Date

US Fish & Wildlife – IPAC Trust Resources Report

State of New Jersey

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Division of Parks & Forestry
State Forestry Service
Mail Code 501-04
Office of Natural Lands Management – Natural Heritage Program
P.O. Box 420
Trenton, NJ 08625-0420
Tel. (609) 984-1339 Fax. (609) 984-1427

BOB MARTIN
Commissioner

April 12, 2016

Andrew Johnson
Cranbury Township Environmental Commission
23-A North Main Street
Cranbury, NJ 08512

Re: Cranbury Township Environmental Resource Inventory Update
Cranbury Township, Middlesex County

Dear Mr. Johnson:

Thank you for your data request regarding rare species information for the above referenced project site.

Searches of the Natural Heritage Database and the Landscape Project (Version 3.1) are based on a representation of the boundaries of your project site in our Geographic Information System (GIS). We make every effort to accurately transfer your project bounds from the topographic map(s) submitted with the Natural Heritage Data Request Form into our Geographic Information System. We do not typically verify that your project bounds are accurate, or check them against other sources.

We have checked the Landscape Project habitat mapping and the Biotics Database for occurrences of any rare wildlife species or wildlife habitat on the referenced site. The Natural Heritage Database was searched for occurrences of rare plant species or ecological communities that may be on the project site. Please refer to Table 1 (attached) to determine if any rare plant species, ecological communities, or rare wildlife species or wildlife habitat are documented on site. A detailed report is provided for each category coded as 'Yes' in Table 1.

This report does not include information concerning known Northern Long-eared Bat hibernacula and maternity roost trees protected under the provisions of the U.S. Fish & Wildlife Service's 4(d) Rule. You must contact the U.S. Fish & Wildlife Service, New Jersey Field Office, for additional information concerning the location of these features, or visit their website at: http://www.fws.gov/northeast/njfieldoffice/endangered/consultation.html.

We have also checked the Landscape Project habitat mapping and Biotics Database for occurrences of rare wildlife species or wildlife habitat in the immediate vicinity (within ¼ mile) of the referenced site. Additionally, the Natural Heritage Database was checked for occurrences of rare plant species or ecological communities within ¼ mile of the site. Please refer to Table 2 (attached) to determine if any rare plant species, ecological communities, or rare wildlife species or wildlife habitat are documented within the immediate vicinity of the site. Detailed reports are provided for all categories coded as 'Yes' in Table 2. These reports may include species that have also been documented on the project site.

The Natural Heritage Program reviews its data periodically to identify priority sites for natural diversity in the State. Included as priority sites are some of the State's best habitats for rare and endangered species and ecological communities. Please refer to Tables 1 and 2 (attached) to determine if any priority sites are located on or in the immediate vicinity of the site.

NHP File No. 16-4007435-9676

A list of rare plant species and ecological communities that have been documented from the county (or counties), referenced above, can be downloaded from http://www.state.nj.us/dep/parksandforests/natural/heritage/countylist.html. If suitable habitat is present at the project site, the species in that list have potential to be present.

Status and rank codes used in the tables and lists are defined in EXPLANATION OF CODES USED IN NATURAL HERITAGE REPORTS, which can be downloaded from http://www.state.nj.us/dep/parksandforests/natural/heritage/nhpcodes_2010.pdf.

If you have questions concerning the wildlife records or wildlife species mentioned in this response, we recommend that you visit the interactive NJ-GeoWeb website at the following URL, http://www.state.nj.us/dep/gis/geowebsplash.htm or contact the Division of Fish and Wildlife, Endangered and Nongame Species Program at (609) 292-9400.

PLEASE SEE 'CAUTIONS AND RESTRICTIONS ON NHP DATA', which can be downloaded from http://www.state.nj.us/dep/parksandforests/natural/heritage/newcaution2008.pdf.

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,

Robert J. Cartica
Administrator

c: NHP File No. 16-4007435-9676

NHP File No. 16-4007435-9676

Table 1: On Site Data Request Search Results (6 Possible Reports)

Report Name	Included	Number of Pages
1. Possibly on Project Site Based on Search of Natural Heritage Database: Rare Plant Species and Ecological Communities Currently Recorded in the New Jersey Natural Heritage Database	Yes	1 page(s) included
2. Natural Heritage Priority Sites On Site	No	0 pages included
3. Rare Wildlife Species or Wildlife Habitat on the Project Site Based on Search of Landscape Project 3.1 Species Based Patches	Yes	1 page(s) included
4. Vernal Pool Habitat on the Project Site Based on Search of Landscape Project 3.1	Yes	1 page(s) included
5. Rare Wildlife Species or Wildlife Habitat on the Project Site Based on Search of Landscape Project 3.1 Stream Habitat File	No	0 pages included
6. Other Animal Species On the Project Site Based on Additional Species Tracked by Endangered and Nongame Species Program	Yes	1 page(s) included

Possibly on Project Site Based on Search of Natural Heritage Database: Rare Plant Species and Ecological Communities Currently Recorded in the New Jersey Natural Heritage Database

Scientific Name	Common Name	Federal Protection Status	State Protection Status	Regional Status	Grank	Srank	Identified	Last Observed	Location
Vascular Plants									
Stachys hyssopifolia	Hyssop Hedge nettle			HL	G4G5	S2	Y - Yes	2012-08-01	Ca. one mile northeast of Cranberry; ca. 1.5 miles northeast of Cranberry.

Total number of records: 1

Rare Wildlife Species or Wildlife Habitat on the Project Site Based on Search of Landscape Project 3.1 Species Based Patches

Class	Common Name	Scientific Name	Feature Type	Rank	Federal Protection Status	State Protection Status	Grank	Srank
Aves								
	Bald Eagle	Haliaeetus leucocephalus	Foraging	4	NA	State Endangered	G5	S1B,S2N
	Brown Thrasher	Toxostoma rufum	Breeding Sighting	2	NA	Special Concern	G5	S3B,S4N
	Great Blue Heron	Ardea herodias	Foraging	2	NA	Special Concern	G5	S3B,S4N
Reptilia								
	Wood Turtle	Glyptemys insculpta	Occupied Habitat	3	NA	State Threatened	G4	S2

Vernal Pool Habitat on the Project Site Based on Search of Landscape Project 3.1

Vernal Pool Habitat Type	Vernal Pool Habitat ID
Vernal habitat area	1810
Vernal habitat area	1824
Vernal habitat area	1831
Potential vernal habitat area	1788
Potential vernal habitat area	1793
Potential vernal habitat area	1797
Potential vernal habitat area	1821
Potential vernal habitat area	1837
Potential vernal habitat area	1886

Total number of records: 9

Other Animal Species
On the Project Site Based on
Additional Species Tracked by
Endangered and Nongame Species Program

Scientific Name	Common Name	Federal Protection Status	State Protection Status	Grank	Srank
Invertebrate Animals					
Metarranthis pilosaria	Coastal Bog Metarranthis			G3G4	S3S4

Total number of records: 1

Tuesday, April 12, 2016

NHP File No.: 16-4007343-9676

Table 2: Vicinity Data Request Search Results (6 possible reports)

Report Name	Included	Number of Pages
1. Immediate Vicinity of the Project Site Based on Search of Natural Heritage Database: Rare Plant Species and Ecological Communities Currently Recorded in the New Jersey Natural Heritage Database	Yes	1 page(s) included
2. Natural Heritage Priority Sites within the Immediate Vicinity	No	0 pages included
3. Rare Wildlife Species or Wildlife Habitat Within the Immediate Vicinity of the Project Site Based on Search of Landscape Project 3.1 Species Based Patches	Yes	1 page(s) included
4. Vernal Pool Habitat In the Immediate Vicinity of Project Site Based on Search of Landscape Project 3.1	Yes	1 page(s) included
5. Rare Wildlife Species or Wildlife Habitat In the Immediate Vicinity of the Project Site Based on Search of Landscape Project 3.1 Stream Habitat File	No	0 pages included
6. Other Animal Species In the Immediate Vicinity of the Project Site Based on Additional Species Tracked by Endangered and Nongame Species Program	Yes	1 page(s) included

Immediate Vicinity of the Project Site
Based on Search of Natural Heritage Database
Rare Plant Species and Ecological Communities Currently Recorded in the New Jersey Natural Heritage Database

Scientific Name	Common Name	Federal Protection Status	State Protection Status	Regional Status	Grank	Srank	Identified	Last Observed	Location
Vascular Plants									
Lysimachia hybrida	Lowland Loosestrife			HL	G5	S3	Y - Yes	1951-07-29	Ca. 1 mile northeast of Cranbury.

Total number of records: 1

Tuesday, April 12, 2016

NHP File No.: 16-4007435.9676

Rare Wildlife Species or Wildlife Habitat Within the Immediate Vicinity of the Project Site Based on Search of Landscape Project 3.1 Species Based Patches

Class	Common Name	Scientific Name	Feature Type	Rank	Federal Protection Status	State Protection Status	Grank	Srank
Aves								
	Bald Eagle	Haliaeetus leucocephalus	Foraging	4	NA	State Endangered	G5	S1B,S2N
	Brown Thrasher	Toxostoma rufum	Breeding Sighting	2	NA	Special Concern	G5	S3B,S4N
	Great Blue Heron	Ardea herodias	Foraging	2	NA	Special Concern	G5	S3B,S4N
Reptilia								
	Wood Turtle	Glyptemys insculpta	Occupied Habitat	3	NA	State Threatened	G4	S2

Tuesday, April 12, 2016

NHP File No.: 16-4007435-9676

Vernal Pool Habitat
In the Immediate Vicinity of
Project Site Based on Search of
Landscape Project 3.1

Vernal Pool Habitat Type	Vernal Pool Habitat ID
Vernal habitat area	1810
Vernal habitat area	1831
Potential vernal habitat area	1788
Potential vernal habitat area	1793
Potential vernal habitat area	1886

Total number of records: 5

Other Animal Species
In the Immediate Vicinity of the Project Site Based on Additional Species Tracked by Endangered and Nongame Species Program

Scientific Name	Common Name	Federal Protection Status	State Protection Status	Grank	Srank
Invertebrate Animals					
Metarranthis pilosaria	Coastal Bog Metarranthis			G3G4	S3S4

Total number of records: 1

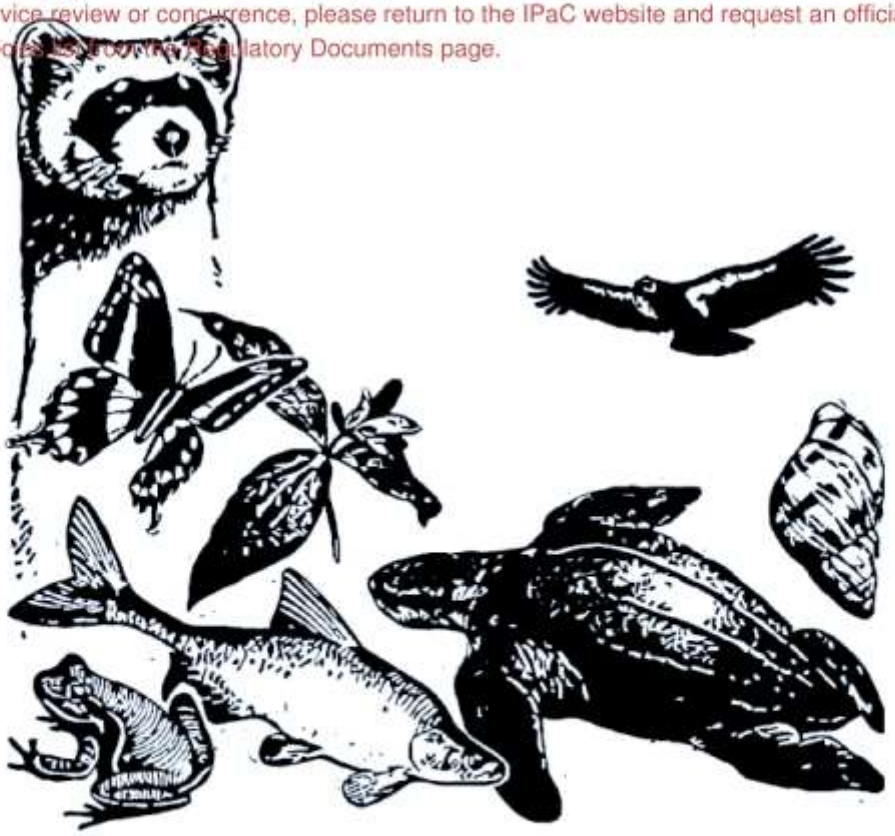
U.S. Fish & Wildlife Service

Cranbury Township Environmental Resource Inventory

IPaC Trust Resources Report

Generated August 01, 2016 12:54 PM MDT, IPaC v3.0.8

This report is for informational purposes only and should not be used for planning or analyzing project level impacts. For project reviews that require U.S. Fish & Wildlife Service review or concurrence, please return to the IPaC website and request an official species list from the Regulatory Documents page.



IPaC - Information for Planning and Conservation (https://ecos.fws.gov/ipac/): A project planning tool to help streamline the U.S. Fish & Wildlife Service environmental review process.

Table of Contents

U.S. Fish & Wildlife Service

IPaC Trust Resources Report

NAME

Cranbury Township Environmental Resource Inventory

LOCATION

Mercer and Middlesex counties, New Jersey

DESCRIPTION

The Township is updating it's Environmental Resource Inventory

IPAC LINK

https://ecos.fws.gov/ipac/project/XMMGO-ATLQB-C37I4-M3E6S-KE6KMA

U.S. Fish & Wildlife Service Contact Information

Trust resources in this location are managed by:

New Jersey Ecological Services Field Office
927 North Main Street, Building D
Pleasantville, NJ 08232-1454
(609) 646-9310

Endangered Species

Proposed, candidate, threatened, and endangered species are managed by the Endangered Species Program of the U.S. Fish & Wildlife Service.

This USFWS trust resource report is for informational purposes only and should not be used for planning or analyzing project level impacts.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list from the Regulatory Documents section.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency.

A letter from the local office and a species list which fulfills this requirement can only be obtained by requesting an official species list either from the Regulatory Documents section in IPaC or from the local field office directly.

The list of species below are those that may occur or could potentially be affected by activities in this location:

Flowering Plants

Swamp Pink Helonias bullata — Threatened

CRITICAL HABITAT
No critical habitat has been designated for this species.
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q2B8

Mammals

Indiana Bat Myotis sodalis — Endangered

CRITICAL HABITAT
No critical habitat has been designated for this species.
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A000

Northern Long-eared Bat Myotis septentrionalis — Threatened

CRITICAL HABITAT
No critical habitat has been designated for this species.
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A0JE

Reptiles

Bog (=muhlenberg) Turtle Clemmys muhlenbergii — Threatened

CRITICAL HABITAT

No critical habitat has been designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=C048

Critical Habitats

There are no critical habitats in this location

Migratory Birds

Birds are protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act.

Any activity that results in the take of migratory birds or eagles is prohibited unless authorized by the U.S. Fish & Wildlife Service.[1] There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured.

Any person or organization who plans or conducts activities that may result in the take of migratory birds is responsible for complying with the appropriate regulations and implementing appropriate conservation measures.

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1. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

Additional information can be found using the following links:

- Birds of Conservation Concern
  http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Conservation measures for birds
  http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Year-round bird occurrence data
  http://www.birdscanada.org/birdmon/default/datasummaries.jsp

The following species of migratory birds could potentially be affected by activities in this location:

American Oystercatcher Haematopus palliatus — Bird of conservation concern
On Land Season: Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0G8

American Bittern Botaurus lentiginosus — Bird of conservation concern
On Land Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0F3

Bald Eagle Haliaeetus leucocephalus — Bird of conservation concern
On Land Season: Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B008

Black-billed Cuckoo Coccyzus erythropthalmus — Bird of conservation concern
On Land Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0HI

Blue-winged Warbler Vermivora pinus — Bird of conservation concern
On Land Season: Breeding

Canada Warbler Wilsonia canadensis — Bird of conservation concern
On Land Season: Breeding

Fox Sparrow Passerella iliaca — Bird of conservation concern
On Land Season: Wintering

Gull-billed Tern Gelochelidon nilotica — Bird of conservation concern
On Land Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0JV

Hudsonian Godwit Limosa haemastica — Bird of conservation concern
At Sea Season: Migrating

Kentucky Warbler Oporornis formosus — Bird of conservation concern
On Land Season: Breeding

Least Bittern Ixobrychus exilis
On Land Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B092

Loggerhead Shrike Lanius ludovicianus — Bird of conservation concern
On Land Season: Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0FY

Peregrine Falcon Falco peregrinus — Bird of conservation concern
On Land Season: Wintering
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0FU

Pied-billed Grebe Podilymbus podiceps — Bird of conservation concern
On Land Season: Year-round

Prairie Warbler Dendroica discolor — Bird of conservation concern
On Land Season: Breeding

Purple Sandpiper Calidris maritima — Bird of conservation concern
On Land Season: Wintering

Red Knot Calidris canutus rufa — Bird of conservation concern
On Land Season: Wintering
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0DM

Rusty Blackbird Euphagus carolinus — Bird of conservation concern
On Land Season: Wintering

Short-eared Owl Asio flammeus — Bird of conservation concern
On Land Season: Wintering
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0HD

Snowy Egret Egretta thula — Bird of conservation concern
On Land Season: Breeding

Upland Sandpiper Bartramia longicauda — Bird of conservation concern
On Land Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0HC

Appendix C – Wildlife Fisheries – Brainerd Lake

Yellow perch (*Perca flavescents*) +

Largemouth bass (*Micropterus salmoides*) +

Black crappie (*Pomoxis aIularis*) *

Bluegill (*Lepomis macrochirus*)+*

Pumpkinseed sunfish (*Lepomis gibbosus*) +

Chain pickerel (*Esox niger*) +

Channel catfish (*Ictalurus punctatus*) *

Golden shiner (*Notemigonus crysoleucas*)

Mud sunfish (*Acantharchus pomotis*)

Brown bullhead (*Ameiurus nebulosus*)+ *

Tessellated darter (*Etheostoma olmstedi*)

Banded sunfish (*Eieacanthus obesus*)

White sucker (*Catostomus commersoni*)
Common carp (*Cyprinus carpio*)

Swamp darter (*Etheostoma fusiforme*)

Blue spotted sunfish (*EIeacanthus gloriosus*)

Eastern mud minnow (*Umbra pygmaea*)

White crappie (*Pomoxis nigromaculatus*)

Creek chubsucker (*Erimyzon oblongus*)

American eel (*Anguilla rostrata*)

Goldfish (*Carassius auratus*)

*Indicates fish species stocked by the Division of Fish and Wildlife.

Source (NJDEP Bureau of Fisheries Management-Warm-water Fisheries)

+ Indicates most common game fish in the lake (info from NJ Lake Survey Fishing Maps Guide, 1999).

APPENDIX D - WILDLIFE (Terrestrial Vertebrate) INVENTORY LISTS

BIRD SPECIES POTENTIALLY WITHIN CRANBURY TOWNSHIP

Scientific Name	Common Name
Podilymbus podiceps	pied-billed grebe
Phalacrocorax auritus	double-crested cormorant
Botaurus lentiginosos	American bittern
Ixobrychus exilis	least bittern **b**
Ardea herodias	great blue heron **b**
Casmerodius albus	great egret
Butorides striatus	green-backed heron **b**
Nycticorax nycticorax	black-crowned night heron
Cygnus columbianus	tundra swan
Cygnus olor	mute swan **b**
Chen caerulescens	snow goose
Branta bernicla	brant
Branta canadensis	Canada goose **b**
Aix sponsa	wood duck **b**
Anas crecca	green-winged teal
Anas rubripes	American black duck
Anas platyrhynchos	mallard **b**
Anas acuta	northern pintail
Anas discors	blue-winged teal
Anas clypeata	northern shoveler
Anas strepera	gadwall
Anas americana	American wigeon
Aythya collaris	ring-necked duck
Bucephala albeola	bufflehead

Lophodytes cucullatus	hooded merganser
Mergus merganser	common merganser
Oxyura jamaicensis	ruddy duck
Coragyps atratus	black vulture
Cathartes aura	turkey vulture
Pandion haliaetus	osprey
Haliaeetus leucocephalus	bald eagle
Circus cyaneus	Northern harrier
Accipiter striatus	sharp-shinned hawk
Accipiter Cooperii	Cooper's hawk **b**
Accipiter gentilis	northern goshawk
Buteo lineatus	red-shouldered hawk
Buteo platypterus	**broad-winged hawk b**
Buteo jamaicensis	red-tailed hawk **b**
Buteo lagopus	rough-legged hawk
Aquila chrysaetos	golden eagle
Falco sparverius	American kestrel **b**

LIST OF BIRD SPECIES - Continued

Scientific Name	**Common Name**
Falco columbarius	merlin
Falco peregrinus	peregrine falcon
Phasianus colchicus	ring-necked pheasant
Bonasa umbellus	ruffed grouse **b**
Meleagris gallopavo	eastern wild turkey **b**
Rallus limocola	Virginia rail **b**
Porzana carolina	sora **b**
Gallinula chloropus	common moorhen **b**
Fulica americana	American coot

Charadrius vociferus	killdeer **b**
Tringa melanoleuca	greater yellowlegs
Tringa flavipes	lesser yellowlegs
Tringa solitaria	solitary sandpiper
Actitis macularia	spotted sandpiper **b**
Calidris pusilla	semipalmated sandpiper
Calidris minutilla	least sandpiper
Calidris melanotos	pectoral sandpiper
Gallinago gallinago	common snipe
Philohela minor	American woodcock **b**
Larus delawarensis	ring-billed gull
Larus argentatus	herring gull
Larus marinus	great black-backed gull
Columba livia	rock dove **b**
Zenaida macroura	mourning dove **b**
Coccyzus erythropthalmus	**black-billed cuckoo b**
Coccyzus americanus	**yellow-billed cuckoo b**
Tyto alba	common barn owl **b**
Otus asio	eastern screech owl **b**
Bubo virginianus	great horned owl **b**
Strix varia	barred owl
Asio otus	long-eared owl
Asio flammeus	short-eared owl
Aegolius acadicus	northern saw-whet owl
Chordeiles minor	common nighthawk
Chaetura pelagica	chimney swift **b ***
Archilochus colubris	ruby-throated hummingbird **b ***
Ceryle alcyon	belted kingfisher **b**
Melanerpes erythrocephalus	red-headed woodpecker

Melanerpes carolinus	red-bellied woodpecker **b**
Sphyrapicus varius	yellow-bellied sapsucker
Picoides pubescens	downy woodpecker **b**
Picoides villosus	hairy woodpecker **b**

LIST OF BIRD SPECIES - Continued

Scientific Name	**Common Name**
Colaptes auratus	northern flicker **b**
Dryocopus pileatus	pileated woodpecker **b**
Contopus borealis	olive-sided flycatcher
Contopus virens	**eastern wood pewee b**
Empidonax flaviventris	yellow-bellied flycatcher
Empidonax virescens	acadian flycatcher
Empidonax alnorum	alder flycatcher
Empidonax traillii	willow flycatcher **b ***
Empidonax minimus	least flycatcher
Sayornis phoebe	eastern phoebe **b**
Myiarchus crinitus	**great crested flycatcher b**
Tyrannus Tyrannus	eastern kingbird **b ***
Eremophila alpestris	horned lark
Progne subis	purple martin **b ***
Tachycineta bicolor	tree swallow **b** *
Stelgidopteryx serripennis	northern rough-winged swallow **b ***
Riparia riparia	bank swallow **b ***
Hirundo pyrrhonota	cliff swallow
Hirundo rustica	barn swallow **b ***
Cyanocitta cristata	blue jay **b**
Corvus brachyrhynchos	American crow **b**

Corvus ossifragus	fish crow
Poecile carolinensis	Carolina chickadee **b**
Parus bicolor	tufted titmouse **b**
Sitta canadensis	red-breasted nuthatch
Sitta carolinensis	white-breasted nuthatch **b**
Certhia americana	brown creeper
Thryothorus ludovicianus	Carolina wren **b**
Troglogytes aedon	house wren **b ***
Troglodytes troglodytes	winter wren
Cistothorus palustris	marsh wren **b**
Regulus satrapa	golden-crowned kinglet
Regulus calendula	ruby-crowned kinglet
Polioptila caerulea	blue-gray gnatcatcher **b ***
Sialia sialis	eastern bluebird **b**
Catharus fuscescens	**veery b**
Catharus minimus	gray-cheeked thrush
Catharus ustulatus	Swainson's thrush
Catharus guttatus	hermit thrush
Hylocichla mustelina	**wood thrush b**
Turdus migratorius	American robin **b**
Dumetella carolinensis	catbird **b ***

LIST OF BIRD SPECIES - Continued

Scientific Name	Common Name
Mimus polyglottos	northern mockingbird **b**
Toxostoma rufum	brown thrasher **b ***
Anthus rubescens	water pipit
Bombycilla cedrorum	cedar waxwing **b**
Sturnus vulgaris	European starling **b**
Vireo griseus	white-eyed vireo **b ***
Vireo solitarius	solitary vireo
Vireo flavifrons	yellow-throated vireo **b ***
Vireo gilvus	warbling vireo **b ***
Vireo olivaceus	**red-eyed vireo b**
Vermivora pinus	blue-winged warbler **b ***
Vermivora chrysoptera	golden-winged warbler
Vermivora peregrina	Tennessee warbler
Vermivora reficapilla	Nashville warbler
Parula americana	northern parula
Dendroica petechia	yellow warbler **b ***
Dendroica pensylvanica	chestnut-sided warbler **b ***
Dendroica magnolia	magnolia warbler
Dendroica tigrina	Cape May warbler
Dendroica caerulescens	black-throated blue warbler
Dendroica coronata	yellow-rumped warbler
Dendroica virens	black-throated green warbler
Dendroica fusca	blackburnian warbler
Dendroica pinus	pine warbler
Dendroica discolor	prairie warbler **b ***
Dendroica palmarum	palm warbler

Dendroica castanea	bay-breasted warbler
Dendroica striata	blackpoll warbler
Dendroica cerulea	cerulean warbler
Miniotilta varia	**black and white warbler b**
Setophaga ruticilla	**American redstart b**
Protonotaria citrea	prothonotary warbler
Helmitheros vermivorus	worm-eating warbler
Seiurus aurocapillus	**ovenbird b**
Seiurus noveboracensis	northern waterthrush
Seiurus motacilla	Louisiana waterthrush
Oporornis formosus	Kentucky warbler
Oporornis philadelphia	mourning warbler
Geothlypis trichas	common yellowthroat **b ***
Wilsonia citrina	hooded warbler
Wilsonia pusilla	Wilson's warbler
Wilsonia canadensis	Canada warbler

LIST OF BIRD SPECIES - Continued

Scientific Name	**Common Name**
Icteria virens	yellow-breasted chat **b** *
Piranga olivacea	**scarlet tanager b**
Cardinalis cardinalis	northern cardinal **b**
Pheucticus ludovicianus	**rose-breasted grosbeak b**
Passerina cyanea	indigo bunting **b ***
Pipilo erythrophthalmus	rufous-sided towhee **b**
Spizella arborea	American tree sparrow
Spizella passerina	chipping sparrow **b**

Spizella pusilla	field sparrow **b**
Passerculus sandwichensis	Savannah sparrow
Ammodramus savannarum	grasshopper sparrow
Passerella iliaca	fox sparrow
Melospiza melodia	song sparrow **b**
Melospiza lincolnii	Lincoln's sparrow
Melospiza georgiana	swamp sparrow **b**
Zonotrichia albicollis	white-throated sparrow
Zonotrichia leucophrys	white-crowned sparrow
Junco hyemalis	dark-eyed junco
Plectophenax nivalis	snow bunting
Dolichonyz oryzivorus	bobolink
Agelaius phoeniceus	red-winged blackbird **b**
Sturnella magna	eastern meadowlark **b**
Euphagus carolinus	rusty blackbird
Quiscalus quiscula	common grackle **b**
Molothrus ater	brown-headed cowbird **b**
Icterus spurius	orchard oriole **b ***
Icterus galbula	northern oriole **b ***
Carpodacus purpureus	purple finch
Carpodacus mexicanus	house finch **b**
Carduelis flammea	common redpoll
Carduelis pinus	pine siskin
Carduelis tristis	American goldfinch **b**
Hesperiphona vespertinus	evening grosbeak
Passer domesticus	house sparrow **b**

b = Potential breeder in Cranbury

Birds in Boldface are forest interior neo-tropical migrants potentially breeding in Cranbury

*** = Neo-tropical migrant that is not forest interior species potentially breeding in Cranbury**

MAMMALS POTENTIALLY WITHIN CRANBURY TOWNSHIP

Scientific Name	**Common Name**	**Exp/Hi**	
Didelphis marsupialis	opossum		X
Sorex cinereus	masked shrew		
Sorex dispar	long-tailed shrew		
Blarina brevicauda	short-tailed shrew		X
Scalopus aquaticus	eastern mole		X
Myotis lucifugus	little brown bat	X	
Lasionycteris noctivagans	silver-haired bat		
Pipistrellus subflavus	eastern pipistrel		
Eptesicus fuscus	big brown bat	X	
Lasiurus borealis	red bat		X
Lasiurus cinereus	hoary bat		
Sylvilagus floridanus	eastern cottontail		X
Tamias striatus	eastern chipmunk	X	
Marmota monax	woodchuck		X
Sciurus carolinensis	gray squirrel		X
Tamiasciurus hudsonicus	red squirrel		
Glaucomys volans	southern flying squirrel		
Castor candensis	beaver		
Peromyscus leucopus	white-footed mouse		X
Microtus pennsylvanicus	meadow vole		X
Ondatra zibethicus	muskrat		X

Rattus rattus	black rat		X
Rattus norvegicus	brown rat		X
Mus musculus	house mouse		X
Napaeozapus insignis	woodland jumping mouse		
Zapus hudsonius	meadow jumping mouse		
Canis latrans, var.	eastern coyote		X
Vulpes vulpes	red fox		X
Urocyon cinereoargenteus	gray fox	X	
Procyon lotor	raccoon	X	
Mephitis mephitis	striped skunk		X
Odocoileus virginianus	white-tailed deer	X	

AMPHIBIANS POTENTIALLY WITHIN CRANBURY TOWNSHIP

Scientific Name	**Common Name**	**Exp/Hi**	
Ambystoma opacum	marbled salamander		
Ambystoma maculatum	spotted salamander		
Notophthalmus v. viridescens	red-spotted newt		
Desmognathus f. fuscus	northern dusky salamander		
Plethodon c. cinereus	red-backed salamander	X	
Plethodon g. glutinosus	slimy salamander		
Hemidactylium scutatum	four-toed salamander		
Pseudotriton r. ruber	northern red salamander		
Eurycea b. bislineata	northern two-lined salamander	X	
Scaphiopus h. holbrookii	eastern spadefoot toad		
Bufo americanus	American toad		
Bufo woodhousii fowleri	Fowler's toad		X
Pseudacris triseriata kalmi	NJ Chorus Frog		

Acris c. crepitans	northern cricket frog		
Hyla c. crucifer	northern spring peeper	X	
Hyla versicolor	northern gray treefrog		X
Pseudacris triseriata kalmi	New Jersey chorus frog		
Pseudacris triseriata feriarum	upland chorus frog		
Rana catesbeiana	bullfrog	X	
Rana virgatipes	carpenter frog		
Rana clamitans melanota	green frog		X
Rana sylvatica	wood frog		X
Rana spenocephala	southern leopard frog		
Rana palustris	pickerel frog		X

REPTILES POTENTIALLY WITHIN CRANBURY

Scientific Name	**Common Name**	**Exp/Hi**
Chelydra s. serpentina	snapping turtle	X
Sternotherus odoratus	stinkpot	X
Kinosternon s. subrubrum	eastern mud turtle	
Clemmys guttata	spotted turtle	X
Clemmys muhlenbergi	bog turtle	
Clemmys insculpta	wood turtle	
Terrapene c. carolina	eastern box turtle	X
Pseudemys rubriventris	red-bellied turtle	X
Pseudemys scripta elegans	red-eared turtle	X
Chrysemys p. picta	eastern painted turtle	X
Nerodia s. sipedon	northern water snake	X
Storeria d. dekayi	northern brown snake	X
Storeria o. occipitomaculata	northern red-bellied snake	
Thamnophis s. sirtalis	eastern garter snake	X

Thamnophis s. sauritus	eastern ribbon snake	X
Virginia v. valeriae	eastern smooth earth snake	
Heterodon platyrhinos	eastern hognose snake	
Diadophis punctatus edwardsi	northern ringneck snake	
Diadophis p. punctatus	southern ringneck snake	
Carphophis a. amoenus	eastern worm snake	X
Coluber c. constrictor	northern black racer	X
Opheodrys aestivus	rough green snake	
Opheodrys v. vernalis	eastern smooth green snake	
Elaphe o. obsoleta	black rat snake	X
Lampropeltis t. triangulum	eastern milk snake	X

Sources:

Wolgast, 1974

S. Angus, Personal Communication, 2006