Natural Resource Inventory

LAKEWOOD TOWNSHIP ENVIRONMENTAL COMMISSION
AND
LAKEWOOD TOWNSHIP PLANNING BOARD

ADOPTED BY THE ENVIRONMENTAL COMMISSION: OCTOBER 4, 2006

APPROVED BY THE TOWNSHIP PLANNING BOARD: _____

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PURPOSE

The Township of Lakewood Environmental Commission, in consultation with the Township of Lakewood Planning Board and Township Committee, has prepared this Natural Resource Inventory (NRI) for use as a reference in the land use and planning decision making process.

The purpose of a Natural Resource Inventory is to identify Lakewood's natural resources and describe their importance for public health, safety and welfare of the community. The NRI will provide essential background data necessary for the Township and its Planning Board to review key environmental characteristics of the Township. The information contained in this NRI can be utilized as a starting point in identifying possible future master plan amendments and reviewing development applications.

Information generated for this inventory was obtained from Federal and State environmental agencies, published materials, and consultation with local officials. All figures were generated using New Jersey Department of Environmental Protection (NJDEP), Geographic Information System (GIS) data and represent the most up-to-date information available. Data presented herein is intended for general municipal-wide planning purposes and is not intended as definitive site-specific information. Site inspections, field verifications or delineations may further define the actual extent of these natural resources and confirm the presence or absence of these resources within a specific site or study area.

INTRODUCTION

The Township of Lakewood is located in northern Ocean County, and borders Howell Township, Monmouth County to the North, Brick Township to the East, Jackson Township to the West and Dover Township to the South (Figure 1). According to the NJDEP, the Township encompasses an area of approximately 25.05 square miles or 16,030 acres and located within the Barnegat Bay Watershed, which encompasses the Metedeconk River and Kettle Creek.

The Township includes approximately 7,126 acres, or 44 percent of Lakewood's total land surface area, in urban land uses (Figure 2). Nearly one-third of the urban uses are residential.

Lakewood also includes 5,995 acres, or 37 percent of Lakewood's total land surface area, in forest cover and 1,882 acres, or 12 percent of Lakewood's total land surface area, in wetlands. The remaining area is encompassed in agricultural and "barren" land uses. Surface water bodies encompass approximately 238 acres.

Lakewood is situated at the confluence of several major roadways, including Route 9, Route 70 and Route 88, and has four exits of the Garden State Parkway. Lakewood also contains freight rail lines and is being considered as part of the proposed reinstatement of a passenger rail line and station for either the Monmouth-Ocean-Middlesex (MOM) or Monmouth-Ocean (MO) rail system.

The Township of Lakewood is located largely within the Suburban Planning Area (PA2), with portions delineated in the Fringe Planning Area (PA3) and in the Environmentally Sensitive Planning Area (PA5). On the 2001 State Plan Policy Map, a Critical Coastal Environmental Site designation surrounds Lake Carasaljo, Lake Shenandoah and wetland areas (Figure 3). The State Development and Redevelopment Plan envisions that localities within PA2 will exemplify compact forms of development, protect the character of existing stable communities, protect natural resources, redesign areas to prevent sprawl, and revitalize cities and towns. The areas east of the Southern Branch Main Line is under the political jurisdiction of the NJDEP Coastal Area Facility Review Act (CAFRA).

Preserved land in Lakewood has been classified on the Statewide GIS in three categories: County parks and open space, municipal parks and open space, and preserved farmland and private open space (Figure 4). The open space areas are predominately located along the South Branch of the Metedeconk River. They include the 565-acre Ocean County Park (former John D. Rockefeller Estate), the 100-acre Lake Shenandoah County Park, the 176-acre Lake Carasaljo, and the 149-acre Pine Park. Preserved under the Ocean County Farmland Preservation Program, the 59.47 acre Dwulet Farm on Joe Parker Road has been preserved as a field and an ornamental crop area. The Township Unified Development Ordinance provides for an open space zone in the areas that surround Lake Shenandoah and Ocean County Park.

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Figure 1: Site Location
Lakewood Township
Ocean County, New Jersey

0 62,500 125,000 250,000 Feet

Prepared by: STK, September 14, 2006
Source: NJDEP; NJDOT; ESRI
File Path: H:\LAKE\00030\Permits\lakeNRI_location2.mxd

N

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

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0 4,500 9,000 Feet

Figure 2: Existing Land Use
Lakewood Township
Ocean County, New Jersey

Prepared by: STK, October 26, 2005
Source: NJDEP
File Path: H:\LAKE\00030\Permits\lake30_landuse.mxd

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

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Figure 3: State Planning Areas
Lakewood Township
Ocean County, New Jersey

0 2,250 4,500 9,000 Feet

Prepared by: STK, September 14, 2006
Source: NJDEP; 2001 State Plan Policy Map
File Path: H:\LAKE\00030\Permits\lakeNRI_splan2.mxd

N

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

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Figure 4: Open Space
Lakewood Township
Ocean County, New Jersey

0 2,250 4,500 9,000 Feet

Prepared by: STK, September 15, 2006
Source: NJDEP
File Path: H:\LAKE\00030\Permits\lakeNRI_openspace2.mxd

N

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

ENVIRONMENTAL COMPONENTS

The Township of Lakewood's Natural Resource Inventory (NRI) considers the following environmental components:

Geology: The Township is located within the Atlantic Coastal Plain physiographic region, and, specifically in the Outer Coastal sub-region. Bedrock type determines the quality and depth of soil layers, the amount of groundwater available, and the recharge capability. The Outer Coastal Plan contains sandy soils that provide ideal conditions for aquifers. The Township is underlain in the Kirkwood-Cohansey aquifer. Groundwater supplies can be vulnerable to pollution and over-pumping of aquifers. Consequently, aquifers need to be conserved and protected. Soils contained in Lakewood are from the Cohansey formation, which are mostly medium to coarse-grained sands, although some thin clay soil layers are present.

Climate: The Township is located within the Pinelands Climatic and Atlantic Coastal Zones and somewhat of a hybrid. For instance, sea breezes may make it into the Township and provide some summer relief, while you may be considerably colder than areas closer to the Atlantic during clear, calm nights.

Hydrology: The Township is located within the Long Island-New Jersey Coastal Drainages system, within which the Barnegat Bay-Little Egg Harbor Watershed is contained. The Metedeconk River System is an important water resource for the Township. The New Jersey Department of Environmental Protection has designated the North and South Branches of the Metedeconk River, as well as Watering Place, Cotterals Branch, Schoolhouse Branch and Cabinfield Branch as Category One waterways. This special level of protection serves not only to protect wildlife and vegetative species, but also to ensure the protection of potable water supplies. In addition, the Township's rivers and Lake Shenandoah and Lake Carasaljo provide recreation activities for residents and visitors.

Wildlife and Vegetative Species: There are significant stands of remaining forest cover and forested wetlands that support wildlife habitat. As the Township is located within the Federal Barnegat Bay priority wetland and the Metedeconk River System, Lakewood

supports a variety of suitable habitat for wildlife and vegetative species. For example, the Township contains suitable habitat for the wintering population of the Federally-threatened and State-endangered Bald eagle and for other state listed species such as Red-shouldered hawks, Pine barrens tree frogs, and Barred owls.

GEOLOGY

Physiography

The Township of Lakewood is located within the Atlantic Coastal Plain physiographic region, and more specifically the Outer Coastal sub-region. The Coastal Plain is categorized as a plain that rises gradually from sea level on the east, west, and south to elevations as high as nearly 120 meters (394 feet), where the Inner and Outer Coastal Plains join at the northeast-southwest trending *cuestas*, a belt of low hills. The Outer Coastal Plain's minerals are mostly marine-deposited sedimentary sands, gravels, and clays overlain with later deposits made in interglacial Pleistocene time. The Outer Coastal Plain contains sandy soils, which provides ideal conditions for the 17 trillion gallon Kirkwood-Cohansey aquifer located in the Pinelands. Although the Pinelands are typically viewed as being very dry, in many places the water table is quite close to the surface, which gives rise to extensive wetland areas. The major rivers originating in the Pinelands in this relatively flat, low-lying region, rich in humates, which impart a brown or tea color to the water, low in nutrients, acidic, are slow-flowing. In addition, many rivers are tidal for significant portions of their length.

Stratigraphy

Most of the sediments of the New Jersey Coastal Plain range in geologic age from Cretaceous to Miocene (135 to 5.3 million years old) and were deposited in deltaic and marine environments; the period of marine deposition ended in the Miocene with the Cohansey Sand. These soils are mostly medium to coarse-grained sands, although some thin clay soil layers are present. The soils developed from the Cohansey formation are very porous and infertile because, for the most part, the parent material has a greater proportion of coarse sand particles than finer clay particles. The greater the proportion of coarse particles in a soil, the less it is able to retain water and nutrients such as calcium, magnesium, phosphorus, and potassium.

According to the United States Department of Agricultural, Natural Resources Conservation Services, Soil Data Mart, Lakewood has a total of fourteen (14) soil series in the Township (Exhibit 1). These soil series are divided into twenty-five (25) corresponding components each with there own soil formation characteristics. The fourteen soil series and twenty-five components are as follows:

Summary of Soil Components

Soil Components	Hydric	Farmland	Septic Suitability
I. Atsion Series			
Atsion sand (AtsA)	X	Unique	Very Limited
II. Berryland Series			
Berryland sand, rarely flooded (BerAr)	X	Unique	Very Limited
Berryland sand, frequently flooded (BerAt)	X		Very Limited
III. Downer Series			
Downer loamy sand (DocB)	X	Statewide	Not Limited
Downer sandy loam (DoeA)	X	Prime	Not Limited
Downer sandy loam (DoeB)		Prime	Not Limited
Downer gravelly sandy loam (DofgB)		Statewide	Not Limited
IV. Evesboro Series			
Evesboro sand (EveB)			Not Limited
Evesboro sand (EveC)			Not Limited
Evesboro sand (EveD)			Not Limited
V. Galloway Series			
Galloway loamy sand (GamB)	X	Statewide	Very Limited
VI. Hammonton Series			
Hammonton loamy sand (HbmB)		Statewide	Very Limited
Hammonton sandy loam (HboA)	Hydric Rated Wetland	Prime	Very Limited
VII. Keyport Series			
Keyport sandy loam (KemA)	X	Prime	Very Limited
VIII. Lakehurst Series			
Lakehurst sand (LakB)	Hydric Rated Wetland		Very Limited
Lakehurst sand, clayey substratum (LakkB)	X	Local	Very Limited
IX. Lakewood Series			
Lakewood sand (LasB)			Not Limited
Lakewood sand (LasC)			Not Limited
X. Manahawkin Series			
Manahawkin muck, frequently flooded (MakAt)	X	Unique	Very Limited
XI. Mullica Series			
Mullica sandy loam MumA	X	Statewide	Very Limited
XII. Phalanx Series			
Phalanx loamy sand (PhbC)			Not Limited
XIII. Psamments Series			
Psamments (PssA)	X		Somewhat Limited
Psamments, sulfidic substratum, frequently flooded (PstAt)	X		Very Limited
Psamments, waste substratum (PsuB)			Not Limited
XIV. Sassafras series			
Sassafras sandy loam (SacB)	X	Prime	Not Limited

Of these soil series, 12,835.97 acres, or 80 percent of Lakewood's total land area are hydric soils (Figure 6). There are fourteen (14) farmland soil series that have been identified as prime, unique, Statewide or locally important (Figure 7). These soils total 8,597.13 acres or 54 percent of Lakewood's total land area. Figure 8, Septic Suitability illustrates the septic suitability of the soil series in Lakewood. The Township has several soil series that are suitable for septic uses. Not listed as a soil series or as a component are pits, sand and gravel (PHG), Urban Land, and Water. PHG encompasses 293.09 acres or 1.8 percent of Lakewood's total land area. Urban Land encompasses 374.72 acres or 2.3 percent of Lakewood's total land area, and Water encompasses 210.83 acres or 1.3 percent of Lakewood's total land area.

Downer loamy sand (DocB) and Evesboro sand (EveB) are the dominant soil series throughout the Township. DocB can be found in the northwest and northeast section of the municipality and below Route 528 and U.S. Highway 70. EveB is more prevalent in the northern section of the Township and in residential areas. The Metedeconk River, which forms a natural northern boundary with Howell Township, has the hydric soil Berryland (BerAt) adjacent to its banks. The Metedeconk River (Southern Branch) connecting Lake Shenandoah and Lake Carasaljo contains a mixture of hydric soils BerAt, Downer sandy loam (DoeA), Lakehurst sand (LakB), Manahawkin muck (MakAt), and Psamments (PssA) and the non-hydric soil, Evesboro sand (EveD). The Kettle Creek watershed located in the southeast part of the municipality is dominated by the hydric soils of DocB, EveB, MakAt, and Berryland sand (BerAr). In terms of developed areas, the historic downtown area is identified as Urban Land and the Lakewood Industrial Complex is dominated by Lakewood sand (LasB).

Hydric soils are not located within the southeast portion of the municipality, where farmland with soils of Statewide importance are located. Farmland soils with Statewide importance are located in the northeast and northwest throughout Lakewood, as well as in the central areas of the Township. The Township also contains Lakehurst sand (LakkB), which is a soil of local farmland importance along the Cotterals Branch. The areas with the least-suitable septic uses are located along the waterways of the Township.

A summary of each soil series and its corresponding component are as follows, which have summarized in Exhibit 1 and in and Appendix A:

I. Atsion Series—This soil series is classified as a hydric soil

a. Atsion sand (AtsA)—AtsA is listed as a farmland hydric soil of unique importance. This soil is comprised of two soil series: Atsion with a flat landform and Berryland with a drainageway flat landform. AtsAs encompasses 982.75 acres or 6.13 percent of Lakewood's total land area. Woodland species supported by this soil series include Blackgum, Pitch pine, and Red maple.

II. Berryland Series—This soil series is classified as a hydric soil.

a. Berryland sand, rarely flooded (BerAr)BerAr is listed as a farmland soil of unique importance. This soil is comprised of four soil series: Atsion, Berryland, Manahawkin and Mullica. Both Atsion and Berryland soil series contain a drainageway flat landform, the Manahawkin soil series is a swamp floodplain landform and the Mullica soil series is a depression landform. This soil encompasses 143.44 acres or 1.0 percent of Lakewood's total land area. Woodland species supported by this soil series include Black oak, Chestnut oak, Pitch pine, Scarlet oak, and White oak.

b. Berryland sand, frequently flooded (BerAt)—BerAt is contained in depression landforms and encompasses 515.90 acres or 3.2 percent of Lakewood's total land area. Woodland species supported by this soil series include Pitch pine.

III. Downer Series—The State legislature has designated the Downer series as the official State soil for New Jersey. Woodland species supported by this soil series include Black oak, Pitch pine, Scarlet oak and White oak.

a. Downer loamy sand (DocB)—DocB is listed as a soil of statewide importance and encompasses 3,500.93 acres or 21.8 percent of Lakewood's total land area. This component is classified as a hydric soil.

b. Downer sandy loam (DoeA)—DoeA is listed as a prime soil and encompasses 770.11 acres or 4.8 percent of Lakewood's total land area. This component is classified as a hydric soil.

c. Downer sandy loam (DoeB)—DoeB is listed as a prime soil and encompasses 679.37 acres or 4.2 percent of Lakewood's total land area. This component is not classified as a hydric soil.

d. Downer gravelly sandy loam (DofgB)—DofgB is listed as a soil of statewide importance and encompasses 684.86 acres or 4.3 percent of Lakewood's total land area. Specific to this soil component, supported woodland species include Black oak, Scarlet oak, Virginia pine, and White oak. This component is not classified as a hydric soil.

IV. Evesboro Series—This soil series is not classified as a hydric soil. Woodland species supported by this soil series include Chestnut oak, Pitch pine, Scarlet oak, and White oak.

a. Evesboro sand (EveB)—EveB encompasses 2,879.09 acres or 18.0 percent of Lakewood's total land area.

b. Evesboro sand (EveC)—EveC encompasses 478.17 acres or 3.0 percent of Lakewood's total land area.

c. Evesboro sand (EveD)—EveD encompasses 155.58 acres or 1.0 percent of Lakewood's total land area. Specific to this soil component, supported woodland species include Black oak, Virginia pine, Chestnut oak, Pitch pine, Shortleaf pine, Virginia pine, and White oak.

V. Galloway Series—This soil series is classified as a hydric soil and supports the following woodland species Pine oak, Sweetgum, Virginia pine and White oak.

a. Galloway loamy sand (GamB)—The GamB encompasses 286.10 acres or 1.8 percent of Lakewood's total land area.

VI. Hammonton Series—This soil series is not classified as a hydric soil.

a. Hammonton loamy sand (HbmB)—HbmB is listed as a soil of statewide importance and encompasses 32.62 acres or less than 0.5 percent of

Lakewood's total land area. The woodland species supported by this component include Black oak, Pitch pine, Red maple, and White oak.

b. Hammonton sandy loam (HboA)—HboA is considered to be a prime farmland soil and consists of a flat drainageway landform. The component encompasses 166.25acres or 1.0 percent of Lakewood's total land area. Specific to this soil component, supported woodland species include Black oak, Pitch pine, Shortleaf pine, Virginia pine, and White oak.

VII. Keyport sandy loam (KemA)—This component is classified as a hydric soil and is considered to be a prime farmland soil. KemA exhibits a depression landform. This soil encompasses 49.71 acres or less than 0.5 percent of Lakewood's total land area. Specific to this soil component, supported woodland species include American beech, Loblolly pine, Northern red oak, and Yellow-poplar.

VIII. Lakehurst series— This soil series exhibits a depression landform.

a. Lakehurst sand (LakB)—LakB encompasses 612.77 acres or 3.8 percent of Lakewood's total land area and contains a wetland related hydric soil rating. Specific to this soil component, supported woodland species include Chestnut oak, Pitch pine, Post oak, and Scarlet oak.

b. Lakehurst sand, clayey substratum (LakkB)—LakkB encompasses 16.88 acres or less than 0.5 percent of Lakewood's total land area and is classified as a hydric soil. LakkB is classified as a farmland soil component of local importance. Specific to this soil component, supported woodland species include Black oak, Virginia pine, Blackgum, Pitch pine, and White oak.

IX. Lakewood sand— This soil series is not classified as a hydric soil.

a. Lakewood sand (LasB)—LasB encompasses 1,905.84 acres or 11.9 percent of Lakewood's total land area. Specific to this soil component, supported woodland species include Chestnut oak, Pitch pine, Post oak, and Scarlet oak.

b. Lakewood sand (LasC)—LasC encompasses 243.05 acres or 1.5 percent of Lakewood's total land area. Specific to this soil component, supported woodland species include Pitch pine, Shortleaf pine, and Virginia pine.

X. Manahawkin muck, frequently flooded (MakAt)—This component is classified as a hydric soil and is listed as unique farmland soil. This soil is comprised of four soil series: Atsion, Berryland, Manahawkin, and Mullica. Both Atsion and Berryland soil series contain a drainageway flat landform. The Manahawkin soil series is a swamp floodplain landform and the Mullica soil series is a depression landform. This soil encompasses 648.89 acres or 4.1 percent of Lakewood's total land area. Specific to this soil component, supported woodland species include the Atlantic white cedar and Red maple.

XI. Mullica sandy loam (MumA)—This component is classified as a hydric soil and is listed as farmland with Statewide importance. This soil is comprised of three soil series: Mullica, Berryland, and Manahawkin. These series all exhibit a depression landform. This soil encompasses 6.17 acres or less than 0.5 percent of Lakewood's total land area. Woodland species include Blackgum, Pitch pine, Red maple, and Sweetgum.

XII. Phalanx Series—This series is not classified as a hydric soil and supports the following woodland species Black oak, Chestnut oak, Pitch pine, Virginia pine, and White oak.

a. Phalanx loamy sand (PhbC)—PhbC encompasses 31.75 acres or less than 0.5 percent of Lakewood's total land area.

XIII. Psamments series

a. Psamments (PssA)—PssA is classified a hydric soil and is comprised of three soil series: Atsion, Berryland, and Mullica. Both the Mullica and Berryland soil series exhibit a depression landform. The Atsion soil series is a flat landform. This soil encompasses 213.69 acres or 1.3 percent of Lakewood's total land area.

b. Psamments, sulfidic substratum, frequently flooded (PstAt)—PstAt is a classified as a hydric soil and is comprised of three soil series, Appoquinimink, Transquaking, and Mispillion. These soil series all exhibit a tidal flat landform. This soil encompasses 55.93 acres or less than 0.5 percent of Lakewood's total land area.

c. Psamments, waste substratum (PsuB)—PsuB is not classified as a hydric soil and encompasses 42.04 acres or less than 0.5 percent of Lakewood's total land area.

XIV. Sassafras sandy loam (SacB)—This component is not classified as a hydric soil, is considered to be prime farmland soil and encompasses 48.90 or less than 1 percent of Lakewood's total land area. Specific to this soil component, supported woodland species include Black oak, Northern red oak, Scarlet oak, White oak, and Yellow-popular.

Exhibit 1: Soil Types and Conditions

Soil	Hydric Rating*	Seasonal Water Table Depth	Septic Suitability ⊖	Surface Runoff	Kf Erodibility Factor⊗	NonIrrigated Capability Class (Irrigated) •	Farmland Soils Designation ♦	Structures Permitted	Road Suitable (Hazard of Erosion)	Open Space Trails

*Hydric criteria codes:
1. All Histels except for Folistels, and Histosols except for Folists.
2. Soils in Aquic suborders, great groups, or subgroups, Albolls suborder, Historthels great group, Histoturbels great group, Pachic subgroups, or Cumulic subgroups that:
   A. are somewhat poorly drained and have a water table at the surface (0.0 feet) during the growing season, or
   B. are poorly drained or very poorly drained and have either:
      1.) a water table at the surface (0.0 feet) during the growing season if textures are coarse sand, sand, or fine sand in all layers within a depth of 20 inches, or
      2.) a water table at a depth of 0.5 foot or less during the growing season if permeability is equal to or greater than 6.0 in/hr in all layers within a depth of 20 inches, or
      3.) a water table at a depth of 1.0 foot or less during the growing season if permeability is less than 6.0 in/hr in any layer within a depth of 20 inches.
3. Soils that are frequently ponded for long or very long duration during the growing season.
4. Soils that are frequently flooded for long or very long duration during the growing season.

⊖Septic Suitability is divided into three classes: 1.) Not limited: Soil feature is compatible with septic use; 2.) Somewhat Limited: Soil feature is moderately compatible with septic use and 3) Very Limited: Soil feature is not compatible with septic use.

⊗Kf Soil erodibility factors quantify the susceptibility of soil detachment by water. These erodibility factors predict the long-term average soil loss, which results from sheet and rill erosion under various alternative combinations of crop systems and conservation techniques. Factor Kf considers the whole soil, and factor Kf factors obtained experimentally vary from 0.02 to 0.69. For the purpose of soil interpretations, the factors have been grouped into 14 classes. The classes are identified by a representative class value as follows: .02, .05, .10, .15, .17, .20, .24, .28, .32, .37, .43, .49., .55, and .64.

•Land Capability Classes include:
   Class 1 soils have slight limitations that restrict their use.
   Class 2 soils have moderate limitations that reduce the choice of plants or require moderate conservation practices.
   Class 3 soils have severe limitations that reduce the choice of plants or require special conservation practices, or both.
   Class 4 soils have very severe limitations that restrict the choice of plants or require very careful management, or both.
   Class 5 soils have little or no hazard of erosion but have other limitations, impractical to remove, that limit their use mainly to pasture, range, forestland, or wildlife food and cover.
   Class 6 soils have severe limitations that make them generally unsuited to cultivation and that limit their use mainly to pasture, range, forestland, or wildlife food and cover.
   Class 7 soils have very severe limitations that make them unsuited to cultivation and that restrict their use mainly to grazing, forestland, or wildlife.
   Class 8 soils and miscellaneous areas have limitations that preclude their use for commercial plant production and limit their use to recreation, wildlife, or water supply or for esthetic purposes.

Each land capability has a corresponding subclass that represents the dominant limitation of each Land Capability Class. They are defined as follows:
   Subclass e is made up of soils for which the susceptibility to erosion is the dominant problem or hazard affecting their use. Erosion susceptibility and past erosion damage are the major soil factors that affect soils in this subclass.
   Subclass w is made up of soils for which excess water is the dominant hazard or limitation affecting their use. Poor soil drainage, wetness, a high water table, and overflow are the factors that affect soils in this subclass.
   Subclass s is made up of soils that have soil limitations within the rooting zone, such as shallowness of the rooting zone, stones, low moisture-holding capacity, low fertility that is difficult to correct, and salinity or sodium content.
   Subclass c is made up of soils for which the climate (the temperature or lack of moisture) is the major hazard or limitation affecting their use.

♦Farmland designations are categorized as: 1) Prime farmland is the land that has the best combination of physical and chemical characteristics for producing food, feed, forage; 2) Unique farmland is land other than prime farmland that is used for production of specific high-value food and fiber crops, i.e. cranberries and 3) State farmland is land classified by a State agency that do not meet the criteria for that of prime or unique. **Lakewood also has a locally designated farmland category.

Soil	Hydric Rating	Seasonal Water Table Depth	Septic Suitability	Surface Runoff	Kf Erodibility Factor	NonIrrigated Capability Class (Irrigated)	Farmland Soils Designation	Structures Permitted	Road Suitable (Hazard of Erosion)	Open Space Trails
AtsA (Atison/Berryland)	2B3/ 2B3, 3	2 Inches	Very Limited	Negligible	.05	5w	Unique	Very Limited	Moderate (Slight)	Very Limited (too sandy)
BerAr (Berryland/Atsion/ Manahawkin/ Mullica)	2B3, 3/2B3/1,3/2 B3		Very Limited	Negligible	.10	5w	Unique	Very Limited	Well (Slight)	Very Limited (too sandy)
BerAt	2B3, 3		Very Limited	Very Low	.10	5w		Very Limited	Poor (Slight)	Very Limited (too sandy)
DocB (Atsion/Mullica)	2B3/2B3	Greater than 6 feet.	Not Limited	Very Low	.20	2s	State	Not Limited	Well (Slight)	Somewhat Limited (too sandy)
DoeA (Mullica)	2B3	Greater than 6 feet	Not Limited	Very Low	.28	1	Prime	Not Limited	Well (Slight)	Not Limited
DoeB		Greater than 6 feet	Not Limited	Low	.28	2e	Prime	Not Limited	Well (Moderate)	Not Limited
DofgB			Not Limited	Very Low	.28		Statewide	Not Limited	Moderate (Slight)	Not Limited
EveB		Greater than 6 feet	Not Limited	Negligible	.10	7s		Not Limited	Moderate (Slight)	Very Limited (too sandy)
EveC		Greater than 6 feet	Not Limited	Negligible	.10	7s		Not Limited	Moderate (Slight)	Very Limited (too sandy)
EveD		Greater than 72 inches	Not Limited	Negligible	.17			Very Limited	Poor (Slight)	Very Limited (too sandy)
GamB (Atison/Mullica)	2B3/2B3	24 to 48 inches	Very Limited	Very Low	.17		Statewide	Somewhat Limited	Well (Slight)	Somewhat Limited (too sandy)
HdmB		18 inches	Very Limited	Very Low	.20	2w	Statewide	Somewhat Limited	Well (Slight)	Somewhat Limited (too sandy)
HboA (Atison/Mullica)	2B3/2B3	18 inches	Very Limited	Very Low	.32	2w	Prime	Somewhat Limited	Well (Slight)	Somewhat Limited

Soil	Hydric Rating	Seasonal Water Table Depth	Septic Suitability	Potential Runoff Class	Kf Erodibility Factor	NonIrrigated Capability Class (Irrigated)	Farmland Soils Designation	Structures Permitted	Road Suitable (Hazard of Erosion)	Open Space Trails
KemA	2B3		Very Limited	Not Rated	.32	2w	Prime	Somewhat Limited	Well (Slight)	Not Limited
LakB	2B3	18 inches	Very Limited	Negligible	.05	4w		Somewhat Limited	Moderate (Slight)	Very Limited (too sandy)
LakkB (Atison/Berryland)	2B3/2B3, 3		Very Limited	Not Rated	.05		Local	Somewhat Limited	Moderate (Slight)	Not rated
LasB		Greater than 6 feet	Not Limited	Negligible	.10	7s		Not Limited	Moderate (Slight)	Very Limited (too sandy)
LasC			Not Limited	Not Rated	.10	7s		Somewhat Limited	Moderate (Slight)	Very Limited (too sandy)
MakAt (Manahawkin/ Atision/Berryland/ Mullica)	1, 3/2B3/ 2B3,3/2B3	0 inches	Very Limited	Negligible	.05	7w	Unique	Very Limited	Poor (Very Serve)	Very Limited (too sandy)
MumA (Mullica/Berryland/ Fallingston)	2B3/ 2B3, 3/ 2B3		Very Limited	Negligible	.05	4w	State	Very Limited	Poor (Slight)	Very Limited
PhbC			Not Limited	Not Rated	.20			Very Limited	Moderate (Slight)	Somewhat Limited (too sandy)
PssA (Atison/ Berryland/Mullica)	2B3/ 2B3, 3/ 2B3		Somewhat limited	Not Rated	.17	7s		Not Limited	Moderate (Slight)	Very Limited (too sandy)
PstAt (Appoquinimink/ Pawcatuck/ Transquaking)	2B3, 3		Very Limited	Very Low	.20	7s		Very Limited	Poor (Slight)	Not Rated
PsuB			Not Limited	Not Rated	Not Rated	8s		Not Limited	Well (Slight)	Not Rated
SacB (Fallsington)	2B3	Greater than 6 feet	Not Limited	Medium	.28	2e	Prime	Not Limited	Well (Moderate)	Not Limited

Source: United States Department of Agriculture Natural Resources Conservation Services. Soil Data Mart, NJ029 Lakewood County, New Jersey. Web search February 17, 2006

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Figure 5: Soil Types
Lakewood Township
Ocean County, New Jersey

0 2,250 4,500 9,000 Feet

Prepared by: STK, September 15, 2006
Source: NJDEP; USDA NRCS
File Path: H:\LAKE\00030\Permits\lakeNRI_soil2.mxd

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Figure 6: Hydric Soils
Lakewood Township
Ocean County, New Jersey

0 2,250 4,500 9,000 Feet

Prepared by: STK, September 15, 2006
Source: NJDEP; USDA NRCS
File Path: H:\LAKE\00030\Permits\lakeNRI_hydric2.mxd

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Figure 7: Farmland Soils
Lakewood Township
Ocean County, New Jersey

0 2,250 4,500 9,000 Feet

Prepared by: STK, September 15, 2006
Source: NJDEP; USDA NRCS
File Path: H:\LAKE\00030\Permits\lakeNRI_farmland2.mxd

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Figure 8: Septic Suitability
Lakewood Township
Ocean County, New Jersey

0 2,250 4,500 9,000 Feet

Prepared by: STK, September 15, 2006
Source: NJDEP; USDA NRCS
File Path: H:\LAKE\00030\Permits\lakeNRI_septic2.mxd

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Climate

Lakewood is located approximately 10 miles from the Atlantic Ocean. Due to its proximity the Atlantic Ocean and the dominate Pineland ecology, the Office of the New Jersey State Climatologist (ONJSC) indicates that Lakewood is in a transition area between two zones: the Coastal Climatic Zone and the Pinelands Climatic Zone. The Coastal Climatic Zone is influenced by land and ocean temperatures. In autumn and early winter, air temperatures in the Coastal Climatic Zone are much warmer than interior regions of the State because of warm ocean waters. In contrast, cooler ocean waters and Ocean breezes during the spring months keep air temperatures along the coast cooler in this zone. Ocean breezes often penetrate 5-10 miles inland, but under more favorable conditions, can affect locations 25-40 miles inland. Being adjacent to the Atlantic Ocean, with its high heat capacity, as compared to land, seasonal temperature fluctuations tend to be more gradual and less prone to extremes. The most extreme weather events are nor'easters between October and April and tropical storms and hurricanes from late Summer to early Fall. The Pinelands Climatic Zone is influenced by its porous sandy soils, and scrub pine and oak forest ecology. There is a wider range of daily maximum and minimum temperatures because the porous soil is rapidly infiltrated, which leaves surfaces quite dry. Being on the border of the two, Lakewood's climate is somewhat of a hybrid and more comparable to the Pinelands Climatic Zone.

The ONJSC provides average annual temperature and precipitation normals from 1971 to 2000. The Township is located within 11 miles of the Toms River monitoring station in the Coastal Climatic Zone and about 12 miles from the Freehold monitoring station in the Pinelands Climatic Zone. For comparison of annual temperature, the ONJSC compares the temperature of Toms River to Lakewood because Toms River does not sit too close to the ocean so as to have the water be an overwhelming influence, yet is not as far inland as Freehold, thus being in a similar climatic zone as Lakewood. At the Toms River monitoring station, the annual mean temperature reported is 53.1°F. The lowest mean temperature is 31.2°F in January and the highest is 75.0°F in July. Annual precipitation totals 48.81 inches in Toms River where precipitation, on average, ranges from 3 to 5 inches per month. The wettest month is in August at 4.35 inches in Toms River.

The ONJSC also records average heating and cooling degree days, where the temperatures are below 65°F and above 65°F respectively. At Toms River monitoring station, the average heating degree days total 5,173 and the highest heating degree month is January. The average cooling degree days total 858 and the highest cooling degree month is July. These figures can be used to target conservation measures for energy consumption high usage time periods.

Air

The entire State, including the Township of Lakewood, is listed in a non-attainment area pursuant to the National Ambient Air Quality Standards for the six criteria pollutants: Carbon Monoxide, Lead, Nitrogen Dioxide, Ozone, Particulate Matter and Sulfur Dioxide. The NJDEP maintains a continuous air monitoring network throughout the State. Approximately 16 miles from Lakewood is the Colliers Mills Monitoring Station, located at the Colliers Mills Wildlife Management Area in Ocean County. The Colliers Mills Monitoring Station measures ozone (O3) only.

The 8-hour-average exceedances for ground-level ozone has been recorded at Colliers Mills since 1998. The 8-hour ozone standard is 0.08 parts per million (ppm). For concentrations to be considered exceedances, they must be 0.085ppm or above. There have been four exceedances days recorded at Colliers Mills: (1) on June 25, 1998 the concentration was 0.113 ppm; (2) on June 10, 2000 the concentration was 0.132 ppm; (3) on August 7, 2001 the concentration was 0.121 ppm; and, (4) on July 9, 2002 the concentration was 0.138 ppm.

Chart 1 shows the number of days where the 8-hour health standard was exceeded for the 1998-2004 time period.

Source: New Jersey Department of Environmental Protection, Bureau of Air Monitoring. Web search May 19, 2005.

Noise

The Noise Control Act of 1972 (42 USC 4901) addresses concerns that noise beyond a certain level generally presents a negative impact health and welfare. This Act directed that the United States Environmental Protection Agency, Office of Noise Abatement produce noise abatements standards for major sources of noise from transportation, vehicles, equipment, machinery, appliances, and other commercial products. Noise abatement standards are deemed by Congress and the State as a local concern. Therefore, a Noise Pollution Clearinghouse maintains records and standards from the former Office of Noise Abatement for Federal standards. The NJDEP Office of Compliance and Enforcement is only authorized to promulgate modal ordinances that can be adopted by municipalities. The Township of Lakewood adopted their noise regulations in September 1970, as BH:16-1 et. al., and does not incorporate the NJDEP model ordinance language.

Noise is measured in decibels (dBA) and frequencies audible to humans for industrial, commercial, public and community facilities during specific times of day. The A-weighted scale is the most common measure of sound that combines the effect of multi-frequency

noises in a manner that stimulates the sensitivity and response of the human ear. The Octave band sound pressure level measures the sound pressure level measured in both decibels and in standard octave bands with a sound level meter. The Township adopted noise regulations are contained in Exhibit 2.

Exhibit 2: Adopted Noise Regulations

Time	7:00 – 22:00	22:00 – 7:00
Maximum A-weighted sound level standard (dBA)	60	55
Octave Band Center Frequency (Hz)	Octave Band Level Pressure Level (dBA)	
20-75	74	79
75-150	69	74
150-300	59	64
300-600	52	57
600-1200	46	51
1200-2400	40	45
2400-2800	34	39
4800-9600	32	37

Source: Township of Lakewood, Ordinances Board of Health, BH:16-1 et. al.

HYDROLOGY

According to the United States Geological Survey National Water-Quality Assessment (NAWQA) Program, the Township of Lakewood is located within the Long Island-New Jersey Coastal Drainages. The Long Island-New Jersey Coastal Drainages encompasses 6,000 square miles in New York and New Jersey, and includes all of Long Island, Staten Island, and the coastal drainages of New Jersey. The principal river systems within the drainage system are the Hackensack, Passaic, Raritan, Toms, Mullica, and Great Egg Harbor Rivers in New Jersey. The Toms (192 square miles), Mullica (569 square miles), and Great Harbor (347 square miles) all drain in the Atlantic Coastal physiographic region. Of the Atlantic Coastal rivers, the combined drainage area includes most of the Pinelands, which consists of water with pristine quality.

Lakewood is in the State Watershed Management Area 13, Barnegat Bay. The Barnegat Bay-Little Egg Harbor Watershed has been included in the United States Environmental Protection Agency's (USEPA) National Estuary Program, which was created by the Clean Water Act Amendments of 1987. The USEPA defines watersheds as the area of land that drains into a body of water such as a river, lake, stream, or bay. The watershed is separated

from other systems by high points in the area such as hills or slopes and includes not only the waterway itself, but also the entire land area that drains into it. The USEPA defines estuaries as partially enclosed bodies of water that are formed where fresh water mixes with salty seawater and are often known as bays, lagoons, harbors, inlets, or sounds. Wetlands adjacent to estuaries serve as natural filtration systems, stabilize shorelines, and prevent erosion.

The Barnegat Bay-Little Egg Harbor Watershed encompasses 660 square miles, and most of Ocean County and four municipalities in Monmouth County. The Barnegat Bay Watershed is comprised of three microtidal bays: Barnegat Bay, Manahawkin Bay, and Little Egg Harbor. The subwatersheds that Lakewood is contained in are the Metedeconk River and Kettle Creek subwatershed, which includes Reedy Creek.

On the local community scale there are 10 subwatersheds delineated by the NJDEP with a minimum basin area of 30,000 acres in Lakewood (Figure 9):

I. Metedeconk River Northern Branch (U.S. Route 9 to Interstate 195
II. Metedeconk River Northern Branch (confluence to U.S. Route 9)
III. Metedeconk River Southern Branch (U.S. Route 9 to Bennetts Pond)
IV. Metedeconk River Southern Branch (confluence to U.S. Route 9)
V. Metedeconk River (Beaverdam Creek to confluence)
VI. Toms River (Hope Chapel Road to Bowman Road)
VII. Toms River (Route 70 to Hope Chapel Road)
VIII. Toms River (Oak Ridge Parkway to Route 70)
IX. Kettle Creek (above Lake Riveria outlet)
X. Kettle Creek (below Lake Riveria outlet)

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Figure 9: Subwatersheds (HUC 14)
Lakewood Township
Ocean County, New Jersey

0 2,250 4,500 9,000 Feet

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Source: NJDEP
File Path: H:\LAKE\00030\Permits\lakeNRI_huc14_2.mxd

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Groundwater

Groundwater exists below the surface in pores between sedimentary particles and in the fissures of more solid rocks. Most groundwater lies at shallower depths in aquifers and accounts for about 20 times more than the total of surface waters on continents and islands. In the United States, 40 percent of groundwater supplies the public water supply. Specifically in New Jersey, more than one-half of New Jersey's drinking water is supplied by over 300,000 wells that serve more than 4 million people (Jones, 2004).

An important component of groundwater protection is the quality of the aquifer. An aquifer is a body of geologic material that can supply useful quantities of ground water to natural springs and water wells. Aquifers rely on precipitation seepage, hydric soils, and wetlands to continuingly supply an underlying aquifer. It is through the hydrologic cycle that aquifers recharge and discharge into the environment. In terms of human health, safe water drinking legislation and regulations have been enacted to ensure a supply of clean drinking water.

The Township's aquifers are underlain in the Kirkwood-Cohansey geological formation, which where formed during the Miocene Age. Since the 1920s, the United States Geological Survey has recorded groundwater levels in 196 wells in New Jersey. Jones (2004) lists two observation wells in close proximity to Lakewood in the Kirkwood-Cohansey aquifer that have been monitored daily since 1995. Located in Plumstead Township, the Fort Dix Military Reservation 75-feet deep observation well is located at Latitude 40°01'20" and Longitude 74°26'53." The land surface is about 180 feet above NGVD (1929).[1] The highest water table recording depth was 45.63 feet below land surface on June 15, 1998 and the lowest water table recording depth is 53.86 feet below land surface on November 18, 2002. The second observation well is the Lakehurst Naval Air Station located in Jackson Township at Latitude 40°02'37" and Longitude 74°21'27." This observation well is 38 feet deep and is screened at 23 feet to 38 feet deep. The land surface is 110 feet above NGVD (1929). The

[1]National Geodetic Vertical Datum of 1929 (NGVD 1929) represents the daily maximum elevation values for groundwater sites and daily mean values for surface-water sites, in feet above sea level.

highest water table recording depth is 22.86 ft below land surface on May 23, 1998 and the lowest water table recording depth is 28.81 ft below land surface on October 13-21, 1995.

Jones (2004) also reports that all of the record low water levels were in wells located in the Coastal Plain in 2004. These record low levels are the result of increasing withdrawals from wells that tap two confined aquifers: the "Atlantic City 800-foot sand of the Kirkwood Formation" and the Piney Point aquifer in the southern part of the State.

The NJDEP Water Supply Administration identifies the Kirkwood-Cohansey water source in Lakewood as a deficit/critical water supply planning area (Planning Area 15 & 16). The Lakewood Municipal Utilities Authority and the New Jersey American Water Company both have water allocation permits to provide water service in Lakewood. The Lakewood Township Municipal Utilities Authority (LTMUA) is permitted to withdraw 3,183.000 million gallons per year (MGY) or 335.760 million gallons per month (MGM) from the Kirkwood-Cohansey aquifer. The firm's capacity is 5.490 million gallons per day (MGD). NJDEP reports a total daily peak figure of 5.356 MGD, a monthly total demand of 170.935 MGM and a yearly total demand of 1231.029 MGY. The firm is operating at a surplus and operates eight wells. The New Jersey American Water Company (NJAWC) is permitted to withdraw 2,128.000 million gallons per year (MGY) of 238.440 million gallons per month (MGM) from the Kirkwood-Cohansey aquifer. The firm's capacity is 13.320 million gallons per day (MGD). NJDEP reports a total daily peak figure of 11.136 MGD, a monthly total demand of 317.294 MGM and a yearly total demand of 2,762.088 MGY. The firm is operating at a surplus and operates nine wells.

Figure 10 depicts the groundwater recharge areas in Lakewood based on a NJDEP ranking system of each county, watershed management conditions, landuse cover, soil suitability, and wetland areas. The ranking are listed from A to E based on their range and includes hydric soils (L), wetlands (W), and no recharge areas (X). The ranking system depicts the annual infiltration rate which expresses the rate of entry into a soil at a depth of water per case year. The following are the individual ranks delineated in Figure 8 and Exhibit 3:

Exhibit 3: Groundwater Recharge Areas in Lakewood

Rank	Range inches/year	Acres	Percent of Lakewood's total area
A	16 to 23	6,753.88	42.1%
B	11 to 15	4,093.63	25.5%
C	8 to 10	5.28	0.0%
D	1 to 7	1893.84	11.8%
E	0	648.27	4.0%
L	NA	515.98	3.2%
W	NA	2,118.72	13.2%
X	NA	0	0.0%
Total		16,029.60	100%

Source: New Jersey Department of Environmental Protection, Geographic Information System Information.

Areas that are ranked "A" or "B" are most likely to have high recharge ranks because there is less impervious coverage, and are most likely to contain land uses that are either open space or agricultural areas. Areas that are ranked "C" or "D" are most likely to have low recharge ranks because the dominate land use is urban and there is more likely to be greater impervious cover. The greatest recharge areas are in the undeveloped sections of the Township, in Ocean County Park, Lake Shenandoah County Park, Pine Park, and the Lakewood Country Club.

In the Kirkwood-Cohansey formation, there are 433 public wells with an average depth of 120 feet. Acknowledging that these wells are essential in providing public water and that these wells can be over-pumped and contaminated, the 1986 amendments to the Federal Safe Drinking Water Act (42, USC 300 et. seq.) directed States to develop a wellhead protection program plan for both community and non-community water-supply wells. The New Jersey wellhead protection plan delineates areas based on the on the time of travel, rate of pumping and aquifer characteristics (confinement status, thickness, transmissivity, porosity, and hydraulic gradient).

Time of travel is directly related to the distance the water has to travel to arrive at a well once its starts pumping. The time is divided into three tiers based on travel time to wells:

- Tier 1: 2 years (730 days)—This boundary is devised to account for the time travel to the outer boundary and presence of bacteria and viruses. The tier extends from the well to the boundary established to represent the 2 year time travel.

- Tier 2: 5 years (1,826 days)—This boundary is devised to account for the discharge of known pollution contamination, and the ability of the NJDEP to locate responsible parties. Although not an exact science, this boundary accounts for the "smearing effect" observed in pollution plumes and the acceleration of groundwater near a pumping well. The NJDEP is in the process of revising the procedures for pollution case management. The tier extends from the perimeter of Tier 1 to the boundary representing the 5 year time travel.
- Tier 3: 12 years (4,383 days)—This boundary is devised to demonstrate the complete zone of contribution and to ensure on-going monitoring of wellhead areas. The tier extends from the perimeter of Tier 2 to the outer boundary representing the 12 year time travel.

Each corresponding year delineation is comprised of pumping rates and related aquifer characteristics that determine the extent of the time of travel which are dependent on the individual aquifer bedrock geology and drainage direction. The aquifer confinement status is critical in determining the delineation of tiers. Tiers are delineated for unconfined wells; while confined wells all have a 50 foot buffer that surround the wells.

All public wellhead protection areas with the 50 foot buffer and delineated tiers are located in Figure 11. Wells that appear as points are all confined wells and the wellhead protection buffer is 50 feet. The unconfined and confined wells managed by the Lakewood Township Municipal Utilities Authority (LTMUA) and the New Jersey American Water Company (NJAWC) are as follows:

Unconfined Wells		Confined Wells	
LTMUA	**NJAWC**	**LTMUA**	**NJAWC**
29-06181	29-25246	29-04116	29-02231
29-17066	29-25247	29-05110	29-03324
29-17067	29-27498		29-04304
29-17068	29-27499		29-04834
29-06246/A			29-05496
			29-06549
Aquifer Source: Kirkwood		Aquifer Source: Englishtown	

The Township of Lakewood's wellhead protection areas are all contained in Suburban Planning Area (PA2).

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Figure 10: Groundwater Recharge Areas
Lakewood Township
Ocean County, New Jersey

0 2,250 4,500 9,000 Feet

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Source: NJDEP
File Path: H:\LAKE\00030\Permits\lakeNRI_gwra2.mxd

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Figure 11: Well Head Protection Areas
Lakewood Township
Ocean County, New Jersey

0 2,250 4,500 9,000 Feet

Prepared by: STK, September 20, 2006
Source: NJDEP
File Path: H:\LAKE\00030\Permits\lakeNRI_whpa2.mxd

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Surface water

The waterways contained in Lakewood are part of the Long Island-New Jersey Coastal Drainages (Figure 12). The two major waterway systems within the Township include the Metedeconk River and Kettle Creek. The Metedeconk River North Branch serves as a natural boundary with the Township of Howell in Monmouth County. The South Branch of the Metedeconk River includes the following lakes: Lake Shenandoah, Lake Carasaljo, and Lake Manetta. Kettle Creek is in the southern portion of the Township and includes Lake Waddill. NJDEP identifies the waterways and the surface water quality standards as follows:

- Cabinfield Branch—Category One
- Cedar Bridge Branch—Category Two
- Cotterals Branch—Category One
- Green Branch—Category Two
- Kettle Creek—Category Two
- Metedeconk River (North Branch)—Category One
- Metedeconk River (South Branch)—Category One
- Schoolhouse Branch—Category One
- Tarkilm Branch—Category Two
- Watering Place Branch—Category One

In New Jersey, all waterbodies, unless otherwise designated as an Outstanding Natural Resource or Category One (C1), are subject to the antidegradation policies set forth in N.J.A.C. 7:9B-1.5(d). Through the rulemaking process, NJDEP has designated C1 waterways because there have been measurable changes in water quality and greater protection of these water resources is necessary. C1 waterways have been designated based on their exceptional qualities of ecological significance, recreational or aesthetic significance, water supply significance, fishery resources, shellfisheries; or, their location within publicly-preserved open space. As part of the new Stormwater Management Rules (N.J.A.C. 7:8), additional protection has been afforded to C1 waterbodies. This includes a 300 foot buffer requirement, a new best management practice to meet antidegradation standards.

The Federal Water Pollution Control Act of 1972 (33 U.S.C. 1251 et. seq.), commonly referred to as the Clean Water Act, requires the State to report to the United States Environmental Protection Agency a list of impaired waters and proposed protection measures. The *New Jersey 2004 Integrated Water Quality Monitoring and Assessment Report* (2004) indicates that the tributaries that drain into the Atlantic Ocean from Long Branch to Cape May have dissolved oxygen and fecal coliform along its waterways. Barnegat Bay area also is subject to dissolved oxygen, fecal coliform and total coliform. The following waterbodies in Lakewood are impaired:

Site ID	Location	Parameters
Lake Carasaljo, North Beach and South Beach	Carasaljo Lake-13	Fecal Coliform
Lake Carasaljo	Carasaljo Lake-13	Phosphorus
AN0515	Kettle Creek at New Hampshire Avenue	Benthic Macroinvertebrates
01408100	Metedeconk River (North Branch)	Phosphorus, Dissolved Oxygen, Nitrate, Dissolved Solids, Total Suspended Solids, Unionized Ammonia, Fecal Coliform, Temperature, pH
AN0507	School House Branch (Cabinfield Branch) at Lanes Mill Road	Benthic Macroinvertebrates
AN0511	Metedeconk River (South Branch) at Cedar Bridge Road	Benthic Macroinvertebrates

Source: New Jersey Department of Environmental Protection Water Monitoring and Standards. New Jersey 2004 Integrated Water Quality Monitoring and Assessment Report. Web search February 21, 2006.

Flood prone areas, including lowland areas located adjacent to a river or a lake, are depicted on Figure 13. Floodplains are designated by the frequency of the flood that is large enough to cover them. The Federal Emergency Management Agency (FEMA) determines the 100-year floodplain and the 500-year floodplain based on analysis of records of river flow, storm tides, and rainfall, and information obtained through consultation with communities. The information obtained at the local level includes floodplain topographic surveys, as well as hydrologic and hydraulic analysis. Typically, only drainage areas that are greater than one square mile are studied. The waterways in Lakewood are located within the 100-year floodplain.

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Figure 12: Surface Water Quality
Lakewood Township
Ocean County, New Jersey

0 2,250 4,500 9,000 Feet

Prepared by: STK, September 20, 2006
Source: NJDEP
File Path: H:\LAKE\00030\Permits\lakeNRI_swqs2.mxd

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Figure 13: FEMA Flood Hazard Areas
Lakewood Township
Ocean County, New Jersey

0 2,250 4,500 9,000 Feet

N

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

Prepared by: STK, September 20, 2006
Source: NJDEP; FEMA
File Path: H:\LAKE\00030\Permits\lakeNRI_flood2.mxd

Wetlands

The United States Environmental Protection Agency (USEPA) defines wetlands as areas where water covers the soil, or is present either at or near the surface of the soil all year, or for varying periods of time during the year, including during the growing season. These conditions lead to the development of unique aquatic and terrestrial species and soils that support types of plant and animal communities living in and on the soil.

According to the United States Fish and Wildlife Services, *Wetlands and Deepwater Habitats Classification National Wetlands Inventory Mapping Code*, a total of 1,887.96 acres or 11.8 percent of Lakewood's total land area. These wetlands include the following:

Palustrine Wetland
Atlantic White Cedar
Coniferous scrub/ shrub
Coniferous wooded
Deciduous scrub/ shrub
Deciduous wooded
Herbaceous
Mixed Forested (Coniferous Dominated)
Mixed Forested Wetland (Deciduous Dominated
Mixed scrub/ shrub (Coniferous Dominated)
Mixed scrub/ shrub (Deciduous Dominated)

Disturbed/Modified
Agriculture
Disturbed
Managed
Right-of-way

The United States Department of Agriculture Natural Conservation Services notes fifteen hydric soils that support ecological conditions for wetlands (Figure 6). Appendix B lists wetland plant communities identified in Ocean County that may occur in Lakewood.

In Lakewood the following are characteristics of freshwater wetlands (Figure 14):

I. Palustrine System—This system includes areas that are grouped as vegetated wetlands (marsh, swamp, bog, fen, and prairie) and are small, shallow, permanent or intermittent water bodies, which are often called ponds. All water regimes, except subtidal, are included. Wetlands are delineated based on the dominate type of vegetation, a total land area less than 20 acres, low water depth and relative salinity. The following species are dominant emergent plants:

Pineland Characteristic Species

Twig rush
Cladium mariscoides

Bayonet rush
Juncus militaris Bigelow

Canada rush
Juncus Canadensis

Pipeworts
Eriocaulon spp.

Bull sedge
Carex bullata

Cottongrass
Eriophorum virginicum

Golden club
Orontium aquaticum

Lowland broomsedge
Andropogon virginicus var. abbreviatus

Manna grass
Glyceria obtuse

Beakrushes
Rhynchospora alga and others

Non-Pineland Characteristic Species

Cattails
Typha latifolia

Common reed
Phragmites australis

Water willow
Justicia americana (L.) Vahl

Purple loosestrife
Lythrum salicaria L.

Rice cutgrass
Leersia oryzoides (L.) Sw.

Burreeds
Sparganium eurycarpum

Arrow arum
Peltandra virginica (L.) Schott

Goldenrods
Solidago sp.

Woolgrass
Scirpus cyperinus (L.) Kunth

Soft ruch
Rubus chamaemorus L.

Pickerelweed
Pontederia cordata L.
Smartweed
Polygonum coccineum

Three-way sedge
Dulichium arundinaceum (L.) Britt.

Sedge
Carex collinsii

a. Atlantic White Cedar Wetland—This wetland accounts for 148.66 acres or 7.9 percent of wetland areas in Lakewood, and is most prevalent along the Cotterals Branch. Woody vegetation in this wetland is at least 6 meters (20 feet) tall. In areas where the woody vegetation is dominated by shrubs, the vegetation is less than 6 m (20 feet) tall. The dominate vegetation is the Atlantic white cedar

(*Chamaecyparis thyoides*); however Pitch pine (*Pinus rigida*) is often present. Common species found in the shrub layer include Dangleberry (*Gaylussacia frondosa*), High-bush blueberry (*Vaccinium corymbosum*), Swamp azalea (*Rhododendron viscosum* (L.) Torr.), Fetterbush (*Leucothoe racemosa*), Sweet pepperbush (*Clethra alnifolia*), and Bayberry (*Morella rubra* Lour.). Plants associated with canopy openings include the Pitcher plant (*Sarracenia* ssp. *jonesi*), Sundew (*Drosera spp.*), and Chain fern (*Woodwardia areolata* (L.) T. Moore).

b. Coniferous scrub/shrub wetland—This wetland encompasses 27.58 acres or 1.5 percent of wetland areas in Lakewood. Woody vegetation in this wetland is less than 6 meters (20 feet) tall. Dominate vegetative species include both broad-leafed and needle-leafed evergreens, true shrubs, young trees (saplings), and trees or shrubs that are small or stunted because of environmental conditions. The substrate is saturated to surface for extended periods during the growing season.

c. Coniferous wooded wetland—This wetland encompasses 379.56 acres or 20.1 percent of wetland areas in Lakewood. This wetland occurs on the South Branch Metedeconck River, Cedar Bridge Branch, Watering Place Branch, and Kettle Creek. Woody vegetation in this wetland is at least 6 meters (20 feet) tall. Dominate woody vegetation include needle-leafed evergreens. There are two saturation scenarios present in this wetland: either the substrate is saturated to the surface for extended periods during the growing season; or, surface water is present for extended periods especially early in the growing season.

d. Deciduous scrub/shrub wetland—This wetland encompasses 45.16 acres or 2.4 percent of wetland areas in Lakewood. This wetland can also be characterized as emergent, defined as an area that is flooded

either seasonally or permanently. Woody vegetation in this wetland is less than 6 meters (20 feet) tall. Dominant vegetative species include broad-leafed deciduous trees, true shrubs, young trees (saplings), and trees or shrubs that are small or stunted because of environmental conditions. The substrate is saturated to surface for extended periods during the growing season.

e. Deciduous wooded wetland—This wetland encompasses 679.5 acres or 36 percent of wetland areas in Lakewood. This wetland occurs on the North and South Branches of the Metedeconck River, Cabinfield Branch, Watering Place Branch, and Kettle Creek. This wetland can also be characterized as emergent, defined as an area that is flooded either seasonally or permanently. Woody vegetation in this wetland is at least 6 meters (20 feet) tall. Dominate vegetative species include broad-leafed deciduous trees, true shrubs, young trees (saplings), and trees or shrubs that are small or stunted because of environmental conditions. There are two saturation scenarios present in this wetland: either the substrate is saturated to the surface for extended periods during the growing season; or, surface water is present for extended periods especially early in the growing season.

f. Herbaceous Wetlands—This wetland encompasses 15.96 acres or 0.8 percent of wetland areas in Lakewood. This wetland can also be characterized as emergent, defined as an area that is flooded either seasonally or permanently. Emergent vegetative species are perennial plants and are characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. In some instances herbaceous wetlands may have broad-leafed deciduous trees. There are two saturation scenarios present in this wetland: either the substrate is saturated to the surface for extended periods during the growing season; or, surface water is present for extended periods especially early in the growing season.

g. Mixed Forested Wetlands (Coniferous Dominated)—This wetland encompasses 183.48 or 9.7 percent of wetland areas in Lakewood. These wetlands occur along Water Place Branch, Kettle Creek and in Lake Shenandoah. Woody vegetation in this wetland is at least 6 meters (20 feet) tall and includes both needle-leafed evergreen and broad-leafed deciduous. As the name implies, there are relatively more needle-leafed evergreens (> 50 percent and < 75 percent) than broad-leafed deciduous vegetative species. These areas exhibit three relative saturation scenarios: the substrate is saturated to the surface for extended periods during the growing season; surface water is present for extended periods, especially early in the growing season; or, there is seasonal flooding.

h. Mixed Forested Wetlands (Deciduous Dominated)—This wetland encompasses 183.48 or 9.7 percent of wetland areas in Lakewood. These wetlands occur along Water Place Branch, Kettle Creek, and Lake Shenandoah. Woody vegetation in this wetland is at least 6 meters (20 feet) tall and includes both needle-leafed evergreen and broad-leafed deciduous. There are relatively more broad-leafed deciduous (> 50 percent and < 75 percent) than needle-leafed evergreens vegetative species. These areas exhibit three relative saturation scenarios: the substrate is saturated to the surface for extended periods during the growing season; surface water is present for extended periods, especially early in the growing season; or, there is seasonal flooding.

i. Mixed Scrub/Shrub Wetlands (Coniferous Dominated)—This wetland encompasses 2.32 acres or 0.1 percent of wetland areas in Lakewood. Woody vegetation in this wetland is less than 6 m (20 feet) and includes true shrubs, young trees (saplings), and trees or shrubs that are small or stunted because of environmental conditions,

needle-leafed evergreen that are young or stunted trees and broad-leafed deciduous. These areas exhibit three relative saturation scenarios: the substrate is saturated to the surface for extended periods during the growing season; surface water is present for extended periods, especially early in the growing season; or, there is seasonal flooding.

j. Mixed Scrub/Shrub Wetlands (Deciduous Dominated)—This wetland encompasses 32.35 acres or 1.7 percent of wetland areas in Lakewood. Woody vegetation in this wetland is less than 6 meters (20 feet) tall, and includes true shrubs, young trees (saplings), and trees or shrubs that are small or stunted because of environmental conditions, as well as broad-leafed deciduous, young or stunted needle-leafed evergreen trees. These areas exhibit three relative saturation scenarios: the substrate is saturated to the surface for extended periods during the growing season; surface water is present for extended periods, especially early in the growing season; or, there is seasonal flooding. The substrate is saturated to the surface for extended periods during the growing season, but surface water is seldom present.

II. Disturbed/Modified Wetland—These areas are former wetlands that have been converted to landfills, agricultural, and other land uses. All the soils in these areas retain their hydric properties.

a. Agricultural Wetlands—These areas encompass 3.43 acres or 0.2 percent of wetland areas in Lakewood.

b. Disturbed Wetlands—These areas encompass 22.47 acres or 1.2 percent of wetland areas in Lakewood. These wetlands occur along the Cedar Bridge Branch. Areas described as disturbed refer to wetlands that have been cleared, filled, or excavated.

c. Managed Wetlands—These areas encompass 30.71 acres or 1.6 percent of wetland areas in Lakewood. Managed wetlands refer to wetlands that are managed for miscellaneous types of agriculture, such as orchards, nurseries, live stock feed lots, sod and seed farms, cranberry and blueberry farms, poultry farms, horse farms, and other specialty farms. There are few managed wetlands along the North and South Branches of the Metedeconk River.

d. Wetland Rights-of-Way—These areas encompass 26.32 acres or 1.4 percent of wetland areas in Lakewood. There is a small portion delineated adjacent to the North Branch of the Metedeconk River.

Lakewood is included in the Barnegat Bay and tributaries priority wetland (USEPA—Region 2 Marine and Wetlands Protection Branch, 1994). The purpose of the priority wetland designation is to protect identified resources from potential adverse impacts of dredge or fill material that is discharged into waterways, as well as recognize regional planning efforts.

The Barnegat Bay resource values identified for protection are:

- Fishery and nursery habitat
- Shellfish nursery and habitat
- Estuarine and palustrine wetlands.
- Wildlife habitat for game and nongame species, including indigenous state listed herptiles (Pine barrens treefrog, Tiger salamander).

The USEPA recognizes that the adverse impacts to this wetland include residential and commercial development pressures, as the Barnegat Bay is a popular shore area.

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Figure 14: Freshwater Wetlands
Lakewood Township
Ocean County, New Jersey

0 2,250 4,500 9,000 Feet

Prepared by: STK, September 25, 2006
Source: NJDEP
File Path: H:\LAKE\00030\Permits\lakeNRI_wet2.mxd

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

WILDLIFE AND VEGETATION

The *New Jersey's Landscape Project, Version 2.0,* prepared by the NJDEP Division of Fish and Wildlife, Endangered and Nongame Species Program, indicates that the Township of Lakewood is in the Pinelands Landscapes. The Pinelands Landscape encompasses all or parts of Atlantic, Ocean, Burlington, Camden, Cape May, Cumberland, and Gloucester counties. This area is an internationally-recognized ecosystem as its waterways support aquatic communities that are unique among the Mid-Atlantic states. In addition, the Pinelands Landscape contains numerous wetland systems that support reptile, amphibian and invertebrate populations, as well as numerous insect species, and Neotropical bird populations.

The Landscape Project lists Federal and State-endangered, threatened, and priority species by habitat type based on the Natural Heritage Program's Biological Conservation Database. The information contained in the Landscape Project is peer-reviewed and scientifically-based. Using this data, the Township is able to locate critical habitat based on the conservation status of the species that are present in the area. Habitat types are categorized as emergent, forested wetland, forest, grassland, and beach in the Landscape Project and are ranked on a scale of 1 to 5, as follows:

Rank	Indication
1	Suitable habitat, no special concern, threatened or endangered species sighted
2	Habitat patch with species of special concern present
3	Habitat patch with State-threatened species present
4	Habitat patch with State-endangered species present
5	Habitat patch with Federal-endangered species present

Lakewood supports a variety of suitable habitats for wildlife species, including suitable Bald eagle foraging area (Figure 15). In Lakewood, 6,826.43 acres or 75.9 percent of the total land area is forest cover, 1,733.79 acres or 19.3 percent of the total land area is forested wetland, 221.11 acres or 1.2 percent of the total land area is grassland, 56.88 acres or 0.6 percent of the total land area is beach, and 46.92 acres or 0.5 percent of the total land area is emergent wetlands. Suitable Bald eagle foraging area encompasses 221.11 acres or 2.5 percent of Lakewood's total land area.

Exhibit 4 lists endangered and threatened wildlife species that are contained in Lakewood based on the species habitat preferences. The Township contains suitable foraging area for the Federally-threatened and State-endangered Bald eagle (*Haliaeetus leucocephalus*). Lakewood supports two State endangered species: Least tern (*Sterna antillarum*) and Red-shouldered hawk (*Buteo lineatus*). The Red-shouldered hawk is an area-sensitive species that prefers vast contiguous freshwater wetlands, such as Hardwood or mixed hardwood/cedar swamps containing Red maple (*Acer rubrum*), Black gum (*Nyssa sylvatica*), Sassafrass (*Sassafras albidum*), Sweetbay magnolia (*Magnolia virginiana*), and Atlantic white cedar (Chamaecyparis thyoides), and large forested tracts surrounded by oak/pine forests or agricultural fields.

Lakewood also supports three (3) State threatened bird species and two (2) State threatened herptile species, including the Cooper's hawk (*Accipiter cooperii*) and the Northern pine snake (*Pituophis melanoleucus melanoleucus*). As a "resident" species, the Copper's hawk utilizes large, remote Red maple (*Acer rubrum*) or Black gum (*Nyssa sylvatica*) swamps and, on occasion, Atlantic white cedar (*Chamaecyparis thyoides*) swamps for breeding. In the winter, its habitat needs are less restrictive and the Cooper's hawks forage within a variety of forest types, as well as woodland edges. In addition, Lakewood supports eight (8) priority bird species, such as the Baltimore oriole (*Icterus galbula*) and five (5) priority herptile species, including the Eastern box turtle (*Terrapene carolina Carolina*). The Eastern box turtle prefers woods and meadows. In hot, dry weather the turtles may be found in muddy areas or shallow pools, or hiding under rotten logs or other decaying vegetation

Exhibit 4: Pinelands Landscapes Endangered, Threatened and Priority Species by Habitat Type

	Emergent Wetlands	Forested Wetland	Forest	Grassland	Beach
Birds					
Federal Threatened					
Bald eagle Foraging Area (NB: Non-breeding population only) *Haliaeetus leucocephalus*					
State Endangered					
Least tern *Sterna antillarum*					**X** **(Suitable)**
Red-shouldered hawk *Buteo lineatus*			**X**		
State Threatened					
Barred owl *Strix varia*		**X**	**X**		
Cooper's hawk *Accipiter cooperii*		**X**	**X**		
Red-headed woodpecker *Melanerpes erythrocephalus*			**X**		
Priority Species[2]					
Baltimore oriole *Icterus galbula*			**X**		
Black and white warbler *Mniotilta varia*			**X**		
Blue-winged warbler *Vermivora pinus*			**X**		
Brown thrasher *Toxostoma rufum*			**X**		

[2]Although not listed in the NJDEP Landscape GIS files, the Township Environmental Commission notes the presence of the Blue heron in Lakewood. The Landscape Project indicates that there are no known areas in Lakewood that contain the priority species Great blue heron or Little blue heron. Habitat suitable for Great blue herons includes emergent wetlands, forested wetlands, and forest areas, while Little blue herons suitable habitat is emergent wetlands areas.

	Emergent Wetlands	Forested Wetland	Forest	Grassland	Beach
Priority Species continued					
Carolina chickadee *Parus carolinensis*			X		
Colonial waterbird Forging Habitat	X				
Eastern towhee *Pipilo erythrophthalmus*		X	X		
Eastern wood-pewee *Contopus virens*			X		
Gray catbird *Dumetella carolinensis*		X	X		
Pine warbler *Dendroica pinus*		X	X		
Purple finch *Carpodacus purpureus*			X		
Red-eyed vireo *Vireo olivaceus*			X		
Scarlet tanager *Piranga olivacea*			X		
White eyed vireo *Vireo griseus*		X	X		
Wood thrush *Hylocichla mustelina*		X	X		
Herptiles					
State Threatened					
Northern pine snake *Pituophis melanoleucus melanoleucus*			X	X	
Pine barrens treefrog *Hyla andersonii*		X	X		

	Emergent Wetlands	Forested Wetland	Forest	Grassland	Beach
Priority Species					
Carpenter frog *Rana virgatipes*		**X**			
Eastern box turtle *Terrapene carolina Carolina*			**X**	**X**	
Fowler's toad *Bufo fowleri*		**X**			
Northern spring salamander *Gyrinophilus porphyriticus*			**X**		
Spotted turtle *Clemmys guttata*		**X**			

Source: New Jersey Department of Environmental Protection, Division of Fish and Wildlife, Endangered and Nongame Species Program—*New Jersey's Landscape Project, Version 2.0.* Web Search February 22, 2006.

Bald Eagle Foraging Area

The Township contains two Bald eagle (*Haliaeetus leucocephalus*) foraging areas on Lake Shenandoah and Lake Carasaljo. Suitable Bald eagle habitat contains areas with forests that are associated with bodies of water. They prefer areas that are free of human disturbance, and build large nests in "supercanopy" trees, which are much taller than the immediate surrounding trees. Typical foraging habitats include large perch trees, which are critical for hunting fish and other waterfowl.

Forest

Forested area makes up a large part of Lakewood's ecology. In the undeveloped portions of the Township, there are contiguous forested areas which provide suitable habitat for identified species. There are twenty-two known endangered, threatened, and priority species that are located within forested areas. Forested supported habitat is utilized by the State-endangered bird species the Red-shouldered hawk and the State-threatened Barred owl, Cooper's hawk, and Red-headed woodpecker. Priority bird species include the Baltimore oriole, Black-and-white warbler, Blue-winged warbler, Brown thrasher, Carolina chickadee, Eastern towhee, Eastern wood-pewee, Gray catbird, Pine warbler, Purple finch, Red-eyed vireo, Scarlet tanager, White eyed vireo, and Wood thrush. In addition, the Township contains suitable habitat for State-threatened herptiles species, including the Northern pine snake and Pine barrens treefrog and the priority species, the Eastern box turtle and Northern spring salamander.

The Pinelands ecology is suitable for the State-threatened Barred owl, also known as the "swamp owl," which is known to breed in the Pinelands. According to Beans and Niles (2003), the Barred owl is a "resident" species and prefers remote, contiguous, old-growth wetland forests, and is often found with species, such as the State-threatened Cooper's hawk. In addition, the state threatened Northern pine snake found in the Township prefers dry pine-oak forests growing on very infertile sandy soil such as Lakehurst and Lakewood.

Forested Wetlands

Forested wetland habitat forms a natural band along the North and South Branches of the Metedeconk River, the Watering Place Branch, the Cotterales Branch, Kettle Creek and Cedar Bridge Branch. The Township provides suitable habitat for eleven known endangered, threatened, and priority species that are located within forested wetland areas. Forested wetland habitat is suitable for the State-threatened Barred owl and Cooper's hawk and the State priority Eastern towhee, Gray catbird, Pine warbler, White eyed vireo, and Wood thrush bird species. In addition, the Township contains suitable habitat for the Pine barren's treefrog a State-threatened herptile and the Carpenter frog, Fowler's toad, and Spotted turtle priority species. Habitat preferences for the Spotted turtles include marshy meadows, bogs, swamps, small ponds, ditches, and other shallow bodies of freshwater.

Grassland

Grasslands encompass an area in the northeastern section of Lakewood, near the Cabinfield Branch. The Township contains habitat that is suitable for the Eastern box turtle and the Northern spring salamander, both of which are State-herptile priority species.

Beach

There is beach-suitable habitat for the Federally-threatened and State-endangered Piping Plover near the Cedar Bridge Branch. The Piping Plover prefers flat areas with sparse vegetation, such as the American beach grass or Sea rocket.

Emergent

Emergent wetland areas are located along the North Branch of the Metedeconck River, Kettle Creek, and Lake Carasaljo, and provide suitable habitat for the foraging area of the Colonial waterbird.

Vegetative Species

Exhibit 5 lists the endangered and threatened vegetative species from the Natural Heritage Database. NJDEP documents rare vegetative species and ecological community habitat as part of the Natural Heritage Database, which is administered through the Office of Natural Lands Management. The database is based on the presences of a rare plant species/ecological community in a GIS grid. There are 100 grid cells, each of 358 or 372 acres in size. Recording of a plant species is based on an occurrence in a grid cell, meaning that the whole grid will be coded as containing said species. However, the species may not be located in every grid cell. Therefore, site-specific studies may be a better and more accurate determinant of the presence or absence of a specific species at a site.

Exhibit 5: Federal, State and Rare Vegetative Species

	Global[3]	Federal[4]	State[5]	Rare

[3]**GLOBAL RANK**

G1 Critically-imperiled globally because of extreme rarity (5 or fewer occurrences), or because of some factor(s) making it especially vulnerable to extinction.
G2 Imperiled globally because of rarity (6-20 occurrences), or because of some other factor(s) making it very vulnerable to extinction throughout its range.
G3 Either very rare and local throughout its range (21 to 100 occurrences), or found locally (even abundantly at some of its locations) in a restricted range (e.g. a physiographic region), or because of some other factor(s) making it vulnerable to extinction throughout its range.
G4 Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.
G5 Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.
GH Historically known, with the expectation that it may be rediscovered.
GX Species believed to be extinct throughout its range with no likelihood that it will be rediscovered.
GU Possibly in peril range-wide, but status uncertain; more information is needed.
G? Species has not yet been ranked.
GNE Exotic in the United States (e.g. Japanese honeysuckle).
Q If a taxon is treated as a full species, a qualifying "Q" is added after the global rank to denote its questionable taxonomic assignment.
T Global ranks containing a "T" qualifier denote that the infraspecific taxon is being ranked differently than the full species. For example, *Polygala cruciata* var. *aquilonia* is ranked G5T4 the full species is ranked G5 and the expression *aquilonia* is ranked G4.

[4]**FEDERAL RANK**

E Formally-listed as Endangered under the Endangered Species Act of 1973 & **T** Formally listed as Threatened under the Endangered Species Act of 1973.
PE Proposed Endangered. & **PT** Proposed Threatened.
C1 Taxa for which the Service currently has on file substantial information on biological vulnerability and threat(s) to support the appropriateness of proposing to list them as endangered or threatened species.
C1* Taxa which may be possibly extinct (although persuasive documentation of extinction has not been made).

Species of Concern (Federal species of concern includes those species formerly considered C2 candidates as described below).

C2 Taxa for which the information now in the possession of the Service indicates that proposing to list them as endangered or threatened species is possibly appropriate, but for which substantial data on biological vulnerability and threat(s) are not currently known or on file to support the immediate preparation of rules.
C3 Taxa that are no longer being considered for listing as threatened or endangered species. Such taxa are further coded to indicate three subcategories, depending on the reason(s) for removal from consideration.
3A Taxa for which the Service has persuasive evidence of extinction.
3B Names that, on the basis of current taxonomic understanding, do not represent taxa meeting the Act's definition of "species."
3C Taxa that have proven to be more abundant or widespread than was previously believed.
SA Similarity of appearance of species.

[5]**STATE RANK**

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

	Global	Federal			State			Rare
		Endangered	Threatened	Rank	Endangered	Threatened	Rank	
Curly Grass Fern *Schizaea pusilla*	G3			3C			LP	X
Low Rough Aster *Aster radula*	G5						LP	
Parker's Pipewort *Eriocaulon parkeri*	G3			3C				
Pine Barren Bellwort *Uvularia puberula* var. *nitida*	G5T3				X			X
Pine Barren Boneset *Eupatorium resinosum*	G3			C2	X		LP	X
Swamp Pink *Helonias bullata*	G3		X		X		LP	X
Pine Barren Reedgrass *Calmovilfa brevipilas*	G4			3C			LP	X

Sources: New Jersey Department of Environmental Protection Office of Natural Lands Management. Natural Heritage Database. Web Search July 28, 2005.
United States Department of Interior Fish and Wildlife Services. National Conservation Training Center Conservation Library.

LP Pinelands: a species listed by the Pinelands Commission as endangered or threatened within their legal jurisdiction.

As part of the directives of the Freshwater Wetlands Protection Act (N.J.S.A. 13:9B-1 et. seq.), NJDEP has provided protocols for determining wetland ecologies with exceptional resource value and provides specific habitat discussion for Swamp pink (*Helonias bullata*), a Federally-threatened and State-endangered vegetative species. The identification of suitable wetland habitat includes defining the presence, absence, and distribution of each species, and identifying associated vegetative species. The most important factor affecting the occurrence of Swamp pink is the hydrologic regime of the habitat, and the dominate woodland species that include both evergreen and deciduous forests, such as Pitch pine (*Pinus rigida*), Atlantic white cedar (*Chamaecyparis thyoides*), Sour gum (*Nyssa sylvatica*), and Red maple (*Acer rubrum*). Swamp pink is more abundant in the southern Coastal Plain counties, and reaches as far north as Middlesex and Monmouth counties and, historically, in Mercer County.

Swamp pink is a member of the Lily family (*Liliaceae*) and is a smooth perennial herb that measures between 9-25 cm (4-10 in) in length and 2-4 cm (0.8-1.6 in) in width and has evergreen, parallel-veined, oblong leaves, which form a basal rosette. A single flower stalk appears in the spring (mid-late April) and features 30 to 50 pink flowers. During the winter months, the leaves of the Swamp pink lie flat or slightly raised from the ground and are often obscured by leaf litter. Swamp pink prefers a variety of wetland habitats: swampy forested wetlands bordering meandering streams, headwater wetlands, sphagnous, hummocky, as well as dense Atlantic white cedar swamps, bogs, and spring seepage areas. Headwater wetlands habitats tend to be extremely sensitive. Therefore, NJDEP generally discourages direct discharge of stormwater into Swamp pink habitats. In addition, the United States Fish and Wildlife Services require that upland buffers of greater than 150 feet be in place for new construction and development.

Listed by the NJDEP Land Use Regulation Program, plant species found in vegetative association with Swamp pink are as follows:

American larch *Larix lariciana*	Atlantic white cedar *Chamaecyparis thyoides*	Black gum *Nyssa sylvatica*
Back spruce *Picea mariana*	Carolina holly *Ilex ambigua*	Cinnamon fern *Osmunda cinnamomea*
Collin's sedge *Carex collinsii*	Common elderberry *Sambucus canadensis*	Common winterberry *Ilex verticillata*

Eastern hemlock
Tsuga canadensis

Golden club
Orontium aquaticum

Highbush blueberry
Vaccinium corymbosum

Lesser prickly sedge
Carex muricata

Mountain blueberry
Vaccinium constablei

Mountain laurel
Kalmia latifolia

Northern long sedge
Carex folliculata

Northern spicebush
Lindera benzoin

Red alder
Alnus serrulata

Red maple
Acer rubrum

Red spruce
Picea rubens

Rough-leaved aster
Aster radula

Smooth azelea
Rhododendron arborescens

Sphagnum moss
Sphagnum spp.

Swamp rose
Rosa palustris

Sweetbay magnolia
Magnolia virginiana

Pitch pine
Pinus rigida

Purple-stemmed aster
Aster puniceus

Three leaf gold thread
Coptis trifolia

Yellow clintonia
Clintonia borealis

Virginia bugleweed
Lycopus virgincus

Witherod
Viburnum cassinoides

White pine
Pinus strobus

Woodland horsetail
Equisetum sylvaticum

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Figure 15: Threatened and Endangered Species Habitat Lakewood Township Ocean County, New Jersey

0 2,250 4,500 9,000 Feet

Prepared by: STK, September 25, 2006
Source: NJDEP; Landscape Project Data
File Path: H:\LAKE\00030\Permits\lakeNRI_TnE2.mxd

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

APPENDIX A

Soil Classification

The United States Department of Agricultural, Natural Resources Conservation Services Soil Data Mart (USDA—NRC, Soils Data Mart) provides technical data on each soil series described below. The following is a description of each soil formation.

Descriptions of Horizons

A1—Surface layer; color varies from very dark gray to black because organic matter is incorporated into the soil

A2—Subsurface; zone of removal of nutrients, iron, and/or clay by downward moving water to lower depths of profile. Usually lighter colored then surface layer

B—Subsoil; acts as a filter accumulating or catching downward moving components removed from subsurface layer. Usually dark iron colored and may contain clay particles

C—Substratum; transition area between soil and parent material; clay layers and mineral particles may be found in this horizon; color is usually lighter than subsoil

Source: New Jersey Pinelands Commission. On-line Curriculum Project, Pinelands Soils Unit Lesson Plans, Grades 7-8. Web Search May 13, 2005.

I. Atsion series

The Atsion series formed in the coastal plain sediments and the Atison sand (AtsA) is contained in Lakewood. AtsA series consists of deep, poorly drained soils on uplands with a slope that ranges from 0 to 2 percent. Typically, these soils have a dark gray sand surface layer over 10 inches of light gray sand. The subsoil from 18 to 24 inches is very dark brown sand, and from 24 to 36 inches is very dark gray sand. The substratum from 36 to 60 inches is brown-loose sand. The depth to a restrictive feature is 16 to 40 inches to an ortstein. The slowest soil permeability within a depth of 60 inches is rapid. Available water capacity to a depth of 60 inches is low, and shrink swell potential is low. Annual flooding is rare, and annual ponding is none.

II. Berryland Series

The Berryland series formed in the coastal plain sediments and consists of deep, very poorly drained soils on uplands with a slope that ranges from 0 to 2 percent. Typically, these soils have a black sand surface layer that is 10 inches thick over 2 inches of gray sand. The subsoil from 12 to 20 inches is firm and consists of weakly cemented dark reddish brown loamy sand. From 20 to 30 inches the subsoil is dark gray-loose sand. The substratum from 30 to 72 inches is grayish brown stratified loose sand. The depth to a restrictive feature is 10 to 16 inches to an ortstein. The slowest soil permeability within a depth of 60 inches is moderately

rapid. Available water capacity to a depth of 60 inches is low, and shrink swell potential is low. Annual flooding and ponding is occasional.

The series contains two components in Lakewood:

Berryland sand, rarely flooded (BerAr)

Berryland sand, frequently flooded (BerAt).

III. Downer Series

The Downer series formed in the acidic moderately coarse-textured coastal plain sediments. This series consists of very deep and well drained soils on uplands.

In Lakewood, the Downer series is comprised of two different soil formations. The first is comprised of the following:

Downer loamy sand (DocB)—The DocB has a slope that ranges from 0 to 5 percent.

Downer sandy loam (DoeA)—The DoeA has a slope that ranges from 0 to 2 percent.

Downer sandy loam (DoeB)—The DoeB has a slope that ranges from 2 to 5 percent.

Typically, these soils have a dark grayish brown, loamy sand surface layer that is 18 inches thick. The subsoil from 18 to 30 inches is a yellowish-brown sandy loam. The substratum from 30 to 40 inches is loose loamy sand. Below 40 inches, the range includes stratified layers of gravel to sandy clay loam. The minimum depth to the top of a restrictive feature is greater than 60 inches. The slowest soil permeability within a depth of 60 inches is moderate. Available water capacity to a depth of 60 inches is moderate, and shrink swell potential is low. Annual flooding and ponding is none. The slope ranges from 0 to 30 percent.

The second soil formation is the Downer sandy loam, gravelly substratum (DofgB), which has a slope of 2 to 5 percent. Typically, these soils have a grayish brown, sandy loam surface layer 4 inches thick. The subsoil from 4 to 23 inches is yellowish-brown or strong brown sandy loam, from 23 to 35 inches is yellowish-red gravelly loamy sand the substratum, and from 35 to 74 inches is yellowish-red, yellow, and very pale brown stratified fine sand to very gravelly sand with strong brown sandy loam or loamy sand thin lamellae. Annual flooding and ponding is none. The slope ranges from 0 to 5 percent.

IV. Evesboro Series

The Evesboro series formed in the acidic sandy coastal plain sediments. The series consists of very deep, excessively drained soils on uplands with a slope that ranges from 0 to 40 percent. Typically, these soils have a grayish-brown sand surface layer that is 3 inches thick

and a yellowish-brown sand layer from 3 to 16 inches. The subsoil between 16 to 30 inches is yellowish-brown sand. The substratum from 30 to 72 inches is loose yellowish-brown sand. The depth to a restrictive feature is greater than 60 inches. The slowest soil permeability within a depth of 60 inches is moderately rapid. Available water capacity to a depth of 60 inches is low, and shrink swell potential is low. Annual flooding and ponding is none.

Each component of the Evesboro series contains a different slope range:

Evesboro sand (EveB)— The EveB has a slope that ranges from 0 to 5 percent.

Evesboro sand (EveC)— The EveC has a slope that ranges from 5 to 10 percent.

Evesboro sand (EveD)— The EveD has a slope that ranges from 10 to 15 percent.

V. Galloway Series—Galloway loamy sand (GamB)

The Galloway series consists of deep, moderately-well drained soil on uplands. The series formed in coarse-textured coastal plain sediments and is hydric. Typically, these soils have a loamy sand surface layer that is 9 inches thick, and is grayish-brown in the upper part and light brownish-gray in the lower part. The substratum from 9 to 39 inches is olive yellow loamy sand, and from 39 to 47 inches it is light brownish-gray sand. The IIC horizon from 47 to 0 inches is yellowish-brown coarse sand. Annual flooding and ponding is none. GamB has a slope that ranges from 0 to 5 percent.

VI. Hammonton Series

The Hammonton series formed in the acidic moderately coarse-textured coastal plain sediments. The series consists of very deep, moderately well-drained soils on uplands and is not a hydric soil. Typically, these soils have a very dark, grayish-brown loamy sand surface layer 8 inches thick and a yellowish-brown loamy sand subsurface layer from 8 to 18 inches. The subsoil between 18 to 36 inches is mottled yellowish-brown sandy loam. The substratum from 36 to 60 inches is loose brownish-yellow sand. The depth to a restrictive feature is greater than 60 inches. The slowest soil permeability within a depth of 60 inches is moderate. Available water capacity to a depth of 60 inches is moderate, and shrink swell potential is low. Annual flooding and ponding is none.

Hammonton loamy sand (HbmB)—The HbmB has a slope that ranges from 0 to 5 percent.

Hammonton loamy sand sandy loam (HboA)—The HboA has a slope that ranges from 0 to 2 percent.

VII. Keyport sandy loam (KemA)

The Keyport series formed in the northern coastal plain sediments. The series consists of very deep, moderately-well drained soils on uplands. Typically these soils have a dark brown,

silt loam surface layer 10 inches thick. The subsoil layers from 10 to 44 inches are yellowish-brown and dark yellowish-brown silty clay loam. The upper substratum from 44 to 60 inches is dark gray, silty clay loam and the lower substratum from 60 to 72 inches is dark gray stratified clay to loamy sand. The KemA has a slope that ranges from 0 to 2 percent.

VIII. Lakehurst Series.

The Lakehurst sand formed in the acidic sandy coastal plain sediments and consists of deep, moderately-well or somewhat-poorly drained soils on uplands. Typically in woodland areas these soils have a dark gray sand surface that is 3 inches thick, and a light gray sand layer from 3 to 15 inches. The subsoil between 15 to 18 inches is dark brown loamy sand.

There are two components in the Lakehurst Series. The difference in the component is in the lower part of the subsoil as follows:

Lakehurst sand (LakB) has a slope that ranges from 0 to 5 percent. The lower part of the subsoil from 18 to 36 inches is yellowish-brown sand. The substratum from 36 to 60 inches is pale-brown loose sand. The depth to a restrictive feature is greater than 60 inches.

Lakehurst sand, clayey substratum (LakkB) has a slope that ranges from 0 to 5 percent. The lower part of the subsoil from 18 to 40 inches is yellowish-brown sand. The substratum from 40 to 60 inches is pale-brown loose sand.

The depth to a restrictive feature is greater than 60 inches. The slowest soil permeability within a depth of 60 inches is moderately rapid. Available water capacity to a depth of 60 inches is low, and shrink swell potential is low. Annual flooding and ponding is none.

IX. Lakewood Series

The Lakewood series formed in the acidic sandy coastal plain sediments. This series consists of deep, excessively-drained soils on uplands with a slope that ranges from 0 to 5 percent. Typically in woodland areas these soils have a black loose sand surface layer that is 1 inch thick, and a light brownish-gray loose sand layer from 1 to 10 inches. The subsoil between 10 and 14 inches is yellowish-brown loose sand. The lower part of the subsoil is yellowish-brown loose sand. The substratum from 36 to 60 inches is brownish-yellow loose sand. The depth to a restrictive feature is greater than 60 inches. The slowest soil permeability within a depth of 60 inches is rapid. Available water capacity to a depth of 60 inches is low, and shrink swell potential is low. Annual flooding and ponding is none.

Lakewood sand (LasB)—The LasB has a slope that ranges from 0 to 5 percent.

Lakewood sand (LasC)—The LasC has a slope that ranges from 0 to 5 percent.

X. Manahawkin muck, frequently flooded (MakAt)

The Manahawkin series consists of very deep, very poorly-drained soils that are formed in organic deposits, over sand and gravel with a slope that ranges from 0 to 2 percent. Typically, they have a black surface and subsurface layer of highly decomposed organic material, of 39 inches thickness. The substratum to a depth of 60 inches is gray sand. Manahawkin soils are in low positions in back swamps, lake basins, and along fresh water channels as they open to tide water. The depth to a restrictive feature is greater than 60 inches. The slowest soil permeability within a depth of 60 inches is moderately rapid. Available water capacity to a depth of 60 inches is very high, and shrink swell potential is low. Annual flooding and ponding is frequent.

XI. Mullica sandy loam (MumA)

The Mullica series formed in the acidic sandy coastal plain sediments. The series consists of very deep, very poorly-drained soils on flats and in depressions. Typically, these soils have a black sandy loam surface layer that is 10 inches thick. The subsurface layer from 10 to 18 inches is gray sandy loam. The subsoil from 18 to 28 inches is mostly gray sandy loam. The substratum from 28 to 60 inches is gray or grayish-brown gravelly sand or sand. The MumA has a slope that ranges from 0 to 2 percent.

XII. Phalanx loamy sand (PhbC)

This component is formed in the acidic sandy coastal plains sediments and consists of deep, well-drained soils on uplands. Typically, these soils have a dark brown, loamy sand surface layer that is 2 inches thick and a reddish-brown loamy sand subsurface layer 4 inches thick. The subsoil from 6 to 46 inches is red sandy loam. The substratum from 46 to 72 inches is yellowish-red sand. There are in the lower part of the b and c horizon, successive layers of fractured indurated iron cemented sandstone. Annual flooding and ponding is none. The PhbC has a slope that ranges from 0 to 25 percent.

XIII. Psamments series

Psamments are excessively-drained to well-drained sandy fill soils that have been smoothed. The thickness of the fill ranges from 24 to 48 inches, but is mainly 36 inches thick. Gravel content ranges from 0 to 50 percent.

Psamments (PssA)—The PssA has a slope that ranges from 0 to 3 percent.

Psamments sulfidic substratum, frequently flooded (PstAt)—The PstAt has a slope that ranges 0 to 3 percent.

Psamments, waste substratum (PsuB)—This component is formed from inactive sanitary landfills. These areas contain smoothed or uneven accumulations and general refuse.

layer, that is 9 inches thick. The subsoil, from 9 to 21 inches, is yellowish-brown loam. From 21 to 32 inches the subsoil is a brown sandy clay loam, and, from 32 to 40 inches, the subsoil is a strong brown sandy loam. From 40 to 52 inches the substratum is a strong brown gravelly sandy loam, and, is brownish-yellow loamy sand from 52 to 70 inches.

The depth to a restrictive feature is greater than 60 inches. The slowest soil permeability within a depth of 60 inches is moderately slow. Available water capacity to a depth of 60 inches is moderate, and shrink swell potential is low. Annual flooding and ponding is none.

SacB has a slope that ranges from 2 to 5 percent.

APPENDIX B

Wetland Plant Communities

The United States Department of Interior Fish and Wildlife *Wetland of New Jersey* (1985) report was reviewed to identify wetland plant communities in Ocean County.

The following lists wetland plant communities with plant species specific to that freshwater wetland:

I. Pine Barrens

Bayonet rush
Juncus militaris Bigelow

Pipeworts
Eriocaulon spp.

Golden club
Orontium aquaticum

Coast sedge
Carex exilis

Beakrushes
Rhynchospora alga and others

Twisted yellow-eyed grass
Xyris torta

Shortleaf milkwort
Polygala brevifolia

Bog aster
Aster nemoralis

Forked rush
J. dichotomus

Woolgrass
Scirpus cyperinus (L.) Kunth

St. John's-worts
Triadenum virginicum and Hypericum spp.

Purple pitcher plants
Sarracenia purpurea

Gold-crest
Lophiola Americana

Bartonia
Bartonia virginica

Wildrice
Zizania aquatica L

Canada rush
Juncus canadensis

Manna grass
Glyceria obtuse

Virginia meadow beauty
Rhexia virginica L.

Redroot
Lachnanthes caroliniana

Sundews
Drosera spp.

Peat mosses
Sphagnum spp.

Toothleaf flatsedge
Cyperus dentatus

Rice cutgrass
Leersia oryzoides (L.) Sw.

Pickerelweed
Pontederia cordata L.

Bladderworts
Utricularia spp.

Bog asphodel
Narthecium americanum

False asphodel
Tofieldia racemosa

Twisted yellow-eyed grass
Xyris torta Sm.

Bull sedge
Carex bullata

Cottongrass
Eriophorum virginicum

Twig rush
Cladium mariscoides

Three-way sedge
Dulichium arundinaceum (L.) Britt.

Lowland broomsedge
Andropogon virginicus var. abbreviatus

Panic grass
Panicum spp.

Wild oat grass
Danthonia sericea var. epilis

Bog rush
Juncus pelocarpus

Eastern bur-reed
Sparganium americanum

Spikerushes
Eleocharis spp

Orchids
e.g., Platanthera blephariglottis

Slender blue flag
Iris prismatica

Royal fern
Osmunda regalis

Ten-angled pipewort
Eriocaulon decangulare

Dense St. John's-wort
Hypricum densiflorum

Inkberry
Ilex glabra

Fetterbush
Leucothoe racemosa

Witherod
Viburnum cassinoides

Big cranberry
Vaccinium macrocarpon

Bayberry
Morella rubra Lour.

Red chokeberry
Aronia arbutifolia

Leatherleaf
Chamaedaphne calyculata

Scattered pitch pine
Pinus rigida

Sheep laurel
Kalmia angustifolia

Black chokeberry
A. melanocarpa

II. Atlantic White Cedar swamps

Atlantic white cedar
Chamaecyparis thyoides

Highbush blueberry
Vaccinium corymbosum L.

Alder
Alnus glutinosa

Big Cranberry
Vaccinium macrocarpon

Virginia cottongrass
Eriophorum virginicum L.

Peat moss and other mosses
Sphagnum majus ssp. *majus*

Swamp pink
Helonias bullata

Swamp pink
Calopogon pulchellus

Rose pogonia
Pogonia ophioglossoides

Twining bartonia
Bartonia paniculata

Liverworts
Hepaticopsida

Black Gum
Nyssa sylvatica

Swamp azalea
Rhododendron viscosum (L.) Torr.

Sweet pepperbush
Clethra alnifolia

Smartweed
Polygonum coccineum

Sedge
Carex collinsii

Bladderworts
Utricularia spp.

Dragon's mouth
Arethusa bulbosa

Green rein orchid
Platanthera clavellata

Round-leaved sundew
Drosera rotundifolia

Curly grass fern
Schizaea pusilla

Reindeer moss
Cladonia incrassata

Fetterbush
Leucothoe racemosa

Red maple
Acer rubrum

Dangleberry
Gaylussacia frondosa

Arrow arum
Peltandra virginica (L.) Schott

Spatulate-leaved sundew
Drosera intermedia

Purple pitcher plants
Sarracenia purpurea

Partridgeberry
Mitchella repens L.

White fringed orchid
P. blephariglottis

Starflower
Trientalis borealis

Wintergreen
Gaultheria procumbens

III. Pitch Pine lowlands

Pitch pine
Pinus rigida

Scrub oak
Quercus ilicifolia

Greenbriar
Smilax glauca and S. rotundifolia

Turkeybeard
Xerophyllum asphodeloides

Lowland broomsedge
Andropogon virginicus L.

Cowwheat
Melampyrum lineare

Sand myrtle
Leiophyllum buxifolium

IV. Palustrine scrub-shrub

Red maple
Acer rubrum

Southern arrowwood
Viburnum dentatum L. var. *venosum* (Britt.) Gleason

Highbush blueberry
Vaccinium corymbosum L.

Bayberry
Morella rubra Lour.

Leatherleaf
Chamaedaphne calyculata

Staggerbush
Lyonia mariana

Sweet pepperbush
Clethra alnifolia

Swamp azalea
Rhododendron viscosum (L.) Torr.

Shrubby St. John's-wort
Hypericum prolificum L.

Sheep laurel
Kalmia angustifolia

Dangleberry
Gaylussacia frondosa

Dwarf Huckleberry
Gaylussacia dumosa

Fetterbush
Leucothoe racemosa

Big Cranberry
Vaccinium macrocarpon

Pitch pine
Pinus rigida

Atlantic white cedar
Chamaecyparis thyoides

Gray birch
Betula populifolia

Inkberry
Cestrum diurnum

Chokeberry
Aronia arbutifolia

Withrod
Viburnum cassinoides L.

Possum haw
Viburnum nudum

Smooth alder
Alnus serrulata

Buttonbush
Cephalanthus occidentalis L.

Dense St. John's-wort
Hypricum densiflorum

V. Hardwood swamps

Black gum
Nyssa sylvatica

Sweet gum
Liquidambar styraciflua

Sweet Bay
Magnolia virginiana

Atlantic white cedar
Chamaecyparis thyoides

Ash
Sorbus aucuparia L.

Tulip tree
Liriodendron tulipifera

American holly
Ilex opaca

Sassafras
Sassafras albidum

Gray birch
Betula populifolia Marsh.

Willow oak
Quercus phellos

Pitch pine
Pinus rigida

Loblolly pine
Pinus taeda

Black Huckleberry
Gaylussacia baccata

Southern arrowwood
Viburnum dentatum L. var. *venosum* (Britt.) Gleason

Leatherleaf
Chamaedaphne calyculata

Inkberry
Cestrum diurnum

Other blueberries
Vaccinium pallidum

Serviceberries
Amelanchier spp.

Mountain laurel
Kalmia latifolia

Skunk cabbage
Symplocarpus foetidus (L.) Salisb. ex Nutt

Royal fern
Osmunda regalis

White grass
Leersia virginica

Sensitive fern
Onoclea sensibilis

False nettle
Boehmeria cylindrica

Poison ivy
Toxicodendron radicans

Wild grape
Vitis spp.

Spicebush
Lindera benzoin

Winterberry
Euonymus bungeanus Maxim.

Chokeberry
Aronia arbutifolia

Tussock sedge
Carex stricat

Beggarticks
Bidens polylepis

Arrow-leaved tearthumb
Polygonum sagittatum

Meadow rue
Thalictrum sp.

Chain fern
Woodwardia areolata (L.) T. Moore

Common greenbriar
Smilax rotundifolia

Virginia creeper
Parthenocissus quinquefolia

Trumpet creeper
Campsis radicans

Smooth alder
Alnus serrulata

Staggerbush
Lyonia mariana

Sheep laurel
Kalmia angustifolia

Rice cutgrass
Leersia oryzoides (L.) Sw

Cinnamon fern
Osmunda cinnamomea L.

Joe-pye weeds
Eupotorium maculatum

Bracken fern
Pteridium aquilinum

Bedstraws
Galium sp

Bamboo vine
Smilax laurifolia

Japanese honeysuckle
Lonicera japonica Thunb.

Maleberry
Lyonia ligustrina (L.) DC.

APPENDIX C

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