Lebanon Township
Natural Resources Inventory
2003

Prepared by the Lebanon Township
Environmental and Open Space Commission

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Acknowledgement

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Table of Contents

List of Map Figures

Introduction

In March 2001, the Lebanon Township Environmental and Open Space Commission (EOC) was reinstituted after several years' absence. The nine member commission is responsible for advising the Lebanon Township Committee and Planning Board on issues relating to the environment and open space.

Based on legislation passed in 1968, and expanded in 1972, the goals of the Lebanon Township EOC are to advise governing bodies on a variety of environmental issues, including informing the Planning and Zoning Boards of Adjustment about environmental impacts of proposals for development and advocating planned open space preservation at the municipal level. Additionally, the EOC investigates environmental problems and proposes solutions, informs residents on environmental matters and ways to help protect the environment, interacts with neighboring commissions to tackle regional and state issues, and maintains a data base on the environmental resources of the municipality, which is known as the Natural Resources Inventory (NRI).

As a planning resource, an NRI is invaluable for township officials in that it is a central resource for environmental information that can impact decisions regarding

- Sustainable development
- Coordination of the master plan and development regulations
- Prevention of excess land consumption
- Recommending ordinances or actions, as determined, to design with nature, provide Green Infrastructure, or use ecological design principles to guide the development of the built environment
- Maximize the ability of natural systems to control runoff and flooding, and to improve air and water quality and supply
- Protection of biological diversity through preservation and restoration of contiguous open spaces and connecting corridors
- Management of public land to protect scenic qualities, forests and water resources
- Management of the character and nature of development for the protection of wildlife habitat, critical slope areas, water resources, and for the provision of adequate public access to a variety of recreational opportunities
- Promotion and preservation of the agricultural industry
- Retention of farmland by coordinating planning and innovative land conservation techniques to protect agricultural viability while accommodating beneficial development and economic growth necessary to enhance agricultural vitality
- Education of residents on the benefits and the special needs of agriculture
- Preservation of the environmentally sensitive nature of the township, including watersheds of pristine waters, trout streams and drinking water supply reservoirs; recharge areas for potable water aquifers; habitats of endangered and threatened plant and animal species; prime forested areas; scenic vistas; and other significant topographical, geological or ecological features

The NRI directly supports the State Planning Act (NJSA 52:18A-196 *et seq*), which has as some of its primary goals the conservation of natural resources, the protection of the quality of the environment and the promotion of beneficial development. Of primary importance to Lebanon Township is that in the State Plan, the Highlands region--where Lebanon Township is located--has been recognized as the first Special Resource Area in New Jersey, containing unique characteristics or resources of statewide importance for regional planning efforts, making the Lebanon Township NRI an essential planning document.

In keeping with the availability of new technologies, this NRI provides data and information in digital format. Graphics associated with the text are indicated as ***bolded*** Adobe pdf-format files found on this CD-ROM. At the end of each section are references to additional documents for more information. See also the following source documents, available on this CD-ROM, for more information:

- Lebanon Township 2001 Master Plan (***Lebanon Township 2001 Master Plan***)

- Lebanon Township 2002 Farmland Preservation Plan Element (2002 ***Farmland Preservation Plan Element)***

- Lebanon Township 2001 Master Plan: Conservation Plan Element (***Lebanon Township 2001 Master Plan***)

- Lebanon Township 2002 Open Space and Recreation Plan (***2002 Open Space and Recreation Plan Element***)

- Evaluation of Groundwater Resources of Lebanon Township, Hunterdon County, New Jersey. Mulhall, Matthew J. Prepared for Lebanon Township Planning Board, 2001. (***Lebanon water resource evaluation***)

Lebanon Township

Lebanon Township is located in the northwest corner of Hunterdon County. Founded in 1731 and incorporated in 1798, the township in 2002 had a population of 6,056 according to estimates from the US Census and 5,816 according to the 2000 Census.

<u>Land Usage</u>
According to November 2002 data provided by the Hunterdon County Division of GIS, the predominant property class in Lebanon Township is agricultural (47%) representing 9,335 acres of the Township's 20,250 acre land area. Residential accounts for 29% of the total, public land 13% and vacant land 8%. Commercial and industrial accounts for 1.3% and 0.2% of the Township, respectively (***Land Use Land Cover Comparison – 1972 to 2002, Zoning Map, May 2002 Land Use Land Cover***).

Agricultural uses account for approximately 19% of the Township's total acreage, or 3,865 acres. Masses of farmland occur in four general areas: along Forge Hill Road, around the Borough of Califon, in the Mount Lebanon Road/Sharrer Road/Anthony Road area, and along West Hill Road. Comparing the land use by property tax to the land use/land cover, almost 60% of the land classified as agricultural by tax class is actually wooded.

The Township has seen an increase in total agricultural use, from 8,735 acres in 1987 to 9,423 acres in 1997.

Areas reported as urban, or high-density residential use account for approximately 17% of Township acreage. The highest concentrations in this category may be found in the hamlets of Bunnvale, Lower Valley, New Hampton and Woodglen. Other concentrations of developed land occur along Route 31, East and West Hill Roads, and Sliker Road. See the following for more information:

- Lebanon Township 2002 Farmland Preservation Plan Element (***Farmland Preservation Plan***)
- Lebanon Township 2001 Master Plan: Land Use Plan Element (***August 2001 Master Plan***)
- Lebanon Township 2001 Master Plan: Conservation Plan Element (***August 2001 Master Plan***)

<u>Open Space</u>
While Lebanon Township does not own a vast inventory of recreation and open space lands, the Township contains a variety of recreational opportunities within its borders (***Open Space and Scenic Qualities***). The majority are State and County parks geared primarily towards passive recreation activities. These facilities include Voorhees State Park, the Ken Lockwood Gorge Wildlife Management Area, the Point Mountain section of the Musconetcong River Reservation, the Columbia Trail section of the South Branch

Reservation and the Teetertown Nature Preserve/Mountain Farm. These facilities comprise 2,030 acres or 10.3% of the Township's total parcel acreage and 90% of the recreation land available to Township residents.

In addition, Lebanon Township has engaged upon an aggressive program of farmland preservation in order to "build core areas of preserved farmland and agricultural districts, preserving an environment that will foster the continuation of agriculture for future generations" (***Farmland Preservation Plan, Farm Assessed Land and Farmland Preservation***). Farmlands considered for preservation include traditional field crop and grazing land as well as non-traditional agricultural activities including timber harvesting, orchards, and growth and sale of nursery stock.

Historic sites

Founded in 1731, Lebanon Township has a number of sites designated as historic. The following sites have been designated historic by the Historians of Lebanon Township

- Forks of the Delaware Raritan Indian Trail
- New Hampton Village
- Anthony Village
- Woodglen Village
- Teetertown Village
- Changewater Village
- Hoffman's Crossing
- Old American Hotel
- Vernoy Quarry
- Sliker Airport
- Magnetite Mine
- Zion's Evangelical Lutheran Church
- Mount Lebanon Methodist Church
- Mount Bethel Church Ruin
- Changewater Methodist Church
- New Hampton Sunday School
- Site of Octagonal School
- Bunnvale School
- Dusenbery Mansion
- General Daniel Morgan's boyhood home
- Traprock Quarry
- Weise Home
- Ken Lockwood Gorge Indian camp and work site
- Fort Foss
- Old Stone Farmhouse on the Voorhees High School campus

For more information, please see:

- Abandoned Iron Mines of Hunterdon County, New Jersey. New Jersey Department of Labor, Division of Workplace Standards, Office of Safety Compliance, 1988.

- Stone Arch Bridge Inventory, Phase II, Hunterdon County, New Jersey. Hunterdon County Planning Board and the Hunterdon County Board of Chosen Freeholders, 1998.

- Lebanon Township Historical Society (http://www.lebanontownship.net)

- NJ DEP Historic Preservation Office, New Jersey and National Register of Historic Places (http://www.nj.gov/dep/hpo/1identify/lists/hunterdon.pdf)

Land and Water

Topography

Lebanon Township is at the foot of the New Jersey Highlands physiographic province and represents the beginning of some of the most varied terrain in New Jersey. The Highlands are home to some of the most scenic areas in the State and represent the most significant animal habitats and forest resources found anywhere in New Jersey outside of the Pinelands area.

Most of the land in the Township is 400' above sea level, with the exception of lands located directly adjacent to the Musconetcong River and the South Branch of the Raritan River. The highest elevation in the Township is located in the vicinity of Pleasant Grove Road and is above 1040' (***Topography and Steep Slope***).

There are a number of scenic ridgelines in the Township (***Ridgelines and Contours***). The area of Point Mountain, a County Park, contains some of the most scenic land found in the County. From the peak of Point Mountain, the terrain runs steeply to the Musconetcong River valley. Both banks of the South Branch run steeply to the River, making for a gorge that runs the entire length of the River through the Township.

The two river valleys, the southwestern corner of the Township bordering Bethlehem Township, the Teetertown Nature Ravine, Rocky Run, Route 513 areas, and the Turkey Top Road area, possess the majority of the Township's steep slopes classified as greater than 15%, and comprise nearly 25% of the Township's land area (***Topography and Steep Slope***). Slopes greater than 25% comprise 7% of land area.

Geology

The bedrock of Lebanon Township can be divided into two general groupings primarily based on age and rock type (***Geology, Surficial Geology***). Precambrian (older than 570 million years) igneous and metamorphic rocks underlie approximately 90 percent of the Township. Gneiss and granite underlie much of this area. The bedrock in this portion of the Township includes members of the Byram and Lake Hopatcong Intrusive Suites, Losee Metamorphic Suite, metasedimentary rocks, diabase intrusions, Chestnut Hill formation, and other rocks of uncertain origin. The Precambrian rocks have been extensively deformed into a series of southwest to northeast trending folds.

The second type of bedrock is mapped beneath approximately 10 percent of the Township along the northern boundary and in the southeastern portion near the Borough of Califon. These rocks include the Ordovician-Cambrian (440-570 million years ago) dolomites and limestones of the Leithsville, Allentown, Beekmantown and Jacksonburg Formations. This group also includes the shales of the Bushkill Member of the Ordovician Martinsburg Formation and the quartzites of the Hardyston Formation.
For more information, please see:

- The Precambrian Geology of the central and northeastern parts of the New Jersey Highlands. Smith, Bennett L. In Geology of Selected Areas in New Jersey and Eastern Pennsylvania. Rutgers University Press, 1969.

- The New Jersey Geological Survey (http://www.state.nj.us/dep/njgs/)

Soils

Lebanon Township has just over 6,000 acres of prime and statewide important soils, as categorized by the State Agricultural Development Committee (SADC) (***Prime and Statewide Important Soils***). This represents 30% of the Township's total acreage.

Three soil associations are found throughout most of Lebanon Township. Along the northwestern boundary of Lebanon Township and the Musconetcong River, as well as near the southeastern border of the Township the soils are comprised of the Rowland-Birdsboro-Raritan association. These soils are found in areas with gentle to nearly level slopes and are well to poorly drained. They are typically associated with flood plains and may be flooded during parts of the year.

Near the borough of Califon in the Long Valley portion of the Township are found Duffield-Washington association soils. These soils are found on gentle to moderately steep slopes and are considered well drained. These types of soils are derived from weathering of the underlying limestone and dolomite bedrock. Solution channels such as caverns, sinkholes and cavities may be present in areas where the Duffield and/or Washington soils are encountered.

Most of Lebanon Township is underlain by the soils of the Parker-Edneyville-Califon association. Soils of this association are found in areas with gentle to steep slopes and are excessively to poorly drained. Cobbles and gravel sized weathered residual rock fragments are often found with these types of soils and in some cases, the gravel fragments comprise more than 20 percent of the soils. The percentage of rock fragments increases with increasing elevation. These soils are typically found from 200 to 1,000' above sea level. The Parker and Edneyville soils form a thin layer (less than 6 feet) over the bedrock surface. In several areas of the Township, the bedrock surface outcrops. In the Califon soils, which are poorly drained, the seasonal water table is shallow (less than 3 feet). The Soil Conservation Service indicates severe limitations for these three soils types and they are considered by this agency inappropriate for septic systems.

A fourth soil association is found in the southern corner of the Township near Spruce Run Reservoir. The Washington-Berks-Athol association comprise 30, 30 and 20 percent, respectively, of this association. These well-drained soils are found in areas with gentle to moderately steep slopes, and are derived from weathering of carbonate bedrock and may overlie solution features such as sinkholes and/or caverns. The Berks soils are derived from weathering of shale. For more information see:

- Soil Survey of Hunterdon County, New Jersey. US Department of Agriculture Soil Conservation Service in cooperation with the NJ Agricultural Experiment Station at Rutgers, 1974.

- Soil Survey of Hunterdon County, New Jersey. Jablonski, C.F. US Department of Agriculture, Soil Conservation Service, 1988.

- Evaluation of Groundwater Resources of Lebanon Township, Hunterdon County, New Jersey. Mulhall, Matthew J. Prepared for Lebanon Township Planning Board, 2001.

<u>Hydrology</u>

Lebanon Township is divided into four hydrogeologic zones with each zone underlain by one of two distinct aquifer systems. The name of each zone is based on the underlying type of bedrock aquifer systems. Most of the Township is underlain by the aquifer system comprised of Precambrian igneous and metamorphic bedrock, known as the Precambrian Crystalline Rock Zone. Precambrian rocks are considered to be poor aquifers with low water yields (NJDEP, 1996). A limited area near the northwestern border of the Township and the area beneath Long Valley in the southeastern portion of the municipality are underlain by limestone and dolomite aquifer systems, referenced as the Limestone/Dolomite Zone. Limestone/dolomite aquifer systems are some of the most prolific in New Jersey (NJDEP, 1996). For more information, readers of this document are referred to:

- Water for the 21st Century: The vital resource. New Jersey Department of Environmental Protection Planning, New Jersey Statewide Supply Plan, 1996.

- Evaluation of Groundwater Resources of Lebanon Township, Hunterdon County, New Jersey. Mulhall, Matthew J. Prepared for Lebanon Township Planning Board, 2001.

<u>Water and Water Quality</u>

The Musconetcong and Raritan River Watersheds divide Lebanon Township. Twenty percent of Lebanon Township is in the Upper Delaware Watershed Management area, while the remaining 80% is in the North and South Branch Raritan Watershed Management Area. North of this divide, surface water, and most likely groundwater, flow towards the Musconetcong River. South of the divide, water flows towards the South Branch of the Raritan River and tributaries.

According to the Statewide Water Quality Management Program Plan, all surface waters in Lebanon Township are classified as FW2 (***Water Quality, AMNET Reference***). The FW2 classification is divided into three categories: FW2-TP: trout production, FW2-TM: trout maintenance, and FW2-NT: non-trout. For more information, readers of this document are referred to:

- Geology and Ground Water Resources of Hunterdon County, NJ. Kasaback, Haig F. Special Report No. 24, Bureau of Geology and Topography, Division of Resource Development, Department of Conservation and Economic Development, 1996.

- Evaluation of Groundwater Resources of Lebanon Township, Hunterdon County, New Jersey. Mulhall, Matthew J. Prepared for Lebanon Township Planning Board, 2001.

Habitats

Lebanon Township contains environmentally sensitive lands, comprised mainly of forested wetlands and mature deciduous forest (***Emergent and Forested Wetlands, Grassland and Forest, Land Use Land Cover Comparison – 1972 to 2002***). Geographically, most of the wetlands are found in the northern half of the Township and are protected by surrounding forested areas. These wetlands and forested areas form a symbiotic relationship, which becomes part of an overall critical habitat system covering 8% of the total area of the township. Overall, wetlands make up 8% of the total area of the Township with barren land and water comprising 0.3% and 0.6% respectively.

<u>Forests</u>
Nearly 56% of the Township is covered by forest, much of which represents high priority habitat for wildlife. The spine of the Township is made up of large contiguous tracts of forest, which provide suitable habitat for a number of animal species, including some that are threatened or critical. A number of these contiguous forested tracts are County and State parkland, preserved in perpetuity.

The wooded tracts of Lebanon Township represent most of the remaining large contiguous forests in Hunterdon County. Many of these forested areas are protected as part of State and County park systems. Voorhees Park, the Musconetcong River Reservation, Teetertown Ravine, Ken Lockwood Gorge and the Columbia trail areas all contain significant contiguous forest resources that are permanently preserved. Nearly 87% of Lebanon Township's forested areas are deciduous forest, with the remainder coniferous (2%), deciduous brush and shrub land (5%), former fields (4%), mixed brush and shrub land (0.7%), mixed forest (3%) and plantations (1.3%).

<u>Wetlands</u>
Wetlands in Lebanon Township are found throughout the township (***Surface Waters, Wetlands and Floodplains, Emergent and Forested Wetlands***), and can be categorized as:

- Agricultural wetlands (modified)
- Artificial lakes
- Coniferous wooded wetlands
- Deciduous scrub/shrub wetlands
- Deciduous wooded wetlands
- Disturbed wetlands (modified)
- Herbaceous wetlands
- Managed wetlands (modified)
- Mixed forested wetlands (deciduous dominant)
- Natural lakes
- Streams and canals
- Wetlands right of way (modified)

The greatest cluster of wetlands in Lebanon Township occurs below the ridge lines in linked systems and in clusters. The vast majority of the wetlands feed into the stream network and are interspersed with many of the forested areas found throughout the Township. Their primary composition is deciduous wooded wetlands. For more information, readers of this document are referred to:

- Plant Communities of New Jersey. Collins, B.R. and K.H. Anderson. Rutgers University Press, 1994.
- The Vegetation of Voorhees State Park. McDonough, W.T and M.F. Buell. American Midland Naturalist. 56:473-490, 1956.
- The New Jersey Highlands: Treasures at risk. Mitchell, A.E. New Jersey Conservation Foundation, 1992.
- New Jersey Landscape Project for the Protection of Rare Species (http://www.nj.gov/dep/fgw/ensp/pdf/landbro.pdf).
- Rare Species and Natural Communities Presently Recorded in the New Jersey Natural Heritage Database, Hunterdon County (http://www.nj.gov/dep/parksandforests/natural/heritage/textfiles/njhunt.txt)

Environmental concerns and controls

<u>Concerns</u>

Several environmental concerns that must be taken into consideration when considering development in Lebanon Township. The needs of the Township and its current and future citizens must be considered in light of the potential effects of

- ✓ Pollution: Pollution (including solid waste disposal, point and non-point pollution of water sources, light and noise) affects residents, wildlife and downstream users of the waters from Lebanon Township. Pollutants degrade and destroy habitats for indigenous species as well as affect the quality of life for residents.

- ✓ Soil limitations for septic systems: Most of Lebanon Township is underlain by the soils of the Parker-Edneyville-Califon association. The Soil Conservation Service indicates severe limitations for these soils types for septic systems. Severe to slight limitations are associated with the Washington-Berks-Athol soil associations, which are also found in Lebanon Township. The Washington soils may be limited for subsurface sewage disposal in areas of solution channels. The Athol and Berks soils are moderately to severely limited for subsurface sewage disposal because of shallow bedrock and/or steep slopes (***Septic Suitability NJAC 7:9A***).

- ✓ Geology: The geological underpinning of Lebanon Township is critical when considering development due to its role in septic system suitability (***Septic Suitability NJAC 7:9A***) and recharge (***Recharge Areas, Geology***).

- ✓ Threatened and endangered species: Several areas in Lebanon Township have been identified as critical for the survival of native flora and fauna (including more than 60 species classified as threatened or endangered), the recharging of aquifers, biodegradation of environmental contaminants, the prevention of flood damage, and the protection of drinking water and air quality, as well as preservation of open space for outdoor recreation (***Emergent and Forested Wetlands, Grassland and Forest***)

- ✓ Wetlands: Wetlands provide critical habitats for endangered and threatened species, as well as being vital to the recharge of aquifers, the prevention of flooding and the removal of pollutants from the environment (***Recharge Areas, Emergent and Forested Wetlands, Surface Waters, Wetlands and Floodplains***).

- ✓ Steep slopes: Steep slopes provide scenic value but are also sites where environmental degradation can occur quickly if not managed properly (***Topography and Steep Slope***).

- ✓ Farm Preservation: With its rich history of farming, a quality of life strongly associated with the presence of agriculture, and the value to serve as corridors for wildlife, the preservation of farmlands in Lebanon Township is a crucial consideration for their value to residents and wildlife alike (***Farm Assessed Land and Farmland Preservation***).

- ✓ Water: Lebanon Township is the location of the headwaters of several of the main water producing streams that serve wide areas of New Jersey. Water quality is high in Lebanon Township, with many streams rated as trout producing, the highest State rating for water quality. Degradation of water quality will affect local residents, wildlife and users of the water that flows from the grounds beneath Lebanon Township. Once degraded, it is difficult to impossible to restore water to its previously pristine state (***Water Quality, AMNET Reference***)

Each of these factors must be considered as part of the planning of development and redevelopment in order to maintain the quality of life and the environment of Lebanon Township.

<u>Controls</u>

As part of its commitment to maintaining the environmental quality of the area, Lebanon Township has developed and approved a series of ordinances which help to preserve the environment (***Environmental Ordinances***). The State as well has developed controls on planning and development which support environmental preservation, including controls on septic system development (***NJAC 7:9A***) and critical species and habitats (http://www.nj.gov/dep/fgw/lndscpe.htm). More information can be found on the New Jersey Department of Environmental Protection website (http://www.state.nj.us/dep/) on topics such as noise pollution, air quality, water quality, hazardous waste management, threatened and endangered species, and historic preservation.

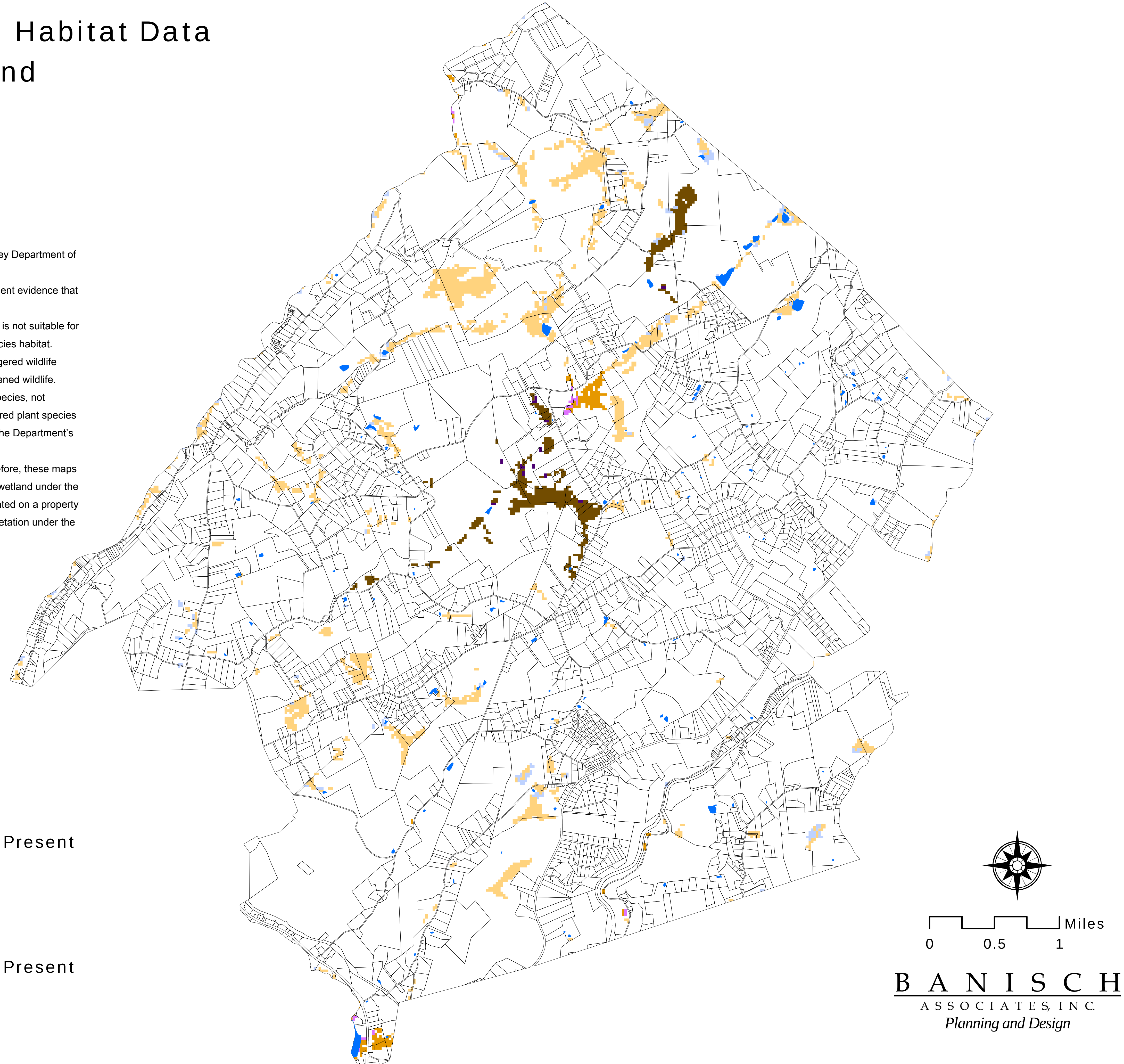
NJ Landscape Project Critical Habitat Data
Emergent and Forested Wetland

Township of Lebanon
Hunterdon County, New Jersey
May 2003

Disclaimer:

- These maps provide information regarding the location of areas identified to date by the New Jersey Department of Environmental Protection (DEP) as habitat for endangered or threatened wildlife species.
- DEP may identify additional endangered or threatened species habitat at any time if there is sufficient evidence that an area qualifies as threatened or endangered species habitat.
- DEP may determine that an area shown on the maps as threatened or endangered wildlife habitat is not suitable for use as habitat. In that case, the area will no longer be classified as endangered or threatened species habitat.
- The maps will be updated periodically to reflect additional areas identified as threatened or endangered wildlife habitat, and to remove areas determined to be no longer suitable habitat for endangered or threatened wildlife.
- These maps show only areas identified as suitable habitat for threatened or endangered animal species, not threatened or endangered plant species. The DEP's method for identifying threatened or endangered plant species habitat can be found in the Department's Freshwater Wetlands Technical Manual, available from the Department's Office of Maps and Publications at (609) 777-1038.
- Any wetlands boundaries shown on these maps are approximate and are for guidance only. Therefore, these maps are not an accurate indication of whether DEP will classify an area as exceptional resource value wetland under the DEP's freshwater wetlands rules. To obtain a determination of whether or where wetlands are located on a property and the resource value classification of a wetland, contact the DEP and apply for a letter of interpretation under the freshwater wetlands rules, N.J.A.C. 7:7A-3.

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



Legend

Forested Wetland

Suitable Habitat

State Threatened Species Present

Federal Threatened and Endangered Species Present

Emergent

Suitable Habitat

State Threatened Species Present

Federal Threatened and Endangered Species Present

Data Sources:
Hunterdon County Division of GIS
New Jersey Department of Environmental Protection, ENSP

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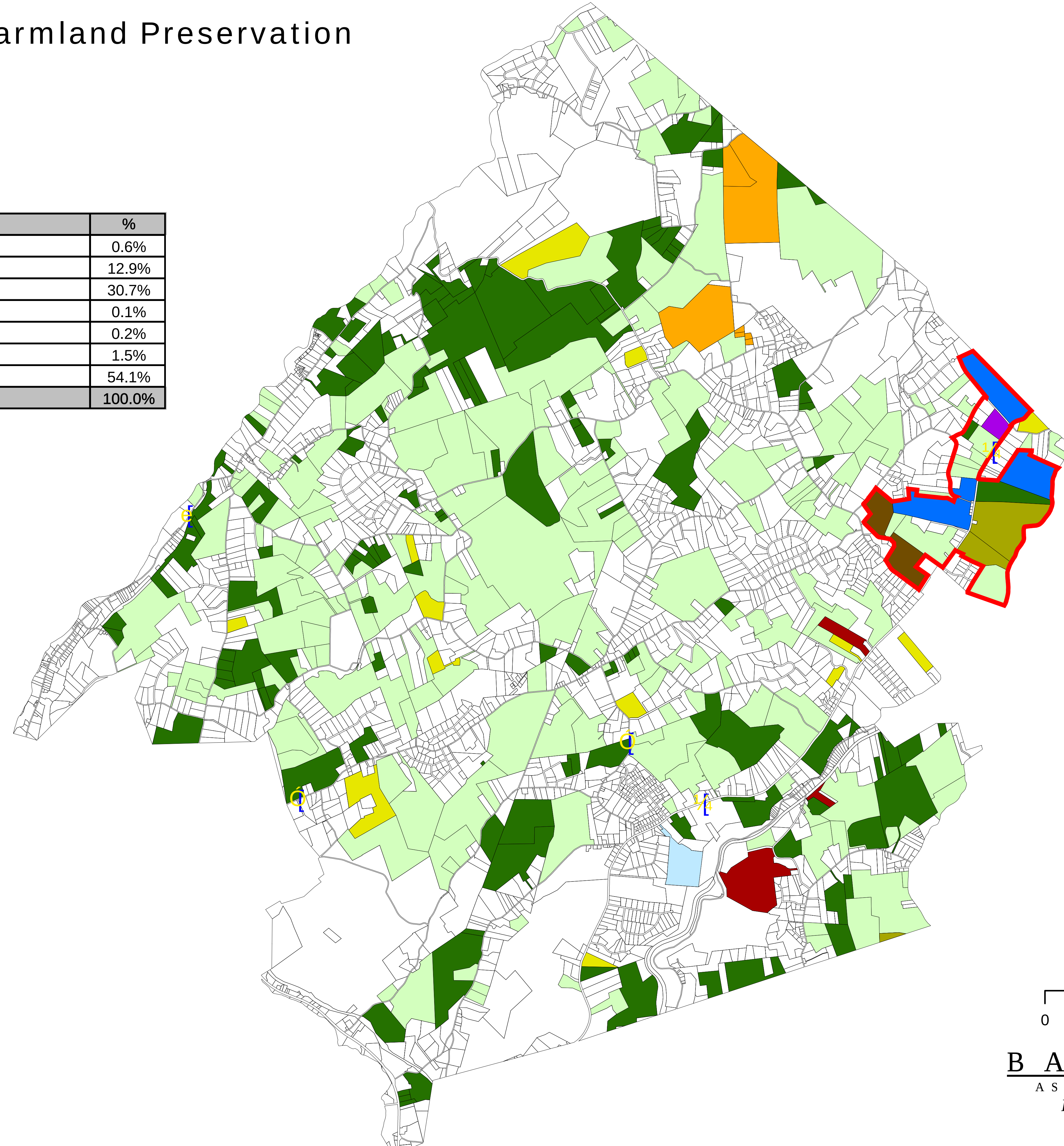
Farm Assessed Land and Farmland Preservation

Township of Lebanon

Hunterdon County, New Jersey

May 2003

Property Class	Acreage	%
Commercial/Farm Qualified	113.34	0.6%
Farm Qualified	2,560.61	12.9%
Farm Regular/Farm Qualified	6,076.94	30.7%
Industrial/Farm Qualified	15.15	0.1%
Public Property/Farm Qualified	44.75	0.2%
Residential/Farm Qualified	288.62	1.5%
Land Not Farm Assessed	10,707.44	54.1%
Total	19,806.85	100.0%



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- Not Farm Assessed
- Farm Regular/Farm Qualified
- Farm Qualified
- Public Property/Farm Qualified
- Residential/Farm Qualified
- Commercial/Farm Qualified
- Industrial/Farm Qualified
- 8 Year Program Farm
- Preserved Farmland
- Planning Incentive Grant Project Area
- Planning Incentive Grant Applicant
- Farmland Preservation Application

Data Sources:
Hunterdon County Division of GIS
Hunterdon County Agriculture Development Board
Banisch Associates, Inc.

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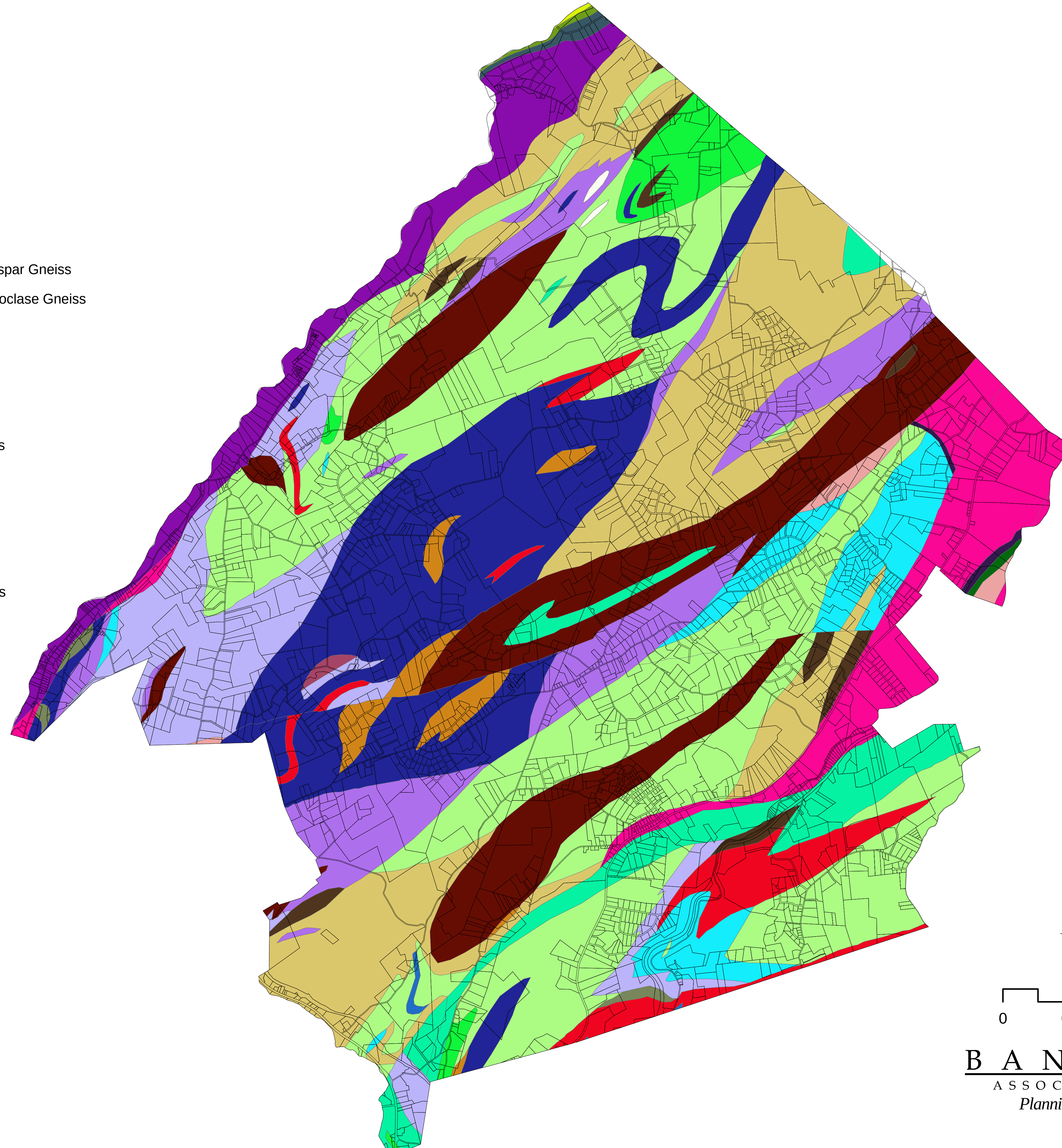
Bedrock Geology

Township of Lebanon
Hunterdon County, New Jersey
May 2003



Legend

- Albite-Oligoclase Granite
- Allentown Dolomite
- Amphibolite
- Biotite-Quartz-Feldspar Gneiss
- Biotite-Quartz-Oligoclase Gneiss
- Bushkill Member
- Chestnut Hill Formation
- Clinopyroxene-Quartz-Feldspar Gneiss
- Diorite
- Epidote Gneiss
- Hardyston Quartzite
- Hornblende Granite
- Hornblende-Quartz-Feldspar Gneiss
- Hypersthere-Quartz-Oligoclase Gneiss
- Jacksonburg Limestone
- Leithsville Formation
- Lower Part
- Microperthite Alaskite
- Potassic Feldspar Gneiss
- Pyroxene Alaskite
- Pyroxene Gneiss
- Pyroxene Granite
- Pyroxene Syenite
- Quartz-Oligoclase Gneiss
- Upper Part

Miles
0 0.5 1

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Planning and Design

Data Sources:
Hunterdon County Division of GIS
New Jersey Geological Survey CD Series, CD 00-1

NJ Landscape Project Critical Habitat Data
Grassland and Forestland

Township of Lebanon
Hunterdon County, New Jersey
May 2003

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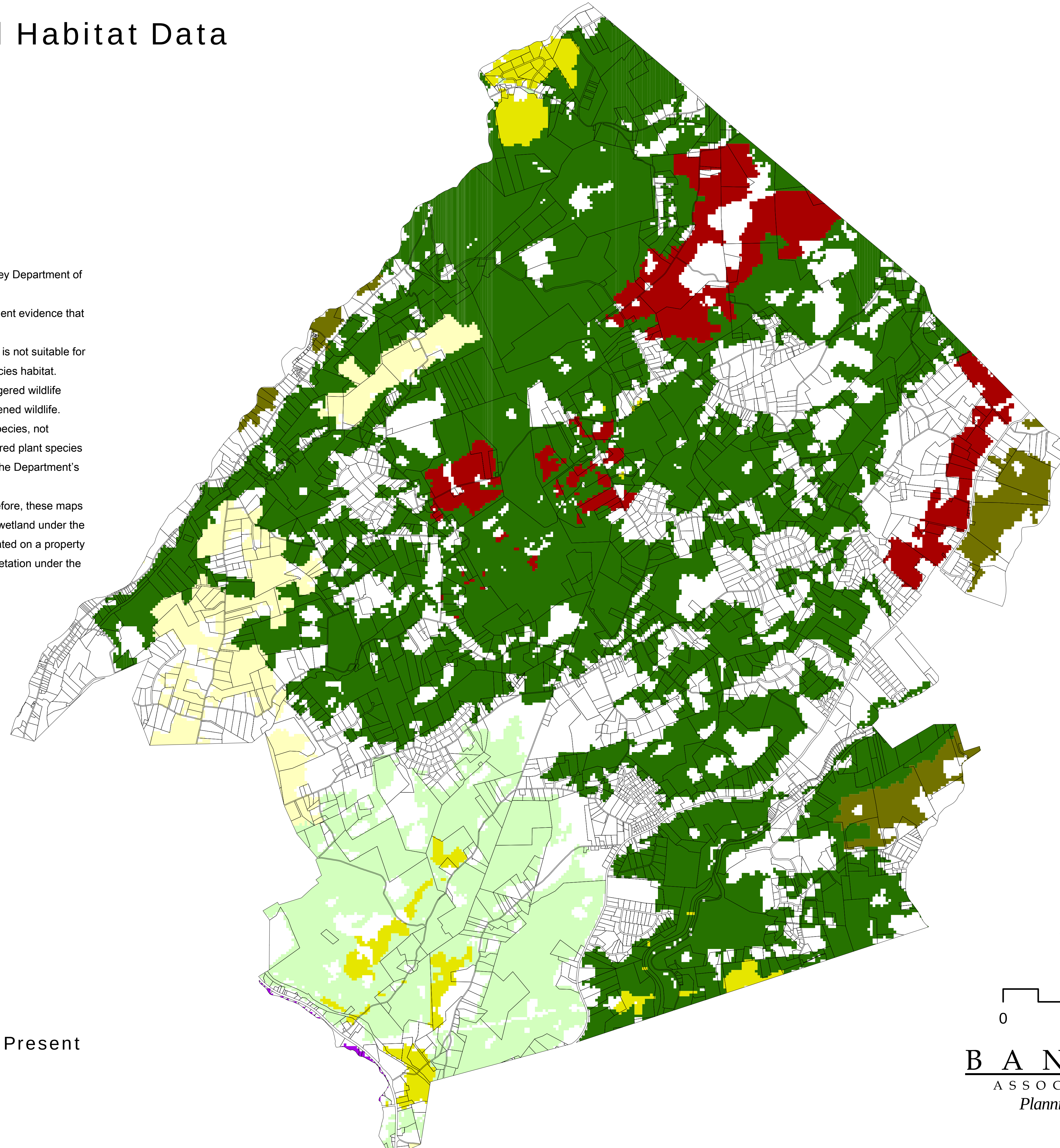

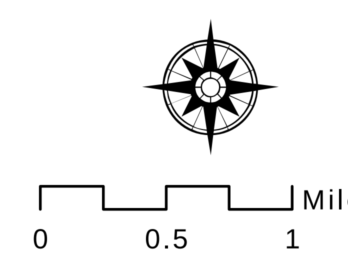

Legend

Forest

- State Threatened Species Present
- State Endangered Species Present
- Federal Threatened and Endangered Species Present

Grassland

- Suitable Habitat
- State Threatened Species Present
- State Endangered Species Present
- Federal Threatened and Endangered Species Present

Data Sources:
Hunterdon County Division of GIS
New Jersey Department of Environmental Protection, ENSP

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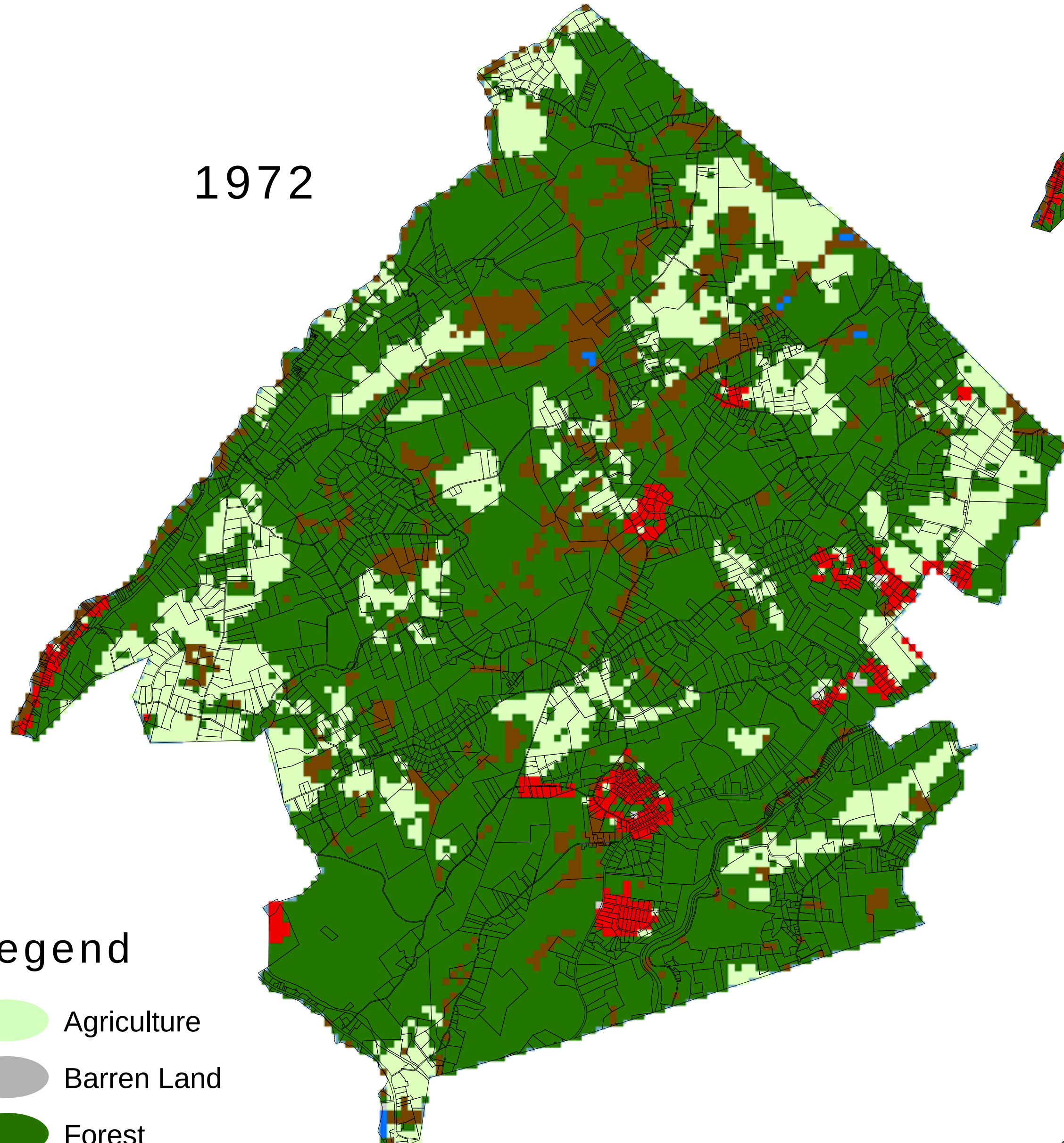
Land Use/Land Cover Comparison - 1972 to 2002

Township of Lebanon
Hunterdon County, New Jersey
May 2003

1972



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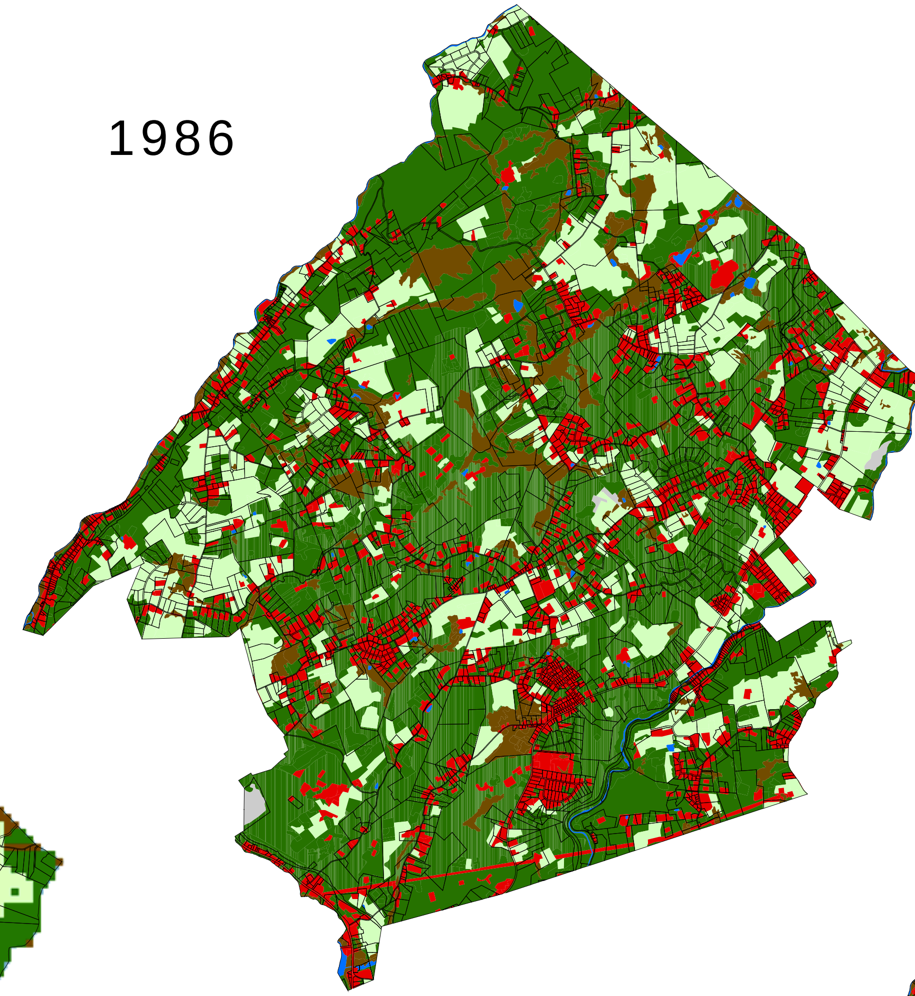
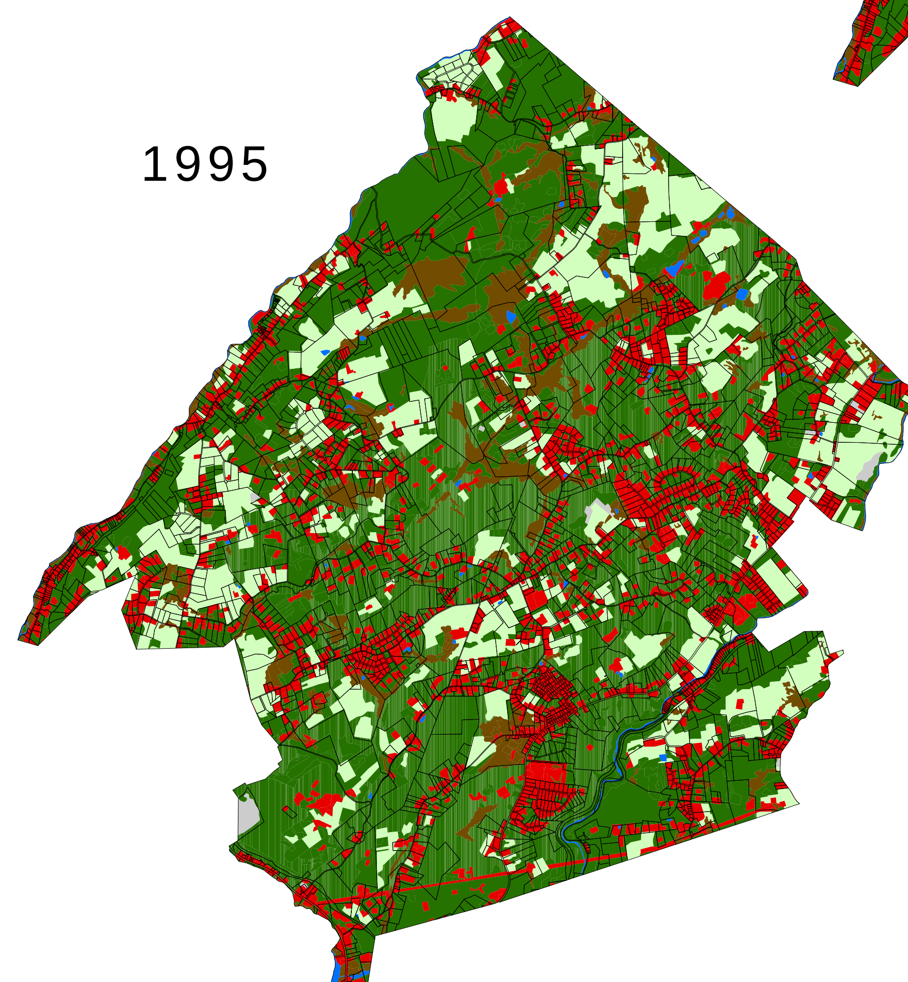
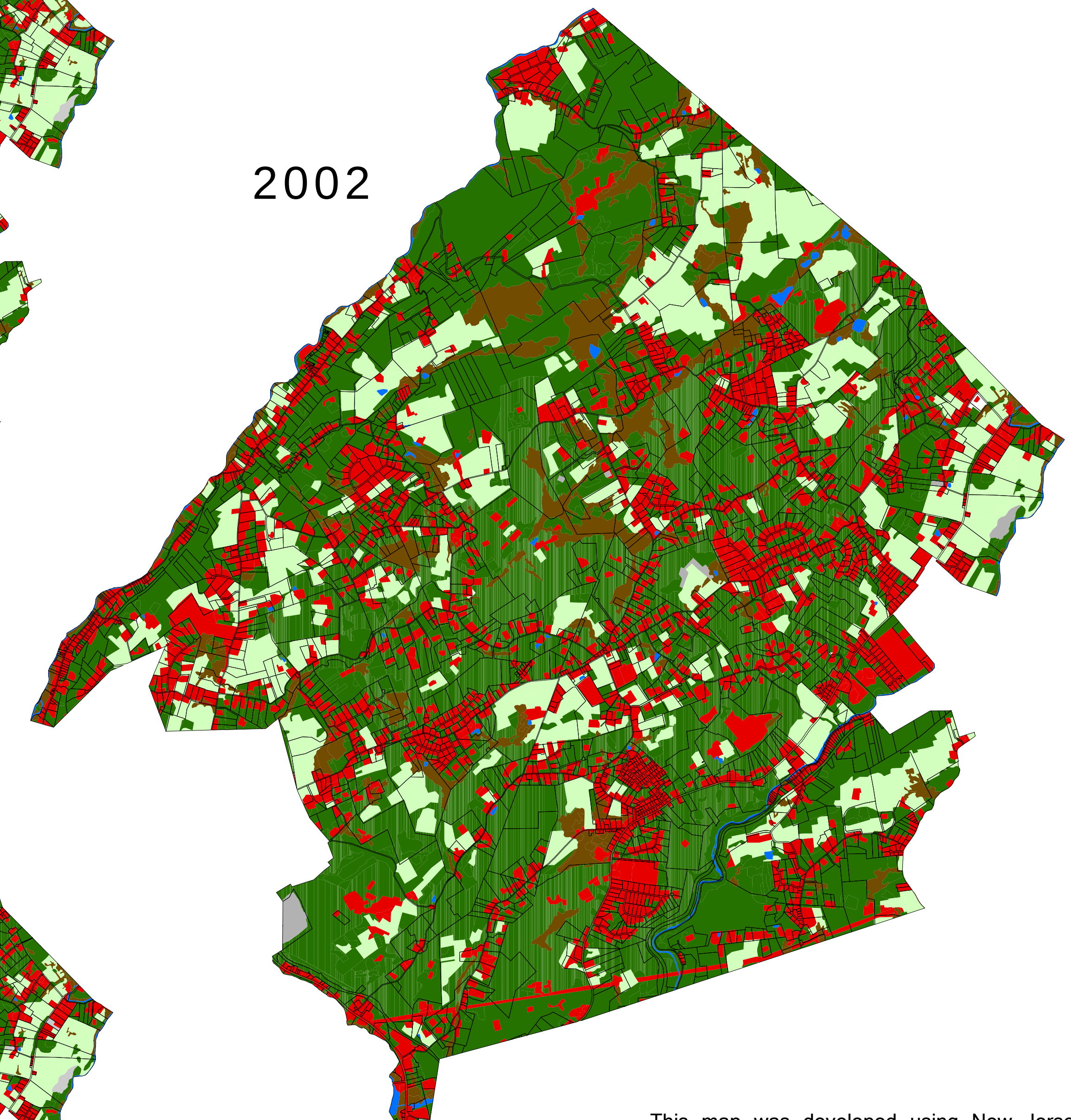


1995



2002



Legend

- Agriculture
- Barren Land
- Forest
- Urban
- Water
- Wetlands

Data Sources:
Hunterdon County Division of GIS
Banisch Associates, Inc.
Grant F. Walton Center for Remote Sensing and Spatial Analysis
Rutgers University
NJDEP

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

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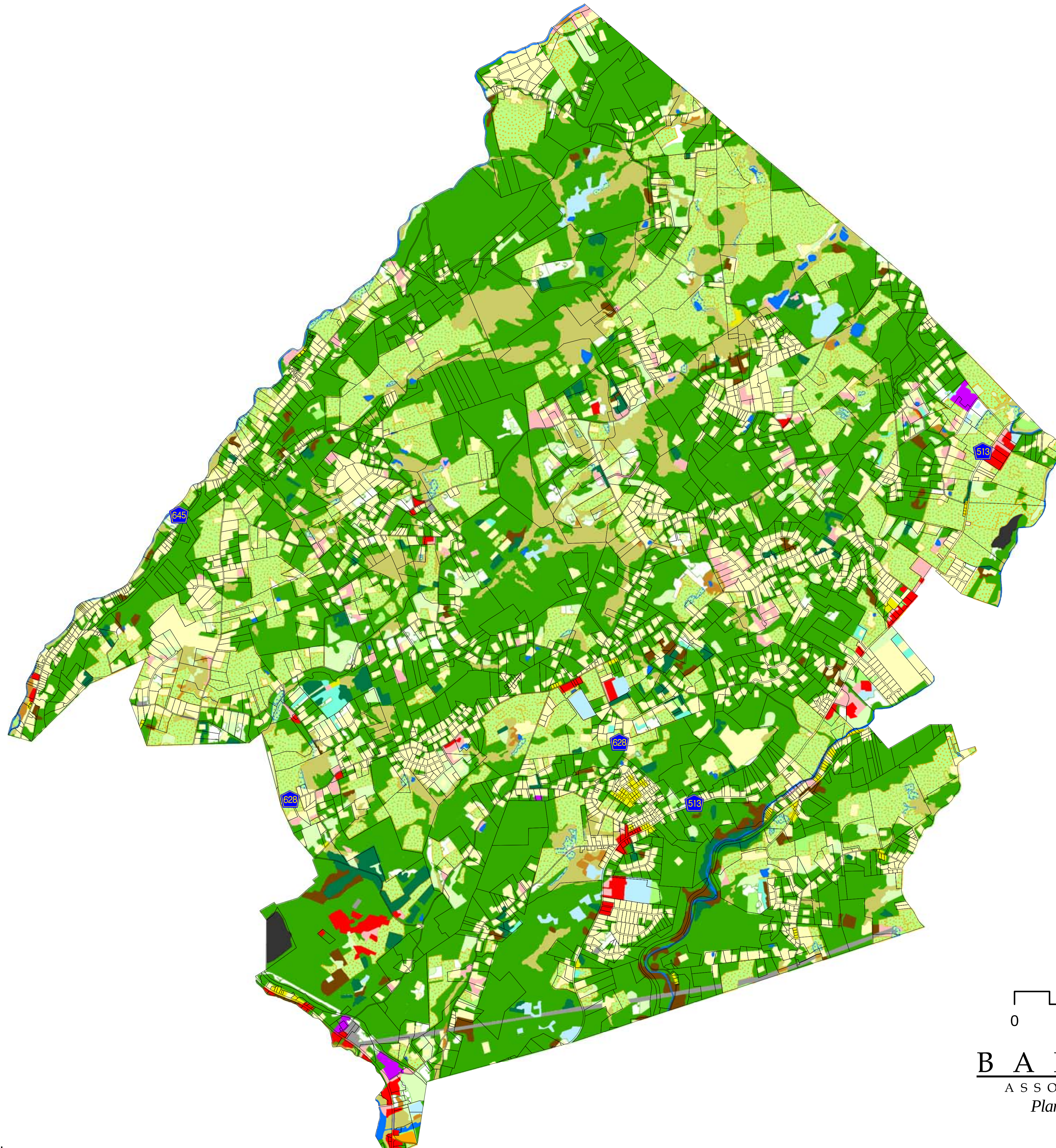
Planning and Design

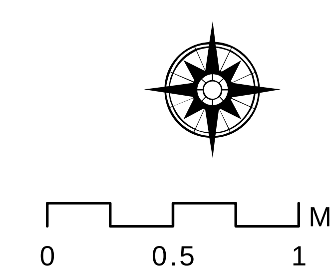
2002 Land Use/Land Cover*

Township of Lebanon
Hunterdon County, New Jersey
May 2003



Legend

- Agricultural Wetlands
- Agriculture
- Barren Land
- Commercial
- Industrial
- Low Density Residential
- Medium Density Residential
- High Density Residential
- Mixed Residential
- Other Urban or Built-up Land
- Brush Covered Field
- Deciduous Shrubland
- Deciduous Forest
- Coniferous Shrubland
- Coniferous Forest
- Mixed Shrubland
- Mixed Forest
- Deciduous Wetlands
- Coniferous Wetlands
- Wetland
- Quarry
- Recreational Land
- Transportation, Communication, Utilities
- Water



Data Sources:
Hunterdon County Division of GIS
Banisch Associates, Inc.
*1995 Land Use/Land Cover updated by
Banisch Associates, Inc., based on 2002 Aerial Photography

BANISCH
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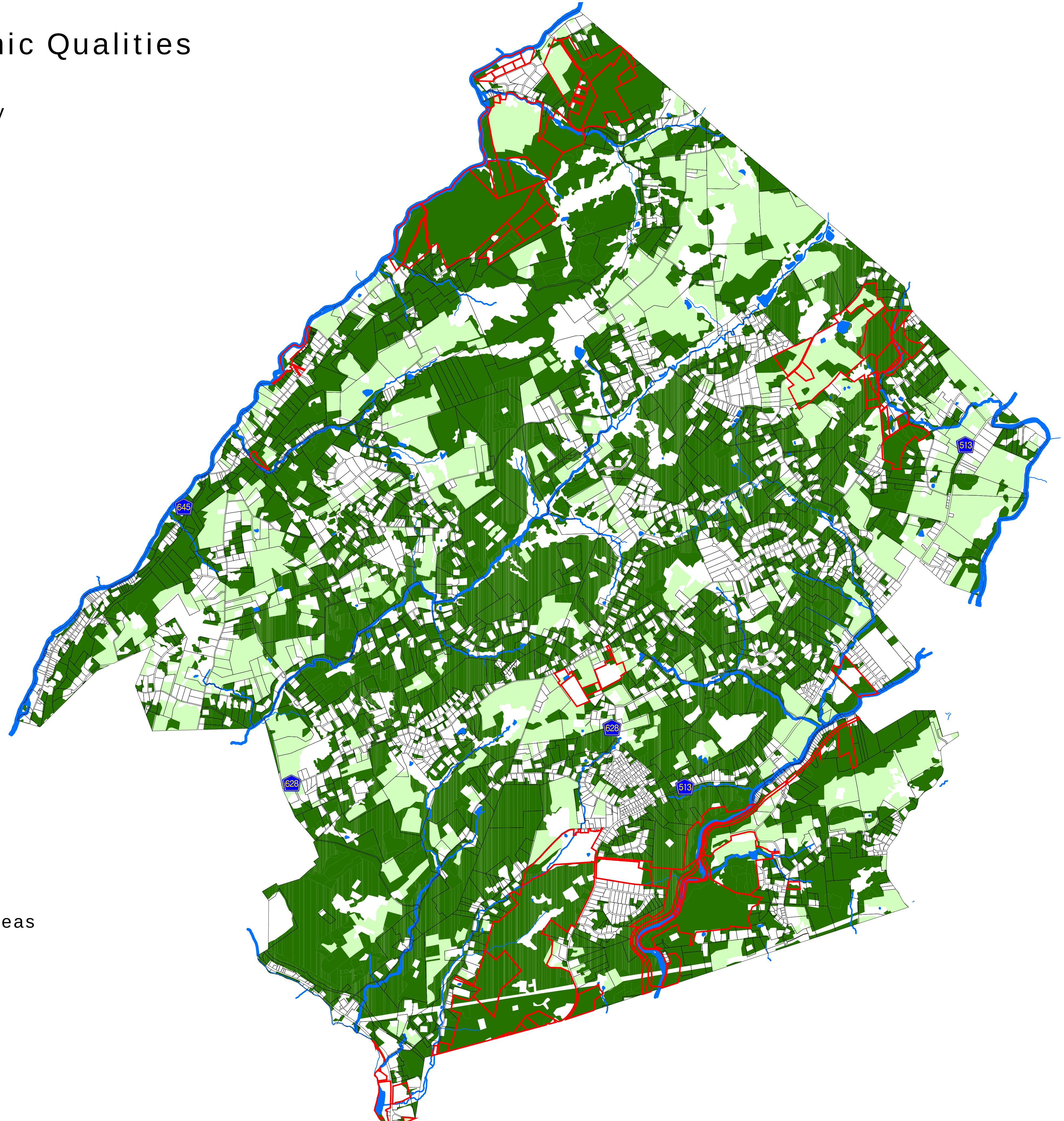
Open Space and Scenic Qualities

Township of Lebanon

Hunterdon County, New Jersey

May 2003



Legend

- Open Space and Recreation Areas
- Lakes, Rivers and Streams
- Forest
- Agriculture

Data Sources:
Hunterdon County Division of GIS
Banisch Associates, Inc.

Miles
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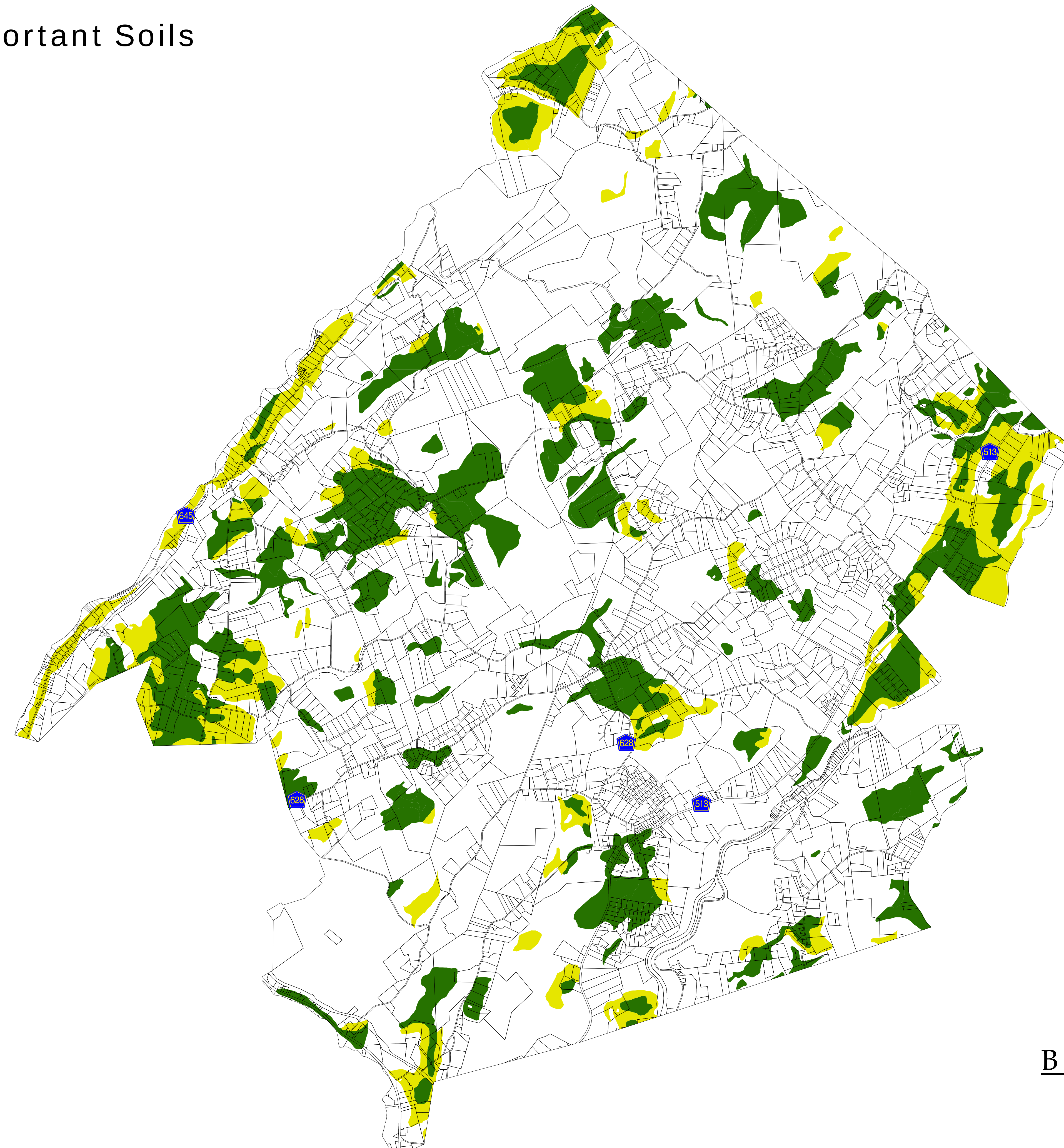
Planning and Design

Prime and Statewide Important Soils

Township of Lebanon
Hunterdon County, New Jersey
May 2003



Legend

Prime Soil

Statewide Important Soil

Data Sources:
Hunterdon County Division of GIS
USDA NRCS

Miles
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BANISCH
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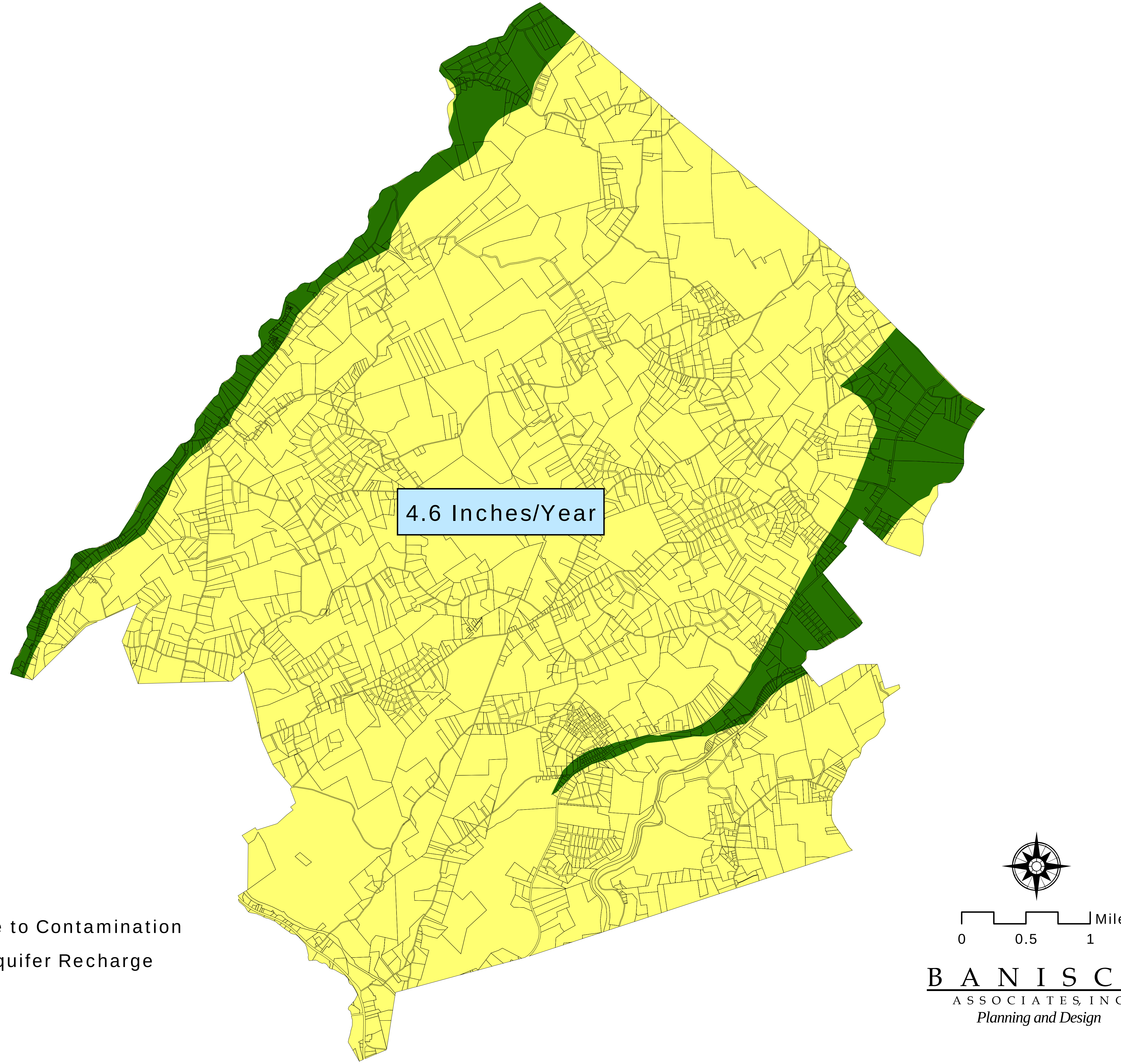
Planning and Design

Aquifer Recharge Areas

Township of Lebanon
Hunterdon County, New Jersey
May 2003



Legend

Carbonate Rock - Highly Susceptible to Contamination

Crystalline Rock Zone - Very Poor Aquifer Recharge

Data Sources:
Hunterdon County Division of GIS
New Jersey Geological Survey CD Series, CD 00-1

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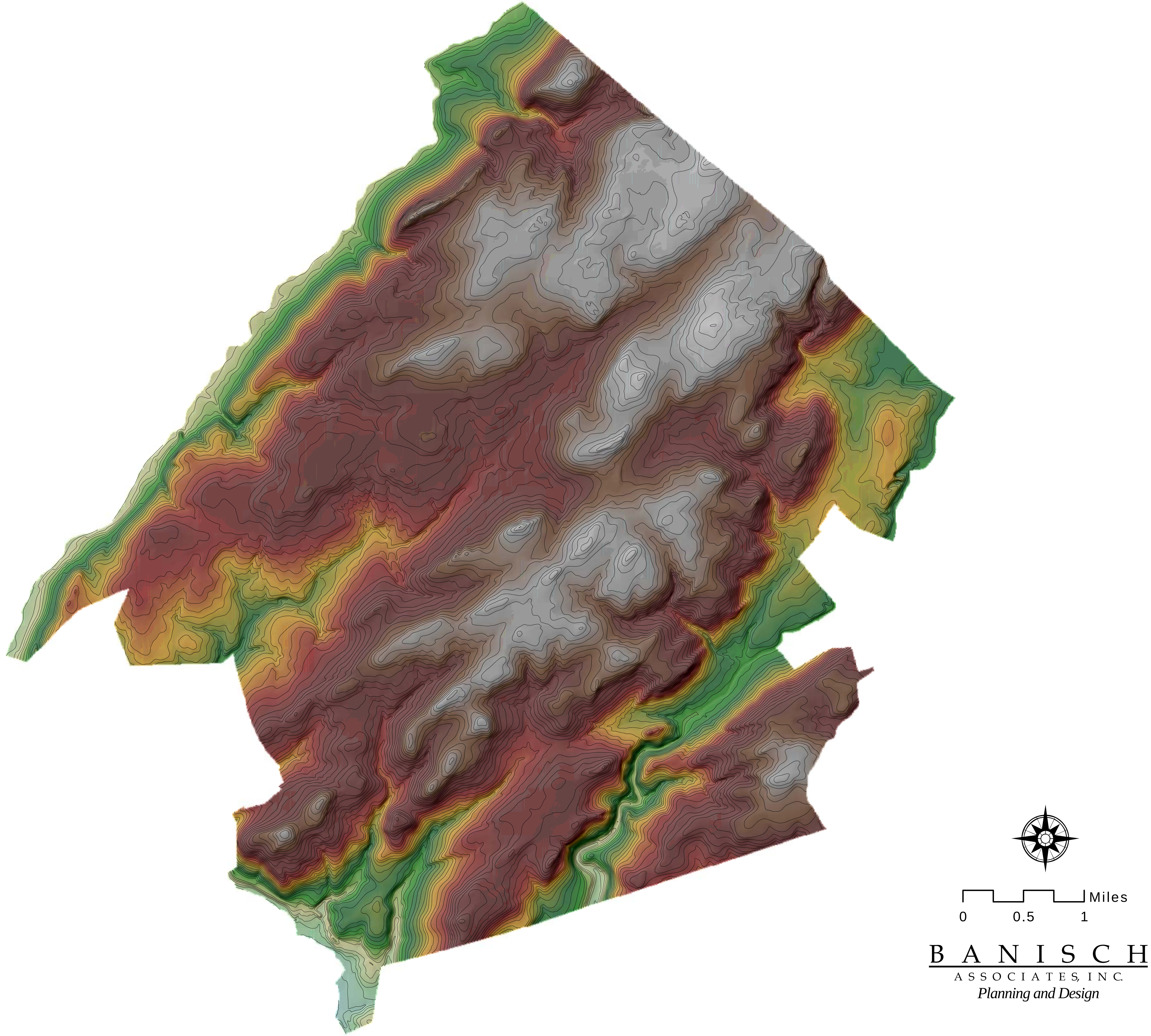
Ridgelines

Township of Lebanon
Hunterdon County, New Jersey
May 2003



Data Sources:
Hunterdon County Division of GIS
NJDEP 10 Meter Elevation Grids
Banisch Associates, Inc.

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Planning and Design

Suitability for On-Site Disposal of Septic Effluent - N.J.A.C. 7:9A

Township of Lebanon
Hunterdon County, New Jersey
May 2003

TABLE 10.1 TYPE OF DISPOSAL FIELD INSTALLATION
C = Conventional Installation
SRB = Soil Replacement, Bottom-lined Installation
SRE = Soil Replacement, Fill-enclosed Installation
M = Mound Installation
MSR = Mounded Soil Replacement Installation1

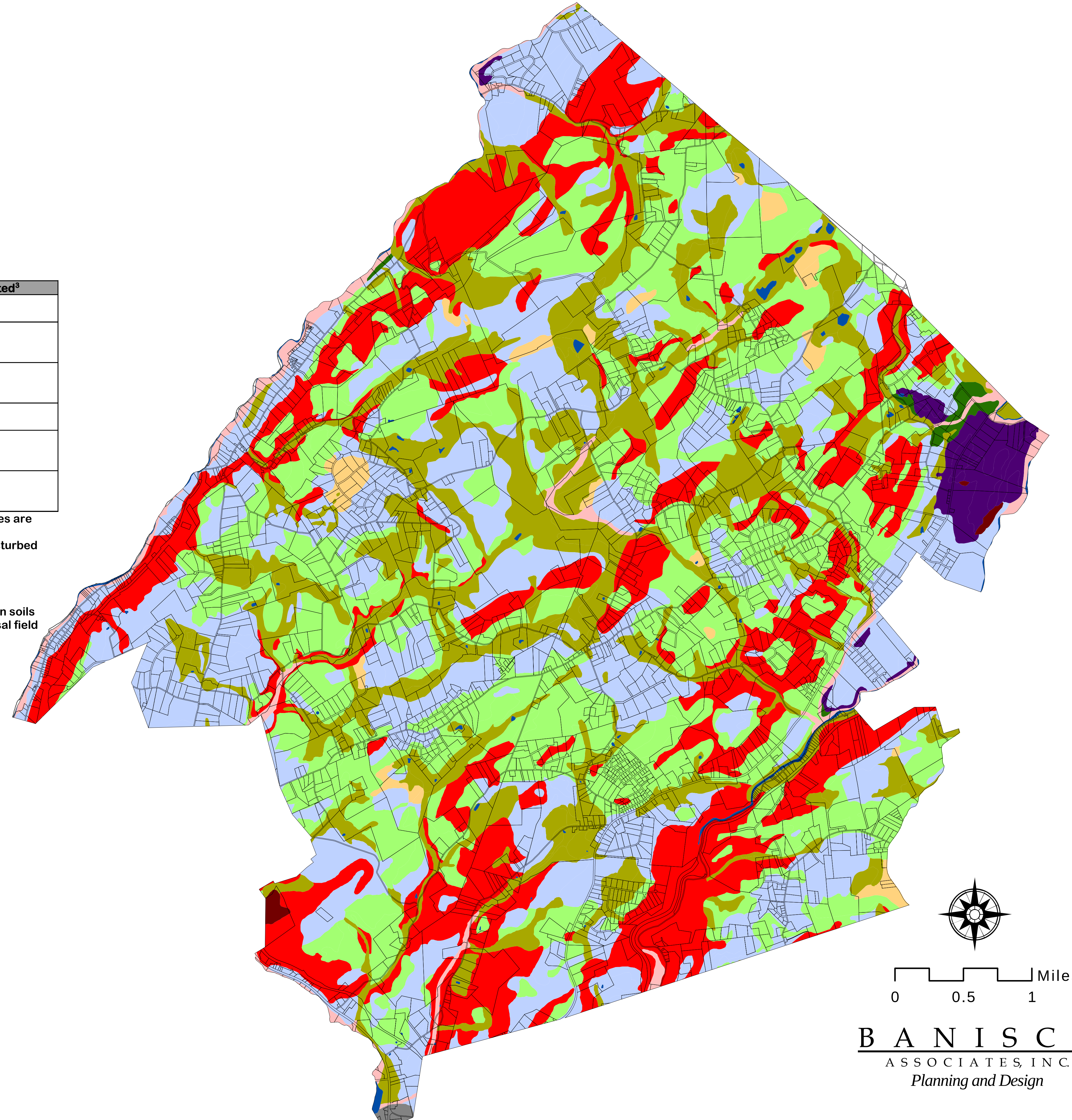
Type of Limiting Zone	Depth[2], ft.	Suitability Class	Type of Installation Permitted[3]
Fracture Rock or Excessively Coarse Substrata	>5 0-5	I IISc	C, (SRB, SRE, M, MSR) SRE, M, (MSR)
Massive Rock Hydraulically Restrictive Substratum	>9 4-9 <4	I IISr IIISr	C, (SRB, SRE, M, MSR) M, (MSR) UNSUITABLE
Hydraulically Restrictive Horizon, Permeable Substratum	>9 4-9 <4	I IIHr IIIHr	C, (SRB, SRE, M, MSR) SRB, SRE, M, (MSR) SRB, SRE, (MSR)
Excessively Coarse Horizon	>5 0-5	I IIHc	C, (SRB, SRE, M, MSR) SRE, M, (MSR)
Zone of Saturation, Regional	>5 2-5 <5	I IIWr IIIWr	C, (SRB, SRE, M, MSR) M, (MSR) UNSUITABLE
Zone of Saturation, Perched	>5 2-5 <5	I IIWp IIIWp	C, (SRB, SRE, M, MSR) C[4], (SRB, SRE, M, MSR) C[4], (SRB, SRE, M, MSR)

(1) Mounded soil replacement systems are generally required only in cases where several limiting zones are present as, for example, in compound soil suitability classes such as IIScWr, IIIHr (IISr) or IIIHr(IIWr).
(2) Depth is measured from the existing ground surface to the top of the limiting zone. In the case of disturbed ground, the depth to the limiting zone shall be measured from the pre-existing natural ground surface, identified as prescribed in N.J.A.C. 7:9A-5.10(c), or the existing ground surface, whichever is lowest.
(3) Installations shown in parentheses are allowed but are generally not the most cost-effective type of installation for the soil suitability class unless other soil limitations are present.
(4) An interceptor drain or other means of removing the perched zone of saturation is required. Note: In soils with a compound soil suitability class, where more than one limiting zone is present in the soil, a disposal field installation shall not be approved unless the type of installation proposed is listed in Table 10.1 as an acceptable option for each of the soil suitability classes which apply.

Legend

- I;IIWr;IISc;IIWrSc
- IISc
- I;IISc
- I;IISr
- IIIHr
- IIIHrWp
- Rock Outcrops, Excessively Coarse Substrata
- Slope, Excessively Coarse
- Disturbed Ground
- Flooding
- Water
- Unclassified

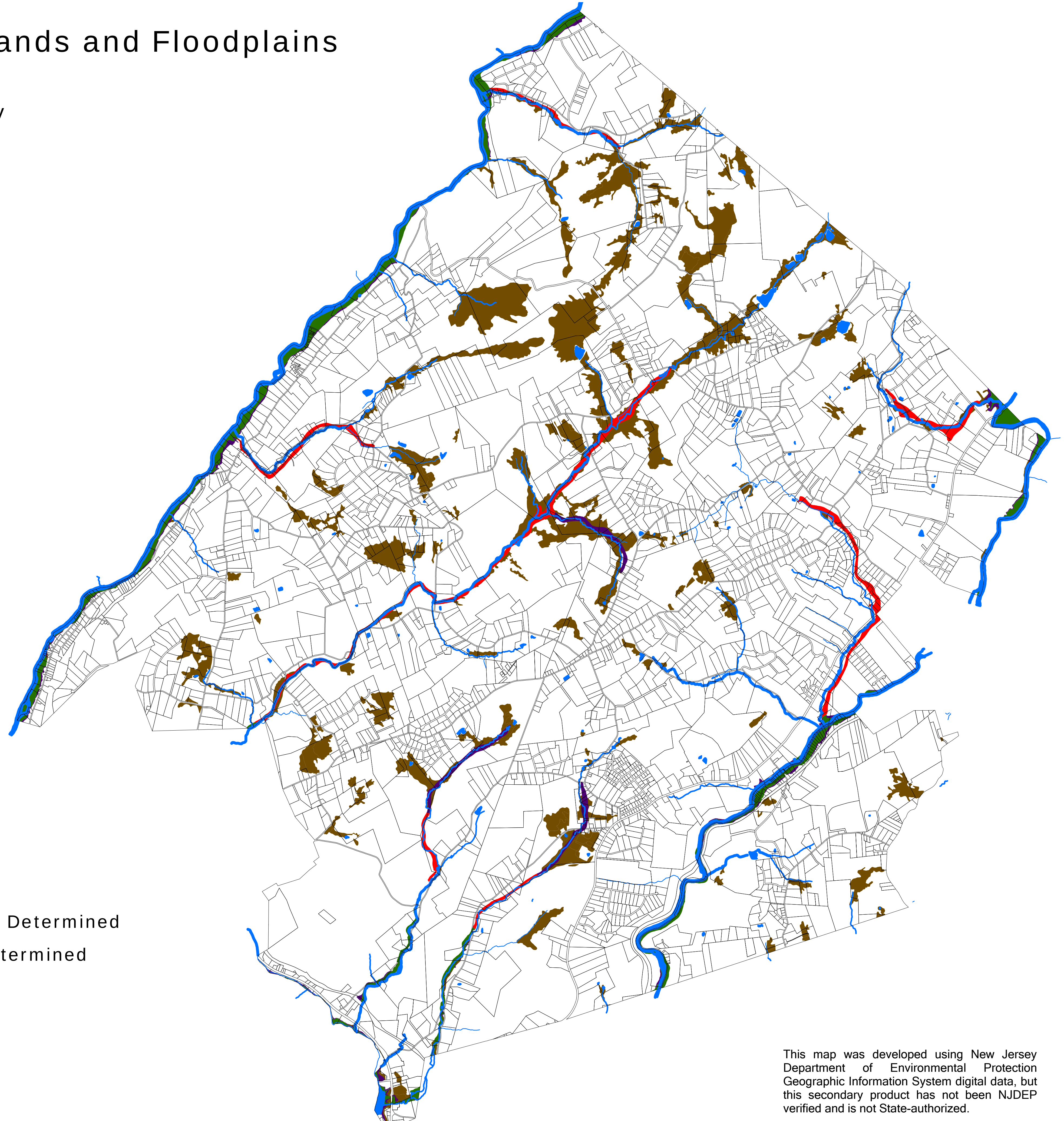
Data Sources:
Hunterdon County Division of GIS
N.J.A.C. 7:9A



B A N I S C H
A S S O C I A T E S, I N C.
Planning and Design

Surface Waters, Wetlands and Floodplains

Township of Lebanon
Hunterdon County, New Jersey
May 2003



Legend

- Lakes, Rivers and Streams
- 100-Year Floodplain - No BFE's Determined
- 100-Year Floodplain - BFE's Determined
- 500-Year Floodplain
- Wetlands

Data Sources:
Hunterdon County Division of GIS
NJDEP
Banisch Associates, Inc.

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

Miles
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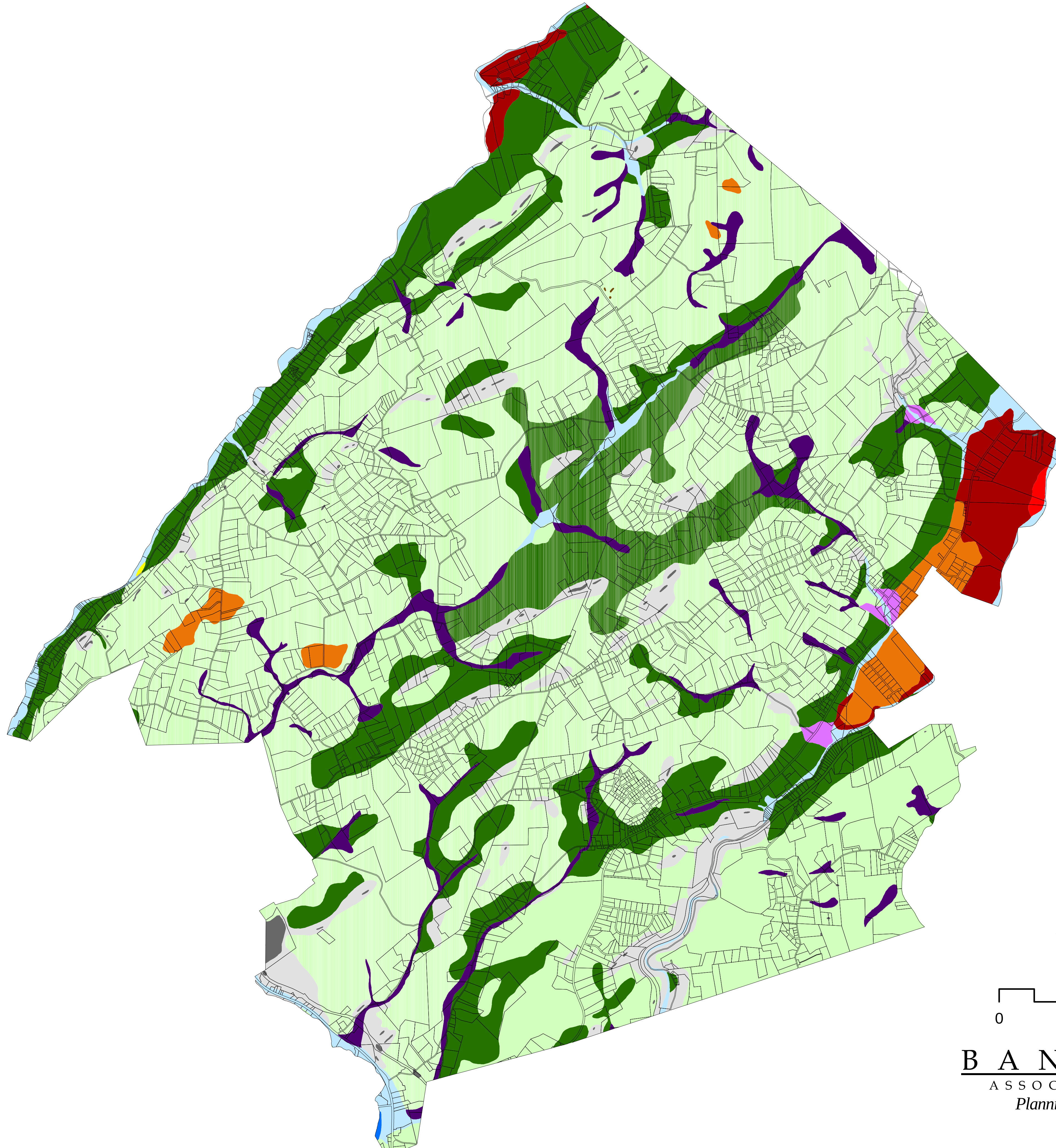
Surficial Geology

Township of Lebanon
Hunterdon County, New Jersey
May 2003



Legend

- Alluvium
- Alluvium Fan Deposits
- Alluvium and Colluvium
- Stream Terrace Deposits
- Lower Terrace Deposits
- Swamp and Marsh Deposits
- Carbonate-Rock Colluvium
- Weathered Carbonate Rock
- Scattered Bedrock Outcrop
- Extensive Bedrock Outcrop
- Gneiss Colluvium
- Weathered Gneiss
- Till
- Water

Data Sources:
Hunterdon County Division of GIS
New Jersey Geological Survey CD Series, CD 00-1

Miles
0 0.5 1

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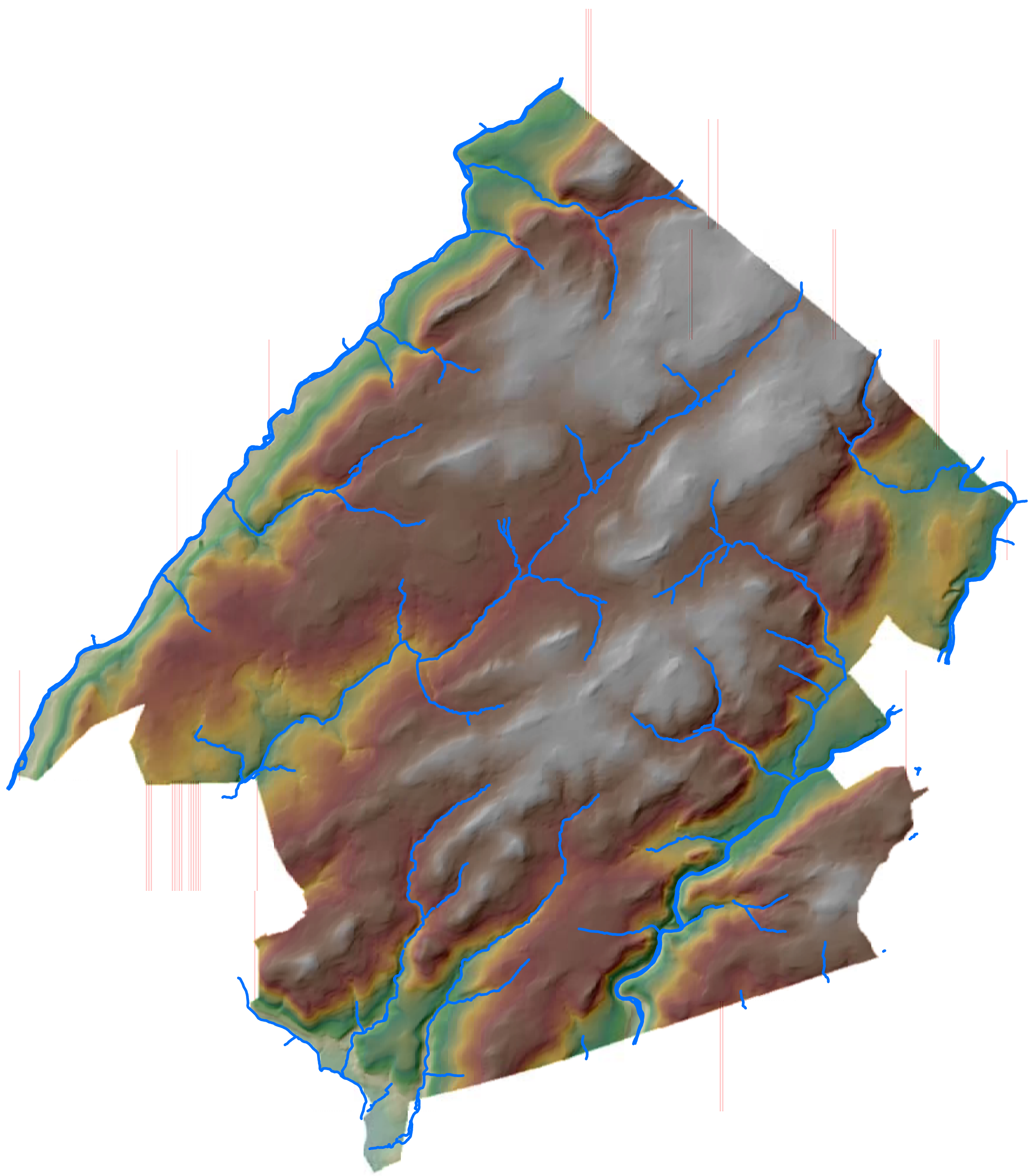
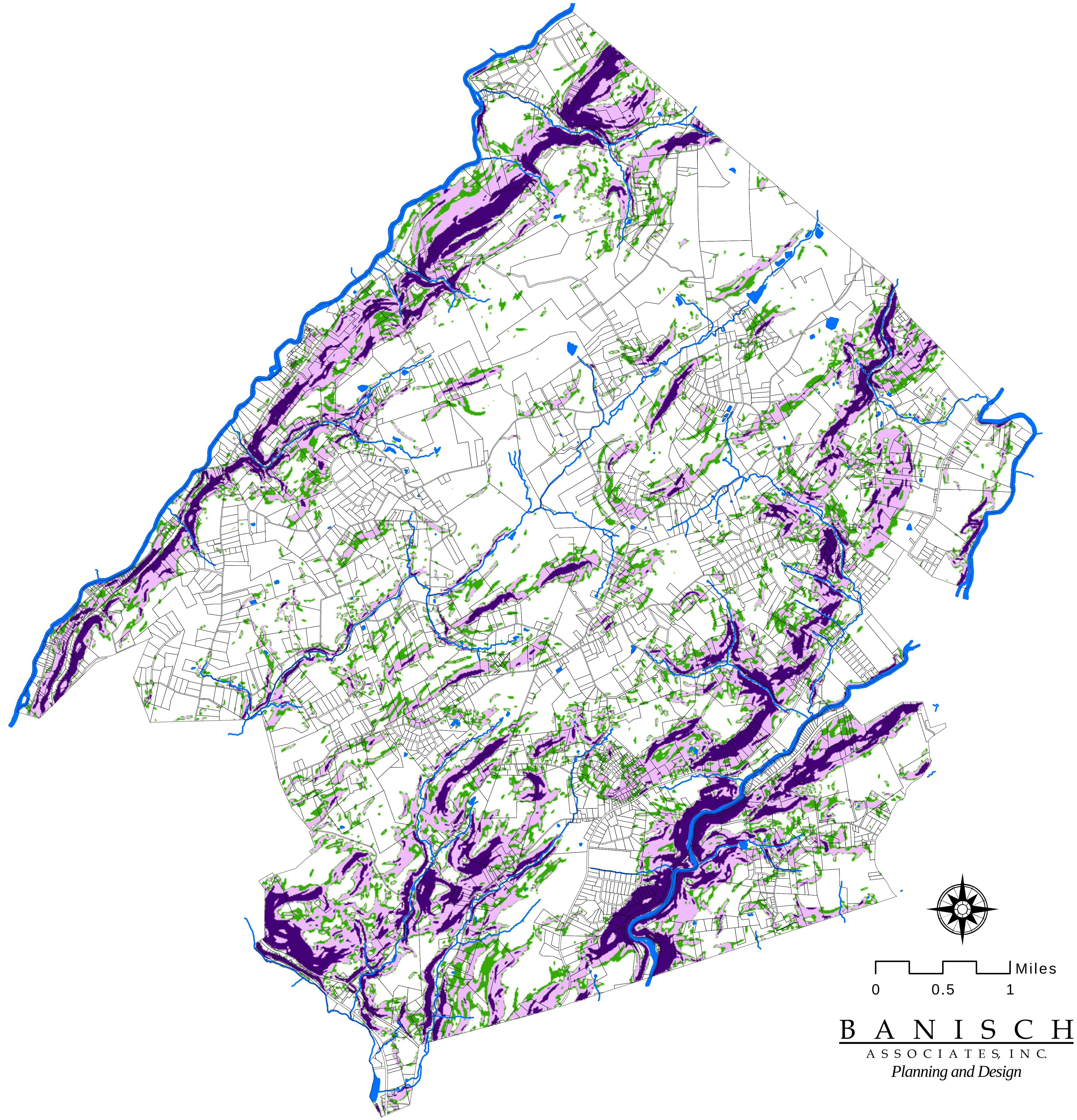
Topography and Steep Slopes

Township of Lebanon
Hunterdon County, New Jersey
May 2003





Legend

- Slopes less than 12%
- Slopes greater than 12% to 15%
- Slopes greater than 15% to 25%
- Slopes greater than 25%

Data Sources:
Hunterdon County Division of GIS
NJDEP 10 Meter Elevation Grids
Banisch Associates, Inc.

Water Quality and Water Quality Monitoring

Township of Lebanon
Hunterdon County, New Jersey
May 2003

AMNET Biological Monitoring Sites
Survey Results

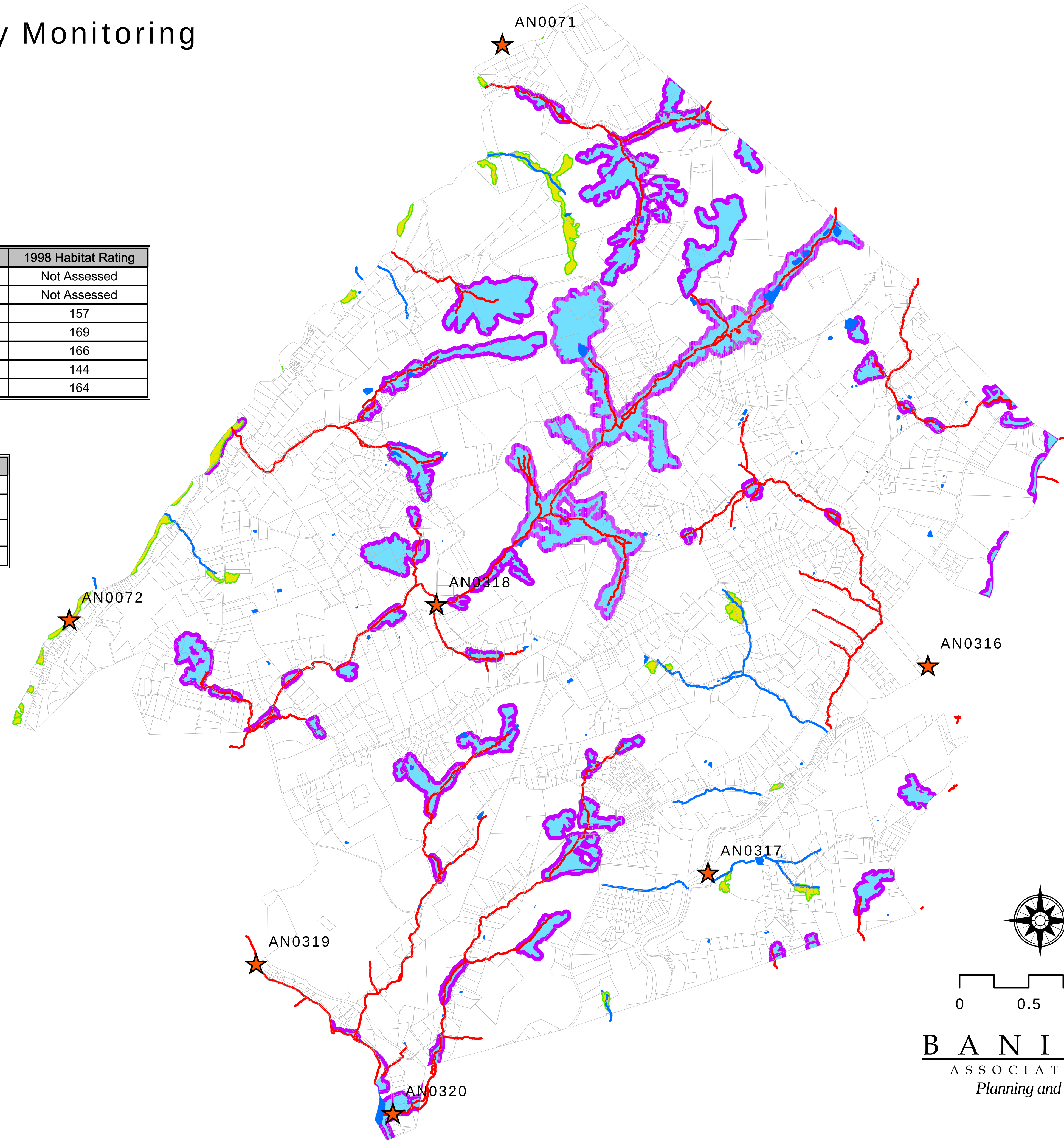
Site	1993 Score	1993 Impairment	1998 Score	1998 Impairment	1998 Habitat Rating
AN0071	27	NONE	30	NONE	Not Assessed
AN0072	27	NONE	15	MODERATE	Not Assessed
AN0316	27	NONE	27	NONE	157
AN0317	27	NONE	30	NONE	169
AN0318	27	NONE	30	NONE	166
AN0319	27	NONE	24	NONE	144
AN0320	30	NONE	27	NONE	164

Impairment Rating

Value	Score
Non-impaired	24-30
Moderately Impaired	9-21
Severely Impaired	0-6

Habitat Rating

Value	Score
Optimal	160 - 200
Sub-Optimal	110 - 159
Marginal	60 - 109
Poor	< 60



Miles
0 0.5 1

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

Legend

- AMNET Biological Monitoring Location
- Category 1 - Trout Production
- Trout Maintenance
- Required Trout Production Wetland Buffer
- Wetland Draining to Trout Production Stream
- Required Trout Maintenance Wetland Buffer
- Wetland Draining to Trout Maintenance Stream

Data Sources:
Hunterdon County Division of GIS
New Jersey Department of Environmental Protection

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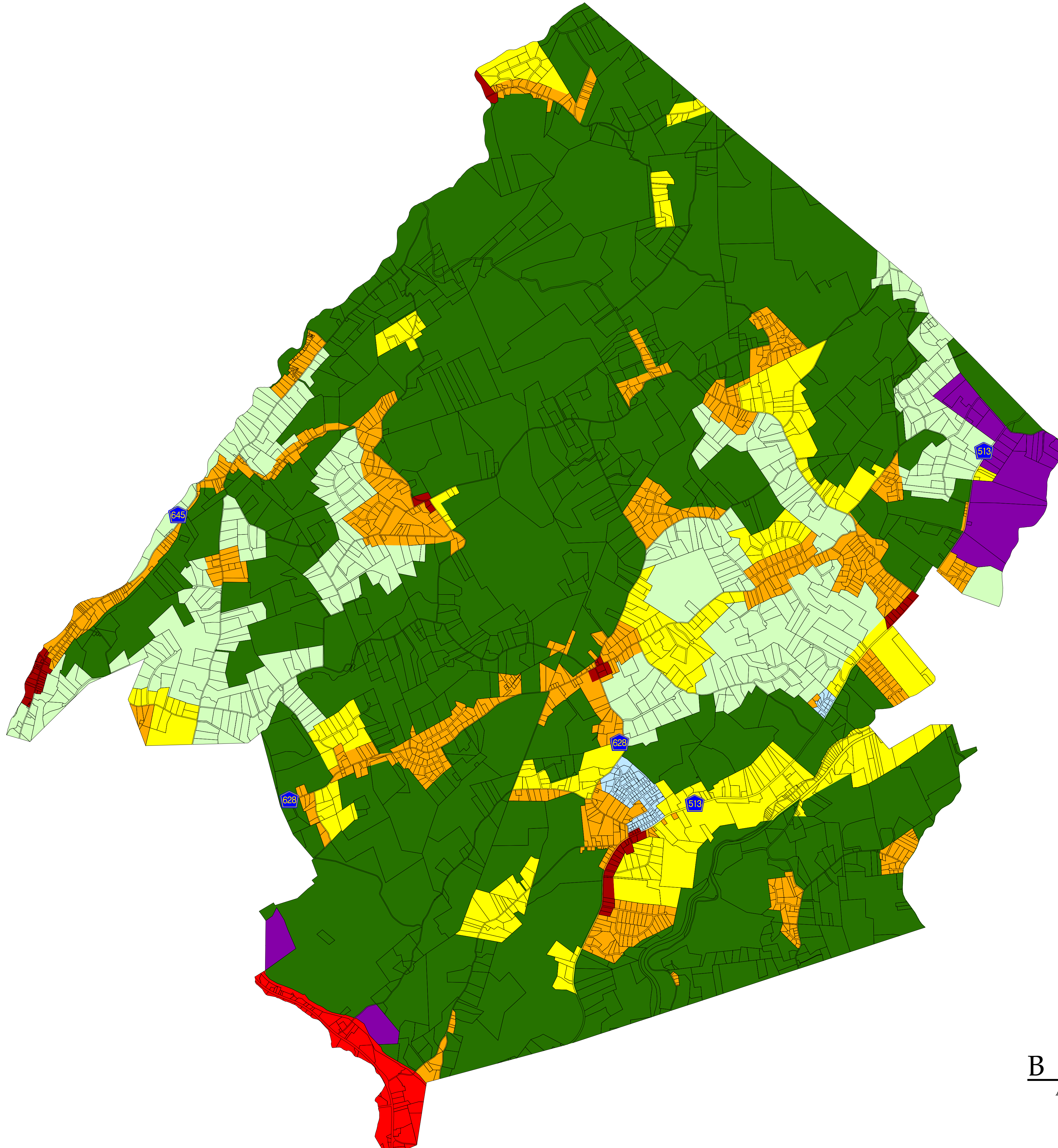
Zoning Map

Township of Lebanon
Hunterdon County, New Jersey
May 2003



Legend

- B-1 (Neighborhood Business)
- B-2 (Highway Business)
- I (Industrial)
- R-15 (One Family Residential)
- R-1 1/2 (One Family Residential)
- R-3 (Rural Residential)
- R-5 (Rural Agricultural)
- RC (Resource Conservation)

Data Sources:
Hunterdon County Division of GIS
Banisch Associates, Inc.

BANISCH
ASSOCIATES, INC.
Planning and Design

AMBIENT BIOMONITORING NETWORK

Watershed Management Areas

Benthic Macroinvertebrate Data

GENERALIZED

EXECUTIVE SUMMARY

Water Monitoring Report Prepared By:

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Victor Poretti

Thomas Miller

Dean Bryson

Map Preparation:

John Sell

Edited By:

Alfred L. Korndoerfer, Jr.

Paul Olsen

Ambient Biomonitoring Network

Watershed Management Areas

Benthic Macroinvertebrate Data

GENERALIZED EXECUTIVE SUMMARY

INTRODUCTION

Historical Perspective

Since the early 1970s the New Jersey Department of Environmental Protection (NJDEP) has conducted biological monitoring of the state's water bodies. These biomonitoring studies, currently conducted by the Bureau of Freshwater and Biological Monitoring (BFBM), have included both long-term ambient monitoring and short-term intensive surveys. The information gathered contributes significantly to State water quality management and pollution mitigation efforts. The United States Environmental Protection Agency (USEPA) has recognized that a thorough program of monitoring aquatic biota can be a cost-efficient means of gauging the quality of water and watershed areas [1, 2]. Because flora and fauna of various trophic levels can integrate the effects of water quality or habitat changes over time, they become very effective pollution indicators. For lotic (running water) systems, analysis of benthic macroinvertebrate communities provides the principal means of achieving this, particularly since macroinvertebrates are more stationary than fish, and less temporal than periphytic, or attached microscopic communities.

New Jersey's initial long-term ambient biological stream monitoring program (started in the mid 1970's), included only a limited number (31) of "fixed stations," many of which proved later to be either inaccessible or in degraded condition. In 1991, however, the BFBM received numerous requests from the Office of Regulatory Policy to reinitiate or upgrade long-term monitoring of benthic macroinvertebrate communities; the data obtained would be most beneficial in the generation of the 305b (Water Quality Inventory) biennial report [3] and in updating the 303d List (of water quality limited stream segments). Thus, the present Ambient Biomonitoring Network (AMNET) program was developed to provide NJDEP with the greater resolution of baseline data now necessary to support sound policy decisions in water quality/watershed management, and to direct regulatory, or "permit," activities. Initiated in 1992, AMNET samples over 800 stream sites statewide, with approximately 200 sites in each of five major drainage basins (upper and lower Delaware, greater Passaic, Raritan and Atlantic) once every five years. This ambitious project is facilitated by the use of Rapid Bioassessment Protocol II (RBPII) methods, devised by the USEPA, which provide an expedient tool for site ranking, screening and trend monitoring [2]. The present report, on the upper Delaware River basin, marks the start of the second round of AMNET.

Rationale for Biological Monitoring

Biological monitoring, as referenced in this report, pertains to the collection and analysis of stream macroinvertebrate communities as indicators of water or habitat quality. Macroinvertebrates are larger-than-microscopic, primarily benthic (bottom-dwelling) fauna, which are generally ubiquitous in freshwater and estuarine environments, and play an integral role in the aquatic food web. Insects (largely immature forms) are especially characteristic of freshwaters; other major groups include worms, mollusks (snails, clams) and crustaceans (scuds, shrimp, water fleas, etc.). They are more readily collected and quantified than either fish or periphyton communities. Species comprising the in-stream community occupy various niches, based on functional adaptation or feeding mode (e.g. predators, filter or detritus feeders, scavengers); their presence and relative abundance is governed by environmental conditions (which may determine available food supply), and by pollution tolerance levels of the respective species. The overall community thus is holistically reflective of conditions in its environment. Assessments of ambient water and habitat quality can then be made based upon standardized procedures, which can show perturbations measured as changes or differences in community structure [2, 4].

Advantages of Using Benthic Macroinvertebrates:

1. They are good indicators of localized conditions of water quality due to their limited mobility. As such, they are well suited for the assessment of site-specific pollution impacts.

2. They are sensitive to environmental impacts from both point and non-point sources of pollution.

3. They integrate the effects of short-term environmental variations, such as oil spills and intermittent discharges.

4. Sampling is relatively easy and inexpensive.

5. They are holistic indicators of overall water quality, even for substances that may be present, but at lower than detectable levels.

6. They are normally abundant in New Jersey waters as well as aquatic environments in general.

7. They serve as the primary food source for many species of commercially and recreationally important fishes.

8. Unlike chemical monitoring, where impacts to the environment tend to be by inference, not direct determination, they provide a direct measure of water quality in a manner consistent with the goals of the Clean Water Act.

9. They can be used to assess nonchemical impacts to the aquatic habitat, such as by thermal pollution, excessive sediment loading (siltation), or eutrophication.

10. To the general public, impacts to resident benthic macroinvertebrate communities are more tangible measurements of water quality than more esoteric listings of chemical test results.

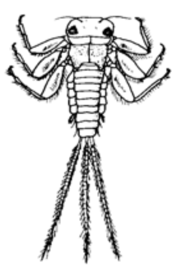
11. When monitored together with relevant chemical/physical parameters, benthic macroinvertebrate communities can be used to identify sources of impairment.

Limitations of Biological Monitoring:

nnot replace chemical monitoring, toxicity testing, and other standard environmental measurements. Each of these tools provides the analyst with specific information available only through its respective methodology.

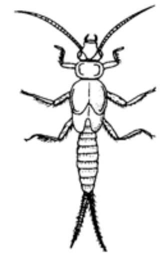
The following illustrations provide an overview of the major macroinvertebrate indicator groups employed in making biological water quality assessments.

Benthic Macroinvertebrates Usually Indicative of Good Water Quality



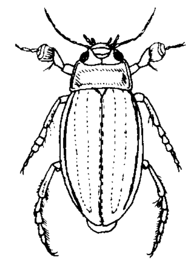
Mayfly nymphs are often abundant wherever the water is clean. They are sensitive to various types of water pollution, including low dissolved oxygen, ammonia, biocides, and metals.

Stonefly nymphs are usually found only in cool, well-oxygenated waters free of pollution. Though not usually found in the numbers characteristic of mayflies, the presence of even a few stoneflies is indicative of good water quality.



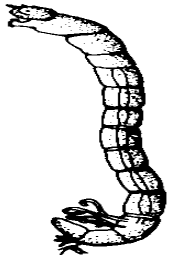
Most **caddisfly larvae**, many of which build portable cases of stones, sticks, sand and other detritus, are intolerant of water pollution.

Aquatic beetles are common in well oxygenated, swiftly running waters; many species are referred to as "riffle beetles." They are usually indicative of clean water since they are sensitive to wetting agents (soaps and detergents) and other pollutants.



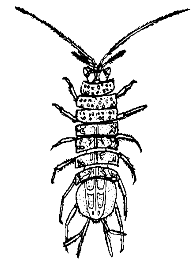
Illustrations modified from W.B. Clapham, Jr., "NATURAL ECOSYSTEMS," The Macmillan Company, New York, 1973.

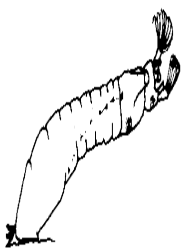
Benthic Macroinvertebrates Usually Indicative of Poor Water Quality



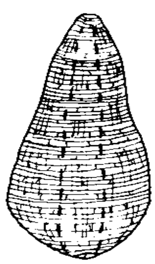
Midges (chironomids) are among the most common of aquatic invertebrates. They occupy a variety of aquatic habitats, including lakes, ponds, bogs, rivers, creeks, and marshes. They even exploit manmade habitats such as sewage treatment plants, water treatment plants, fish pools, irrigation ditches, and birdbaths. Many species are very tolerant of pollution.

Aquatic sowbugs, or freshwater isopods, are abundant in waters enriched with organic nutrients and low in dissolved oxygen. They are commonly observed in the recovery areas below sewage treatment plants.

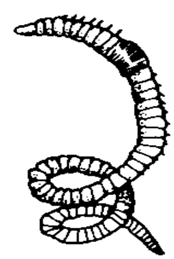




Black fly larvae are filter feeders, capturing and ingesting plankton and bacteria from the surrounding water with specialized antennae. Some species are very tolerant of poor water quality and thus can be used as indicators of pollution.



Leeches and other segmented worms are very common in our lakes and streams, though not often noticed. They are tolerant of poor water quality and severe pollution.



Illustrations modified from W.B. Clapham, Jr., "NATURAL ECOSYSTEMS," The Macmillan Company, New York, 1973

STUDY DESIGN

Data Quality Objectives

The major goal of AMNET is to establish a network of stream sites that would adequately represent New Jersey's major drainage basins and NJDEP's Watershed Management Areas (WMA). Twenty WMAs have recently been delineated within New Jersey's five basins. Each basin constitutes a "Water Region." Within each WMA are several sub-basins, delineated by the United States Geological Survey (USGS) as "hydrologic units," scale 11 (HUC11). The sampling frequency reflects a realistic temporal lag between cessation of an environmental perturbation and recovery of the impacted biological community. The 305b Water Quality Inventory [3], which reexamines changes in New Jersey's stream systems on a two-year cycle, has indicated that five years is an optimum period for long-term biomonitoring. An ample network of stations is required for the creation of a long-term database, which in turn, is necessary for trend analysis and operation of water quality predictive models.

Another program goal is to monitor a complete basin's complement of stations within a fiscal year (beginning July 1), giving our modelers and planners a snapshot of ambient biological impacts during that particular year. Monitoring will be rotated to a different basin each new fiscal year.

The spatial distribution of stations is adequate to provide biological impact data on a long-term, basin-wide or statewide scale. It is likely not sufficient, however, to assess the biological impact(s) of any one point source of pollution, as this would be better served by a site-specific or intensive survey of the stream segment in question.

Biological monitoring cannot replace chemical monitoring, toxicity testing, and other standard environmental measurements. Each of these tools provides the analyst with specific information available only through its respective methodology.

Site Selection

On the smallest tributaries, sampling sites were located as close to headwaters as practical. To ensure enough flow for sampling, sites on "first-order" streams were situated at least three miles downstream of headwaters (first order streams are those with no tributaries). Since most streams at this level have very little, or only intermittent, flow, most of our sites were situated on second-order streams (with only first-order streams as tributaries) and higher (with a greater hierarchy of tributaries). All sites were located in reasonably accessible and primarily wadable segments of a stream.

To maximize data correlation, AMNET, wherever possible, incorporated existing stations of the ambient Surface Water Chemical Monitoring Network, which is administered jointly by NJDEP and the USGS [7]. Furthermore, so as to gauge the effects of major tributaries and larger lakes, many AMNET sites were located near their confluence or outlet. Also considered when selecting sites were known sources of contamination (e.g. point-source discharges, agricultural operations) and significant natural features such as wetlands, parks or wildlife management areas.

Exact AMNET site locations were determined via the Global Positioning System (GPS) using Trimble Pathfinder units and the appropriate correction sources utilized by NJDEP. All positions were logged into the Geographical Information System (GIS) (see Maps, Appendix A).

ANALYSIS OF BIOLOGICAL IMPAIRMENT

Biological impairment may be caused by several major factors such as organic enrichment, habitat degradation, or toxicological effects. It may be manifested in several aspects of the benthic macroinvertebrate community; these include absence of pollution-sensitive taxa, especially the EPT group, i.e. Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies); in excessive dominance of pollution-tolerant taxa such as Chironomidae (midges) and Oligochaeta (worms); in low overall taxa numbers, or with other perceptible differences in community structure relative to a reference condition.

Benthic macroinvertebrate sampling and analysis is performed in accordance with NJDEP Field Sampling Procedures [8], Rapid Bioassessment Protocol II guidelines of the USEPA [2], and Standard Operating Procedures (SOP) of the BFBM Aquatic Biomonitoring Laboratory [9].

Benthic Community Analysis

The data analysis is an important part of the RBP protocol, developed under USEPA auspices as an expedient and cost-effective monitoring tool. It recognizes a multiple approach, utilizing several "biometrics," that measure different components of community structure, including population and functional parameters, each with a different range of sensitivity to pollution stresses [2, 4]. The use of a variety of biometrics assures a more robust or valid assessment; therefore, an anomaly in any one metric is less likely to invalidate the study findings. The results are integrated through common scoring criteria, derived from an established comparable database, to determine a final numerical rating and consequent biological condition category (see Table 1). This provides the analyst with an easily communicated evaluation of relative impairment, referred to in this report as the "bioassessment rating." For RBP II protocols, results are based on 100 organism sub-samples, and scoring criteria are validated for family level taxonomy, giving three final rating categories (non-impaired, moderately impaired, and severely impaired).

The biometrics we employ are modified from RBP II methods, having been statistically validated for New Jersey, based upon data from 200 stream sites throughout the state [10]. The final numerical rating is referred to as the "New Jersey impairment score" (NJIS). The scoring criteria and rating categories are presented in Table 1. The metrics from which the NJIS is derived are explained below:

1. **Total Taxa or Taxa Richness** (# families) — an index of community diversity; the number usually increases with increasing water or habitat quality.

2. **Percent Contribution of the Dominant Family** (to the total # families) — dominance by relatively few species/families would indicate environmental stress.

3. **# EPT Families** — the number of families represented within the orders Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies), which are generally pollution-sensitive.

4. **Percent EPT** (of the total # individuals) — would increase with increasing water quality.

5. **Hilsenhoff (Family) Biotic Index** — tolerance values of 0 - 10 assigned to individual families increase as water quality decreases; summarizes the overall pollution tolerance of the entire benthic macroinvertebrate community with a single value.

Morphological Abnormalities

Occasionally, morphological abnormalities have been found in individual macroinvertebrates recovered in our AMNET collections. These deformities have been most readily detected in the Chironomidae (midges), where they occur primarily in the head appendages (antennae) and mouth parts (mentum and mandibles). While the incidence has been most frequent in the chironomids, especially those species categorized as detritivores, herbivores or periphyton feeders, abnormalities have also been observed in individuals of other taxonomic groups. Although this is not a factor in the NJIS data analysis, such features are noted, as they may signify possible contaminants or stressful conditions in the respective drainages.

In the course of identification, chironomid larvae were examined for abnormalities. These results are summarized by sample site in Table 3. For chironomidae, the data is displayed as (# of chironomids with abnormalities / # of chironomids examined). For all other taxa, just the number of individuals with abnormalities is presented. Deformities found in greater than five percent (>5%) of chironomids examined were considered to be significant (personal communication — R. Bode, New York Department of Environmental Conservation; J. Kurtz, NJDEP). Abnormalities were considered to be "chronic" at a particular station if that site yielded >5% abnormalities for the sampling periods (see Table 3). Photographic examples of abnormalities in midge larvae and amphipods (scuds), plus maps of the sites where these were found, are contained in APPENDIX B. AMNET sites found with significant and chronic abnormalities in chironomids are also indicated in Maps.

SUPPLEMENTAL ANALYSIS / EVALUATION

Habitat Assessment

The physical attributes of habitat play an integral role in the health of the macroinvertebrate community. Where stations are physically comparable, detected impacts can be attributed to water quality factors; however, habitat degradation alone can account for biological impairment in a stream [2]. Parameters we evaluated included in-stream substrate, channel morphology, bank structural features, and riparian vegetation. The area evaluated included the sample site and its immediate surroundings (usually within a 100 – 200 foot radius).

The qualitative habitat assessment involves four condition categories, rating each parameter as optimal, suboptimal, marginal or poor based on recently revised USEPA criteria [11]. Habitat assessments may be temporarily downgraded by adverse weather conditions, such as excessive rainfall or prolonged drought (which existed during this study period). It should also be noted that habitat assessments are performed independently of the macroinvertebrate community analysis; thus they do not factor into the final impairment score, but are used primarily as supplementary information. For each parameter, the range of conditions and the numerical rating scale are presented for high and low gradient streams, respectively, in Table 4. Comparisons of these final scores against the respective NJIS scores and relative trends, are shown in ***Appendix C***.

All streams in the northern portion of New Jersey, i.e. the Piedmont, Valley/Ridge and Highlands regions, are considered to be "high gradient" streams, having substrates of rock and cobble of various sizes, and with relatively swift flow. Those in the Coastal Plain region of southern New Jersey are considered as "low gradient" streams, having slower flow and more homogeneous substrates, primarily of sand or gravel and finer sediments. These major physiographic subregions are illustrated in the New Jersey State EcoMap [12]. The transition from high gradient to low gradient is marked by the "Fall Line," a geologic/topographic feature that bisects New Jersey in a southwest–northeasterly direction from the Delaware River at Trenton through the lower Raritan River near New Brunswick.

Sediment Toxicity Testing

To supplement the results of the benthic macroinvertebrate sampling, the BFBM performs acute sediment toxicity tests on several AMNET sites that exhibited "severely impaired" biological conditions. The methods conformed to standardized USEPA protocols as reflected in our laboratory Standard Operating Procedures [9]. The amphipod, *Hyalella azteca*, was used as the test organism in the 10-day tests that measured effects on both survival and growth. Results from the test sites were compared to the responses observed in reference sediment from non-impaired AMNET sites that were similar in morphology or habitat features.

RESULTS AND DISCUSSION

Overall, bioassessment ratings developed for each of the monitoring stations were used as the basis for evaluating the degree of biological impairment within the coincident stream segments. The estimated bioassessment ratings for each stream segment are presented as color-coded highlighted segments on the GIS maps. In each WMA, starting from the AMNET station farthest downstream, estimated bioassessment ratings were assigned to the stream segments by interpolating from the downstream station to the next contiguous upstream station. These ratings are best estimates of the in-stream biological impairment based upon the available data. For any given segment, however, the actual in-situ conditions may vary due to unknown differences in habitat or sources of degradation. Detailed taxonomic and statistical data, bioassessment ratings, habitat assessment scores and observations for each AMNET site are given in the full report complement to the present executive summary.

Habitat Assessment vs. Biological Condition

Habitat assessment scores and corresponding NJIS scores for each station in the AMNET sites are plotted along a spatial gradient, north to south/upstream to downstream, in Appendix C. In this scenario, paralleling of the trend lines, in some degree (which is seen in much of the data), would reflect a direct relationship or positive correlation between the two parameters. In a few situations, a non-impaired biological community was found where habitat appeared to be impaired. Conversely, in some cases of optimal habitat, an impaired biological community was found; therefore, water quality or other physiochemical factors likely were involved. Habitat assessments were not performed in the first round of the AMNET survey; thus, no temporal comparisons could be made. Further assessments and statistical analyses relating habitats assessments to biological condition should be conducted in order to reveal possible trends and correlations.

Causes and Conditions of Impairment

Biological impairment, as determined through RBP analysis, is manifested by alterations or differences in macroinvertebrate community structure, compared to a reference or "ideal" condition. In an impaired situation, species of pollution-tolerant groups (such as worms and midges) tend to dominate over pollution-intolerant forms (e.g. mayflies, stoneflies, etc.), with an overall depression in species diversity. Such discrepancies are typically due to degraded instream environmental conditions, which may be caused by various human activities or land-uses and, in some cases, by natural features or events. Environmental factors that may adversely affect stream biology, including both chemical and physical parameters, are listed below:

1. Lack of dissolved oxygen

2. Higher than normal temperature

3. Excessive turbidy

4. Presence of toxicants (in various chemical forms)

5. Eutrophication (= excessive nutrients promoting undesirable vegetation or algal blooms, and increased turbidity

6. Degraded habitat (see Table 4)

    a. lack of bank vegetation/canopy (= poor bank stability, lack of shade)

    b. excessive sedimentation (= poor substrate and water clarity)

    c. lack of streamflow (= low dissolved oxygen, possible sedimentation, undesirable vegetation)

Inter-related human activities or practices, land uses, and natural features or events contributing to degraded stream quality:

1. Deforestation/development/construction (largely via runoff from non-point sources)
2. Urbanization/industrialization (largely via runoff from non-point sources)
3. Agricultural operations (largely via runoff from non-point sources)
4. Municipal or industrial wastewater discharge (point source)
5. Artificial channelization or habitat alteration
6. Upstream impoundment, lake or pond
7. Drought conditions

Levels of benthic community impairment (or lack of it) have been statistically related to different physiographic land types, corresponding land uses and other anthropogenic factors, on a statewide scale, using data generated from the AMNET program [13]. These findings strongly indicate that human land uses and practices, superimposed on the minimally disturbed physical terrain, play a major role in controlling the degree of pollution or degradation in a stream system. These relationships are reflected in the results of the present AMNET study.

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TABLE 1

BIOLOGICAL CRITERIA FOR SCREENING WATER QUALITY

IN NEW JERSEY FRESHWATER STREAMS

Scoring Criteria for Rapid Bioassessments

MAPS

AMNET Study

WMAs

AMNET site locations and their respective biological ratings, for each major sub-basin, are shown in the following maps. Also identified are sites that exhibited significant and chronic macroinvertebrate abnormalities.

APPENDIX B

Pictures and Site Locations of Morphological Abnormalities in Larval Chironomidae and Amphipoda Recovered in the AMNET Study

APPENDIX C

Graphical Comparison of Habitat Assessment Scores and New Jersey Impairment Scores from the AMNET Study

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Click here to see a list of the Taxonomic References used by the staff

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Last Update: 01/08/02

New Jersey Department of Environmental Protection
Bureau of Freshwater and Biological Monitoring

http://www.state.nj.us/dep/wmm/bfbm/

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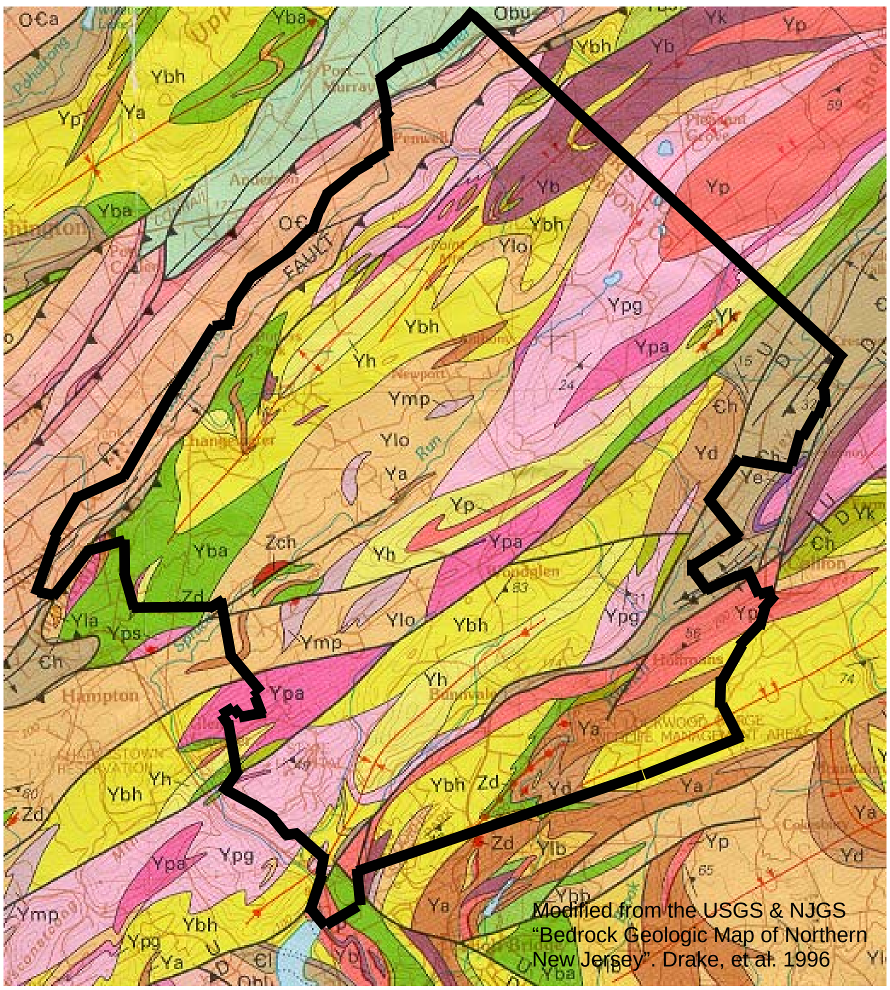
Lebanon Water Resource Evaluation

Evaluation of Groundwater Resources of Lebanon Township, Hunterdon County, New Jersey



Modified from the USGS & NJGS "Bedrock Geologic Map of Northern New Jersey". Drake, et al. 1996

Water: A Natural Renewable Resource

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Water: A Natural Renewable Resource

EVALUATION OF GROUNDWATER RESOURCES OF LEBANON TOWNSHIP, HUNTERDON COUNTY, NEW JERSEY

MARCH 23, 2001

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Water: A Natural Renewable Resource

EVALUATION OF GROUNDWATER RESOURCES OF LEBANON TOWNSHIP, HUNTERDON COUNTY, NEW JERSEY

TABLE OF CONTENTS

Water: A Natural Renewable Resource

TABLE

FIGURES

Water: A Natural Renewable Resource

EVALUATION OF GROUNDWATER RESOURCES OF LEBANON TOWNSHIP, HUNTERDON COUNTY, NEW JERSEY

INTRODUCTION

Lebanon Township of Hunterdon County retained M^2 Associates in October 2000 to conduct an evaluation of the groundwater resources of the Township. The location of Hunterdon County in New Jersey is shown on Figure 1. The location of Lebanon Township in Hunterdon County is shown on Figure 2.

Lebanon Township requested the groundwater resource evaluation because of the following:

1. The source of drinking water for Township residents is groundwater. Water is primarily supplied to these residents from individual wells completed in fractured bedrock aquifers. The hydrogeologic characteristics of these aquifers are dependent on the type of bedrock and nature of the fractures and other openings. The type of bedrock limits recharge rates, sustained yields, interference effects, groundwater quality, and contaminant removal/dilution rates.

2. The Township is located within the “Northwest New Jersey Sole Source Aquifer” as defined by the New Jersey Department of Environmental Protection (NJDEP) and designated by the US Environmental Protection Agency (USEPA) in the Federal Register on May 23, 1988. The NJDEP and USEPA consider groundwater to be the single source of potable water within the basin and indicate that measures should be taken to protect this critical resource.

3. Approximately 80 percent of the Township is located in New Jersey Regional Water Resource Planning Area (RWRPA) 10, which is the third most populated RWRPA in the State and this population is expected to grow an additional 31 percent in the next 50 years (NJDEP 1996). This portion of the Township, which has some of the highest elevations within the RWRPA, is an upland recharge area for the Raritan River Watershed. The northern 20 percent of Lebanon Township is located within RWRPA 8, which is a narrow planning area along the Musconetcong River. Sections of Lebanon Township provide recharge to this environmentally critical watershed.

4. The density of housing and application of surface/subsurface improvements can impact aquifers and may result in reduced recharge, lowered yields, increased interference, and degradation of groundwater

quality. In areas of the Township where aquifer yields and/or recharge are limited or strained, additional housing/improvements may impact current users of groundwater.

Lebanon Township wants to protect its valuable groundwater resources for current and future residents and businesses. Furthermore, as a headwaters and recharge area for one of the most populous and fastest growing regions in the State, Lebanon Township is concerned with protecting the water resource availability and quality for downstream consumers in the RWRPA 10 and the Spruce Run Reservoir system. The Township also wants to protect the ecological needs of the Raritan River and Musconetcong River watersheds.

The evaluation of the groundwater resources included but was not limited to the following:

1. A review of published maps and reports on the geology of Lebanon Township and neighboring municipalities in Hunterdon County.

2. An assessment of surface-water basins and potential groundwater recharge rates within these basins.

3. A review of published reports and data on file with the Hunterdon County Health Department regarding groundwater quality.

The data/information from this review was used to assess the recharge area requirements for supporting the drinking-water needs for a single-family residence and to dilute nitrate contaminants from a septic system discharge. In addition, the recharge area requirements were evaluated to minimize potential downstream impacts to the water resources and ecology of the Raritan River and Musconetcong River watersheds.

GEOLOGY

PHYSIOGRAPHIC PROVINCE

Lebanon Township is bounded to the northwest by Washington Township of Warren County, to the northeast by Washington Township, Morris County, to the east by Tewksbury Township and the Borough of Califon, to the southeast by Clinton Township and the Borough of High Bridge, and to the southwest by Bethlehem Township and the Boroughs of Hampton and Glen Gardner (see Figure 2). The Township encompasses approximately 32 square miles of the northern-most portion of Hunterdon County.

The boundary between the Highlands and Piedmont Physiographic Provinces is located south of the Lebanon Township's borders indicating that the entire

Township is within the Highlands Physiographic Province. This boundary is shown on Figure 3. In New Jersey, steep, rounded ridges separated by narrow valleys characterize the Highlands Province.

In general, the ridges are comprised of poorly fractured, erosion-resistant crystalline igneous and metamorphic rocks whereas; the valleys are comprised of more easily eroded rocks of sedimentary origin. The topography of Lebanon Township is characterized by a number of steep ridges and rounded hills that separate the Musconetcong Valley to the northwest and Long Valley to the southeast.

Based on the U.S. Geological Survey (USGS) topographic maps depicting the Township, the highest elevation is 1034 feet above mean sea level and was measured northeast of the Township elementary school and the intersection of Woodglen and East Hill Roads. At least three other locations in the Township have measured elevations exceeding 1000 feet above mean sea level and Lebanon Township has the highest elevations in Hunterdon County. The lowest elevation depicted on the topographic maps is approximately 270 feet above mean sea level and is located where Willoughby Brook drains into Spruce Run Reservoir in the southern corner of the Township. Figure 4 is a composite of the High Bridge, Washington, Hackettstown, and Califon USGS topographic quadrangles, each of which depicts a portion of Lebanon Township.

SURFACE WATER

The Musconetcong and Raritan River Watersheds divide Lebanon Township. The topographic divide between these watersheds is shown on Figure 4 and corresponds to the border between RWRPAs 8 and 10.

North of this divide, surface water and most likely, groundwater are flowing toward the Musconetcong River. South of the divide, surface water and most likely, groundwater are flowing toward the South Branch of the Raritan River and tributaries to this River such as Willoughby and Little Brooks, and Spruce and Rocky Runs.

The headwaters for several tributaries to the South Branch of the Raritan River are located at the higher elevations within Lebanon Township. Similarily, the headwaters for several tributaries to the Musconetcong River originate in Lebanon Township.

SOILS

The U.S. Department of Agriculture Soil Conservation Service published the “Soil Survey Hunterdon County, New Jersey” in 1974 and republished this document in 1988. Based on this document, three general soil associations are encountered beneath most of Lebanon Township. A fourth soil association is encountered in the southern corner of the Township near Spruce Run Reservoir. The locations of these soil associations are shown on Figure 5.

Along the northwestern boundary of Lebanon Township and the Musconetcong River, the soils are comprised of the Rowland-Birdsboro-Raritan association. This soil association is also encountered beneath the flood plain of the South Branch of the Raritan River near the southeastern border of the Township. Soils of the Rowland-Birdsboro-Raritan association are found in areas with gentle to nearly level slopes and are well to poorly drained. These soils are typically associated with flood plains and may be flooded during parts of the year.

Near the Borough of Califon in the Long Valley portion of the Township, the Duffield-Washington association soils are encountered. These soils are found on gentle to moderately steep slopes and are considered well drained. These types of soils are derived from weathering of the underlying limestone and dolomite bedrock. Solution channels such as, caverns, sinkholes and cavities may be present in areas where the Duffield and/or Washington soils are encountered.

Most of Lebanon Township is underlain by the soils of the Parker-Edneyville-Califon association. Soils of this association are found in areas with gentle to steep slopes and are excessively to poorly drained. Cobbles and gravel-sized weathered residual rock fragments are often found with these types of soils and in some cases, the gravel fragments comprise more than 20 percent of the soils. The percentage of rock fragments increases with increasing elevation. These soils are typically found from 200 to 1,000 feet above mean sea level.

The Parker and Edneyville soils form a thin layer (less than 6 feet) over the bedrock surface and in several areas of the Township, the bedrock surface outcrops. In the Califon soils, which are poorly drained, the seasonal water table is shallow (less than 3 feet). The Soil Conservation Service indicates severe limitations for these three soil types and they are considered by this agency inappropriate for septic systems.

In a very small portion of the Township southwest of the Borough of High Bridge and near the northern corner of Spruce Run Reservoir, the Washington-Berks-Athol association is encountered. The Washington, Berks, and Athol soils comprise approximately 30, 30, and 20 percent, respectively, of the association. These well-drained soils are found in areas with gentle to moderately steep slopes. The Washington and Athol soils are derived from weathering of carbonate bedrock and may overlie solution features such as, sinkholes and/or caverns. The Berks soils are derived from the weathering of shale.

The Soil Conservation Service indicates severe to slight limitations associated with community planning for these three soil types. The Washington soils may be limited for subsurface sewage disposal in areas of solution channels. The Athol and Berks soils are moderately to severely limited for subsurface sewage disposal because of shallow bedrock and/or steep slopes.

BEDROCK

Similar to soils, the bedrock of Lebanon Township can be divided into two general groupings primarily based on age and rock type. The geology of Lebanon Township is shown on Figure 6. This figure is from the USGS and New Jersey Geological Survey (NJGS) report entitled “Bedrock Geologic Map of Northern New Jersey” published in 1996.

Precambrian (older than 570 million years) igneous and metamorphic rocks underlie approximately 90 percent of the Township. Gneiss and granite underlie much of this area. The rocks in this portion of the Township include members of the Byram and Lake Hopatcong Intrusive Suites, Losee Metamorphic Suite, metasedimentary rocks, diabase intrusions, Chestnut Hill Formation, and other rocks of uncertain origin. The Precambrian rocks have been extensively deformed into a series of southwest to northeast trending folds.

Most of the major earthquake faults have been mapped within the Township near the boundaries between the Precambrian crystalline rocks and the younger Cambrian-Ordovician sedimentary rocks along the Musconetcong and Long Valleys. A few minor splays apparently associated with the Longwood Valley, Tanners Brook, and Turkey Brook normal fault systems transect the crystalline rocks. Some of these splays quickly terminate in the crystalline rock and do not appear extensive.

Near the Borough of Califon, the Precambrian rocks are bounded on both sides of Long Valley by regional southeast dipping normal faults associated with the Longwood Valley and Tanners Brook Fault systems. The Ordovician-Cambrian rocks found within the valley moved downward with respect to the older Precambrian rocks forming a graben.

The Precambrian igneous and metamorphic rocks are also fault bounded to the northwest by the Musconetcong Thrust Fault. The older crystalline rocks were thrust over the younger limestones and dolomites that form the valley in the northern portion of Lebanon Township.

The second grouping of rocks are mapped beneath approximately 10 percent of the Township along the northern boundary and in the southeastern portion near the Borough of Califon. These rocks include the Ordovician-Cambrian (440 to 570 million years ago) dolomites and limestones of the Leithsville, Allentown, Beekmantown, and Jacksonburg Formations. This group also includes the shales of the Bushkill Member of the Ordovician Martinsburg Formation and the quartzites of the Hardyston Formation.

The dolomites and limestones of the Allentown Formation are the primary rock-types underlying the Musconetcong Valley within the northern portion of Lebanon Township. The Leithsville Formation is the primary dolomite underlying Long Valley in the southeastern portion of the Township. The Allentown and Leithsville rocks along with the Beekmantown units in the Musconetcong Valley are susceptible to the formation of cavities, sinkholes, and caverns.

WATER SUPPLY

PRECAMBRIAN IGNEOUS AND METAMORPHIC ROCKS

In the Precambrian igneous and metamorphic rocks, groundwater is stored and transmitted along fractures, joints, and foliation planes. These openings in the bedrock are separated by a few inches to several feet of competent, unweathered bedrock. Since these unweathered rocks have no primary porosity and can be generally considered impermeable, the water-supply characteristics of the Precambrian units are dependent on the degree of weathering, the size and interconnection of openings in the rock, and the spacing between these openings.

For example, if a well is drilled through competent unweathered bedrock into a series of highly weathered and interconnected fractures. Testing of this well would likely indicate that the aquifer is capable of transmitting and storing a significant quantity of water through these fractures and that the well is high yielding. If a second well is drilled nearby and intersects a single unweathered fracture isolated from the fractures in the first well, the testing results would likely indicate a poorly transmissive aquifer with limited storage capability. The second well may not yield sufficient volume of water to sustain a single-family household.

Because of the limited interconnection of fractures in the Precambrian rocks, wells are often completed to significantly different depths on nearby properties. Based on data supplied by the Hunterdon County Health Department, wells drilled on Lebanon Township Block 12 Lots 10, 10.04, 10.05, and 10.06, which are all located within a few hundred feet of each other, were completed to depths of 350, 500, 200, and 150 feet below ground surface, respectively. The driller's estimated the respective yields for these wells at 4, 1.5, 15, and 50 gallons per minute (gpm) indicating that the deepest wells had the lowest yields.

The Precambrian rocks are considered to be poor aquifers with low yields (NJDEP 1996). Generally, groundwater occurs under water-table conditions (Kasabach 1966) in areas where fractures are open to the overlying weathered

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residual soils. Yields of wells completed near major faults or streams are usually greater than wells completed distant from these features. The yield increase near a major fault is the result of an increased fracture density. The yield increase near a stream is because the stream can provide water to the fractures that intersect the well and stream.

The 1966 report entitled “Geology and Ground Water Resources of Hunterdon County, N. J.” prepared by Haig F. Kasabach indicates that specific capacities for 124 wells in Hunterdon County completed in the Precambrian crystalline rocks range from 0 to 8.3 gallons per minute per foot of drawdown (gpm/ft). Kasabach’s (1966) report summarizes data for wells completed in Lebanon Township and these data were used to calculate the specific capacities for domestic wells completed in the crystalline rocks beneath the municipality. The median specific capacity for 54 domestic wells is 0.43 gpm/ft, which indicates an estimated aquifer transmissivity of 860 gallons per day/foot (gpd/ft) (Driscoll 1986). The median specific capacity and transmissivity estimate are indicative of a poor water-supply aquifer.

ORDOVICIAN-CAMBRIAN LIMESTONES AND DOLOMITES

The limestones and dolomites of the Ordovician-Cambrian formations store and transmit groundwater along fractures, joints, foliations, and bedding planes. A significant difference between the limestones/dolomites and the crystalline Precambrian rocks is the effect of dissolution and weathering. Water in combination with carbon dioxide and/or organic carbon can chemically react with limestones and dolomites and dissolve sections of rock forming solution channels such as, cavities, caverns, and sinkholes. These enlarged openings can store and transmit vast quantities of water. Limestone/dolomite aquifer systems are some of the most prolific in New Jersey (NJDEP 1996).

Although a well can be completed in relatively unweathered limestone and have a poor yield, limestones and dolomites are less resistant to weathering and are often, more susceptible to fracturing than crystalline igneous and metamorphic rocks. Therefore, the yields of wells, and the transmission and storage characteristics of limestones/dolomites are significantly greater than associated with the crystalline rocks. Based on the Kasabach (1966) report, the median specific capacity for 10 wells completed in the limestone/dolomite bedrock of Lebanon Township is 1 gpm/ft. This value indicates an estimated transmissivity for the aquifer of 2,000 gpd/ft, which is indicative of a moderate water-supply aquifer.

In other portions of Hunterdon County, the limestones and dolomites have much higher yields and specific capacities than reported by Kasabach (1966) for Lebanon Township. The lower values for Lebanon Township are most likely a result of the limited portions of the Township underlain by these carbonate rocks.

Within Hunterdon County, the limestones/dolomites have specific capacities ranging from 0.004 to 10 gpm/ft with an average of 1.83 gpm/ft.

WELL YIELDS

The yield of a well completed in bedrock is generally dependent on the geologic rock type, the number of water-bearing fractures encountered, the size of fracture openings, and the interconnection of the fractures to each other and to a source of recharge. The yields of wells completed in the Cambrian-Ordovician limestones and dolomites of Lebanon Township are greater than for wells completed in the Precambrian igneous and metamorphic crystalline rocks.

The Kasabach (1966) report indicates that yields for wells completed in Precambrian rocks within Hunterdon County range from 0 to 66 gpm with an average of 14 gpm. This report indicates a range of yields for domestic wells from 1.5 to 60 gpm with a median yield of 10 gpm for 61 wells completed in crystalline rocks beneath Lebanon Township.

The Hunterdon County Health Department (Warner, personal communication), has compiled water quality and well construction information in a database since 1990. The database includes Lebanon Township Block and Lot numbers, which were used to locate wells within the municipality and to determine the type of underlying bedrock. Table 1 summarizes the well data obtained from the Hunterdon County Health Department database

The data from the Hunterdon County Health Department for 336 wells completed in the Precambrian igneous and metamorphic rocks beneath the Township indicates that the yields range from 0.5 to 70 gpm with a median of 10 gpm. The depths of these wells range from 50 to 798 feet below ground surface with a median depth of approximately 285 feet.

The Kasabach (1966) report indicates that yields for wells in Hunterdon County completed in limestone/dolomite bedrock range from 0.5 to 50 gpm with an average of 17 gpm. This report indicates a range of yields for domestic wells from 5 to 43 gpm with a median yield of 15 gpm for 13 wells completed in limestone and dolomite beneath Lebanon Township.

The data for 54 wells completed in areas of Lebanon Township underlain by Ordovician-Cambrian formations indicate yields ranging from 2.5 to 100 gpm with a median yield of 20 gpm. The depths of these wells range from 80 to 998 feet below ground surface with a median depth of approximately 206.5 feet.

Based on the median yields, a Lebanon Township well completed in the Cambrian-Ordovician limestones and dolomites is likely to have yield 50 to 100 percent greater than a well completed in the Precambrian crystalline rocks. In addition, the median well drilled in the Precambrian bedrock will be nearly 80 feet deeper.

HYDROGEOLOGIC ZONES

Figure 6 shows that the major fractures/faults mapped by the USGS/NJGS in Lebanon Township are located near the contacts between the Precambrian and Ordovician-Cambrian rocks or within the Ordovician-Cambrian formations. A few minor splays of the Longwood Valley, Tanners Brook, and Turkey Brook regional faults appear to quickly terminate in the Precambrian rocks beneath Lebanon Township. The USGS/NJGS map does not indicate extensive fracturing of the Precambrian crystalline rocks.

Given the differences in median specific capacities, transmissivity estimates, depths, and well yields between the Precambrian igneous and metamorphic rocks and the Ordovician-Cambrian limestones and dolomites, Lebanon Township was divided into four hydrogeologic zones with each zone underlain by one of two distinct aquifer systems. The name for each zone is based on the underlying type of bedrock aquifer system. These zones are shown on Figure 7.

Most of the Township including a very small section near Califon Borough is underlain by the aquifer system comprised of Precambrian igneous and metamorphic rocks and therefore, both zones are referenced as Precambrian Crystalline Rock Zone. A limited area near the northwestern border of the Township and the area beneath Long Valley in the southeastern portion of the municipality are underlain by limestone and dolomite aquifer systems and therefore, these zones are referenced as Limestone/Dolomite Zone.

AQUIFER RECHARGE

Water Balance

Precipitation

A water balance can be used to evaluate inflow and outflow parameters associated with a hydrologic system. The inflow parameter to the equation, precipitation, can be directly determined from historical information. The outflow parameters, evapotranspiration, groundwater recharge, and surface-water runoff are determined by indirect methods. The water balance can be used to evaluate the assumptions made in estimating these indirect parameters. Since the equation is a balance, the inflows must equal the outflows. This balance allows for improvements in the outflow parameter estimations.

Bedrock aquifers are replenished by incident precipitation that infiltrates through soils into fractures and other openings in the rock. Rough estimates have been developed that 10 to 25 percent of incident precipitation infiltrates through soils and recharges groundwater in fractured bedrock aquifers (Kasabach 1966). Based on historical precipitation measurements collected by the National Climatic Data Center and as shown in the 1996 Statewide Water Supply Plan (NJDEP 1996), Lebanon Township receives approximately 46 inches of precipitation per year. In general, this precipitation is evenly divided throughout the year.

Using the water balance of the hydrologic cycle, precipitation must equal the sum of groundwater recharge, evapotranspiration, and surface runoff. If an area has one or more large water bodies, direct precipitation to this body and the resulting evaporation from this body, may also be included in the water balance. The water balance is often described by the following equation:

$$P = GWR + SWR + ET + (DP-E)$$

Where:

P = Precipitation
GWR = Groundwater Recharge
SWR = Surface-Water Runoff
ET = Evapotranspiration
DP = Direct Precipitation to large surface water body
E = Evaporation from large surface water body

Since Lebanon Township does not have any large surface water bodies the parameters for direct precipitation and evaporation can be eliminated. The remaining parameters of the equation can be rearranged to evaluate the groundwater recharge parameter.

Surface-Water Runoff

Surface-water runoff, also referred to as overland flow occurs when the infiltration capacity of the soils is exceeded and the water flows over the land surface to a stream channel. In poorly drained soils and/or highly developed areas with impervious surfaces, surface runoff can account for much of the precipitation. Additionally, runoff is dependent on the types and density of vegetation, surface area of impervious materials, steepness of slopes, and the intensity and duration of rainfall. Miller (1974) reported that runoff is high in the Highlands Physiographic Province.

Kasabach (1966) indicated that because of the limited size and interconnection of openings in the crystalline bedrock in Hunterdon County, fractures are often recharged early during storm events forcing subsequent precipitation to runoff. Interflow, which is water that infiltrates through soils but can not migrate through an underlying impermeable or low permeability layer and therefore, flows laterally in the unsaturated zone, can increase the volume of runoff. Water infiltrates the permeable weathered soils, encounters the low permeability Precambrian crystalline bedrock surface, and follows the path of least resistance down slope to a discharge point where it then flows overland to a stream channel. This path is through the weathered materials immediately above the interface between the soils and bedrock. Given the shallow nature of bedrock, the lack of fracturing of the crystalline bedrock, and the steep slopes, surface runoff and interflow are expected to be a large percentage of incident precipitation in Lebanon Township.

A USGS study of streamflow data for a portion of New Jersey underlain by igneous intrusions indicates that surface-water runoff is approximately 15.9 inches per year or approximately 34 percent of annual precipitation (Lewis-Brown 1995). These results indicate that more than one-third of annual precipitation in areas underlain by poorly fractured crystalline rocks will runoff to streams.

In limestone/dolomite areas of New Jersey and eastern Pennsylvania, surface-water runoff rates can vary significantly based on the type of underlying limestone/dolomite, the susceptibility of these rocks to the formation of solution channels, the extent of fracturing, and the type of rock underlying topographically upgradient areas. In karst areas with a high degree of fracturing, surface-water runoff may be only a few inches per year.

Evapotranspiration

As part of the hydrologic cycle, water is returned to the atmosphere by evaporation from open water bodies and surface soils, and transpiration from vegetation. These two variables of the water balance are referred to as evapotranspiration.

Evapotranspiration is greatest during the summer months because of higher temperatures and active growth of plants and trees. During the winter months evapotranspiration is usually negligible.

Evapotranspiration is the largest component of the water balance and may account for more than 60 percent of precipitation. The USGS estimated that the average evapotranspiration in the Little Lehigh Creek drainage basin, which is located approximately 32 miles west of Lebanon Township, between 1975 and 1984 was 24.6 inches per year, which is approximately 55 percent of annual precipitation. The NJDEP estimated that the potential evapotranspiration near Somerville, New Jersey is 30.3 inches per year (Charles 1993), which is approximately 66 percent of annual precipitation. However, the NJDEP estimate assumes that water is always available in the root zone for transpiration and evaporation. During summer months, the moisture content in the root zone varies significantly between rainfall events and therefore, water is not always available for evapotranspiration.

Groundwater Recharge

Surface runoff including interflow, and evapotranspiration are estimated to account for approximately 90 percent of incident precipitation in the hydrogeologic zones of Lebanon Township underlain by crystalline bedrock. Based on the lack of fracturing and the poor permeability of the crystalline bedrock, it is estimated that 10 percent of incident precipitation recharges the fractured bedrock aquifer beneath this portion of the Township. Based on this estimate, the crystalline bedrock aquifer receives approximately 4.6 inches per year or 340 gallons per day per acre (gpd/acre) of recharge. This value is based on a normal rate of precipitation of 46 inches per year.

Within the small limestone/dolomite hydrogeologic zones of Lebanon Township, the slopes are relatively gentle and bedrock is susceptible to solution cavities/channels. Therefore, surface runoff accounts for a lesser percentage of incident precipitation. In this portion of Lebanon Township, recharge is estimated to range from 20 to 30 percent of precipitation, which is approximately 9.2 to 13.8 inches per year or 680 to 1025 gpd/acre.

NJGS Modified Method

The New Jersey Geological Survey (NJGS) developed a method for estimating groundwater recharge based on soil types, land use, and municipal climate factors. The NJGS method modifies the water balance equation by using factors for recharge, climate, and drainage basin that are based on general soil types, municipal location, and land use/land cover.

The NJGS states that this method is for determining groundwater recharge as opposed to aquifer recharge. In most definitions, the technical terms groundwater recharge and aquifer recharge are synonymous. The NJGS makes the distinction by indicating that groundwater recharge is the volume of water that migrates through soils whereas, aquifer recharge is the volume of water that enters a geologic formation that is capable of economically yielding water to wells or springs. This distinction is significant because water may migrate through soils in a bedrock environment but unless it encounters a fracture or opening in the rock, this water will discharge to a stream as interflow or to a seep as throughflow. If the water does not recharge an aquifer, it can not be used in Lebanon Township for water supply. The NJGS method may be more reflective of soil recharge than groundwater recharge.

The bedrock beneath the Precambrian Crystalline Rock Zone of Lebanon Township is considered impermeable except in areas where fractures, joints, or

Water: A Natural Renewable Resource

other openings are encountered. More permeable weathered residual soils comprised of sand-, gravel-, cobble-, and boulder-sized particles are encountered overlying the bedrock. The size of these particles increases with increasing depth. In addition, the slopes in most areas of the Crystalline Rock Zone of Lebanon Township can be considered very steep to steep. In many areas the slopes are in excess of 20 percent (see Figure 4). Given the steep slopes, relatively impermeable bedrock, and more permeable weathered residual soils, groundwater recharge as defined by the NJGS will migrate downward until it encounters the bedrock surface. The groundwater will migrate laterally until it either encounters a stream, an opening in the rock capable of receiving water, or seeps out of a slope. Only a small percentage of this water is likely to recharge an aquifer.

The NJGS method suggests that approximately 14.2 to 17.3 inches per year or 1055 to 1290 gallons per day per acre (gpd/acre) of precipitation recharges groundwater within the Precambrian Crystalline Rock Zone. The method calculates the same range of values for the Limestone/Dolomite Zone.

The water balance does not support equivalent recharge to the Precambrian Crystalline Rock Zone and Limestone/Dolomite Zone aquifer systems. Furthermore, empirical data such as baseflow in streams does not support equivalent recharge to igneous/metamorphic rocks and limestone/dolomite rocks. The NJGS model does not account for steep slopes, which are encountered in much of Lebanon Township, and these slopes increase the runoff potential and decrease the infiltration potential. Since the NJGS made the clear distinction that its method does not calculate aquifer recharge, it should not be used to evaluate groundwater resource conditions in Lebanon Township.

Other Studies

In the 1974 Land Oriented Reference Data System (LORDS) study published by the NJGS, aquifer recharge rates were estimated for bedrock environments encountered within Hunterdon County. Based on this study, the aquifer recharge rate for the Precambrian Crystalline Rock Zone during a dry year is approximately 190 gpd/acre and for a normal year of precipitation is approximately 390 gpd/acre. These values are approximately equal to 2.6 to 5.3 inches per year of precipitation. Miller (1974) reported that recharge rates to Precambrian crystalline bedrock environments of Sussex County range from approximately 160 gpd/acre during a drought to approximately 310 gpd/acre under normal precipitation.

Based on the LORDS study, in the Limestone/Dolomite Zone, the recharge rate is estimated for a dry year to be approximately 350 gpd/acre, which is approximately equal to 4.7 inches per year. During a year of normal precipitation, the recharge rate is approximately 550 gpd/acre, which is approximately equal to 7.4 inches per year of precipitation. In Sussex County, recharge rates to limestone and dolomite aquifers range from 340 gpd/acre in a dry year to 1,100 gpd/acre in a year of normal precipitation (Miller 1974).

Baseflow

During periods of dry weather, the flow of water in a stream is a result of groundwater discharging to that stream. This discharge of groundwater is referred to as baseflow. Since groundwater recharge is generally considered equal to groundwater discharge, the baseflow in a stream should equal groundwater recharge.

Baseflow can be measured with a stream gauge and used to estimate groundwater recharge. Under ideal conditions, the stream drainage basin should be entirely underlain by a single aquifer system and the stream gauging measurements should be collected daily over a period of several years.

The USGS has established numerous stream-gauging stations throughout New Jersey. One of these stations is located along Spruce Run at Glen Gardner, New Jersey. Based on the USGS/NJGS bedrock geologic map, the Spruce Run drainage basin upstream of the USGS gauging station is entirely underlain by the Precambrian igneous and metamorphic rocks of the Lebanon Township Crystalline Rock Zone. Figure 8 shows streamflow measurements for the period December 11, 1991 to September 30, 1998.

The NJDEP considers baseflow as the primary criterion in managing the water resources of New Jersey (NJDEP 1966). The most common method suggested by the NJDEP is the 7-day, 10-year (MA7CD10) method. With this method, the lowest flow over 7 consecutive days of a 10-year period is used. This method is considered conservative because the lowest flow occurs during periods of extensive dry weather. The method indicates recharge rates with a recurrence interval of approximately 1 in 100 years and therefore, is similar to standard flood planning. The MA7CD10 method provides the best approach for ensuring adequate and safe water supplies during extensive periods of drought. The NJDEP indicates that water supplies should be capable of sustaining withdrawals without adverse impacts during dry weather conditions similar to the drought of record.

The drought of record occurred in the 1960's and is often used for determining the MA7CD10 flow rate. However, the streamflow in Spruce Run at Glen Gardner was not reported by the USGS prior to December 11, 1991. The lowest flow rate for the period of reporting was measured from August 20 to 26, 1995 (see Figure 8). The average flow rate for these 7 days was 1.47 cubic feet per second for this 11.3 square mile drainage basin. The flow rate in Spruce Run was similar at the end of the recording period in late September 1998 and the flow rate may have been lower during the Summer 1999 drought.

The average flow rate for August 20 to 26, 1995 in the South Branch of the Raritan River at nearby High Bridge was 3 cubic feet per second greater or 116.8 percent of the historic low flow measured in 1965 and 1966 (Laskowski 1970). Precambrian crystalline rocks and Ordovician-Cambrian formations underlie the South Branch of the Raritan River upstream of High Bridge. If the difference in flow rates in Spruce Run was the same as those measured in the South Branch of the Raritan River, then the MA7CD10 flow rate for the 1960's drought in Spruce Run at Glen Gardner would have been approximately 1.26 cubic feet per second in comparison to the 1.47 cubic feet per second reported for August 1995.

Based on the 1995 MA7CD10 flow rate for Spruce Run at Glen Gardner, the recharge rate for periods of below normal precipitation to the Precambrian igneous/metamorphic bedrock in the Lebanon Township Crystalline Rock Zone is approximately 130 gpd/acre.

The USGS has streamflow data for the Musconetcong River near Bloomsbury, New Jersey from October 21, 1921 to September 30, 1998 available on the Internet. The lowest 7 consecutive-day flow rate was reported from September 8 to 14, 1965. The average flow rate for these 7 days is 32.7 cubic feet per second. Although this 141 square mile drainage basin is not entirely underlain by limestone/dolomite bedrock, the low-flow data indicate a recharge rate of approximately 230 gpd/acre.

Limestone and dolomite are susceptible to solution channels and in some areas; streams will flow partially or entirely underground in these bedrock environments. Streams and rivers flowing through limestone and dolomite valleys can gain water from and lose water to the bedrock. Therefore, baseflow for a watershed partially or entirely underlain by carbonate bedrock may be lower than recharge because a portion of the recharge is lost below ground surface and can not be quantified. The MA7CD10 flow rate for the Musconetcong River may be lower than actual recharge to the limestone and dolomite aquifer system because some water is flowing in subsurface solution channels. However, the MA7CD10 rate may accurately measure recharge if the subsurface channels are discharging at or upgradient of the stream measuring station. Since the subsurface component of recharge cannot be quantified, the MA7CD10 rate may provide a small margin of safety to ensure adequate water supplies.

Summary

The water balance estimate, LORDS study, Sussex County report, and the MA7CD10 method indicate that groundwater recharge to the Precambrian bedrock aquifer ranges from 130 to 390 gpd/acre. The lower end of this range represents periods of dry weather whereas; the upper end of the range represents years of normal precipitation.

The estimates of recharge to the Limestone/Dolomite Zone aquifers range from 230 to 1,100 gpd/acre. The lower end of this range is associated with periods of below normal precipitation whereas; the upper end of the range represents years of normal precipitation. The MA7CD10 flow rate may be lower than recharge because of water loss to solution cavities as the Musconetcong River flows across limestone and dolomite bedrock. However, the MA7CD10 rate may accurately reflect recharge under drought conditions for the Limestone/Dolomite Zone and any additional subsurface flow not quantified by stream gauging should be assumed as a margin of safety.

WATER-SUPPLY

DEMAND

As part of the recent statewide planning efforts, the NJDEP assumed a per capita water use rate of 75 gallons per day for residential self-supplied demand. Based on US Census data, the 2000 population of Lebanon Township was 5,816 persons. Based on the population, demographics, and the rural character of the Township, the average dwelling unit density is 3 persons. Therefore, the average demand per dwelling unit is approximately 225 gallons per day.

The water use rate of 75 gpd and the subsequent demand estimate of 225 gallons per day per dwelling unit are significantly lower than suggested for use in N.J.A.C. 7:10-3.32 and 7:10-12.6. The average daily demand required in these New Jersey regulations is 100 gallons per day per person and the dwelling unit requirement is as much as 200 gallons per day per bedroom. Although the 75 gallons per day per person and 3 persons per dwelling unit may better reflect actual water usage, these values do not provide the margin of safety included in the New Jersey Administrative Code.

DEPENDABLE YIELD

The NJDEP (1996) Statewide Water Supply Plan defines the dependable yield as "…the water yield maintainable by a ground water system during projected future conditions, including both a repetition of the most severe drought of record and long-term withdrawal rates without creating undesirable effects." The NJDEP indicates that the dependable yield has not been determined for most aquifers and recommends the use of a planning threshold.

To ensure that water is available during all weather conditions for human consumption as well as ecosystems dependent on groundwater discharges without creating undesirable effects, the NJDEP established the “Planning Threshold”. The NJDEP determined that the Planning Threshold should equal 20 percent of aquifer recharge. The threshold proposes to limit human consumption of water within a watershed/basin to 20 percent of recharge and establishes the dependable yield at this level.

Similar to planning for floods, a recurrence interval of 1 in 100 years represents a worst reasonable case. Therefore, the MA7CD10 recharge rate of 130 gpd/acre is the appropriate rate for evaluating the dependable yield of the Precambrian crystalline rocks beneath Lebanon Township. Application of the Planning Threshold to this recharge rate indicates that the water volume available for human consumption is approximately 26 gpd/acre.

Based on the dependable yield of 26 gpd/acre for the Crystalline Rock Zone and the demand estimate of 225 gallons per day per household, the average recharge area per dwelling unit required to sustain the water-supply requirements is approximately 8.7 acres. The recharge areas should be flat to gently sloping and open to incident precipitation. These areas should not be covered with impervious materials or buildings. The aquifer recharge areas should be located within areas in which the underlying bedrock is highly fractured.

Based on the recharge estimate of 230 gpd/acre as determined for the Musconetcong River at Bloomsbury during the drought of the 1960’s, the dependable yield to the Limestone/Dolomite Zones of Lebanon Township should be approximately 46 gpd/acre. Therefore, the recharge area per dwelling unit within the Limestone/Dolomite Zones should be approximately 4.9 acres. Gentle slopes characterize the Limestone/Dolomite Zone and these slopes may be included within the recharge area. Streams, seeps, wetlands, bedrock outcrops, and impervious improvements should not be included within the recharge area.

The minimum recharge areas per dwelling unit for the Precambrian and Ordovician-Cambrian bedrock aquifers have been calculated to provide a dependable water-supply yield to a single-family residence with a dwelling unit density of 3 persons. These recharge areas assume that the water is depleted from the aquifer and not returned. Furthermore, these recharge areas do not include additional water consuming devices such as irrigation systems and/or pools.

In Lebanon Township, nearly all residences use septic systems for disposal of wastewater. As a result, an estimated 80 percent of the water removed from the aquifer is returned. However, the wastewater contains contaminants such as nitrates that are highly mobile and are not readily removed. Therefore, additional recharge is required to dilute the nitrates to a level that is deemed safe for consumption.

NITRATE DILUTION

Nitrate

Nitrate is not typically found in groundwater because of natural conditions. Nitrate can be introduced to groundwater from sewage discharges, fertilizers, animal waste, and decomposing plants. In addition, some agricultural crops such as legumes and alfalfa can fix atmospheric nitrogen and transfer it to soils. Nitrate is used as an indicator of anthropogenic impacts to groundwater, especially impacts associated with sewage disposal. Elevated nitrates can cause methemoglobinemia in infants and can also be an indicator of pathogenic bacterial contamination.

Nitrate is a highly soluble, stable, and mobile compound in groundwater when sufficient dissolved oxygen is available. Fractured bedrock aquifers, especially those under water-table conditions, contain high concentrations of dissolved oxygen. Under these conditions, nitrate can migrate large distances and result in an extensive plume of groundwater contamination. Since nitrate is not easily removed from groundwater, the source(s) of the contamination must be identified and removed, and the concentrations diluted to achieve safe drinking-water conditions.

Background Concentrations

On January 7, 1993, the NJDEP established groundwater classifications and quality criteria (N.J.A.C. 7:9-6). In accordance with these New Jersey Ground Water Quality Standards, groundwater within Lebanon Township is classified as Class II-A. The nitrate as nitrogen criteria for Class II-A water is 10 milligrams per liter (mg/l). This criterion is the same as the USEPA standard for nitrate as nitrogen in drinking water.

As part of New Jersey's groundwater quality standards, the NJDEP established an antidegradation policy to protect groundwater in which, the background concentration of a contaminant does not exceed the quality criteria. The policy limits the discharge of contaminants to groundwater to a percentage of the difference between the background concentration and the quality criteria. For Class II-A water, the limit is the background concentration plus 50 percent of the difference between the background concentration and the quality criteria.

Based on data from the Hunterdon County Health Department, the median background concentration of nitrate in groundwater in areas of the county underlain by Precambrian igneous and metamorphic rocks ranges from 0.6 to 1.11 milligrams per liter (mg/l). Within Lebanon Township, the Health Department's data indicates a median nitrate background concentration of 0.47

mg/l. The Health Department's data indicate that nitrate background concentrations in the limestone/dolomite aquifer system beneath the Musconetcong Valley section of the Township is approximately 1.0 mg/l.

Based on the average background concentration of nitrates in the crystalline rock aquifer system, the antidegradation limit for septic system discharges of nitrate is 5.24 mg/l. Within the Limestone/Dolomite Zone, the septic system discharge limit for nitrate is 5.50 mg/l.

Trela-Douglas Model

The Trela-Douglas nitrate-dilution model was developed in 1978 on behalf of the New Jersey Pinelands Commission. This model has been widely accepted and used by the NJDEP for evaluating potential nitrate discharges from septic systems to groundwater and for determining the recharge area necessary to dilute nitrate concentrations. The Trela-Douglas Model is the nitrate-dilution model recommended in the draft document "A Model of Residential Carrying Capacity for New Jersey, Based on Water Quality" that was included with the recently proposed Watershed Management Rules. Apparently the Trela-Douglas model will continue to be used by the NJDEP for evaluating potential impacts from septic systems.

The Trela-Douglas model is considered conservative because it does not account for denitrification of nitrate in soils. However, this assumption is appropriate for a fractured bedrock environment where shallow soils are well drained. The shallow well-drained soils and bedrock fractures offer limited retention time and are usually well oxidized and therefore, denitrification will not significantly reduce the concentrations in septic system effluent.

Nitrates can quickly migrate from a septic system with infiltration through a bedrock fracture into a water-bearing zone. Once the nitrate is in one or more water-bearing fractures, there is little opportunity for removal or retardation. Since most of the soils in Lebanon Township's Crystalline Rock Zone are considered inadequate for septic systems, they are unlikely to prevent nitrates or other contaminants from impacting groundwater used for water supply. Therefore, adequate recharge should be made available to dilute the concentration of contaminants to safe drinking conditions.

The Trela-Douglas nitrate dilution model is based on several assumptions, which for Lebanon Township include the following (the values used in the calculations are provided in parenthesis):

1. The groundwater use rate is 75 gallons per day per person and 3 persons occupy each residence. Approximately 80 percent of the groundwater used in a residence is returned to the aquifer through the septic system.

The other 20 percent is assumed lost through evaporation. Therefore, if the groundwater use is 225 gallons per day then 180 gallons per day (24.06 ft^3/day) are returned to the aquifer.

2. The aquifer recharge rate is 130 gpd/acre (3.99 x 10^{-4} feet/day) for the Precambrian Crystalline Rock Zone and 230 gpd/acre (7.06 x 10^{-4} feet/day) for the Limestone/Dolomite Zones. These recharge rates were selected to reduce potential impacts to water supplies during extensive dry weather conditions.

3. The nitrate-nitrogen concentration in the septic system effluent is approximately 40 mg/l.

4. The nitrate concentration at the boundary of the recharge area is in accordance with the NJDEP antidegradation policy.

The model parameters and the equations used to calculate these parameters are as follows:

C — The concentration of nitrate at the boundary of the recharge area, which is 5.24 mg/l for the Precambrian Crystalline Rock Zone and 5.50 mg/l for the Limestone/Dolomite Zone.

C_0 — The nitrate concentration in the septic system effluent, which is estimated at 40 mg/l.

DF — The dilution factor, which is calculated from the following equation: DF = C_0/C. The dilution factor for the Crystalline Rock Zone is 7.63 and for the Limestone/Dolomite Zone is 7.27.

SD — The septic discharge per day, which as outline above, is approximately 24.06 ft^3 per day.

IA — The infiltration over the area, which is calculated from the following equation: IA = [(DF)(SD)]-SD. For the Crystalline Rock Zone, IA equals 159.63 ft^3/day. For the Limestone/Dolomite Zone, IA equals 150.95 ft^3/day.

IR — The infiltration rate of precipitation, which is 3.99 x 10^{-4} feet/day for the Crystalline Rock Zone and 7.06 x 10^{-4} feet/day for the Limestone/Dolomite Zones.

RA — The recharge area per dwelling unit, which is calculated by the following equation: RA = IA/IR. For the Crystalline Rock Zone, RA equals 400,097 ft^2 or approximately 9.2 acres. For the

Limestone/Dolomite Zone, RA equals 213,840 ft^2 or approximately 4.9 acres.

Similar to the recharge areas for water supply, the recharge areas necessary to dilute nitrate concentrations should be in areas with flat to gentle slopes and open to precipitation. The areas should not be covered with impervious surfaces or buildings that can prevent precipitation from infiltrating into bedrock fractures. In addition, the recharge areas should not be heavily wooded to prevent interception of rainfall by trees and other vegetation. Portions of lots that include seeps, wetlands, streams, bedrock outcrops, and/or steep slopes should not be included in the recharge areas.

CONCLUSIONS

Based on the data, reports, and maps reviewed in preparation of the Lebanon Township water resource evaluation, the following conclusions are made:

1. Lebanon Township is located within the Highlands Physiographic Province of New Jersey. Approximately 80 percent of Lebanon Township is located within RWRPA 10 and the Raritan River Watershed. Lebanon Township is located in a critical upstream recharge area for the third most populated and one of the fastest growing regional watersheds in New Jersey. The South Branch of the Raritan River is a vital water-supply resource for much of central New Jersey.

2. Approximately 20 percent of the Township is located within RWRPA 8, which is a critical watershed along the Musconetcong River.

3. Lebanon Township's groundwater resources are of value to the current and future residents of the Township as well as downstream consumers and ecological receptors. Lebanon Township wants to protect these critical resources.

4. Approximately 90 percent of the Township is underlain by Precambrian igneous and metamorphic bedrock. Soils above bedrock are thin and generally, well drained. Groundwater is stored and transmitted in fractures and other openings in the bedrock. Unfractured portions of the bedrock are considered impermeable and incapable of yielding sufficient water for supply. Well yields are dependent on the number and interconnection of fractures/openings in the bedrock.

5. Ordovician-Cambrian limestones and dolomites underlie approximately 10 percent of Lebanon Township. These carbonate rocks are found along the northern boundary of the Township in the Musconetcong Valley and near the Borough of Califon in Long Valley. The limestones and dolomites

are susceptible to the formation of solution channels, which can store and transmit large quantities of water.

6. Groundwater recharge to the Precambrian bedrock aquifer ranges from 130 to 390 gpd/acre. The lower end of this range represents periods of dry weather whereas; the upper end of the range represents years of normal precipitation. The estimates of recharge to the Limestone/Dolomite Zone aquifers range from 230 to 1,100 gpd/acre. The lower end of this range is associated with periods of below normal precipitation whereas; the upper end of the range represents years of normal precipitation. In addition, the low end of the range may be lower than recharge because of water loss to solution cavities as the Musconetcong River flows across limestone and dolomite bedrock and therefore, should provide an additional factor of safety.

7. Based on the population, demographics, and rural character of Lebanon Township, a dwelling unit density of 3 persons was used to determine the average water-supply demand, which is approximately 225 gallons per day. This daily demand does not include the factor of safety provided in N.J.A.C. 7:10-3.32 and 7:10-12.6 in which, the average daily demand is 100 gallons per day per person and the dwelling unit requirement is as much as 200 gallons per day per bedroom. Applying the planning threshold policy to the all weather conditions recharge rate of 130 gpd/acre, a recharge area of 8.7 acres per lot is required to maintain a dependable yield for residential dwellings in the Crystalline Rock Zone of the Township. Based on the recharge rate of 230 gpd/acre, the recharge area per dwelling unit within the Limestone/Dolomite Zone should be approximately 4.9 acres to maintain a dependable yield.

8. Nitrate is a highly soluble, stable, and mobile compound in groundwater in fractured bedrock aquifers and can migrate large distances and result in an extensive plume of groundwater contamination. The median background concentration of nitrate in groundwater in areas of Lebanon Township underlain by igneous/metamorphic rocks is 0.47 mg/l. The median background concentration of nitrate in the limestone/dolomite aquifer system beneath the Musconetcong Valley is approximately 1.0 mg/l.

9. The Trela-Douglas model was used to calculate recharge areas for diluting nitrates from septic system effluent in groundwater. Based on the results of this model, the recharge area per dwelling unit in the Crystalline Rock Zone is approximately 9.2 acres. For the Limestone/Dolomite Zone, the recharge area per dwelling unit is approximately 4.9 acres.

10. The recharge areas per lot should have flat to gentle slopes and should be open to precipitation. The areas should not be covered with impervious surfaces or buildings that can prevent precipitation from infiltrating into bedrock fractures. In addition, the recharge areas should not be heavily wooded to prevent interception of rainfall by trees and other vegetation. Portions of lots that include seeps, wetlands, streams, bedrock outcrops, impervious surfaces, buildings, and/or steep slopes should be in addition to the recharge areas.

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Warner, Todd of Hunterdon County Health Department personal communication to Matt Mulhall of M^2 Associates. February 20, 2001.

Table 1: Water-Supply Well Information and Nitrate Levels in Lebanon Township, Hunterdon County, New Jersey.

Note: All data in table obtained from Hunterdon County Health Department.

Block	Lot	Geologic Zone	Diameter (inches)	Depth (ft bgs)	Yield (gpm)	Static-Water Level (ft bgs)	Nitrate Concentration (mg/l)
2.04		Precambrian Crystalline Rock					ND
3	2	Precambrian Crystalline Rock					ND
3	48	Precambrian Crystalline Rock					ND
4	1.01	Precambrian Crystalline Rock					ND
5	4	Precambrian Crystalline Rock	10	400	7	40	ND
5	6	Precambrian Crystalline Rock	10	500	8	8	ND
6	5	Precambrian Crystalline Rock	10	400	10	150	ND
6	6.03	Precambrian Crystalline Rock	10	200	10	25	ND
6.15	30	Precambrian Crystalline Rock	6	253	50	30	1
7	9	Precambrian Crystalline Rock					ND
7	27.05	Precambrian Crystalline Rock	6	240	20	80	1.43
8	2.02	Precambrian Crystalline Rock	6	200	10		ND
8	6.01	Precambrian Crystalline Rock	6	540	7	15	1
10	3.021	Precambrian Crystalline Rock	10	535	5	80	ND
10	24	Precambrian Crystalline Rock	6	305	8	4	
10	27.02	Precambrian Crystalline Rock	10	355	10	30	ND
10	35	Precambrian Crystalline Rock	6	220	10	60	
10	36	Precambrian Crystalline Rock					1
10	37	Precambrian Crystalline Rock	6	355	10	30	1
10	42.01	Precambrian Crystalline Rock	6	673	20	25	ND
10	42.01	Precambrian Crystalline Rock	6	298	20	10	
10	58	Precambrian Crystalline Rock	6	305	10	20	2.21
10	59	Precambrian Crystalline Rock	6	340	1.5	60	ND
11	4	Precambrian Crystalline Rock	6	180	12	44	ND
11	10.01	Precambrian Crystalline Rock	6	300	10	60	ND
11	10.02	Precambrian Crystalline Rock	6	450	12	20	1
11	13	Precambrian Crystalline Rock	6	273	7	56	0.18
12	10	Precambrian Crystalline Rock	10	350	4	30	ND
12	10.03	Precambrian Crystalline Rock	10	300	25	40	ND
12	10.04	Precambrian Crystalline Rock	10	500	1.5	30	1
12	10.05	Precambrian Crystalline Rock	10	200	15	15	ND
12	10.06	Precambrian Crystalline Rock	10	150	50	30	ND
12	10.08	Precambrian Crystalline Rock	10	350	9	30	ND
12	10.12	Precambrian Crystalline Rock	10	300	8	50	ND
12	10.14	Precambrian Crystalline Rock	6	175	30	20	2.79
12	25	Precambrian Crystalline Rock	6	345	8	60	
12	30	Precambrian Crystalline Rock	6	535	1	40	
13	10	Precambrian Crystalline Rock	6	320	0.5	100	
16	17.01	Precambrian Crystalline Rock	6	175	8	60	1.34
16	17.03	Precambrian Crystalline Rock	6	200	30	60	1.92
16	17.03	Precambrian Crystalline Rock					1.92
16	22	Precambrian Crystalline Rock	10	248	18	45	ND
16	22.02	Precambrian Crystalline Rock	6	200	10	30	ND

Table 1: Water-Supply Well Information and Nitrate Levels in Lebanon Township, Hunterdon County, New Jersey.

Note: All data in table obtained from Hunterdon County Health Department.

Block	Lot	Geologic Zone	Diameter (inches)	Depth (ft bgs)	Yield (gpm)	Static-Water Level (ft bgs)	Nitrate Concentration (mg/l)
16	28	Precambrian Crystalline Rock	6	205	10	20	1
16	61	Precambrian Crystalline Rock	10	300	7	20	ND
16	62	Precambrian Crystalline Rock	6	120	50	15	ND
17	1.01	Precambrian Crystalline Rock	10	500	3	30	ND
17	1.02	Precambrian Crystalline Rock	10	298	8	45	ND
17	2	Precambrian Crystalline Rock	6	200	25	50	6.28
17	6.01	Precambrian Crystalline Rock	10	300	10	40	ND
17	6.02	Precambrian Crystalline Rock	6	305	12	30	2
17	9	Precambrian Crystalline Rock	6	600	7	15	
17	10.01	Precambrian Crystalline Rock	6	260	18	28	6.64
17	10.02	Precambrian Crystalline Rock					ND
18	1.01	Precambrian Crystalline Rock	6	305	10	12	1.61
18	5	Precambrian Crystalline Rock					ND
18	11	Precambrian Crystalline Rock					ND
18	14	Precambrian Crystalline Rock	6	180	40	70	ND
18	28.03	Precambrian Crystalline Rock					ND
18	29.01	Precambrian Crystalline Rock	6	450	30	40	ND
24	5.11	Precambrian Crystalline Rock	6	298	32	46	2.4
24	8.04	Precambrian Crystalline Rock	6	165	10	40	2.83
24	13	Precambrian Crystalline Rock	6	175	30	60	1
24	15	Precambrian Crystalline Rock	6	700	8	80	ND
24	15.01	Precambrian Crystalline Rock	6	510	6	30	3.56
24	22	Precambrian Crystalline Rock	10	275	10	80	ND
24	37	Precambrian Crystalline Rock	6	223	12	24	
24	41	Precambrian Crystalline Rock					ND
24	69	Precambrian Crystalline Rock	6	100	25	100	1
26	33	Precambrian Crystalline Rock	6	255	12	40	
26	34	Precambrian Crystalline Rock	6	80	22	24	
26	49.01	Precambrian Crystalline Rock	6	205	10	30	5.03
26	49.02	Precambrian Crystalline Rock					ND
27	2.01	Precambrian Crystalline Rock					ND
29	13	Precambrian Crystalline Rock					ND
30	39	Precambrian Crystalline Rock					ND
30	47.01	Precambrian Crystalline Rock	06	300	10	42	1
30	48	Precambrian Crystalline Rock	6	175	15	60	1
33	1.01	Precambrian Crystalline Rock	6	305	10	50	1.03
33	2.02	Precambrian Crystalline Rock	6	260	15	40	0.8
33	2.03	Precambrian Crystalline Rock	6	375	6	45	1
33	2.04	Precambrian Crystalline Rock	6	200	15	50	1
33	2.05	Precambrian Crystalline Rock	6	345	18	70	0.7
35	2.01	Precambrian Crystalline Rock					ND
35	2.02	Precambrian Crystalline Rock	6	140	25		ND
35	16.01	Precambrian Crystalline Rock	6	200	25	30	1.69

Water: A Natural Renewable Resource

Table 1: Water-Supply Well Information and Nitrate Levels in Lebanon Township, Hunterdon County, New Jersey.

Note: All data in table obtained from Hunterdon County Health Department.

Block	Lot	Geologic Zone	Diameter (inches)	Depth (ft bgs)	Yield (gpm)	Static-Water Level (ft bgs)	Nitrate Concentration (mg/l)
35	24	Precambrian Crystalline Rock	6	305	7	30	3.45
35	25	Precambrian Crystalline Rock	10	205	10	30	ND
35	27	Precambrian Crystalline Rock	6	100	18	40	9.46
35	31.12	Precambrian Crystalline Rock	6	165	12	80	
35	33	Precambrian Crystalline Rock	6	145	25	70	
35	38.01	Precambrian Crystalline Rock	6	125	50	55	0.5
35	48	Precambrian Crystalline Rock	10	200	20	12	ND
35	51	Precambrian Crystalline Rock	6	340	30	70	1
35	57.04	Precambrian Crystalline Rock					ND
35	57.05	Precambrian Crystalline Rock	6	250	9	50	ND
35	74.01	Precambrian Crystalline Rock					ND
35	75.01	Precambrian Crystalline Rock	6	140	15	40	0.8
35	76.03	Precambrian Crystalline Rock	6	192	16	70	1
35	77	Precambrian Crystalline Rock					ND
35	90	Precambrian Crystalline Rock					ND
35	91	Precambrian Crystalline Rock	6	200	10	30	ND
35	91.04	Precambrian Crystalline Rock	6	400	12	80	1
35	91.07	Precambrian Crystalline Rock	6	123	50	50	1
35	91.09	Precambrian Crystalline Rock	6	205	40	10	0.6
35	93.01	Precambrian Crystalline Rock	6	375	4	3	1
35	93.01	Precambrian Crystalline Rock	6	375	4	30	
36	11	Precambrian Crystalline Rock	10	205		30	1
36	11.01	Precambrian Crystalline Rock	6	205	25	30	1
36	11.02	Precambrian Crystalline Rock	6	105	10	15	1
36	16.01	Precambrian Crystalline Rock					1
36	18.01	Precambrian Crystalline Rock	6	305	10	30	1
36	18.03	Precambrian Crystalline Rock	6	148	30	12	1
36	22	Precambrian Crystalline Rock					ND
36	29.02	Precambrian Crystalline Rock	06	405	9	32	1
36	29.03	Precambrian Crystalline Rock	10	200	30	28	2.23
36	29.04	Precambrian Crystalline Rock	6	525	10	40	0.9
36	29.05	Precambrian Crystalline Rock					1.5
36	32.01	Precambrian Crystalline Rock	10	505	30	40	ND
37	4.01	Precambrian Crystalline Rock	10	200	10	50	ND
37	16.01	Precambrian Crystalline Rock	6	205	10	30	3.65
37	18.01	Precambrian Crystalline Rock					1.61
37	18.02	Precambrian Crystalline Rock	10	198	10	33	ND
37	18.04	Precambrian Crystalline Rock	6	200	10	31	1.61
37	19.05	Precambrian Crystalline Rock					ND
37	22	Precambrian Crystalline Rock	6	205	10	20	10
37	22.01	Precambrian Crystalline Rock	10	223	10	10	ND
37	22.02	Precambrian Crystalline Rock	6	273	15	38	1.63
37	22.03	Precambrian Crystalline Rock	6	123	15	25	2.97

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Block	Lot	Geologic Zone	Diameter (inches)	Depth (ft bgs)	Yield (gpm)	Static-Water Level (ft bgs)	Nitrate Concentration (mg/l)
37	22.04	Precambrian Crystalline Rock	10	148	11	35	ND
37	22.05	Precambrian Crystalline Rock	10	423	5	55	ND
37	22.06	Precambrian Crystalline Rock	10	148	27	50	2.78
37	22.07	Precambrian Crystalline Rock					ND
37	22.08	Precambrian Crystalline Rock	6	355	7	30	1
37	22.09	Precambrian Crystalline Rock	6	173	15	15	2.35
37	22.1	Precambrian Crystalline Rock	6		20		1.16
37	22.11	Precambrian Crystalline Rock	6	105	20	20	1
37	22.11	Precambrian Crystalline Rock	6	105	20	20	
37	23	Precambrian Crystalline Rock	10	300	15	40	ND
37	23.01	Precambrian Crystalline Rock					ND
37	23.03	Precambrian Crystalline Rock	6	285	10	35	ND
37	23.04	Precambrian Crystalline Rock	10	305	10	40	ND
37	23.05	Precambrian Crystalline Rock					ND
37	23.13	Precambrian Crystalline Rock	10	250	30	25	ND
37	23.14	Precambrian Crystalline Rock	6	340	10	34	0.43
37	23.15	Precambrian Crystalline Rock	6	305	10	30	1
37	23.16	Precambrian Crystalline Rock	6	205	10	30	1
37	23.17	Precambrian Crystalline Rock	6	400	8	40	1
37	23.18	Precambrian Crystalline Rock	6	305	10	30	0.96
37	23.19	Precambrian Crystalline Rock	6	305	7	30	1
37	23.2	Precambrian Crystalline Rock	6	473	10	25	1
37	23.21	Precambrian Crystalline Rock	6	305	35	30	1
37	23.22	Precambrian Crystalline Rock	10	275	20	60	ND
37	23.23	Precambrian Crystalline Rock	10	280	8	90	ND
37	23.24	Precambrian Crystalline Rock	6	320	12	60	ND
37	24.04	Precambrian Crystalline Rock	10	305	36	80	ND
37	33	Precambrian Crystalline Rock	10	75	30	11	2.02
37	38	Precambrian Crystalline Rock					1.17
37	39	Precambrian Crystalline Rock	6	125	40	15	ND
37	42	Precambrian Crystalline Rock					ND
37	42.05	Precambrian Crystalline Rock	10	125	25	35	ND
37	42.06	Precambrian Crystalline Rock	6	200	30	28	1
37	42.07	Precambrian Crystalline Rock	6	150	5	25	ND
37	43	Precambrian Crystalline Rock	10	250	40	28	1
37	43.01	Precambrian Crystalline Rock	6	200	30	54	1
37.01	3	Precambrian Crystalline Rock	10	245	10	40	ND
37.01	4	Precambrian Crystalline Rock	10	205	10	40	ND
37.01	5	Precambrian Crystalline Rock	10	200		40	ND
37.01	8	Precambrian Crystalline Rock	6	295	25	80	ND
37.01	9	Precambrian Crystalline Rock	10	175	40	60	ND
37.01	10	Precambrian Crystalline Rock	6	480	12	60	0.5
37.01	11	Precambrian Crystalline Rock	6	300	10	10	1.01

Table 1: Water-Supply Well Information and Nitrate Levels in Lebanon Township, Hunterdon County, New Jersey.

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Block	Lot	Geologic Zone	Diameter (inches)	Depth (ft bgs)	Yield (gpm)	Static-Water Level (ft bgs)	Nitrate Concentration (mg/l)
37.02	4	Precambrian Crystalline Rock					1
38	5.04	Precambrian Crystalline Rock	6	325	30	32	1
38	7.01	Precambrian Crystalline Rock	6	435	20	50	ND
38	7.02	Precambrian Crystalline Rock	6	300	16	40	1
38	7.03	Precambrian Crystalline Rock	6	720	7	50	1.32
38	7.04	Precambrian Crystalline Rock	6	248	15	45	
38	7.041	Precambrian Crystalline Rock	6	305	13	10	1
38	7.06	Precambrian Crystalline Rock	10	750	6	48	1
38	7.07	Precambrian Crystalline Rock	6	760	3	28	1
38	7.08	Precambrian Crystalline Rock	10	500	4	20	ND
38	7.09	Precambrian Crystalline Rock	6	175	12	40	1
38	7.1	Precambrian Crystalline Rock	10	500	4	30	ND
38	7.11	Precambrian Crystalline Rock	6	280	18	30	1
38	7.12	Precambrian Crystalline Rock	6	505	7	20	1
38	7.13	Precambrian Crystalline Rock	6	698	23	62	1
38	18.01	Precambrian Crystalline Rock	6	200	30	50	1
38	18.03	Precambrian Crystalline Rock	6	180	10	80	0.7
38	18.05	Precambrian Crystalline Rock	6	300	10	100	ND
38	18.06	Precambrian Crystalline Rock	6	305	10	30	
38	18.09	Precambrian Crystalline Rock	6	550	7	48	1
38	18.1	Precambrian Crystalline Rock					ND
38	20	Precambrian Crystalline Rock	6	500	2.5	100	
38	26	Precambrian Crystalline Rock					ND
38	103.02	Precambrian Crystalline Rock	6	225	15	50	1
38	112	Precambrian Crystalline Rock					ND
40	4.02	Precambrian Crystalline Rock	6	505	7	15	1
40	4.03	Precambrian Crystalline Rock	10	798	2	40	ND
40	5.01	Precambrian Crystalline Rock	6	305	10	120	1.21
44	8	Precambrian Crystalline Rock	6	703	3	50	1
46	20	Precambrian Crystalline Rock	10	298	2	40	ND
46	24	Precambrian Crystalline Rock	6	205	30	10	ND
46	24.03	Precambrian Crystalline Rock	6	205	5.5	30	2.8
46	24.07	Precambrian Crystalline Rock					ND
46	29.05	Precambrian Crystalline Rock	6	300	12	35	1.46
46	29.06	Precambrian Crystalline Rock	6	523	20		1
46	34.02	Precambrian Crystalline Rock					1
47	1	Precambrian Crystalline Rock	6	223	12	46	1.53
48	2	Precambrian Crystalline Rock	10	200	10	40	ND
48	2.02	Precambrian Crystalline Rock	6	205	10	30	1
48	2.03	Precambrian Crystalline Rock	6	255	10	40	1
48	2.04	Precambrian Crystalline Rock	10	155	10	30	ND
48	2.08	Precambrian Crystalline Rock	6	205	10	30	1
48	2.09	Precambrian Crystalline Rock	6	305	7	30	1

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Block	Lot	Geologic Zone	Diameter (inches)	Depth (ft bgs)	Yield (gpm)	Static-Water Level (ft bgs)	Nitrate Concentration (mg/l)
48	2.1	Precambrian Crystalline Rock	10	255	10	20	ND
48	3	Precambrian Crystalline Rock	10	300	10	20	ND
48	6	Precambrian Crystalline Rock					ND
48	7	Precambrian Crystalline Rock					ND
48	16	Precambrian Crystalline Rock					ND
48	20.01	Precambrian Crystalline Rock					ND
48	20.01	Precambrian Crystalline Rock					ND
49	4	Precambrian Crystalline Rock	6	398	8	36	ND
49	4.03	Precambrian Crystalline Rock	6	573	4	38	0.65
49	4.04	Precambrian Crystalline Rock	6	173	20	28	0.2
49	4.05	Precambrian Crystalline Rock	6	123	17	22	2.28
49	4.06	Precambrian Crystalline Rock	6	273	50	150	0.59
49	42.01	Precambrian Crystalline Rock	10	165	3	40	ND
49	46	Precambrian Crystalline Rock	6	430	10		1
49	50.04	Precambrian Crystalline Rock					ND
49	50.05	Precambrian Crystalline Rock	6	505	7	20	1
49	50.06	Precambrian Crystalline Rock					ND
49	70	Precambrian Crystalline Rock	6	300	20	32	2
49	71	Precambrian Crystalline Rock	10	400	4	60	ND
49	71.01	Precambrian Crystalline Rock	6	405	2.5	30	0.7
49	71.02	Precambrian Crystalline Rock	6	405	10	20	ND
49	71.03	Precambrian Crystalline Rock	10	198	30	38	ND
50	7	Precambrian Crystalline Rock	10	305	10	60	ND
50	11	Precambrian Crystalline Rock	6	350	5		ND
51	13	Precambrian Crystalline Rock	6	575	20	60	
51	13	Precambrian Crystalline Rock					1
51	14.03	Precambrian Crystalline Rock	6	230	7	40	1
51	20	Precambrian Crystalline Rock	6	205	15	50	
53	8.01	Precambrian Crystalline Rock	10	130	30	0	ND
53	10	Precambrian Crystalline Rock	6	300	18	35	1.07
53	10.03	Precambrian Crystalline Rock	6	248	20	35	1
53	19	Precambrian Crystalline Rock	6	748	15	25	
54	17	Precambrian Crystalline Rock	6	305	15	30	1
54	17.01	Precambrian Crystalline Rock	10	300	10	50	ND
54	17.02	Precambrian Crystalline Rock					ND
56	9	Precambrian Crystalline Rock	6	600	20	40	
56	10.01	Precambrian Crystalline Rock	10	202	10	25	ND
57	17.01	Precambrian Crystalline Rock	6	298	20	26	1
57	17.03	Precambrian Crystalline Rock	6	243	10	72	1
57	17.05	Precambrian Crystalline Rock	6	215	20	10	ND
57	17.5	Precambrian Crystalline Rock					ND
57	20	Precambrian Crystalline Rock	6	525	3	5	1
57	20.01	Precambrian Crystalline Rock	10	400	5	3	ND

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Block	Lot	Geologic Zone	Diameter (inches)	Depth (ft bgs)	Yield (gpm)	Static-Water Level (ft bgs)	Nitrate Concentration (mg/l)
57	20.02	Precambrian Crystalline Rock	10	100	5	20	ND
57	20.03	Precambrian Crystalline Rock	10	285	10	200	ND
57	20.04	Precambrian Crystalline Rock	6	340	5.5	40	0.6
57	20.05	Precambrian Crystalline Rock	6	280	18	40	0.5
57	21.01	Precambrian Crystalline Rock	6	500	3	25	ND
57	28.02	Precambrian Crystalline Rock	10	50	5	13	ND
57	28.03	Precambrian Crystalline Rock	6	550	12	40	1
57	32.01	Precambrian Crystalline Rock	6	300	18	22	ND
57	34	Precambrian Crystalline Rock	10	300	5	3	ND
57	50	Precambrian Crystalline Rock					ND
59	10.01	Precambrian Crystalline Rock	6	200	30	30	ND
59	25	Precambrian Crystalline Rock	6	148	20	80	1
59	26	Precambrian Crystalline Rock					ND
59	27.01	Precambrian Crystalline Rock	6	400	10	40	ND
59	27.02	Precambrian Crystalline Rock	6	305	10	30	1.65
59	28	Precambrian Crystalline Rock	10	150	5	30	ND
59	31	Precambrian Crystalline Rock					ND
59	34	Precambrian Crystalline Rock	6	580	10	42	1
59	34.02	Precambrian Crystalline Rock					1
59	43.01	Precambrian Crystalline Rock	10	350	10	200	ND
59	46	Precambrian Crystalline Rock	10	300		60	ND
59	48	Precambrian Crystalline Rock	6	698	1.4	26	
59	56.01	Precambrian Crystalline Rock					ND
59	59	Precambrian Crystalline Rock	10	298	5	10	ND
59	61	Precambrian Crystalline Rock	6	340	2	60	ND
59	41 & 42	Precambrian Crystalline Rock	10	300	10	50	ND
61	23.01	Precambrian Crystalline Rock	6	300	8	20	2.49
61	23.02	Precambrian Crystalline Rock	6	260	8	50	2.12
61	23.03	Precambrian Crystalline Rock	6	155	8	30	2.11
61	23.04	Precambrian Crystalline Rock	6	420	5	20	1.99
61	23.06	Precambrian Crystalline Rock	6	180	8	5	2.65
61	23.07	Precambrian Crystalline Rock	6	220	15	60	6.68
61	23.08	Precambrian Crystalline Rock					3.92
61	23.09	Precambrian Crystalline Rock	6	225	14	20	1.88
61	23.1	Precambrian Crystalline Rock	6	180	25	25	2.15
61	23.11	Precambrian Crystalline Rock	6	200	30	20	1
61	23.12	Precambrian Crystalline Rock	6	300	12	30	1
61	23.13	Precambrian Crystalline Rock	6	200	18	25	1.43
61	23.14	Precambrian Crystalline Rock	6	425	4	40	3.7
61	25.06	Precambrian Crystalline Rock	6	250	7	27	1.23
61	25.07	Precambrian Crystalline Rock	6	200	10	30	0.7
61	26	Precambrian Crystalline Rock					ND
61	27.02	Precambrian Crystalline Rock	6	673	10	19	ND

Water: A Natural Renewable Resource

Table 1: Water-Supply Well Information and Nitrate Levels in Lebanon Township, Hunterdon County, New Jersey.

Note: All data in table obtained from Hunterdon County Health Department.

Block	Lot	Geologic Zone	Diameter (inches)	Depth (ft bgs)	Yield (gpm)	Static-Water Level (ft bgs)	Nitrate Concentration (mg/l)
61	27.02	Precambrian Crystalline Rock	6	160	10	4.5	ND
61	27.04	Precambrian Crystalline Rock	6	200	10	30	1
61	27.05	Precambrian Crystalline Rock	10	355	7	40	1
61	27.06	Precambrian Crystalline Rock	10	355	5	20	ND
61	27.07	Precambrian Crystalline Rock	10	305	10	20	1
61	27.08	Precambrian Crystalline Rock	10	405	10	30	1.36
61	27.09	Precambrian Crystalline Rock	10	255	5	20	ND
61	27.1	Precambrian Crystalline Rock	10	205	10	30	ND
61	27.11	Precambrian Crystalline Rock	10	205	10	25	ND
61	27.12	Precambrian Crystalline Rock	10	100	10	40	1
61	27.13	Precambrian Crystalline Rock	6	405	7	30	1
61	27.14	Precambrian Crystalline Rock	10	155	10	15	1
61	27.15	Precambrian Crystalline Rock	10	155	10	30	1
61	35.01	Precambrian Crystalline Rock	6	400	8	60	1
61	38	Precambrian Crystalline Rock	6	225	30	30	1
61	40	Precambrian Crystalline Rock	6	165	20	18	ND
61	41	Precambrian Crystalline Rock	10	545	20	115	ND
61.01	16	Precambrian Crystalline Rock	6	300	15	30	1.22
61.01	18	Precambrian Crystalline Rock	6	275	12	15	1
62	1	Precambrian Crystalline Rock	6	420	20	35	ND
63	41	Precambrian Crystalline Rock					2.77
64	1	Precambrian Crystalline Rock	6	200	20	25	2.35
64	7	Precambrian Crystalline Rock	10	305	10	40	ND
64	11	Precambrian Crystalline Rock	6	505	1	12	
65	6	Precambrian Crystalline Rock	6	162	20	25	
65	6.01	Precambrian Crystalline Rock	6	425	13	20	1
65	12	Precambrian Crystalline Rock	6	400	4.5	20	1.1
65	14	Precambrian Crystalline Rock					ND
65	16.01	Precambrian Crystalline Rock	6	300	40	42	1
65	16.02	Precambrian Crystalline Rock	6	200	30	20	1
65	20.01	Precambrian Crystalline Rock	10	500	3.5	15	ND
65	20.03	Precambrian Crystalline Rock	6	300	3.5	40	ND
65	20.07	Precambrian Crystalline Rock	6	205	10	50	1.85
65	20.08	Precambrian Crystalline Rock	10	50	20	20	2.23
66	2	Precambrian Crystalline Rock	6	250	8	60	10.6
66	2.02	Precambrian Crystalline Rock	10	125	30	20	ND
66	3.03	Precambrian Crystalline Rock	10	545		40	ND
66	3.05	Precambrian Crystalline Rock					ND
66	3.06	Precambrian Crystalline Rock	10	225	25	16	4.55
66	3.07	Precambrian Crystalline Rock	6	575	1	30	0.95
66	3.08	Precambrian Crystalline Rock	6	250	40	65	1.04
66	12.04	Precambrian Crystalline Rock	6	160	8	20	
66	12.05	Precambrian Crystalline Rock	6	180	20	30	2.96

Water: A Natural Renewable Resource

Table 1: Water-Supply Well Information and Nitrate Levels in Lebanon Township, Hunterdon County, New Jersey.

Note: All data in table obtained from Hunterdon County Health Department.

Block	Lot	Geologic Zone	Diameter (inches)	Depth (ft bgs)	Yield (gpm)	Static-Water Level (ft bgs)	Nitrate Concentration (mg/l)
66	12.06	Precambrian Crystalline Rock	6	179	20	27	9.7
66	12.08	Precambrian Crystalline Rock	10	300	4	15	ND
66	14.03	Precambrian Crystalline Rock	6	165	15	20	ND
66	15.01	Precambrian Crystalline Rock	6	510	5	15	4.02
66	16.03	Precambrian Crystalline Rock	6	165	20	15	1.4
66	17	Precambrian Crystalline Rock	6	250	10		ND
67	1.01	Precambrian Crystalline Rock	10	400	5	80	ND
67	2.02	Precambrian Crystalline Rock	6	200	12	50	ND
67	2.04	Precambrian Crystalline Rock	10	125	15		ND
67	2.05	Precambrian Crystalline Rock	10	125	10	50	ND
68	4	Precambrian Crystalline Rock	10	150	10	95	ND
68	4.01	Precambrian Crystalline Rock	10	120	10	60	ND
68	4.02	Precambrian Crystalline Rock	10	150	10	40	ND
69	1.01	Precambrian Crystalline Rock	6	245	20	20	1
69	1.02	Precambrian Crystalline Rock					1
69	1.03	Precambrian Crystalline Rock	6	398	3	25	ND
69	1.04	Precambrian Crystalline Rock					0.9
69	1.05	Precambrian Crystalline Rock	6	198	10	40	2.4
69	2	Precambrian Crystalline Rock					ND
69	2	Precambrian Crystalline Rock	6	250	10	60	ND
69	2.03	Precambrian Crystalline Rock	10	305	10	20	ND
69	2.05	Precambrian Crystalline Rock	10	275		225	ND
69	2.06	Precambrian Crystalline Rock	10	150	10		ND
69	2.07	Precambrian Crystalline Rock	10	315		160	ND
69	2.08	Precambrian Crystalline Rock	10	300		40	ND
69	2.09	Precambrian Crystalline Rock	10	150	10	60	ND
69	2.11	Precambrian Crystalline Rock	10	400	5	30	ND
69	2.12	Precambrian Crystalline Rock	10	300		10	ND
69	2.13	Precambrian Crystalline Rock	10	275	10	20	ND
69	2.14	Precambrian Crystalline Rock	10	410	5	50	ND
69	2.15	Precambrian Crystalline Rock	10	300	10	40	ND
69	2.16	Precambrian Crystalline Rock	10	400	5	80	ND
69	2.17	Precambrian Crystalline Rock	10	400	3.5	50	ND
69	3	Precambrian Crystalline Rock	10	252	70	14	1.34
69	7	Precambrian Crystalline Rock	6	380	5	50	ND
69	52.01	Precambrian Crystalline Rock	6	300	18	23	3.55
69	52.02	Precambrian Crystalline Rock	6	305	10	40	3.51
69	52.03	Precambrian Crystalline Rock	6	540	5	140	ND
69	52.04	Precambrian Crystalline Rock	6	540	3	80	ND
69	52.05	Precambrian Crystalline Rock	6	600	7	52	0.6
69	52.06	Precambrian Crystalline Rock	6	400	8.5	30	2.35
69	52.06	Precambrian Crystalline Rock	6	400	8.5	30	
69	52.07	Precambrian Crystalline Rock	6	480	7	100	1.3

Table 1: Water-Supply Well Information and Nitrate Levels in Lebanon Township, Hunterdon County, New Jersey.

Note: All data in table obtained from Hunterdon County Health Department.

Block	Lot	Geologic Zone	Diameter (inches)	Depth (ft bgs)	Yield (gpm)	Static-Water Level (ft bgs)	Nitrate Concentration (mg/l)
69	52.08	Precambrian Crystalline Rock	6	340	10	20	5.2
69	54	Precambrian Crystalline Rock	6	102	50		3.6
69	56	Precambrian Crystalline Rock	6	177	10	50	2.9
69	56.01	Precambrian Crystalline Rock					11.3
69	56.02	Precambrian Crystalline Rock	6	485	6	29	4.08
69	56.03	Precambrian Crystalline Rock	6	285	6	20	2.9
73	40	Precambrian Crystalline Rock	6	205	10	60	
73	55	Precambrian Crystalline Rock					ND
73	55.01	Precambrian Crystalline Rock	6	255	10	30	1.55
73	55.03	Precambrian Crystalline Rock	10	275	7	240	ND
73	55.04	Precambrian Crystalline Rock	6	200	15	40	ND
73	55.05	Precambrian Crystalline Rock	6	250	4	30	7.88
12	45.05	Limestone/Dolomite	6	120	12	30	ND
12	47	Limestone/Dolomite					ND
19	23	Limestone/Dolomite	10	155	10	10	ND
19.02	7	Limestone/Dolomite					ND
21	7	Limestone/Dolomite	10	280	30	60	ND
21	27	Limestone/Dolomite	10	185	10	30	ND
23	1	Limestone/Dolomite	10	205	20	4	ND
25.03	19	Limestone/Dolomite	6	230	10	30	
40	10.02	Limestone/Dolomite	10	370		120	ND
41	2.01	Limestone/Dolomite	10	309	8	69	ND
41	4	Limestone/Dolomite	6	380	10	42	3.92
41	4.01	Limestone/Dolomite					ND
41	7	Limestone/Dolomite	6	573	8	80	
43	1.01	Limestone/Dolomite	6	201	25	20	3.1
43	2	Limestone/Dolomite	6	80	10	60	1.2
43	2.01	Limestone/Dolomite	6	300	15	40	0.73
43	2.02	Limestone/Dolomite	6	168	40	30	ND
43	2.04	Limestone/Dolomite	6	260	30	70	ND
43	2.05	Limestone/Dolomite	6	115	30	52	1.3
43	2.06	Limestone/Dolomite	6	135	25	56	2.1
44	24.07	Limestone/Dolomite	6	200	10	30	1
44	24.08	Limestone/Dolomite	6	775	2.5	15	ND
44	24.19	Limestone/Dolomite					ND
55	1	Limestone/Dolomite					ND
55	1.02	Limestone/Dolomite	10	655	5	140	ND
55	1.03	Limestone/Dolomite	10	275	10	40	ND
56	21	Limestone/Dolomite	6	303	30	93	1
56	21.02	Limestone/Dolomite	6	160	30	60	1
59	5	Limestone/Dolomite	6	148	25	15	1
60	16	Limestone/Dolomite	6	105	20	20	2.93
60	30.01	Limestone/Dolomite	10	175	20	60	ND

Table 1: Water-Supply Well Information and Nitrate Levels in Lebanon Township, Hunterdon County, New Jersey.

Note: All data in table obtained from Hunterdon County Health Department.

Block	Lot	Geologic Zone	Diameter (inches)	Depth (ft bgs)	Yield (gpm)	Static-Water Level (ft bgs)	Nitrate Concentration (mg/l)
60	41	Limestone/Dolomite	6	243	40	79	1.16
60	41.03	Limestone/Dolomite	6	105	13	15	4.96
69	22	Limestone/Dolomite	6	110	25	25	
69	25.01	Limestone/Dolomite	6	298	7	60	1
70	23	Limestone/Dolomite	6	208	5	25	
70	24	Limestone/Dolomite					1
72	1	Limestone/Dolomite	6	100	52	40	4.26
72	15	Limestone/Dolomite	10	100	10	30	ND
72	18.19	Limestone/Dolomite					ND
72	21	Limestone/Dolomite	10	245	15	40	ND
73	27	Limestone/Dolomite	10	150		40	ND
77	6	Limestone/Dolomite	10	80	50	5	ND
77	7.03	Limestone/Dolomite	6	98	30	45	2
77	7.04	Limestone/Dolomite	6	198	20	60	1.63
77	7.05	Limestone/Dolomite	6	123	20	24	1.76
77	7.06	Limestone/Dolomite	6	123	10	45	3.6
77	7.07	Limestone/Dolomite	6	198	25	60	3.2
77	7.08	Limestone/Dolomite	6	148	10	75	2
77	7.09	Limestone/Dolomite	6	373	100	60	3.3
77	7.1	Limestone/Dolomite	6	248	15	46	3.4
77	7.11	Limestone/Dolomite	6	648	18	50	2.3
77	7.12	Limestone/Dolomite	6	235	30	90	2.1
77	7.13	Limestone/Dolomite	6	148	15	48	3.5
77	7.14	Limestone/Dolomite					3.1
77	7.15	Limestone/Dolomite	6	190	50	50	2.3
77	8.02	Limestone/Dolomite	6	300	30	120	
77	8.04	Limestone/Dolomite	10	300	30	80	ND
77	8.05	Limestone/Dolomite	10	300	30	150	ND
77	8.06	Limestone/Dolomite	10	400	5	80	ND
77	8.06	Limestone/Dolomite					ND
77	9	Limestone/Dolomite					ND
77.01	2	Limestone/Dolomite	6	298	20	65	6.2
77.01	3	Limestone/Dolomite	6	298	20	70	1.2
77.01	4	Limestone/Dolomite	6	998	15	617	2.6
77.01	5	Limestone/Dolomite	6	598	40	80	2.1

Figure 1: Hunterdon County, New Jersey

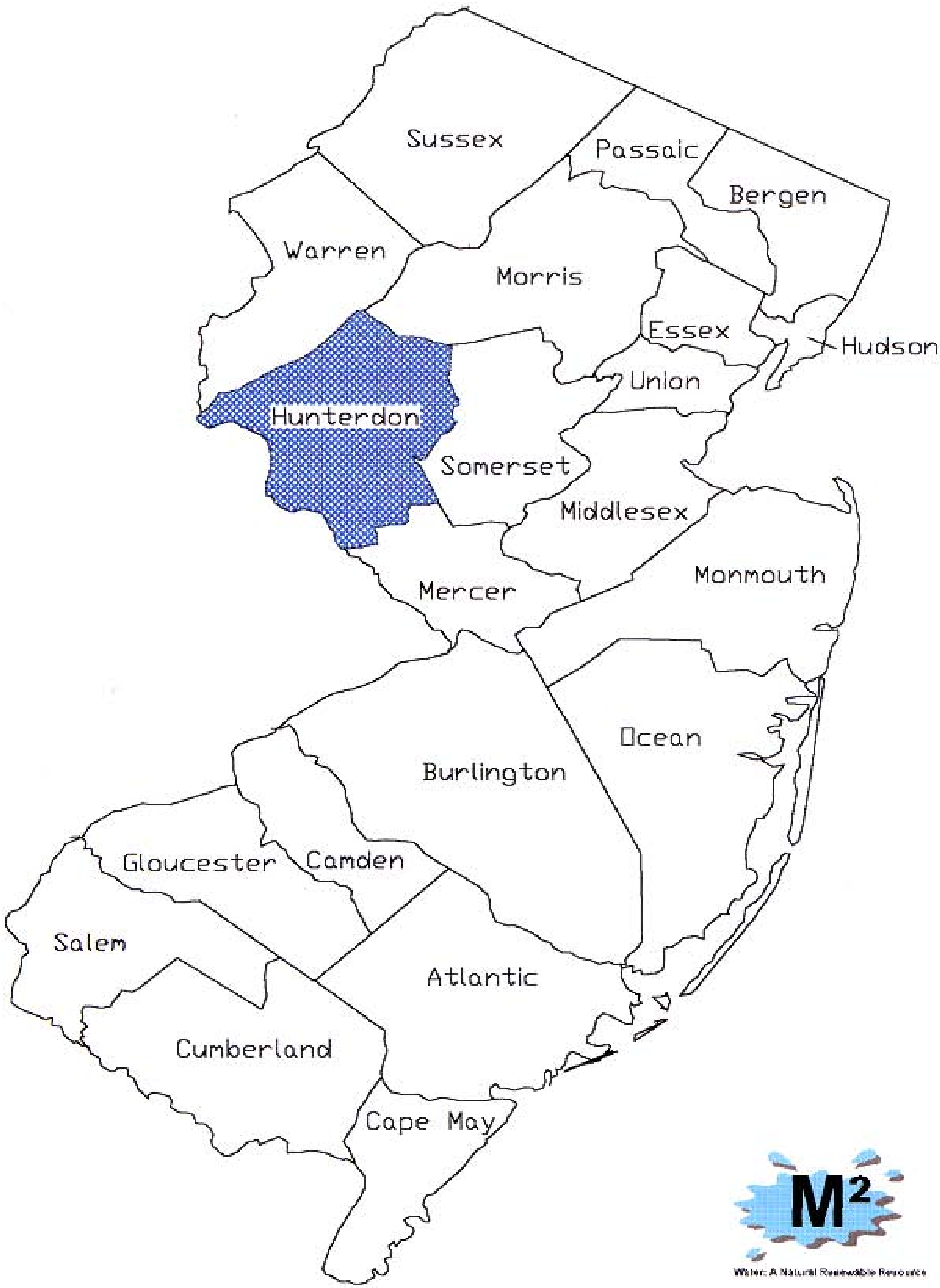


Figure 2: Lebanon Township, Hunterdon County

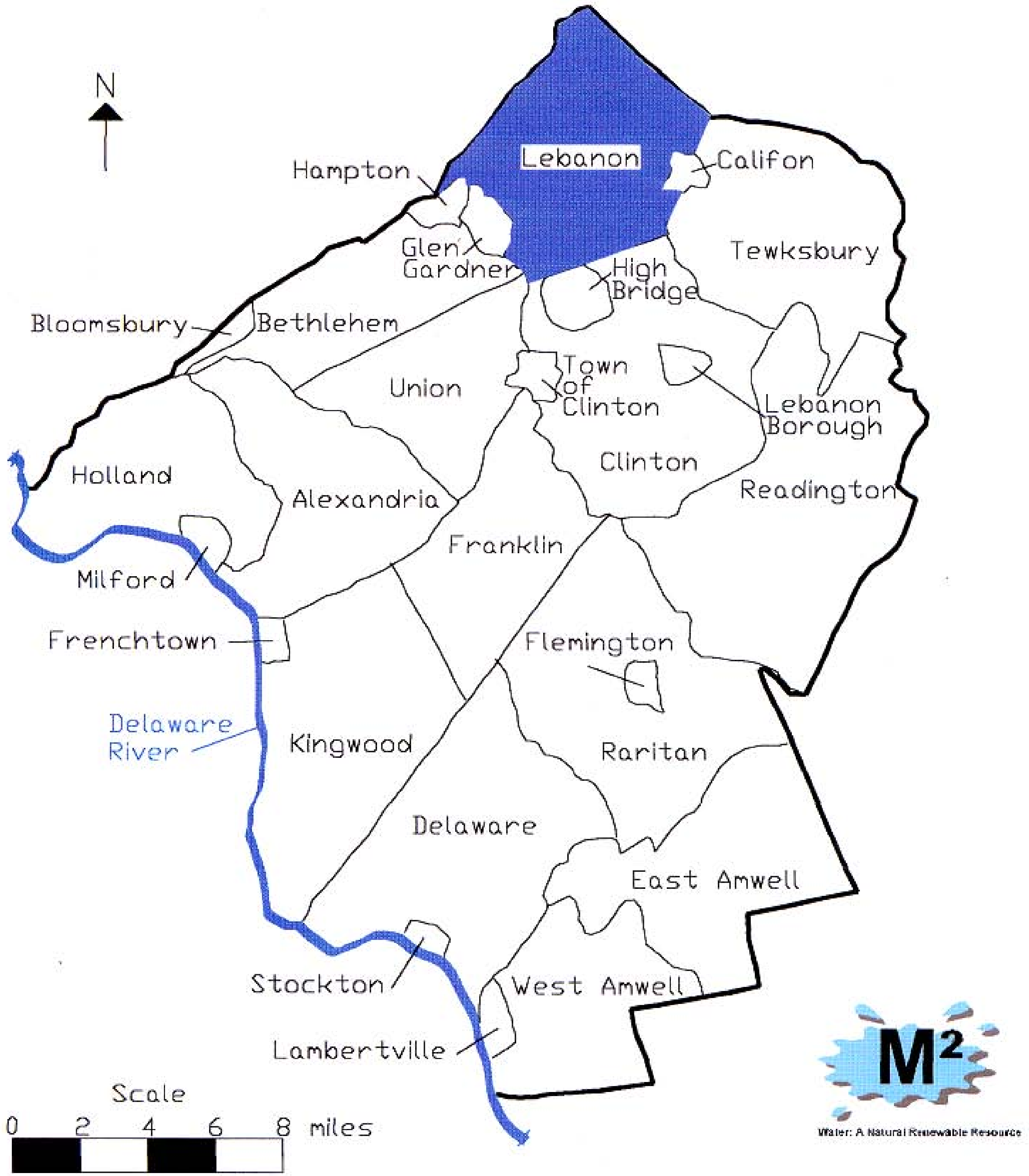


Figure 3: Boundary of Physiographic Provinces in Hunterdon County

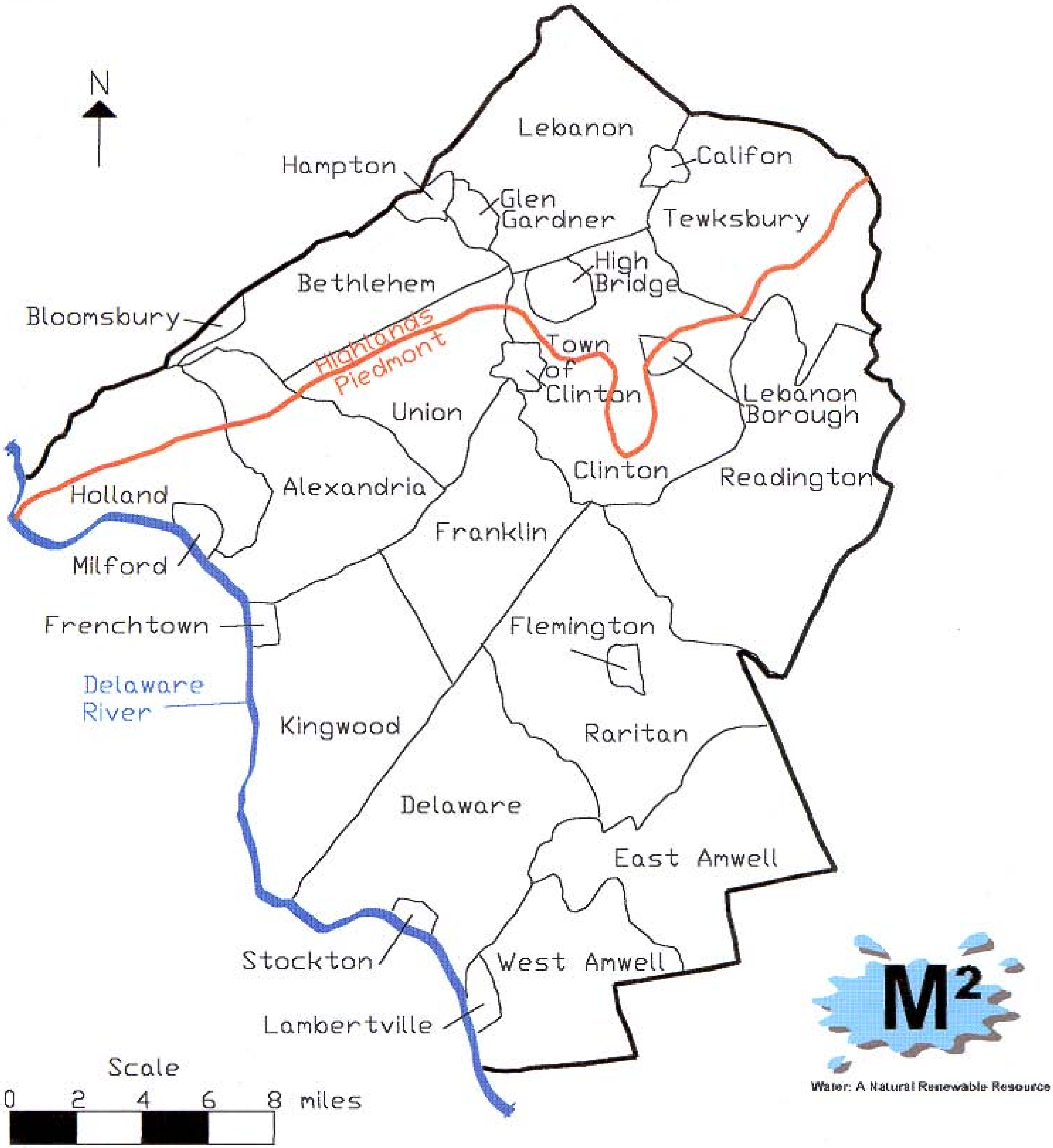


Figure 4: Topography of Lebanon Township, Hunterdon County, New Jersey.

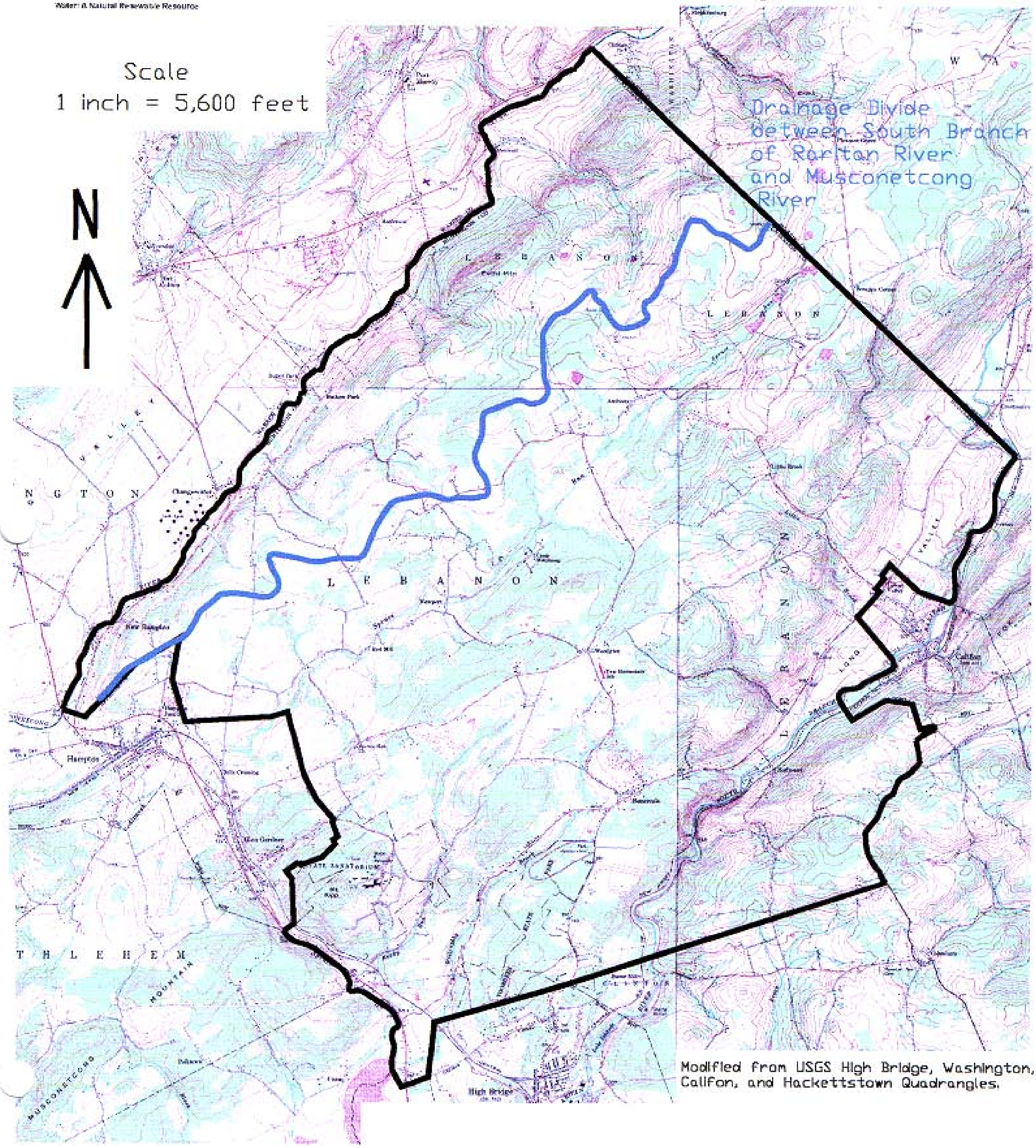
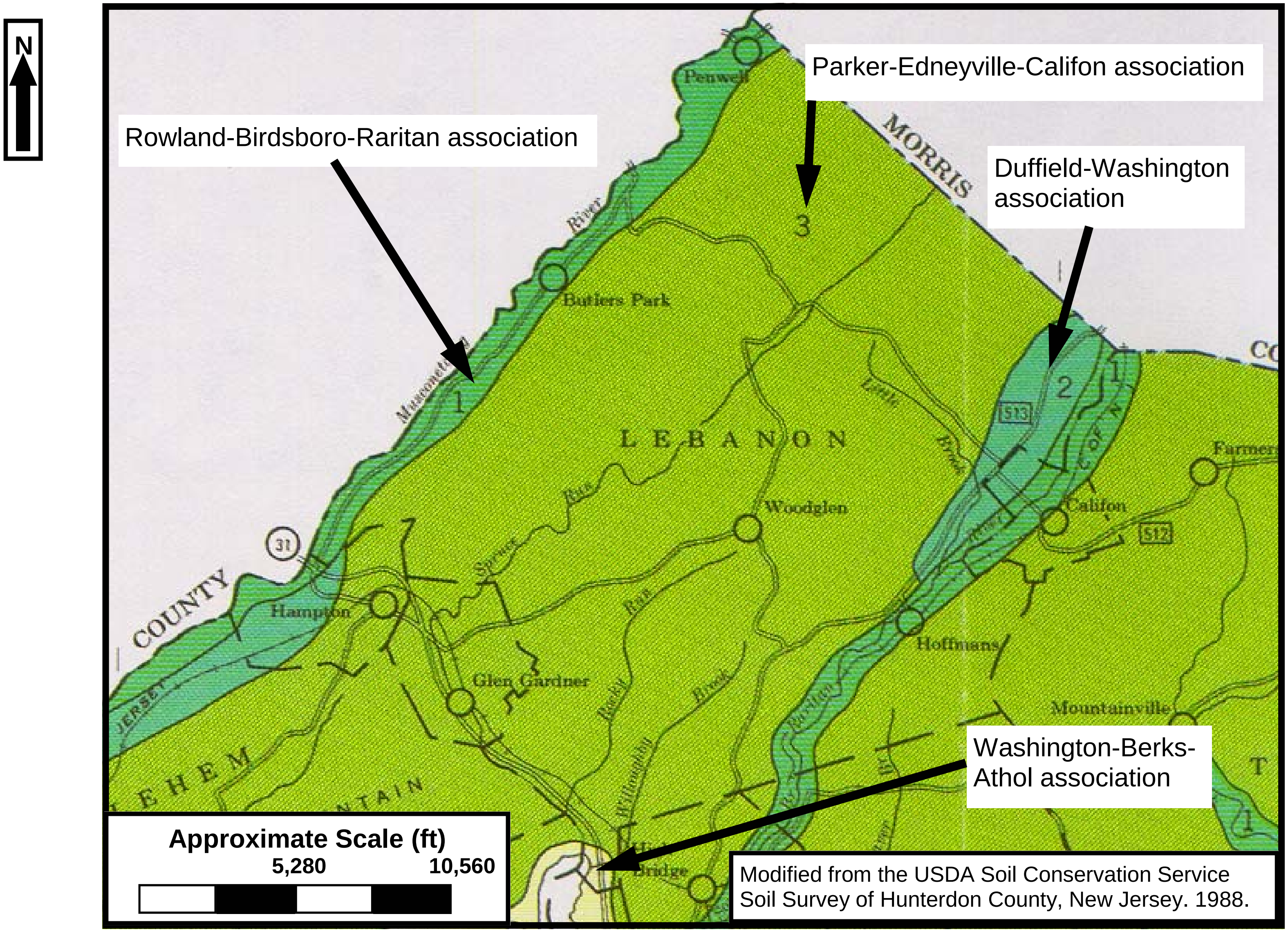
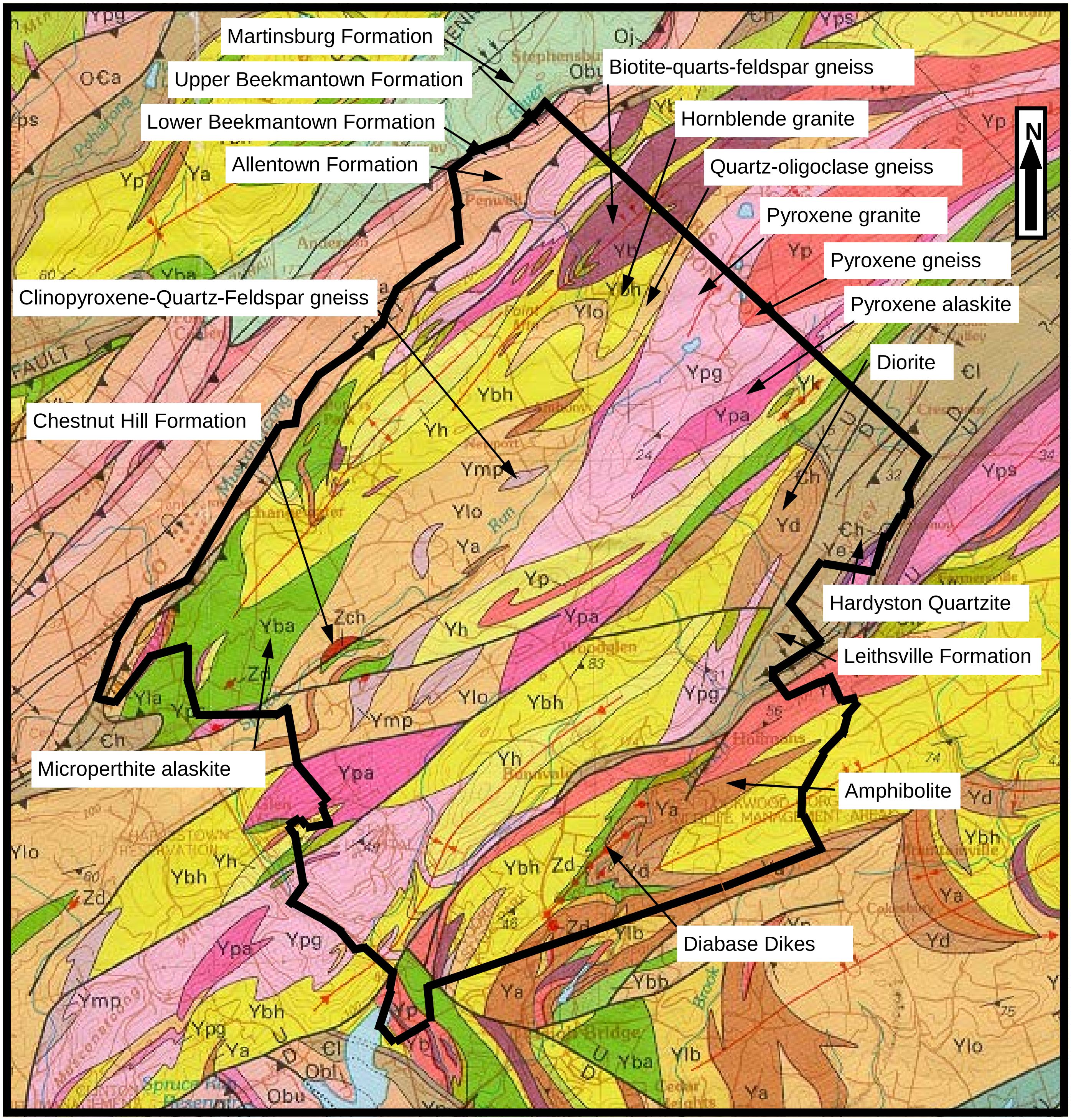


Figure 5: Soils of Lebanon Township
Hunterdon County, New Jersey



Water: A Natural Renewable Resource

Figure 6: Geology of Lebanon Township Hunterdon County, New Jersey



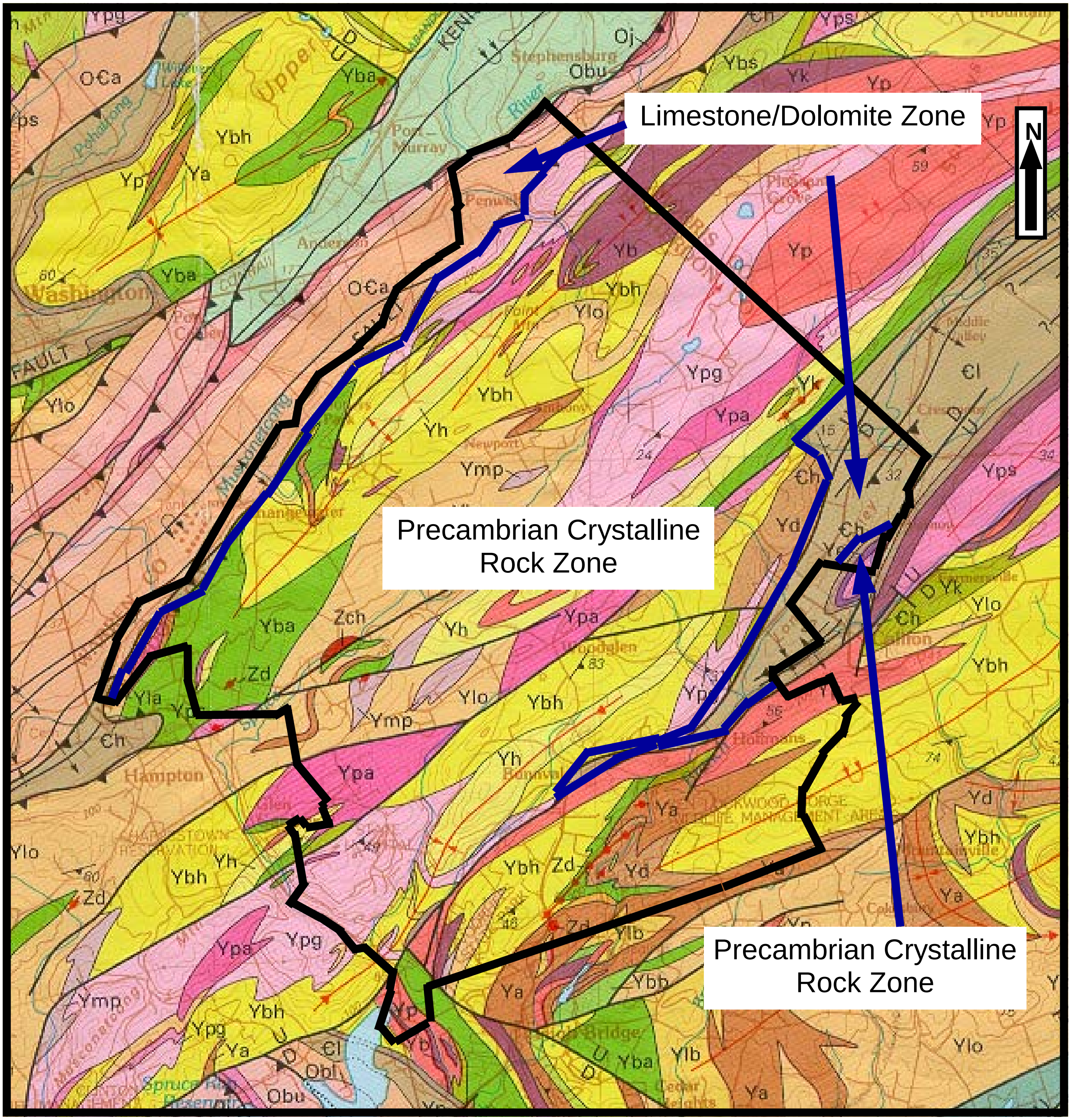
Approximate Scale (ft)

7000 14,000

Modified from the USGS & NJGS "Bedrock Geologic Map of Northern New Jersey". Drake, et al. 1996

M²
Water: A Natural Renewable Resource

Figure 7: Hydrogeologic Zones of Lebanon Township
Hunterdon County, New Jersey

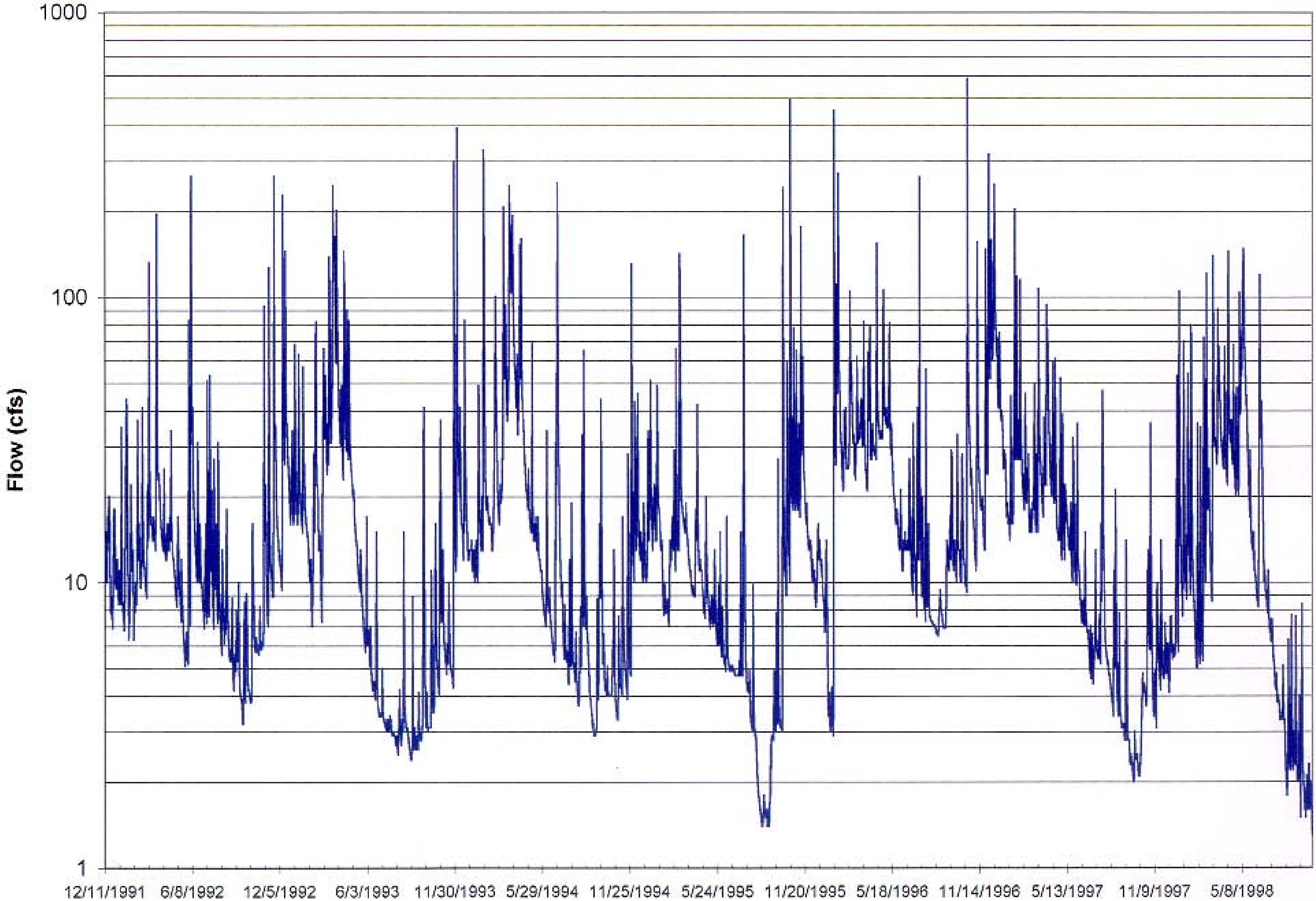


Approximate Scale (ft)

7000 **14,000**

Modified from the USGS & NJGS "Bedrock Geologic Map of Northern New Jersey". Drake, et al. 1996

Figure 8: Stream Flow in Spruce Run at Glen Gardner, New Jersey



Lebanon Township 2001 Master Plan

2001 Master Plan

Land Use Plan Element
Conservation Plan Element

Township of Lebanon
Hunterdon County, New Jersey

Prepared by the Lebanon Township Planning Board
in consultation with Banisch Associates, Inc.

Prepared August, 2001

Adopted: September 26, 2001

The original of this report was signed and sealed
in accordance with N.J.A.C. 13:41-1.3

LEBANON TOWNSHIP MASTER PLAN

TABLE OF CONTENTS **Page**

TABLE OF CONTENTS (continued)

LIST OF FIGURES

Following Page

LEBANON TOWNSHIP

2001 Master Plan

Foreword

Lebanon Township offers a great diversity of land and water resources. Bounded by two of the preeminent recreational rivers in New Jersey, the South Branch of the Raritan River and the Musconetcong River, and containing the highest elevation in Hunterdon County, the Township offers a mosaic of hills and valleys, forests and agricultural land. The Township's rugged terrain present an obstacle for development, but its desirable characteristics also provide an attraction for those seeking a rural, agricultural landscape. The dominant land uses in the Township remain forest and farmland, which imparts the rural character the Township seeks to protect.

Lebanon Township is a rural agricultural community where beautiful rolling hills provide long views and vistas, largely wooded or farmed, laced with streams and brooks and dotted with ponds. It is well suited to low intensity residential and farm use for those who prefer a rural agricultural lifestyle amid the beauties of nature. The slopes associated with the rolling terrain and the wetlands and heavy soils, which are a natural accompaniment of the streams and ponds, limit the suitability of much of the Township land for industrial or commercial use or high density residential development.

Two principal concerns have motivated past Township Committees and its Planning Boards. One has been the preservation of the rural agricultural countryside and the farms that are an essential part of its lifestyle. The second has been the careful management of development in environmentally sensitive areas. Accordingly, steep slopes and wetlands ordinances have been enacted and large lot zoning patterns have been designed to minimize the adverse impacts of high density development on land not suitable for it. Township officials have neither encouraged commerce and industry to settle in the Township nor developed an infrastructure of roads or public water and sewer facilities which would attract it.

Indeed, Lebanon Township was among the first Hunterdon County municipalities to limit the intensity of land use in response to environmental considerations. This Master Plan refines these regulatory limitations to better respond to the goals of environmental protection and agricultural retention. These local actions support the intent of the State Development and Redevelopment Plan and, when responsibly enacted by municipalities, obviate the need for home rule intervention by state boards or authorities.

A fundamental assumption of the Township's planning program has been that the Township's predominant 5 acre zoning, coupled with the difficult physical conditions in the Township, would protect the rural characteristics and environmental resources of the Township, and would serve to control major development. However, pressures on the

Township's land and water resources are becoming ever greater, leading to a need for more rigorous development controls. Changes in State and County policies concerning farmland and open space preservation make it apparent that more effective approaches to land management and preservation are needed.

As the supply of easily developable land in the Township dwindles, increasing pressure is being placed on more environmentally constrained areas and the remaining supply of agricultural land. The same attributes which the Township seeks to protect - its scenic quality, natural resources and agricultural lands - are those which attract new residential development. Thus, the Township has reexamined its planning policies and principles and developed more proactive methods, including regulatory and acquisition approaches, to retain farmland and protect the quality of the environment.

Guiding Principles

This Master Plan is dedicated to preserving, protecting and enhancing Lebanon Township's natural and cultural resources, and promoting a sustainable future for the Township and the region. The vision for addressing and managing change in Lebanon's future is reflected in these key principles:

The essential character of Lebanon Township as a community of single family homes and small farms should be maintained.

Residential and agricultural zones should provide a restful environment secure from intrusion by uses not directly related to residential and agricultural pursuits.

Farming and agriculture should be encouraged and promoted.

Community character should be maintained through an orderly and controlled development pattern within the limits of available water supplies, the capacity for effluent disposal and the preservation of the Township's natural beauty.

Water quality and quantity should be protected for the current and future use and enjoyment of residents, downstream users and ecological receptors.

Design and performance standards should protect environmentally sensitive areas with the goal of improving the quality of the air and water that flow through Lebanon Township.

Future development should be managed to protect the rural character of the Township's countryside and road network, including its tree-shaded lanes, meandering streams and brooks, open fields and pastures, wooded areas, and rugged topography.

Commercial development should be limited to development nodes where services and facilities can be provided and maintained most economically. Industrial *development should be sharply restricted, as it produces negative effects on the residential and agricultural nature of the Township.*

The realization of these objectives will require a combination of public actions, such as farmland and open space preservation, and sustainable land use strategies and zoning techniques, as well as a variety of private conservation efforts.

Introduction

The preparation of this Master Plan was prompted by the 2000 Reexamination Report adopted by the Planning Board in August 2000. The Planning Board had also completed Reexamination Reports in 1988 and 1994. Following the recommendations of the 1988 Reexamination Report, the Planning Board adopted the 1991 Master Plan Review and Update, which updated the background data that forms the basis for the Master Plan. The 1991 Master Plan Review and Update also revised the objectives of the Township's prior Master Plans.

This 2001 Master Plan includes the statement of objectives, principles, assumptions, policies and standards upon which the subsequent proposals for the physical, economic and social development of the Township are based; the mandatory Land Use Plan Element, which a community is required to adopt in order to maintain the authority to zone; and, the Conservation Plan Element, which is intrinsically related to the proposals in the Land Use Plan Element. The Planning Board adopted the other required Master Plan element, the Housing Plan Element, in 1998.

The optional elements of the Master Plan will be prepared as part of a multi-year, continuing planning program. A Farmland Preservation Plan and an Open Space and Recreation Plan, which will provide the Township with tools to actively pursue acquisition and preservation efforts, assume a high priority in future planning efforts.

Goals and Objectives

Through the statement of objectives, principles, assumptions, policies and standards the Planning Board articulates the vision for the future development of the municipality. This vision builds upon what has come before, incorporates these conditions, and expresses what the Township wants to be in the future.

The purposes of the Municipal Land Use Law (MLUL) articulate the objectives of the State in providing municipalities with the power to plan and zone. These purposes of the enabling legislation combine with detailed local goals and objectives to guide the development of the Master Plan. The purposes of the Municipal Land Use Law (NJSA 40:55D-2) are as follows:

a. To encourage municipal action to guide the appropriate use or development of all lands in this State, in a manner which will promote the public health, safety, morals, and general welfare;

b. To secure safety from fire, flood, panic and other natural and manmade disasters;

c. To provide adequate light, air and open space;

d. To ensure that the development of individual municipalities does not conflict with the development and general welfare of neighboring municipalities, the county and the State as a whole;

e. To promote the establishment of appropriate population densities and concentrations that will contribute to the well being of persons, neighborhoods, communities and regions and preservation of the environment;

f. To encourage the appropriate and efficient expenditure of public funds by the coordination of public development with land use policies;

g. To provide sufficient space in appropriate locations for a variety of agricultural, residential, recreational, commercial and industrial uses and open space, both public and private, according to their respective environmental requirements in order to meet the needs of all New Jersey citizens;

h. To encourage the location and design of transportation routes which will promote the free flow of traffic while discouraging location of such facilities and routes which result in congestion or blight;

i. To promote a desirable visual environment through creative development techniques and good civic design and arrangements;

j. To promote the conservation of historic sites and districts, open space, energy resources and valuable natural resources in the State and to prevent urban sprawl and degradation of the environment through improper use of land;

k. To encourage planned unit developments which incorporate the best features of design and relate the type, design and layout of residential, commercial, industrial and recreational development of the particular site;

l. To encourage senior citizen community housing construction;

m. To encourage coordination of the various public and private procedures and activities shaping land development with a view of lessening the cost of such development and to the more efficient use of land;

n. To promote utilization of renewable energy sources; and

o. To promote the maximum practicable recovery and recycling of recyclable materials from municipal solid waste through the use of planning practices designed to incorporate the State Recycling Plan goals and to complement municipal recycling programs.

It is interesting to note that over half of the purposes of the statute are directed at protecting the environment, retaining open space and preventing urban sprawl. The statute also seeks to provide a desirable visual environment.

In addition to the MLUL purposes, and the goals of rural conservation and resource protection outlined above in the Introduction, the objectives of the 1991 Master Plan have been refined and expanded in this Master Plan. The statement of objectives is the fundamental component that guides the Planning Board's development of policies, strategies and standards. These include:

Land Use and Management

- To exercise stewardship over the lands and waters of Lebanon Township to ensure that these resources are available for the sustenance and enjoyment of present and future generations.

- To protect and maintain the prevailing rural character and unique sense of place of the Township, including diverse residential neighborhoods, historic settlement areas and scenic landscapes, which result from the natural topography, agricultural lands, woodlands and watercourses.

- To promote the goals and objectives of Lebanon Township through the incorporation of local policies and strategies that respond to the basic premises, intent and purposes of the State Development and Redevelopment Plan and the Hunterdon County Growth Management Plan.

- To provide a future land use pattern that preserves large contiguous areas of farmland and other open lands and serves the needs of the community for housing, community services and a safe and healthful environment.

- To continue and expand upon land use policies that promote controlled development at suitable locations and appropriate intensities by discouraging the extension of growth-inducing infrastructure into rural areas.

- To establish development densities and intensities at levels which do not exceed the current planning capacity of the natural environment and available infrastructure, based on the sensitivities and limitations of these systems.

- To offer flexibility in development techniques which recognize new approaches and technologies that are responsive to evolving demographic, economic and environmental needs.

Community Design

- To develop standards to ensure good visual quality and design for all land use categories.

- To ensure that new development is visually and functionally compatible with the physical character of the Township.

- To provide for a proactive approach to physical design and community planning so that adjacent land uses function compatibly and harmoniously in terms of scale and location.

- To improve the visual and physical appearance of developed areas through the implementation of design standards for features such as signs and buffering and protect residential neighborhoods from encroachment by incompatible uses.

- To retain to the greatest extent practicable attractive vistas from public rights-of-way, including views of hills, valleys, ridgelines, woodlands, farmlands, hedge rows, stream corridors, flood plains and other natural areas.

Natural Resources

- To protect environmental resources which contribute to the rural character of the Township, including but not limited to steep slopes, ridgelines, trout streams, wetlands, stream corridors, potable water supplies, watersheds, aquifers, rivers, viewsheds, forests and other vegetation, habitats of threatened and endangered species and unique natural systems.

- To limit the intensity of development, in areas relying on groundwater supplies and on-site sewage disposal, based on conservative estimates of available water resources and the ability of the soil and ground water to sustain on-lot disposal systems without degrading or impairing the water quality.

- To promote the protection of biological diversity through the maintenance of large contiguous tracts and corridors of recreation, forest, flood plain and other open space lands.

- To continue the acquisition of important open space through the use of the Township's open space tax and other sources of funding.

- To promote land use and management policies that provide for clean air and protection from noise and light impacts.

- To promote the development and adoption of resource management standards to manage land use activities in a manner that protects and maintains natural resources for the future use and enjoyment of generations to come.

- To identify and manage stream corridor buffer areas by maintaining undisturbed vegetation in order to protect and improve water quality, wildlife corridors and opportunities for passive and active recreation.

- To ensure that development involving steep slopes is required to meet design standards which enhance the attractiveness of the site.

- To refine the Township's tree protection ordinance so that the high quality forests of the Township, which contribute so much to the Township's environmental quality and scenic beauty, are preserved and maintained

- To protect groundwater supply and quality through the adoption of aquifer management programs, including relevant standards for wellhead protection programs, and standards to protect groundwater recharge areas, such as impervious coverage limitations.

- To protect the sensitive headwaters of the Musconetcong River and the South Branch of the Raritan River.

- To protect groundwater resources to meet the demands of the Township and as a resource to the region.

Housing

- To promote and support the development and redevelopment of affordable housing intended to address the Township's fair share of the region's lower income housing.

- To provide a range of housing opportunities within the Township.

- To develop housing strategies to address the needs of various age groups, including housing for senior citizens.

- To provide for residential densities and lot sizes that do not exceed the capabilities and limitations of natural systems and available infrastructure.

Agriculture

- To encourage the preservation of agriculture through proactive planning where there are suitable conditions for the continued operation and maintenance of agricultural uses.

- To preserve a large contiguous land base to assure that agriculture remains a viable, permanent land use.

- To coordinate agricultural preservation activities with the State Agriculture Development Committee (SADC), Hunterdon County Agricultural Development Board and other open space preservation activities in the Township.

- To continue to seek the expansion and preservation of Agricultural Development Areas.

- To recognize agriculture as a significant economic industry in the community and to encourage economic opportunities in this industry.

- To provide financial incentives, financing mechanisms and enhanced opportunities for agricultural businesses that assist in maintaining agriculture as a viable economic activity.

- To encourage compatibility between agricultural operations and neighboring non-agricultural development through the right-to-farm ordinance.

Transportation

- To create a circulation plan sufficient to accommodate planned development, while retaining the unique and scenic features of the rural road network.

- To coordinate with other municipalities and governmental bodies for a regional approach to transportation that respects and enhances the character of the community.

- To establish transportation policies and programs that improve connections among housing, employment and commercial uses, including provisions for vehicular and pedestrian travel and bicycle paths.

- To control development in rural areas so that traffic will not exceed the capacity of the existing rural road network to provide safe, efficient and convenient traffic movements, based on rural road service standards designed to maintain the character of the community.

- To recognize that roadways are public lands that deserve aesthetic design consideration as well as efficient movement of vehicles, and to carefully plan entrances to the Township because they represent a visitor's first impression of the Township.

- To encourage transportation funding for maintenance of the existing transportation system, rather than encouraging the development of new systems in rural areas.

- To minimize the impacts of transportation systems on the environment, including air and noise pollution.

Economic Development

- To provide for desirable non-residential development in appropriate areas of the Township that will complement the existing character of the community and aid in broadening the local tax base.

- To promote the redesign of existing commercial sites to provide a more efficient land use pattern through such approaches as reduced curb cuts, interconnecting driveways, improved pedestrian and bicycle linkages and enhanced landscaping.

- To provide for new commercial areas in compact forms in areas with utilities in order to concentrate businesses and provide a variety of services.

- To coordinate such items as architectural design, access, landscaping, adequate parking, lighting, signs and similar design features to produce visually and functionally compatible economic development.

Historic and Cultural Resources

- To safeguard and conserve the heritage of the Township by preserving those resources that have historic, archaeological, social, cultural, economic and architectural significance, based on national, state and local importance and criteria.

- To discourage encroachment on historic structures and sites by uses and buildings that are incompatible or detract from the design of the historic features.

- To encourage the preservation, rehabilitation or adaptive reuse of historic buildings and structures that protects their architectural integrity and preserves their context within the historic landscape.

- To encourage the development of land use regulations which acknowledge and permit special treatment for historic landscapes, districts, sites, and structures including setbacks, buffers and other design criteria.

Community Facilities and Utilities

- To plan for the expansion of necessary public services, such as utilities, community facilities and recreation, at a reasonable cost in response to the proposals in the land use plan element.

- To establish a system whereby necessary capital improvements can be programmed and planned in advance, and land can be reserved to meet the future needs for community facilities and open space.

- To provide facilities for community groups and cultural activities.

- To ensure that the development process acknowledges and addresses the impact on community facilities and utilities through the payment of the fair share of any off-tract improvements for community facilities to the extent permitted by law.

- To encourage the coordination of facilities between the Township and local School District so that the schools serve as multi-age facilities for the community.

Recreation and Open Space

- To promote the provision of appropriate and balanced public open space and recreational facilities through public action and the development review process.

- To prepare and maintain a recreation and open space master plan to establish and enhance recreational lands and public open space; to establish linkages of public spaces through the use of greenways, greenbelts, waterways, paths and bikeways; and, to establish as the highest priority for public acquisition, areas of unique recreational, scenic or environmental value.

- To encourage the public acquisition of areas of exceptional recreational or scenic value, or environmental sensitivity, at all levels of government, with priority given to acquisition of land to meet present and future demand for active and passive recreation.

- To support State and County open space programs and ongoing acquisitions for their value to the goals of the community.

- To promote cultural activities that provide recreational opportunities for a broad spectrum of residents and guests.

- To assess and provide opportunities for active and passive recreation to meet the needs of all citizens.

- To devise appropriate strategies for the public and private ownership and maintenance of open space and recreation lands.

- To encourage the continuation and expansion of non-profit camps for their valuable contribution to the recreation and open space resources of the Township.

THE LAND USE PLAN

This Land Use Plan Element has been designed to implement the foregoing goals, objectives, principles and assumptions in a manner which respects and responds to the capabilities and limitations of the natural conditions - groundwater quantity and quality, surface water resources, agricultural use opportunities, soils, woodlands, wetlands and flood prone areas. The Plan generally depicts the proposed location, extent and intensity of development of land to be used in the future for varying types of residential, commercial and industrial purposes, as shown on the Land Use Plan Map. These land use planning proposals become effective agents for managing change when implemented through the zoning ordinance.

The Land Use Plan Element is the fundamental unit of the Master Plan, with the broadest scope and most far-reaching consequences. It represents a municipality's basic statement about the future disposition of land and the physical form of the community. Informed by the other plan elements, which play supporting roles, the Land Use Plan and the Conservation Plan have the greatest influence on the Township's future, as they shape local zoning.

This Plan maintains the policy orientation of prior Master Plans, but refines land use strategies to better address evolving conditions and concerns. It provides a more detailed description of the goals, objectives and intent of the Plan, and suggests new planning initiatives to achieve the Township's objectives. The recommendations of the 2000 Reexamination Report are also reflected in this Land Use Plan.

Residential Land Use

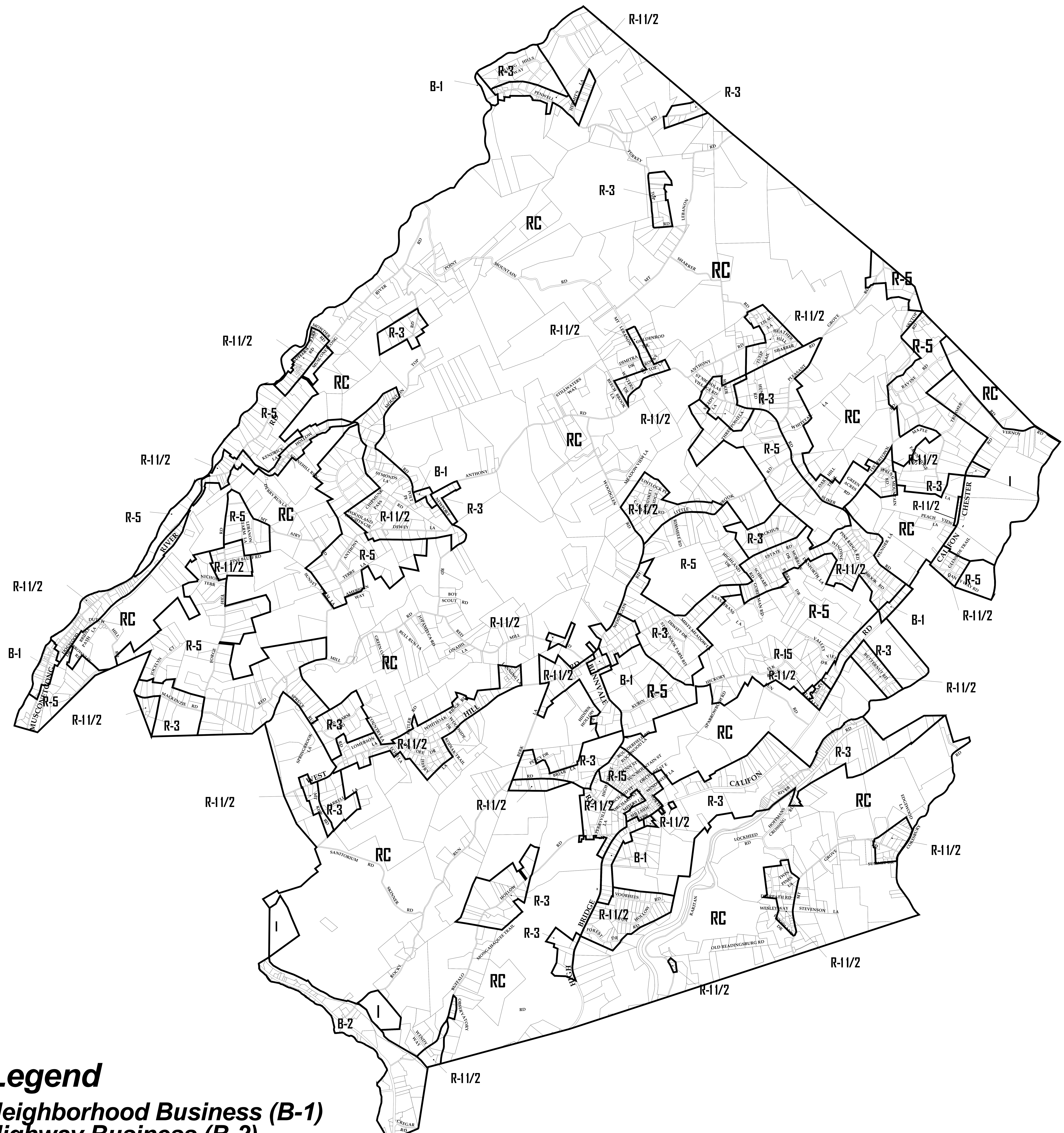
The residential lands in the Township traditionally have been divided into four districts, predominantly reflecting historical development patterns and existing lot sizes. These four districts cover a broad spectrum of lot sizes and environmental conditions, ranging from small-lot neighborhoods to expansive wooded and agricultural areas. This Land Use Plan proposes an additional residential district, as indicated on the Land Use Plan map and discussed below.

The Plan acknowledges that changes in land use classifications and densities will create nonconforming vacant lots. With regard to vacant lots in any residential zone throughout the Township, the Plan proposes the grandfathering of all vacant lots of 30,000 square feet or greater, so that each of these vacant lots has a residential development opportunity. The Plan also acknowledges that changes in land use classifications and minimum lot sizes will create nonconformities for developed lots that should receive appropriate treatment in the implementing ordinances, in order to provide reasonable opportunities for the modification and/or expansion of preexisting housing units.

Resource Conservation District

The Resource Conservation (RC) District is intended to comprehensively address the goals of protecting groundwater quantity and quality, preserving surface water resources, conserving the scenic rural character and promoting continued agricultural use opportunities. The RC District embodies the rural and agricultural countryside that the Township's planning program has sought to maintain throughout its history.

Land Use Plan
Lebanon Township
August 2001



Legend

Neighborhood Business (B-1)
Highway Business (B-2)
Industrial (I)
One- Family Residential (R-1 1/2)
One- Family Residential (R-15)
Rural Residential (R-3)
Rural Agricultural (R-5)
Resource Conservation (RC)

Map Scale=1:20,000

1 0 1 Miles

Mapped Information Prepared by:
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Data Sources:
Hunterdon County Division of GIS

The lack of public water and sewer infrastructure throughout the District limits future development potential, which should be designed in response to the carrying capacity limitations of the natural systems. Capacity-based planning involves the measurement of a municipality's ability to accommodate growth and development within limits defined by natural resource capabilities and existing infrastructure. A capacity analysis determines the limiting factors in an area's ability to grow and evaluates the capacity of the limiting factor. With the absence of public water and sewer infrastructure the limiting factor thus becomes an element of the natural environment, such as water.

Sustainable development policies provide a land use framework that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable development respects capacity limits and provides a margin of safety, and incorporates the goals of stewardship over land and water resources, and the prolonged maintenance of a desirable physical environment.

A dominant theme in the planning process has been the protection of water resources, with a particular emphasis on groundwater quantity and quality. Because of the singular importance of this resource, the Planning Board commissioned a study of the groundwater resources of the Township. This study analyzed the ability of the groundwater system to provide a sustainable yield of water, and the parameters which affect the quality of groundwater. The Township's groundwater resources are of value not only to the current and future residents of the Township, but also to downstream consumers and ecological receptors. As a recharge and headwaters area for one of the most populous and fastest growing regions in the State, the responsible course of action is for the Township to protect these resources through all available measures.

The Township is underlain by two distinct types of geologic formations. The characteristics of this bedrock geology dictate how well they function as aquifers, or groundwater systems. Approximately 90% of the Township is underlain by Precambrian igneous and metamorphic bedrock, consisting of gneiss and granite. This area is designated as the Precambrian Crystalline Rock area in the groundwater resources report. The remainder of the Township, lying along the Musconetcong River and the South Branch Raritan River near Califon, consists of Ordovician-Cambrian limestones and dolomites, or carbonate formations. These areas are designated the Limestone/Dolomite area in the groundwater resources report.

The characteristics of the Limestone/Dolomite area indicate that there is more available groundwater in this formation than in the Precambrian Crystalline Rock area, but the Limestone/Dolomite is susceptible to hazards such as sinkhole formation, subsidence and rapid transport of pollutants. The storage potential of the Limestone/Dolomite formation is enhanced by the presence of solution channels which provide spaces for groundwater storage, while the Precambrian Crystalline Rock formation is less porous with limited fracturing and limited available groundwater.

The groundwater management strategy represented by the RC District seeks to balance the goals of limiting the degradation of groundwater while also permitting appropriate uses of land. The land and water management policies of this Plan do not attempt to achieve non-degradation of groundwater, which would essentially prevent further development in these areas. While a strong argument can be made that the Township's groundwater resources merit a non-degradation approach, this Plan seeks a balance between resource protection and reasonable development expectations. Thus, this Plan seeks to program development at densities which permit limited degradation while protecting the potability and availability of groundwater resources.

Additional support for the limited degradation policy that underlies the RC District is provided by the surface water resources of the Township. Approximately 20% of the Township drains to the Musconetcong River, a trout maintenance stream and valued recreational resource. The other 80% of the Township drains to the Spruce Run Reservoir and the South Branch of the Raritan River, a trout maintenance stream, which flows through the Ken Lockwood Gorge, one of New Jersey's premier trout streams. The South Branch of the Raritan River is also a vital water supply resource for much of central New Jersey, and is one of the fastest growing regional watersheds in New Jersey. The tributaries to these rivers are all headwaters, or places of origin for the surface water system. Headwaters are particularly vulnerable to degradation because of the limited available flow, and any degradation in headwaters is felt downstream throughout the surface water system. The headwaters flowing to the Musconetcong River are all trout production streams, New Jersey's highest surface water classification outside of public conservation lands, and the headwaters of the South Branch are classified as trout production or trout maintenance streams.

In addition to the protection of groundwater and surface water resources, the RC District responds to the goals of conserving significant elements of the rural and agricultural countryside. The scenic vistas, wooded hillsides, agricultural fields and historic settlement patterns create the rural character that pervades much of Lebanon Township. These are fragile resources, which are highly susceptible to degradation. Full development at previously permitted densities has consumed most of the countryside, with little consideration given to the conservation of important natural and cultural features. In this development pattern, permitted units have been situated in a somewhat geometric arrangement that fails to recognize the natural patterns of the landscape and tends to eliminate or mar scenic vistas and characteristics.

The Township's wooded hillsides are an especially valuable resource that help define the beauty of Lebanon Township and provide many important functions. Often associated with steep slopes and poor drainage conditions, the forests prevent erosion, permit recharge, protect water quality, improve air quality, provide habitat for threatened and endangered species, and preserve streams. With over 56% of the Township's land area in forests, and over 85% of the forest consisting of deciduous forest and forested wetlands, the Township's tree cover is a critical resource that must be maintained and improved.

The importance of the Township's forests is also reflected in the critical wildlife habitat they provide. The NJDEP has developed a ranking system that prioritizes critical areas, defined as forests, wetlands and grasslands, by habitat wildlife value. The ranking system produces detailed wildlife and habitat maps that identify critical wildlife areas and critical habitat areas. The forests of Lebanon Township fall into the highest categories of critical priority areas, indicating the presence of and habitat for endangered, threatened and priority species. The maintenance of large, contiguous areas of forested lands is an effective method to increase biodiversity on an ecosystem basis.

Full development has also required dramatic alteration of rural roadways to accommodate traffic movements and increased carrying capacity. As this alteration occurs, roadside features (trees, hedgerows, stone rows, etc.) and alignments (narrow cartways and winding alignments) are frequently lost. The rural character undergoes a subtractive process, resulting in conversion to a more suburban appearance, along with the impacts associated with this form of development.

Similarly, suburban development has consumed substantial agricultural lands in the Township. Suburban development can result in land use conflicts with agriculture as new neighbors object to the noise, odor, and other impacts of agricultural land uses on residential neighborhoods. The RC District limits the extent of residential development so that farms have fewer potentially incompatible neighbors and more lands can be retained for agricultural use. Since agriculture is reliant on the availability of significant water resources, lower densities also mean that more water is available for agricultural needs. As agriculture becomes more intensive and entrepreneurial, smaller agricultural parcels can play a meaningful role in agricultural production, especially with the advantageous access to the regional highway network and markets for ease of distribution to densely populated areas.

The long-term utility and viability of this resource is enhanced if critical masses of agricultural lands ands soils are maintained wherever they currently exist. Farmland assessed parcels still account for almost half of the Township's land area. While active agricultural operations occupy less than half the farmland assessed parcels, the combination of fields and wooded parcels provides the open lands that the Township seeks to maintain. Most of the prime farmlands and soils of statewide importance remain in agricultural use. The combination of prime soils, access to densely populated markets and the Township's regional location all combine to assure an agricultural future, so long as the farmland base can be preserved. The significant amount of farmland can make farming a permanent part of the local landscape and economy.

Many different programs are available, and have been used, to preserve, protect and maintain the Township's agricultural base. The Township's farmland preservation approach involves a range of preservation strategies with a number of options for the landowner. As recommended in the Reexamination Report, a farmland preservation plan, outlining a variety of mechanisms to preserve farmland, should be prepared. In addition to the acquisition and management strategies outlined in the farmland preservation plan, land use regulation can assist agriculture by preserving two vital physical resources, land and water. If residential and non-residential development consumes all of the available water, then agriculture will not have it available. Similarly, if development consumes all of the land, then the farmland base is lost forever.

The RC District corresponds to those areas in the Township with the lowest groundwater supply potential, the greatest concentrations of steep slopes, the most limiting soil characteristics, the highest quality surface water, the best agricultural soils and the most scenic vistas. Although the District includes scattered residential developments interspersed among the agricultural and wooded lands that dominate the Township, the extent of development has not dramatically altered the scenic character and desirable natural and cultural features.

To implement the objectives, policies and principles outlined in this Plan, and to protect the environmental characteristics of the community, the RC District permits residential development at a density of 0.1 unit per acre, the equivalent of one unit per 10 acres. While the permitted development can be arranged in a conventional subdivision on 10 acre lots, the Plan also suggests other development options that better address the goals of the Plan to retain significant land areas in an undeveloped state, and which permit increased densities in order to achieve the goals.

Open lands zoning is a development concept that seeks to promote the objectives of this Plan to protect the Township's critical resources. This concept requires most of a tract to remain open and available for farmland or other resource use, and defines minimum standards for soil quality and usable land for the open lands. The remaining land is then planned to accommodate the permitted residential development. The open lands zoning technique provides for the retention of 65 to 70% of the parcel for continuing agricultural or resource conservation use, and limits the areal extent of residential development to no more than 30 to 35% of the parcel, arranged on lots of 2 acres. In order to promote the use of this technique, it is recommended that a density of one unit per 7.5 acres be permitted when a conforming open lands subdivision is proposed. This technique dramatically reduces the sprawl typically resulting from conventional zoning, and a vehicle is provided for the permanent preservation and conservation of major portions of the natural and agricultural landscape while accommodating permitted development. The taxable status of all resulting lots is maintained, since all properties remain in private ownership, and private ownership eliminates questions about the long-term maintenance of public or homeowners' open space and any related municipal responsibilities. As with the clustering option discussed below, a minimum tract size of 30 acres is required for an open lands subdivision.

Two other development options, clustering and lot averaging, are also recommended for the RC District. Clustering, designed to provide useful tracts of open space as a byproduct of residential development, permits a reduction in the minimum lot size in return for permanent commitments of open space areas, with the open space dedicated to either a public body of homeowners' association. Clustering is permitted where at least 65% of the tract can be retained in open space, subject to a minimum lot size of 2 acres. As with open lands zoning, a density of one unit per 7.5 acres is permitted to promote the potential use of the cluster zoning technique. With clustering, open lands zoning and lot averaging, the applicant must also submit a conforming conventional subdivision plan to establish the number of lots that could be developed under a conventional subdivision.

Lot averaging, under which the reduction in the size of some lots is permitted provided that other lots exceed the minimum lot area requirements, is a recommended development option for tracts of 30 acres or less. It is further recommended that a density of one unit per 7.5 acres be permitted when a lot averaging subdivision is proposed. The lot averaging approach should require that a majority of the lots fall within a specified range of lot sizes, such as 2 to 5 acres, in order to create larger lots designed to meet specific conservation objectives. This form of lot averaging offers greater potential to conserve critical resources than some other forms of this development concept. The benefits of lot averaging over clustering include maintaining the taxable status of all resulting lots, since all properties remain in private ownership. In addition, private ownership also eliminates any questions about the long-term maintenance of public or homeowners' open space and any related municipal responsibilities. This technique should be permitted for any subdivision involving 30 acres or less.

In addition to the residential development options outlined above, the Resource Conservation District also permits the principal and conditional uses outlined under the R-5, Rural Agricultural District.

<u>R-5 Rural Agricultural District</u>

The R-5 District is designed to recognize those areas of the Township which have largely developed under the 5-acre zoning that has prevailed in the Township. These areas include the following: the Forge Hill Road area north of Glen Gardner, which has been the location of several major subdivisions; along Musconetcong River Road near Butler Park; near Symonds Lane in the north central part of the Township; between Woodglen and East Hill Roads east of Woodglen; along Hollow Brook Road near Teetertown; and, along Sliker Road from East Hill Road to St. Nicholas Village.

In order to promote the goals of the Plan relative to resource conservation, it is recommended that the R-5 District also permit open lands zoning and lot averaging as development options, at the prevailing density of one unit per 5 acres. Under the open lands zoning development option, approximately 50% of the tract can be retained for continuing agricultural or resource conservation use, with the remaining area accommodating the permitted residential development on 2 acre lots. With the lot averaging option, a majority of the proposed lots should fall within a specified range of smaller lot sizes, such as 2 to 3 acres, in order to create larger lots designed to meet specific conservation objectives. As with the standards for the RC District, the applicant must submit a conforming conventional subdivision plan to establish the maximum number of lots that could be developed.

The R-5 District also allows single family detached dwellings with minimum lot areas of 5 acres and farms as permitted uses in the District. Also permitted as conditional uses are animal farms, animal kennels, institutional and public uses, nursing homes, supplementary apartments and home occupations. This District, as well as the R-3 and

R-1 ½ Districts, also permits camps, private country clubs and private recreation facilities, and roadside farm stands as conditional uses.

R-3 Rural Residential District

The R-3 Residential District is scattered through many parts of the Township, and takes several forms. The largest concentration of the R-3 District occurs along the High Bridge-Califon Road (Route 513) from Bunnvale to the outskirts of Califon. Other large concentrations occur along Sliker Road from Teetertown to Saint Nicholas Village, and along East Hill Road to the east of Woodglen. These locations recognize existing development patterns along some of the major collector roads in the Township. Other R-3 Districts, near Penwell, Bunnvale, the Borough of Hampton and along West Hill Road, serve as a transitional land use category between higher and lower density residential uses.

The R-3 District permits single family detached dwellings with minimum lot areas of 3 acres and farms as the principal permitted uses in the District. The permitted conditional uses include most of the conditional uses listed under the R-5 District, except that animal farms, animal kennels and nursing homes are not permitted.

R-1 ½ Residential District

The R-1 ½ District is identified throughout many parts of the Township, and generally takes one of two forms. Each of the Township's historical settlement areas, including Woodglen, Bunnvale, New Hampton, Changewater, Penwell, and the Califon area, has some R-1 ½ District to identify the higher density development node. The R-1 ½ District also occurs linearly radiating from the development nodes along the surrounding country roads. This situation occurs along West Hill Road, Musconetcong River Road and Sliker Road. Older subdivisions are another form of the R-1 ½ District.

The R-1 ½ District permits single family detached dwellings with a minimum lot size of 1 ½ acres and farms as the principal permitted uses in the District. Permitted conditional uses are the same as those permitted in the R-3 District.

R-15 Residential District

The R-15 Residential District is located in only two parts of the Township, on the north and east sides of the village of Bunnvale at the intersection of Bunnvale Road and Route 513, and along Route 513 east of Hickory Run Road. The Bunnvale area is one of two sections of the Township that have available a community water supply system, with the other section being one subdivision adjacent to Califon Borough.

The R-15 is completely developed with residential dwellings on lots with a minimum area of 15,000 square feet. The Land Use Plan proposes to retain this settlement area in its existing configuration and subject to existing standards.

Non-residential Land Use

The non-residential districts in the Township are characterized by two types of development patterns, small commercial nodes near existing villages and hamlets, and linear development along the Township's two major thoroughfares, Route 31 and Route 513. For the most part the Township's non-residential districts, with the exception of the Route 513 industrial district, represent historic development patterns arranged in a linear fashion near older settlement areas. To preserve and protect the scenic, agricultural character of the countryside and residential neighborhoods, the Township has not encouraged large-scale industrial development, and encouraged commercial development in nodes, where services and facilities can be economically provided and maintained.

The Land Use Plan includes three non-residential districts, including six small-scale, neighborhood business districts, one highway commercial district and two industrial zones. This Plan also recommends some modifications of the existing non-residential districts to limit development in inappropriate areas. Due to the prominence of the non-residential districts along the major transit corridors in the Township, and the proximity of these districts to residential areas, attentive site design is important to protect the scenic amenities and residential character of the Township. Therefore, each of the non-residential districts should include screening, buffering and landscaping standards designed to promote attractive and compatible development.

Industrial (I) District

The major Industrial (I) District is located on Route 513 at the eastern end of the Township adjacent to Washington and Tewksbury Townships. The district is partially developed with industrial, storage and office uses, but is largely in farm uses. A second Industrial District, the site of a former quarry, is located west of Mt. Kipp at the boundary with Glen Gardner, and a third Industrial District is located on Rocky Run Road east of the railroad. The primary non-residential uses permitted in the district include business, administrative, executive and professional offices; industrial and manufacturing uses; and, research laboratories. Permitted conditional uses include commercial roadside stands, institutional and public uses, and detached one-family dwellings. The permitted principal and conditional uses are not proposed for change in this Plan, but it is recommended that the minimum lot size for conditional residential uses in this district be increased.

The former Land Use Plan included one additional industrial district, consisting of one lot, located on Anthony Road at the end of Wood Glen Road. For a variety of reasons, including accessibility and proximity to residential areas, this Plan recommends the elimination of this isolated industrial district.

Highway Business (B-2) District

The Highway Business (B-2) District is located in one part of the Township, along both sides of Route 31 in the Township's southwest corner. The district is bounded by the

Spruce Run to the west and the Conrail railroad line to the east. The corridor is primarily developed with a mix of commercial and residential uses, and includes public property owned by the State as part of the Spruce Run Reservoir. Existing lot sizes vary widely, from residential and commercial uses on lots of less than one acre to an undeveloped lot of 23 acres.

There are two defining characteristics of this corridor through the Township. Physically, the area is a narrow band constrained by the Spruce Run on one side and the Conrail line on the other. From a land use perspective, the lot pattern and mix of uses along the corridor reflect over a century of development when Route 31 was not the major artery it is today.

The area is largely developed, or the combination of lot size and environmental constraints precludes much additional development. Redevelopment opportunities are somewhat limited by the same factors, and the proximity of the Spruce Run, one of the major feeder streams to Spruce Run Reservoir, to the west side of the corridor heightens environmental concerns. The Township will continue its efforts to improve this district through careful planning of development and redevelopment opportunities.

<u>Neighborhood Business (B-1) District</u>

The Neighborhood Business (B-1) Districts are located in proximity to the Township's villages, hamlets and other small settlement areas. The largest and most developed of the commercial areas is located on Route 513 adjacent to the northwest side of Califon Borough. This area includes the major retail commercial uses, including a grocery store and small shopping centers, and is linked to the Califon commercial center on Route 513. The Bunnvale commercial area is also located on Route 513, and consists of several retail establishments, including a restaurant and motor vehicle-related uses. The other four neighborhood business districts, at New Hampton and Pennwell along Musconetcong River Road; at Woodglen, the municipal service center in the Township; and, Anthony Road at Newport Road, recognize existing long-standing uses.

The intent of these districts is to provide limited commercial activities in close proximity to neighborhoods and existing uses. Because these districts are interwoven with the surrounding residential and agricultural community, only limited expansion opportunities are afforded.

Lebanon Township Conservation Plan Element

Introduction

The Municipal Land Use Law (NJSA 40:55D-1 et seq.) authorizes municipalities to plan and zone to promote the general welfare. The 15 purposes of the MLUL (NJSA 40:55D-2) explain the State legislature's rationale for the statutory authorization for municipal land use planning and regulation. More than half of these purposes highlight the importance of conserving natural resources and a clean healthy environment. The public health and safety (subsection "a") bear a direct relationship to the use and management of New Jersey's land and water resources. Securing safety from floods and other natural and manmade disasters (subsection "b") and providing adequate light, air and open space (subsection "c") are similarly directed at conserving natural resources. "Preservation of the environment", in part through planning for "appropriate population densities and concentrations" (subsection "e"), is a key underpinning of local land use policy.

"Providing sufficient space in appropriate locations" for a variety of land uses, "according to their respective environmental requirements", is intended "to meet the needs of all New Jersey citizens" (subsection "g") for a healthy environment. The statute also seeks to promote the conservation of "open space, energy resources and valuable natural resources in the State and to prevent urban sprawl and degradation of the environment through improper use of land" (subsection "j"). The conservation of energy is cited in subsection "n" ("promote utilization of renewable energy sources)" and subsection "o" ("promote the maximum practicable recovery and recycling of recyclable materials").

Preventing urban sprawl has long been an objective of New Jersey's planning and zoning law, which is supported by the related objectives of protecting the natural environment and preventing its degradation.

In furtherance of these conservation objectives, the MLUL provides for preparation and adoption of a Conservation Plan Element (NJSA 40:55D-28b.8.) which reads as follows:

> "Conservation plan element, providing for the preservation, conservation and utilization of natural resources, including, to the extent appropriate, energy, open space, water supply, forests, soil, marshes, wetlands, harbors, rivers and other waters, fisheries, endangered or threatened species, wildlife and other resources, and which systematically analyzes the impact of each other component and element of the Master Plan on the present and future preservation, conservation and utilization of those resources;"

This Conservation Plan outlines Lebanon Township's strategies to meet the statutory mandate to protect the environment. While it is designed to function in concert with the other plan elements, the most important linkage will be between the Land Use Plan and the Conservation Plan. Together, these plan elements propose the location, scale and intensity of new development and the resource management strategies needed to protect the environment.

This Master Plan recognizes that "business as usual" will not meet the conservation objectives of the MLUL. Retaining suburban residential zoning and other high intensity zoning options will overtax the natural environment, with substantial degradation of surface water and groundwater quality. It will also entail the removal of substantial forested areas, which are in short supply, and farmlands, which are particularly vulnerable to suburban sprawl. The principles of sustainable development demand that resource commitments made during this generation will be sustainable—that is, able to be continued for the benefit of future generations.

The most effective way to protect farmland and natural resource lands is to buy the land or the development rights. This approach permanently preserves these valuable features, and is most effective at limiting the effects of development. The continuing New Jersey voter commitment to open space preservation, most recently evidenced in the approval of the $1 billion Garden State Preservation Trust, bodes well for such acquisitions. However, hundreds of thousands of acres of undeveloped and "underdeveloped" land will remain beyond the reach of publicly funded acquisitions. Thus, local land use regulations continue to play a controlling role in how the environment is managed, during and after development. Air, water and soil are the essential resources which support a healthy biota.

Fragmentation and degradation of vegetation, land and water resources has been a byproduct of human activity. Woodlands, initially cleared for agricultural use, have given way to residential neighborhoods easily developed on these high, dry and usable soils. Water quality has been progressively altered and impacted by human activity. The quality of the air we breathe and the water we drink determines the health of the human organism and all life forms. This Conservation Plan seeks to minimize further degradation of these resources and establish an arsenal of environmental health-building tools for the 21st century and beyond. This calls for a systems approach to natural resource conservation, where interconnected natural systems are viewed as a collective resource, not a series of separate features.

The variety of biological species is an indicator of the health of an ecosystem. Maintaining biological diversity requires protection of critical habitat areas. While habitats of endangered or threatened plant or animal species are of special importance, threatened or endangered status may be transient. For instance, the great blue heron and bald eagle have been removed from the protected list, yet their critical habitats remain essential to their continued survival. Additionally, the extirpation of rare species removes elements from the food chain that help maintain ecological balance. The explosive deer population in New Jersey is but one example of the damage that can be wrought when this natural balance is lost.

Protecting biodiversity requires the protection of terrestrial and aquatic habitats that are highly susceptible to degradation. Pristine waters cannot be maintained without protection of their watershed areas. Freshwater wetlands play an important role in filtering contaminants from the surface water and groundwater regime and, while protected by state statutes, are not immune from impacts that occur beyond the regulated areas. Similarly, prime forested areas, including mature stands of native species, are easily lost or damaged through fragmentation, a manmade impact that reduces bio-diversity.

The scenic wonder of ridgelines, slopes and ravines is only one aspect of the value of these natural features, without which certain species will not remain. Similarly, grassland habitats are essential to the nesting, feeding and breeding of a variety of grassland bird species, yet such areas are frequently lost to development. The effects of agriculture and suburban development have isolated woodland segments, and eliminated or prevented the interconnection of the remaining woodlands. The background studies identify woodland areas by forest cover type, as well as critical wetland, water and grassland habitats. Land development should be arranged to maximize the conservation of substantial masses of critical habitat areas, by limiting the aerial extent of development and promoting conservation techniques targeted to these resources.

Carrying capacity is a planning technique used to establish the maximum population level of a species based on the availability of natural resources. Carrying capacity had its genesis in ecological studies, used to manage wildlife habitat rangeland for grazing. In the context of land use planning, carrying capacity has been defined as the ability of natural and man-made systems to support a level of population growth and ancillary development while maintaining established standards of performance. When applied to regulating land use, an assessment of carrying capacity is useful in establishing maximum densities or intensities of development. However, sustainability requires that we provide a margin of safety, and not plan for the maximum development that can currently be supported.

The policies and strategies of this Conservation Plan seek to limit the impacts of development and retain the natural terrain and features to the greatest extent practicable. This plan also promotes the restoration of natural systems that have been degraded by past activities. As new regulatory tools or techniques become available, they should be evaluated for their ability to promote the Conservation Plan objectives and adopted where appropriate. Additionally, open space acquisition priorities should be established to address the goals of the Conservation Plan.

Energy and Air Quality

Protection of the Township's air quality is largely dependent on regional, state, national, and even international factors. Similarly, energy conservation and utilization is shaped by a host of factors. However, local land use regulations determine future land use patterns, which have a direct effect on air quality and energy use. Management approaches that the Township can initiate to mitigate air pollution and promote energy conservation include the following:

a. Promote alternative means of transit by providing opportunities and access for alternative transportation systems (buses, car and van pooling, bicycling, and walking).

b. Adopt development regulations that provide for residential neighborhoods and retain existing wooded areas and large contiguous open land areas.

c. Reduce the need for vehicular trips by facilitating better interconnections among residential, commercial, office, and recreational uses.

d. Encourage energy conservation through subdivision design, building design, building orientation, and the evaluation of microclimate conditions such as solar access and wind direction.

e. Recommend landscaping standards that provide buildings with maximum solar access, shading, and wind protection.

f. Encourage the maximum recovery of recyclable materials and the use of renewable energy sources.

g. Design bikeways, pedestrian walkways and other routes to maximize opportunities for non-motorized travel in existing and new development.

Forest Resources and Native Vegetation

Woodlands and other native vegetation perform a series of important functions related to the ecological balance Forests produce oxygen, giving them intrinsic value. They reduce soil erosion and surface runoff and promote aquifer recharge, because of the high moisture holding capacity of the forest soils and tree canopy. Forests provide habitats for plant and animals and provide open space and recreation lands. They enhance the visual character of scenic corridors, create a feeling of privacy and seclusion and reduce noise impacts. And they affect local climatic conditions near or within their boundaries, such as the cooling effect on trout streams. Woodlands and other native vegetation also provide visual diversity in the terrain, enhancing the value of property. Removal of trees and other vegetation can result in ecological, hydrological, and economic impacts.

The following approaches are recommended to preserve, protect and improve the forest resources in the Township.

a. A woodland conservation program, including identification of the floodplain, mesic and upland forest stands on the tract should be required as part of any application for development.

b. Performance standards should be established limiting the extent of forest removal, based on the quality of the forest type. Priority wooded areas for preservation include unique forest types, woodlands adjacent to public water supply tributaries, habitats critical for endangered and threatened species, 100-year floodplains, wetlands, stream corridors, and slopes of 15% or greater.

c. Performance standards should encourage the preservation of habitat areas that are as large and circular as possible, gradual and undulating at the edges and connected by wildlife corridors wide enough to maintain interior conditions (i.e. 300' or more). Development activities in forested areas should minimize disturbance to important woodlands.

d. Hedgerows and forest areas along traveled roadways and established property boundaries should be retained and enhanced, where appropriate.

e. Woodland areas along open space corridors should be preserved and interconnections among existing woodlands should be promoted.

f. Reforestation and afforestation of open spaces, resulting from cluster designs, should be required to enhance habitat, promote recharge and reduce surface runoff, erosion and flooding.

g. Reductions in residential density and commercial/industrial impervious coverage standards should be considered to promote the retention of forests in Lebanon Township.

Groundwater

The groundwater resources of the Township provide irrigation and potable water supplies to much of the Township's rural areas. In addition, groundwater provides the base flow to rivers and streams during low flow periods, and sensitive plant and animal communities are dependent upon this surface hydrology. The importance of groundwater resources is highlighted in the report *The Groundwater Resources of Lebanon Township*, prepared by M2 Associates for the Planning Board. The following activities are recommended to protect and maintain this critical resource:

a. A public education program should be established to provide information to septic system owners concerning the proper maintenance of these facilities. An improved septic testing ordinance also should facilitate better operation of septic systems.

b. Ongoing public education should be directed at preventing the discharge of toxic and hazardous pollutants to groundwater.

c. The Environmental Commission, in conjunction with the Health Department, should conduct an environmental inventory of groundwater quality, including an analysis of existing groundwater samples and an identification of existing facilities which could adversely impact groundwater. Among the facilities that should be mapped and inventoried are the following:

1. Underground storage tanks.
2. Gas, fuel, and sewer line locations.
3. Large septic systems for commercial/industrial users.
4. Permitted community septic systems.
5. Hazardous substance storage areas and facilities.
6. Permitted NJPDES groundwater or surface discharge facilities.

d. The Township should consider the establishment of a wellhead protection program.

e. Landscaping standards should require the use of native and locally adapted plants, and designs which minimize irrigation, maintenance and turf areas and require mulches to preserve soil moisture.

f. The Township's aquifer testing ordinance should be monitored and periodically reviewed to ensure that it accomplishes the goal of assuring adequate water supply.

g. Reductions in residential density and commercial/industrial impervious coverage standards will serve to protect the availability and potability of groundwater.

Scenic Resources

Scenic character is an important element in the general perception of the quality of life in Lebanon Township. The protection of scenic vistas, particularly those seen from public rights-of-way, will serve to maintain the Township's rural character. Since the local development review process plays a primary role in shaping new land use patterns, local review agencies are the appropriate administrative authority to encourage conservation of scenic characteristics. The following activities are recommended:

a. Scenic roads and corridors should be identified and categorized in terms of the scenic elements that contribute to their quality.

b. Design standards should be developed to guide the location and configuration of development, in order to protect the various categories of attractive views, including enclosed roadside views, extended roadside views, and distance views.

Steep Slopes

Development of steep slopes produces a variety of environmental impacts, including increased soil erosion and sedimentation, decreased surface water quality, decreased soil fertility, increased overland flow, decreased groundwater recharge, and altered natural drainage patterns. In order to reduce the potential for these negative impacts, the Township should:

a. Review and revise, if necessary, standards that relate the intensity of development to the slope gradient.

b. Develop standards that limit tree removal and soil disturbance on steep slopes.

Stream Corridors

The Township is laced with a network of headwater tributaries to the Musconetcong and South Branch Raritan Rivers. In order to protect stream corridors from development impacts, it is recommended that the Township consider the following management approaches:

a. Woodlands and other vegetated buffers should be maintained or established along all stream corridors.

b. Where past land use practices have resulted in the removal of trees along stream corridors, management practices should include the reestablishment of the tree cover.

c. A stream corridor protection ordinance, modeled after the programs established by the Delaware and Raritan Canal Commission and the Stony Brook Millstone Watershed Association, which seeks to protect the stream corridor and adjacent wetlands, floodplains, and contributory uplands with steep slopes, should be implemented.

d. Management and monitoring strategies should be developed for stream corridor areas.

Surface Water

Surface water is impacted by both point and non-point source pollution. Non-point source pollution, which has become a major concern, can be mitigated by local land use strategies and management approaches. Non-point source pollutants include septic system effluent, agricultural runoff, stormwater runoff, and construction activities. In order to mitigate potential impacts to the Township's surface waters, the following management approaches are recommended:

a. Water quality best management practices should be adopted or refined, to protect the quality of surface waters and promote maximum habitat values. These include:

Clustering development on the least porous soils, to promote infiltration

Buffer strips and techniques to maximize overland flow, such as grassed swales and filter strips

Regional stormwater management approaches and extended detention facilities

Wet ponds (retention basins) and wetland or marsh creation

Detain runoff using infiltration practices, including trenches, basins, drywells and other structural solutions

Water quality inlets and oil/grit separators

b. Reductions in residential density and impervious coverage standards can reduce the potential impact to surface waters from non-point pollution.

Threatened and Endangered Plant and Animal Species

Threatened and endangered plant and animal species are indicators of ecological diversity and environmental quality. Like the canaries in the coal mine, they warn us when we are spoiling the quality of the environment beyond natural tolerances. The presence of rare species in the Township are testament to the historical emphasis on land stewardship. In order to protect and maintain these species, the Township should:

a. Conduct an ongoing inventory of threatened and endangered species.

b. Design development so that it will not result in adverse impacts on the survival of threatened and endangered species.

c. Develop a list of habitat requirements for endangered species.

d. Map and preserve critical habitats, either through the open space acquisition or the development review process.

e. Riparian wildlife corridors should be preserved, expanded or established.

f. Preserve significant uplands areas where unique associations of habitats (some rare, some not) combine to promote biodiversity.

g. Preserve nodes of biodiversity wherever they occur.

h. Reductions in permitted residential density can also promote the preservation of critical habitats.

Wetlands

Since wetlands are regulated by the State and Federal governments, the Township is preempted from adopting conflicting regulations. However, management of protected wetlands and transition areas remains an important issue, and site design decisions will affect wetlands ecosystems.

a. A system to periodically monitor and enforce conservation easement restrictions should be developed.

b. Permitted development should be arranged to avoid all significant wetlands, and when road crossings are unavoidable, they should be located at the point of minimum impact.

Relationship To Land Use Plan

The Conservation Plan identifies natural resource protection strategies which support the Land Use Plan. The resource management standards outlined in the Conservation Plan will serve to shape the development permitted by the Land Use Plan in a manner that will preserve and protect the Township's natural resources. In addition, the Conservation Plan is intended to involve local agencies, other than the Planning Board, in a comprehensive program to conserve critical resources.

Land Use and Natural Resource Background Information

Land Use by Property Class

Tax class is often times a good indicator of the type of use present on a property. With the availability of tax data at the municipal level, and coupled with a tax parcel coverage, a map can be composed showing various land uses and ownership categories and give a fairly accurate picture of land use patterns. However, a land use classification system by tax class assigns a single use to each lot, and thus tends to obscure more detailed information concerning woodlands and wetlands on a lot.

According to data provided by the Hunterdon County Division of GIS, the predominant property class in Lebanon Township is agricultural at 47%, representing 9,335 acres of the Township's 20,250 acre land area (see Figure 2). This is followed by residential at 29% of the total, public land at 13%, and vacant land at 8%. Commercial and industrial uses comprise a mere 1.3% and 0.2% of the Township, respectively.

These data were also analyzed by zoning district, and show an interesting pattern relative to the land use characteristics of the different residential zoning districts. As the density of the zoning district decreases, the amount of residential development also decreases, and the amount of agricultural, vacant and public lands increases.

Given the differences in methodology and mapping conventions, it is not possible to directly compare current land use to land use summaries in past Master Plans. However, in general, residential development has resulted in a loss of agricultural and vacant lands, while public lands have increased as a result of open space acquisitions.

Land Use/Land Cover

A more detailed and accurate depiction of land use can be taken from the Land Use/Land Cover classification, completed by the New Jersey Department of Environmental Protection. This data was derived from the 1995 Digital Ortho Quarter-Quads, flown for the entire State. As a comparison to the Land Use by Property Class, the Land Use/Land Cover data shows what is actually on the ground. The Property Class information may show an entire property as farm assessed, giving the impression that all of its acreage is farmed. In truth, 50% of the tract may be wooded and not farmed at all. The Land Use/Land Cover is more accurate in that it will show the true land use of the property, where, for example, 5% may be residential, 50% wooded and 45% cultivated.

Generally speaking, Lebanon Township is primarily wooded (see Figure 3). Nearly 56% of the land in the Township is covered by forest, much of which represents high priority habitat for wildlife. The spine of the Township is made up of large contiguous tracts of forest, which provide suitable habitat for a number of animal species, including some that are threatened or critical. A number of these contiguous forested tracts are County and State parkland, preserved in perpetuity.

Agricultural uses cover approximately 19% of the Township's total acreage, or approximately 3,865 acres. Masses of farmland occur in four general areas: along Forge Hill Road; around the Borough of Califon; in the Mt. Lebanon Road, Sharrer Road, and Anthony Road area; and, along West Hill Road. Comparing the land use by property tax to the land use/land cover, almost 60% of the land classified as agricultural by tax class is actually wooded.

Land Use/Land Cover designated as urban on the mapping covers land uses that range from single rural residential units to commercial and industrial uses. The general classification of urban describes areas that are developed in one fashion or another. The urban land covers approximately 17% of the Township. There are certain hamlets that have a higher concentration of urban types of uses, including Bunnvale, Lower Valley, New Hampton and Woodglen. Other concentrations of developed lands occur along Route 31, West and East Hill Roads, and Sliker Road.

Lebanon Township contains other environmentally sensitive lands, comprised mainly of forested wetlands and mature deciduous forest. Geographically, most of the wetlands are found in the northern half of the Township and are protected by surrounding forested areas. These wetlands and forested areas are a part of the overall critical habitat system and represent a symbiotic relationship. Overall, wetlands make up 8% of the total area of the Township.

Barren land and water make up a very small portion of the Township's overall land use at 0.3% and 0.6% respectively.

Geology and Hydrogeologic Zones

The bedrock of Lebanon Township can be divided into two general groupings primarily based on age and rock type. The geology of Lebanon Township is shown on Figure 4.

Precambrian (older than 570 million years) igneous and metamorphic rocks underlie approximately 90 percent of the Township. Gneiss and granite underlie much of this area. The rocks in this portion of the Township include members of the Byram and Lake Hopatcong Intrusive Suites, Losee Metamorphic Suite, metasedimentary rocks, diabase intrusions, Chestnut Hill Formation, and other rocks of uncertain origin. The Precambrian rocks have been extensively deformed into a series of southwest to northeast trending folds.

The second groupings of rocks are mapped beneath approximately 10 percent of the Township along the northern boundary and in the southeastern portion near the Borough of Califon. These rocks include the Ordovician-Cambrian (440 to 570 million years ago) dolomites and limestones of the Leithsville, Allentown, Beekmantown, and Jacksonburg Formations. This group also includes the shales of the Bushkill Member of the Ordovician Martinsburg Formation and the quartzites of the Hardyston Formation.

Given the differences in median specific capacities, transmissivity estimates, depths and well yields between the Precambrian igneous and metamorphic rocks and the Ordovician-Cambrian limestones and dolomites, Lebanon Township was divided into four hydrogeologic zones with each zone underlain by one of two distinct aquifer systems. The name of each zone is based on the underlying type of bedrock aquifer system. These zones are shown on Figure 4.

Most of the Township, including a very small section near Califon Borough, is underlain by the aquifer system comprised of Precambrian igneous and metamorphic rocks and therefore, both zones are referenced as a Precambrian Crystalline Rock Zone. A limited area near the northwestern border of the Township and the area beneath Long Valley in the southeastern portion of the municipality are underlain by limestone and dolomite aquifer systems and therefore, these zones are referenced as Limestone/Dolomite Zone.

<u>Topography</u>

Lebanon Township is at the foot of the New Jersey Highlands physiographic province and represents the beginning of some of the most varied terrain in New Jersey. The Highlands are home to some of the most scenic areas in the State and represent the most significant animal habitats and forest resources found anywhere in New Jersey outside of the Pinelands Area.

Most of the land in the Township is 400' above sea level, with the exception of lands located directly adjacent to the Musconetcong River and the South Branch of the Raritan River. Even in these areas, elevations are close to 400' feet above sea level. The highest elevation in the Township is located in the vicinity of Pleasant Grove Road and is above 1040'(see Figure 5).

There are a number of scenic ridgelines in the Township. The area of Point Mountain, a County Park, represents some of the most scenic land found in the County. From the peak of Point Mountain, the terrain runs steeply to the Musconetcong River valley, providing many breathtaking views, which stretch the entire length of the Township's eastern border. The terrain from the Warren County side of the Musconetcong River slopes gently to the waterway, providing sharp contrast to the Lebanon Township side. It also provides vistas of many miles, consisting of rolling hills and farmland. The valley of the South Branch of the Raritan River also provides unique views, although not stretching as far as those of the Musconetcong Valley. Both sides of the South Branch run steeply to the River, making for a gorge that runs the entire length of the River through the Township. The Columbia Trail, which runs next to the South Branch, provides wonderful hiking along steep and often varied terrain, offering stunning views of the River itself.

The two river valleys, along with the southwestern corner of the Township where it borders Bethlehem Township, the Teetertown Ravine Nature Preserve, the Rocky Run and Route 513 areas, and the Turkey Top Road area, possess the majority of the Township's steep slope areas. These are slopes classified as greater than 15%, which comprise nearly 25% of the Township's land area. Slopes greater than 25% comprise 7% of the Township's area, as shown on Figure 6. These areas of the Township deserve special attention and management approaches to reduce runoff and erosion and to maintain water quality and water supply.

Forested Areas

Nearly 87% of Lebanon Township's forested areas are deciduous forest, according to data provided by the New Jersey Department of Environmental Protection (see Figure 7). As stated earlier, on the whole, 56% of the Township's area is forested. Much of this forested area represents lands that are of significant resource value as habitat for threatened and endangered species.

Lebanon Township contains most of the remaining large contiguous forests in Hunterdon County. These forests are attractive habitat for a number of different bird and animal species. Contiguous forest provides a greater diversity of territory, along with less chance of human intervention. This is an important resource that must be given priority for preservation efforts amongst State, County and local plans.

Many of the contiguous forested areas of the Township have been protected through the preservation efforts of both the State and the Hunterdon County Parks System. Vorhees State Park, the Musconetcong River Reservation, Teetertown Ravine, Ken Lockwood Gorge and the Columbia Trail areas all contain significant contiguous forest resources that are permanently preserved.

The other forested areas of the Township are made up of coniferous forest (2% of the forested areas), deciduous brush and shrub land (5%), former fields (4%), mixed brush and shrub land (0.7%), mixed forest (3%) and plantations (1.3%). These categorizations together comprise only 13% of the forested area in the Township and are not as significant in terms of habitat provision as the deciduous forest areas.

Freshwater Wetlands

The regulatory framework for the identification and protection of freshwater wetlands in New Jersey was established by the Freshwater Wetlands Protection Act (FWPA) of 1987. Among the unique values of wetlands are the purification of surface water and groundwater resources; the mitigation of flood and storm damage through the storage and absorption of water during high runoff periods; the retardation of soil erosion; the provision of essential breeding spawning, nesting and wintering habitats for the State's fish and wildlife; and, the maintenance of critical base flows to surface waters through the gradual release of stored flood waters and groundwater. The method for identifying and designating wetlands includes three parameters; hydrology, soil and vegetation. The hydrological factor relates to the degree of flooding or soil saturation found through soil borings; the soil factor relates to the presence of hydric soils; and, the vegetation factor relates to the presence of hydrophytes or plant species adapted to hydric conditions.

One of the requirements of the FWPA was that the N.J. Department of Environmental Protection (NJDEP) provide a comprehensive mapping of wetlands in the State. The attached map of Freshwater Wetlands is provided from the 1995 Land Use/Land Cover data, derived from digital aerial photography. Although the wetlands are not broken down by category on the mapping, they include the following classifications:

- Agricultural wetlands (modified)
- Artificial lakes
- Coniferous wooded wetlands
- Deciduous scrub/shrub wetlands
- Deciduous wooded wetlands
- Disturbed wetlands (modified)
- Herbaceous wetlands
- Managed wetlands (modified)
- Mixed forested wetlands (deciduous dominate)
- Natural lakes
- Streams and canals
- Wetlands rights-of-way (modified)

The greatest concentrations of wetlands occur below the ridge lines, in linked systems and in clusters. The vast majority of the wetlands feed into the stream network and are interspersed with many of the forested areas found throughout the Township (see Figure 8). Their primary composition is deciduous wooded wetlands, making them a contributing factor to the Township's already extensive high quality wildlife habitat.

Although the NJDEP mapping of wetlands can provide guidance as to the location of wetlands, only a field investigation can substantiate the presence or absence of wetlands. It is through this investigation that the resource value of wetlands is determined, providing for the appropriate buffers in order to aid in their continuing function.

Water Quality

Lebanon Township's streams discharge into the Spruce Run Reservoir and South Branch of the Raritan River or the Musconetcong River. Downstream, the Musconetcong drains into the Delaware River. Lebanon Township is in the Upper Delaware Watershed Management Area 1 (20% of the Township) and the North and South Branch Raritan Watershed Management Area 8 (80% of the Township).

The Upper Delaware and Raritan River watersheds provide recreational and water supply opportunities which depend upon high quality river water. Water pollution sources are categorized as either point or non-point source pollutants.

A point source pollutant emanates from an identifiable source such as a wastewater treatment plant discharge pipe or an industrial plant outfall. Non-point source pollutants enter rivers and streams by non-specific means such as septic system effluent, agricultural runoff, stormwater runoff and construction activities. Both point and non-point sources of pollution affect Lebanon Township's surface water quality.

The NJDEP has developed Water Quality Standards to replace the Water Quality Index, which were found to be archaic in its approach to water quality assessment. Water quality is evaluated with respect to Surface Water Quality Standards (SWQS) and water quality issues or concerns occur when SWQS are not met or are threatened. New Jersey's Surface Water Quality Standards (N.J.A.C.7:9B) establish the water quality goals and policies underlying the management of the state's water quality. These standards designate the use or uses of the water and establish policies and narrative and numerical criteria necessary to protect the uses.

According to the Statewide Water Quality Management Program Plan, all surface waters in Lebanon are included in the classification of FW2. This plan, prepared by NJDEP, notes that the ". . .FW2 classification is subdivided into three sub-categories: FW2-TP (trout production), FW2-TM (trout maintenance), and FW2-NT (nontrout). The water quality standards criteria for suspended solids, dissolved oxygen, temperature, and un-ionized ammonia are more stringent for FW2-TP and FW2-TM waters than they are for FW2-NT waters. In addition, the Surface Water Quality Standards identify all FW2-TP waters (and other upstream from these waters) as Category One Waters for purposes of antidegradation policy."

Water Classifications: Surface waters are grouped into classifications as follows:

- **FW1:** Fresh Water 1: Fresh surface waters that are to be maintained in their natural state and not subjected to man-made wastewater discharges or increases from runoff from anthropogenic activities.

- **FW2:** Fresh Water 2: General fresh surface water classification applied to fresh waters that are not FW1 or Pinelands Waters.

- **FW- TP:** Fresh Water - Trout Production waters are designated for trout spawning/nursery during their first year.

- **FW- TM:** Fresh Water - Trout Maintenance waters are designated for the support of trout throughout the year.

- **FW- NT:** Fresh Water - Non Trout: fresh surface waters that have not been designated TM or TP. These waters are generally unsuitable for trout because of their physical, chemical, or biological species, but are suitable for a wide variety of other fish species.

- **C1:** Category 1 waters are designated for implementation of antidegradation policies for protection from any measurable change in water quality. C1 may be applied to any surface water classification except those designated as FW1 or PL.

Note: the Department is currently proposing a clarification between the definition of ND and C1 antidegradation policies.

The following list identifies the rivers and streams in Lebanon that have been designated according to water quality standards established by the NJDEP (see Figure 9):

• South Branch Raritan River :	FW2-TM
➢ South Branch Raritan River (Ken Lockwood Gorge and its tributaries):	FW2-TM(C1)
• Musconetcong River:	FW2-TM
• Spruce Run:	FW2-TP
• Rocky Run:	FW2-TP
• Willoughby Brook:	FW2-TP
• Teetertown Brook:	FW2-TP
• Little Brook:	FW2-TP

Although the surface waters in Lebanon Township generally consist of good water quality and healthy fish communities, future growth may have deleterious effects. Thus, management strategies for existing and future land uses should be designed to maintain and to improve river water quality.

Agricultural Soils

The State Agricultural Development Committee (SADC) established the current classification system used throughout the State in 1990 under the Agriculture Retention and Development Act of 1983. This system refines the agricultural capability classifications established by the USDA, NRCS, which had been the standard for 20-30 years, by rating agricultural soils for their specific applicability to New Jersey. While the USDA classification system provided ratings of agricultural soils based on an eight part system (Agricultural capability classes I-VIII), the classification system developed under the Agriculture Retention and Development Act established a five part system; prime farmlands, soils of statewide importance, farmland of local importance, unique farmlands and other. This system is used to classify soils shown on Figure 10.

Agriculture makes up 19% of the land use in the Township, according to the Land Use/Land Cover map, but includes 47% of the Township's land area within the farmland assessed property tax class, indicating its importance to the open lands in the Township. The mapping of prime farmland and soils of statewide importance found within Lebanon provides some indication of why this is so. Prime farmland comprises only 15% of the soil classes and soils of statewide importance a mere 8%. A comparison of the land use/land cover mapping with the agricultural soils mapping indicates, however, that most of the prime and statewide important soils in the Township continue to be used for agriculture.

Prime and statewide important soils, as rated by the SADC, are an irreplaceable resource, but also have many of the qualities that make them attractive for residential and non-residential development. Attributes such as level land, good drainage and fertility create competition between agriculture and development. While prime and statewide important soils will continue to provide fertile ground for agricultural uses, they will slowly yield to development interests if support for agriculture as an industry does not continue.

The following descriptions of prime farmlands and soils of statewide importance are taken from the "New Jersey Important Farmlands Inventory", prepared by the SADC in 1990. Not included in this description are soils of local importance and unique farmlands. There are no soils of local importance within Lebanon Township that are identified by the SADC. Unique farmlands are poorly drained soils that are uniquely suited to the production of cranberries and blueberries, and which do not occur in the Township.

Prime Farmlands **–** Prime Farmlands include all those soils in Land Capability Class I and selected soils from Land Capability Class II. Prime Farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops and is also available for these uses. It has the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops when treated and managed according to acceptable farming methods. Prime Farmlands are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding.

Soils of Statewide Importance- Farmlands of statewide importance include those soils in Land Capability Class II and III that do not meet the criteria as Prime Farmland. These soils are nearly Prime Farmland and economically produce high yields of crops when treated and managed according to acceptable farming methods. Some may produce yields as high as Prime Farmland if conditions are favorable.

Limitations for the Onsite Disposal of Sewage Effluent

Figure 11 depicts limitations for the onsite disposal of sewage effluent. This map is a soils classification map that applies numerous factors to provide a composite representation of environmental limitations. Important soil properties represented in this depiction are percolation rate, depth to seasonal high water, slope, rockiness, depth to and type of bedrock and hazard to flooding. While this map layer does not have regulatory implications, it provides a general depiction of which soils within the Township are most likely constrained for future development interests. The descriptions below give an idea of the general factors that went into each classification.

Severe Limitations- The severe limitations category identifies soil phases which indicate that soil properties are so unfavorable or difficult to overcome that the soil is unsuitable for development or requires special design. This produces significant increases in construction costs and requires intensive maintenance. Approximately 21% of the soil phases in Lebanon Township are categorized as having severe limitations. The factors identified in the Soil Survey of Hunterdon County (USDA, NRCS) which contribute to severe limitations are as follows:

- High water table (0-1’ below the surface)
- Water table moderately high (1-2 ½’ below the surface)
- Frequent stream overflow
- Slow permeability
- Very stony
- Depth to bedrock (½ - 6’)
- Moderately steep slopes (12-18%)
- Steep slopes (18-30%)

Moderate Limitations **–** The moderate limitations category identifies soil phases that indicate that soil properties are unfavorable but that limitations can be overcome by careful planning and design, careful construction and good management. Approximately 29% of the soils in the Township are classified as having moderate limitations for onsite disposal of sewage effluent. The factors identified in the Soil Survey Manual that contribute to the moderate limitations category are as follows:

- Depth to bedrock (4-6’ or 5-10’)
- Stream overflow hazard
- Strong slopes (6-12%)

Slight Limitations **–** The slight limitations category includes soil phases that have soil properties that are generally favorable for the onsite disposal of sewage effluent or, in other words, have minor limitations that are easily overcome. Approximately 28% of the soil phases in Lebanon have only slight limitations for onsite disposal; however, most of these soils are already developed or are permanently preserved as public lands.

Unclassified Soils - Of significance relative to this classification are those soils in the Township that are unclassified for disposal of effluent. This is due to their unusually steep slopes and generally stony composition, making the factors that contribute to disposal capability not quantifiable. The inability to quantify the limitations because of the poor quality indicates that these soils have similar characteristics to those with severe limitations. These soil types are found mainly on ridges and steep slopes that form stream corridors, which are lands unsuitable for development. Examples of where the soils are unclassified are the Ken Lockwood Gorge; Point Mountain and the associated severe slopes, extending to Turkey Top Road; the severe slopes along Musconetcong River Road; and, the severe slopes along Route 31.

Depth to Bedrock

Depth to bedrock is the measure of the thickness of the soil above rock and fractured material. Bedrock occurring within 5’ of the surface has associated with it problems of foundation placement, grading, location of utilities and lack of soil volume necessary to filter sewage effluent. These are all factors that limit, but often do not prohibit construction in areas that possess bedrock within 5’ of the surface. Many times, the practice of engineering will arrive at a solution that addresses concerns associated with limiting factors and allow for development, although at a greatly increased cost. All of these factors must be considered when determining the types of development that are appropriate to various contributing factors.

Figure 12 shows the location and classification for all of the soil phases found in the Township. There are no soil phases which have bedrock less than 3.5’ from the surface, yet this still contributes to moderate limitations for septic effluent disposal and would limit foundations for dwellings and excavation for roadways or utilities. It should be noted that most of the categories presented on the map have variation within the categories, some of them substantial. There is a notable difference in suitability for many construction practices just within the 3.5-8’ categorization, as 5’ is the true point of limitations.

There is a considerable amount of land in the Township that is incapable of classification with respect to depth to bedrock. Nearly 21% of the soil phases are unclassified due to their steep slopes and stony composition. This comprises a relatively large percentage of the Township as a whole. The category of 3.5-8’ is variable and presents more limitations than not. As stated previously, bedrock at a depth of 5’ or less presents limitations in construction practices. This category comprises 52% of the land and taken with the unclassified soil phases, presents limitations on more than 75% of the Township. Approximately 20% of the soil phases in the Township have bedrock at a depth of 6-10’+, which should indicate deep soils with relatively few limitations for construction.

<u>Depth to Seasonal High Water</u>

The depth to seasonal high water table is the distance from the surface to the highest level that groundwater reaches in the soil. This is referred to as seasonal high water as groundwater generally reaches its highest level between December and April. The depth to seasonal high water table is an important determinant of the limitations and opportunities for development.

Shallow depths to the water table present a number of problems with development. High water table can cause frequent flooding of basements and weaken foundations, while also presenting very serious limitations for onsite disposal of septic effluent. Effluent must permeate the soil in order to be properly processed and can be blocked by a high water table. In addition, while shallow water table depths are not appropriate for development, they often support diverse vegetation and wildlife communities. Protection of soils having shallow water tables will limit the destruction of property while also promoting diversity amongst plant and animal communities.

Figure 13 shows that 42% of the soil phases fall within the ranges that are considered limited with respect to the problems noted above. These include soils with high water tables from 0-3’ below the land surface. The remaining soil phases in the Township have a depth of 4-8'+, generally indicating adequate depth to the seasonal high water table for a number of different planning factors.

Figure 2
Land Use By Property Class
Lebanon Township
August 2001

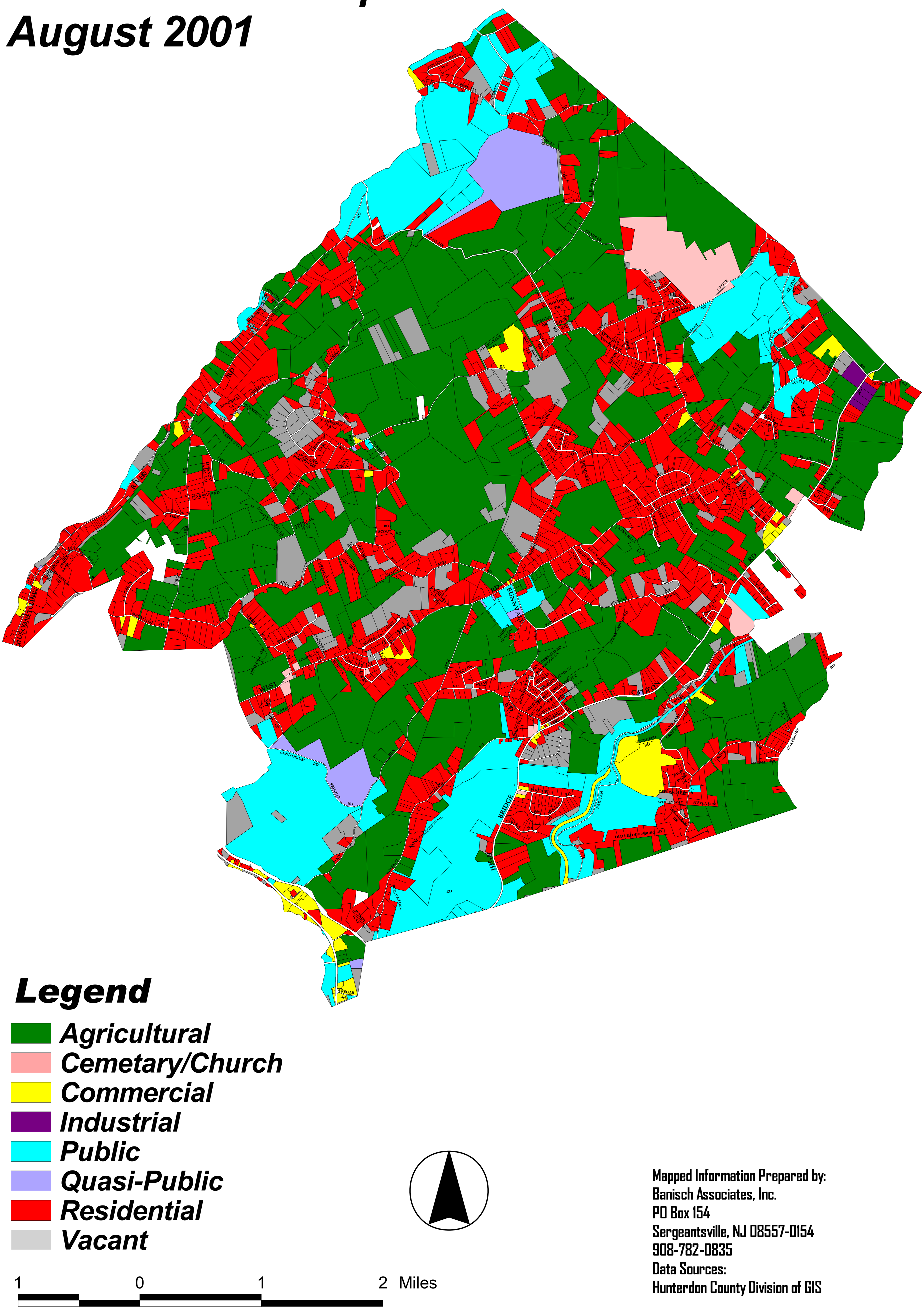

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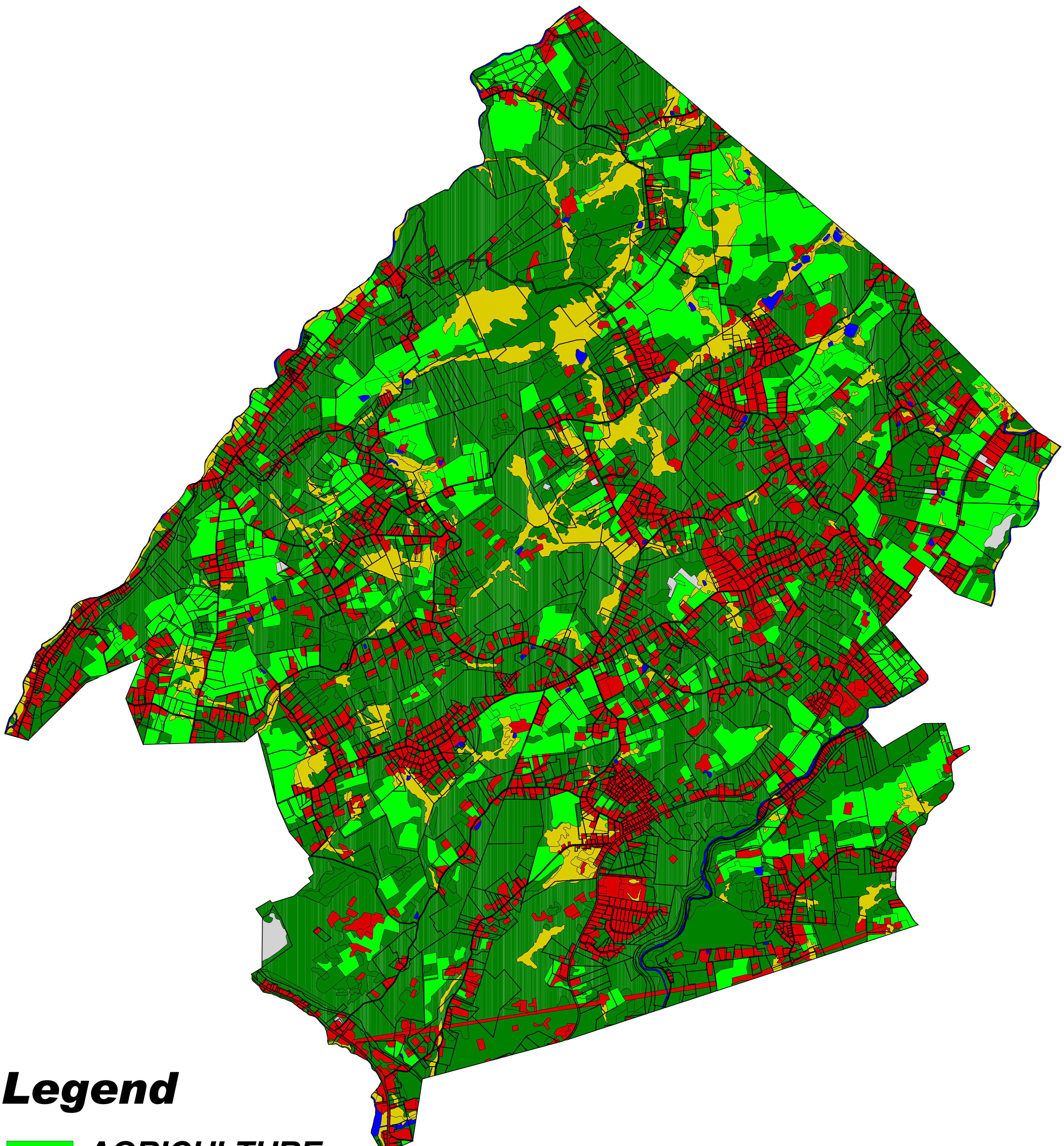
Figure 3
Land Use /Land Cover
Lebanon Township
August 2001



Legend

- AGRICULTURE
- BARREN LAND
- FOREST
- URBAN
- WATER
- WETLANDS

1 0 1 2 Miles

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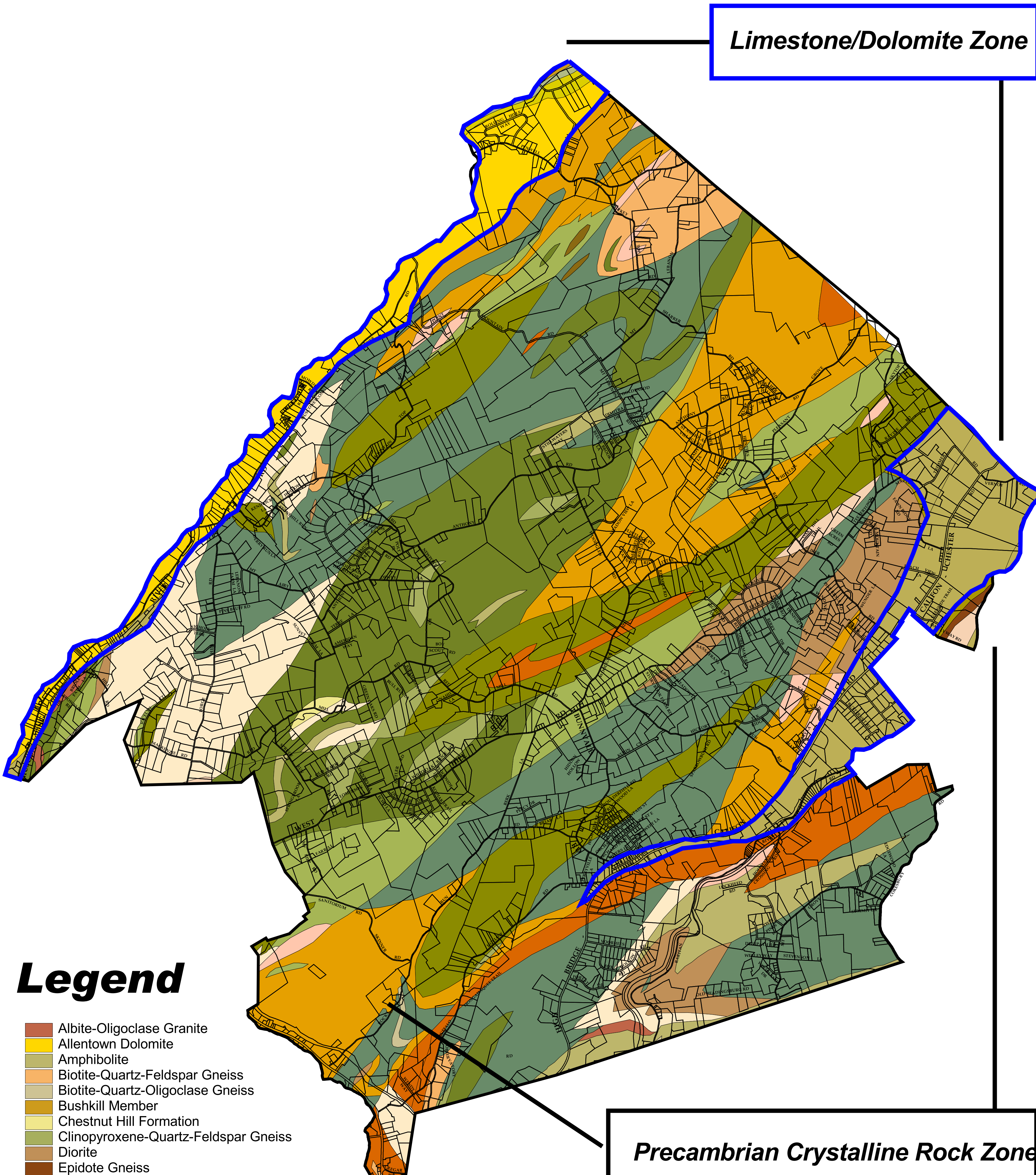
Figure 4
Geology
Lebanon Township
August 2001



Legend

- Albite-Oligoclase Granite
- Allentown Dolomite
- Amphibolite
- Biotite-Quartz-Feldspar Gneiss
- Biotite-Quartz-Oligoclase Gneiss
- Bushkill Member
- Chestnut Hill Formation
- Clinopyroxene-Quartz-Feldspar Gneiss
- Diorite
- Epidote Gneiss
- Hardyston Quartzite
- Hornblende Granite
- Hornblende-Quartz-Feldspar Gneiss
- Hypersthere-Quartz-Oligoclase Gneiss
- Jacksonburg Limestone
- Leithsville Formation
- Lower Part
- Microperthite Alaskite
- Potassic Feldspar Gneiss
- Pyroxene Alaskite
- Pyroxene Gneiss
- Pyroxene Granite
- Pyroxene Syenite
- Quartz-Oligoclase Gneiss
- Upper Part

1 0 1 2 Miles

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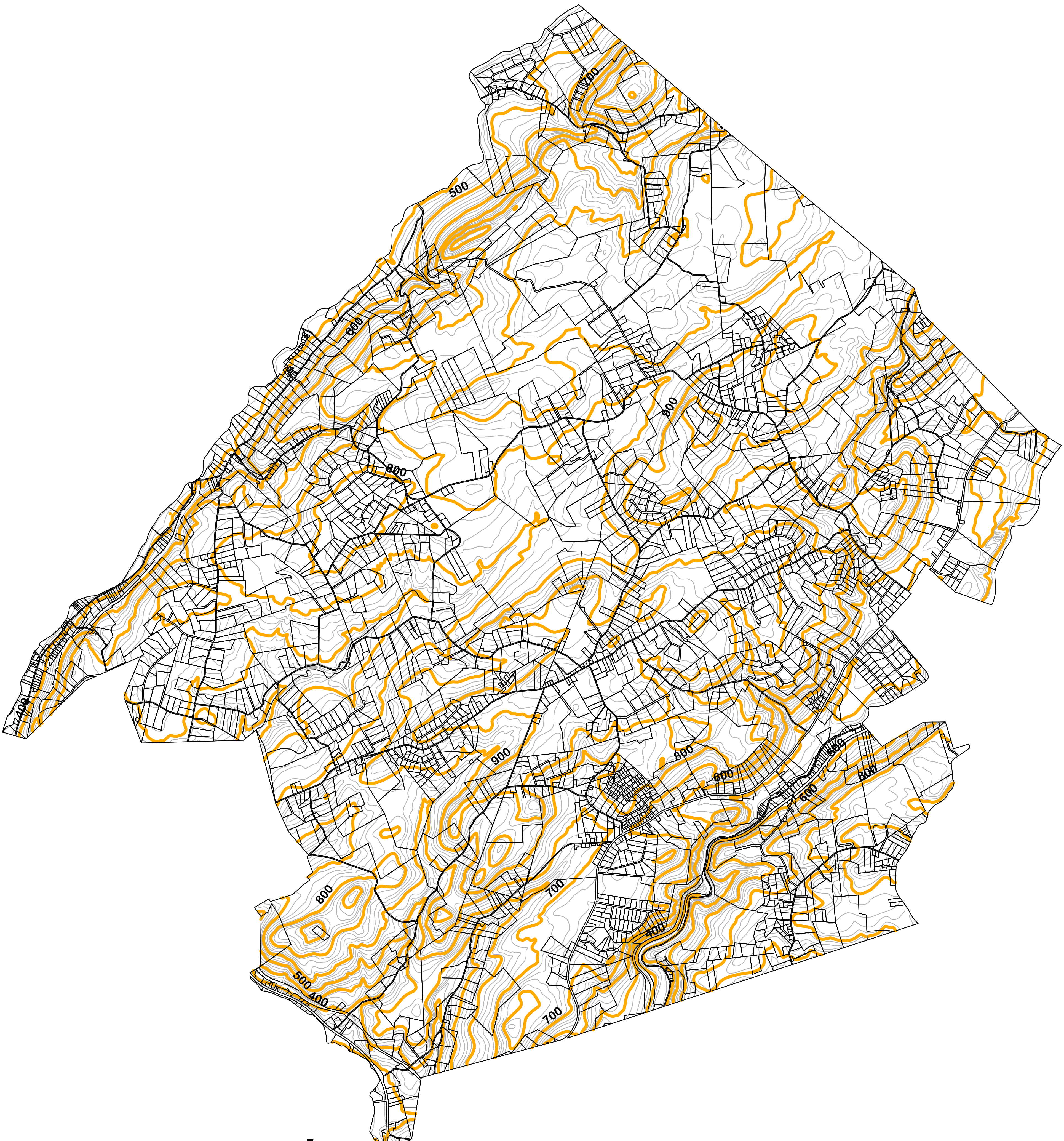
Figure 5
Topography
Lebanon Township
August 2001



Legend

20 Foot Contour
100 Foot Contour

N
W E
S

1 0.5 0 1 2 Miles

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Data Sources:
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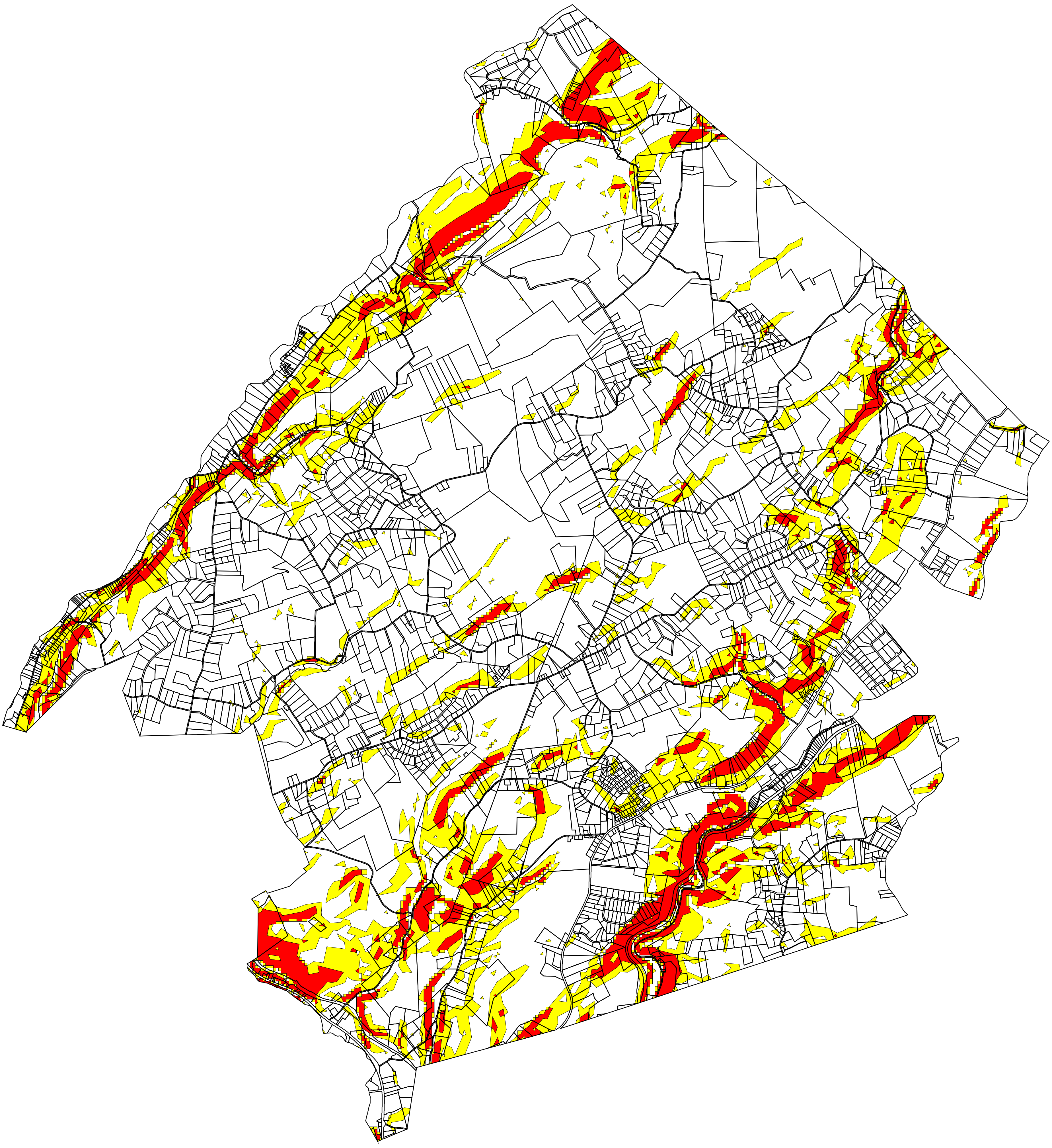
USGS

Figure 6
Steep Slopes
Lebanon Township
August 2001



Legend

Slopes of 15%-24.99%

Slopes of 25% and Greater

1 0 1 2 Miles

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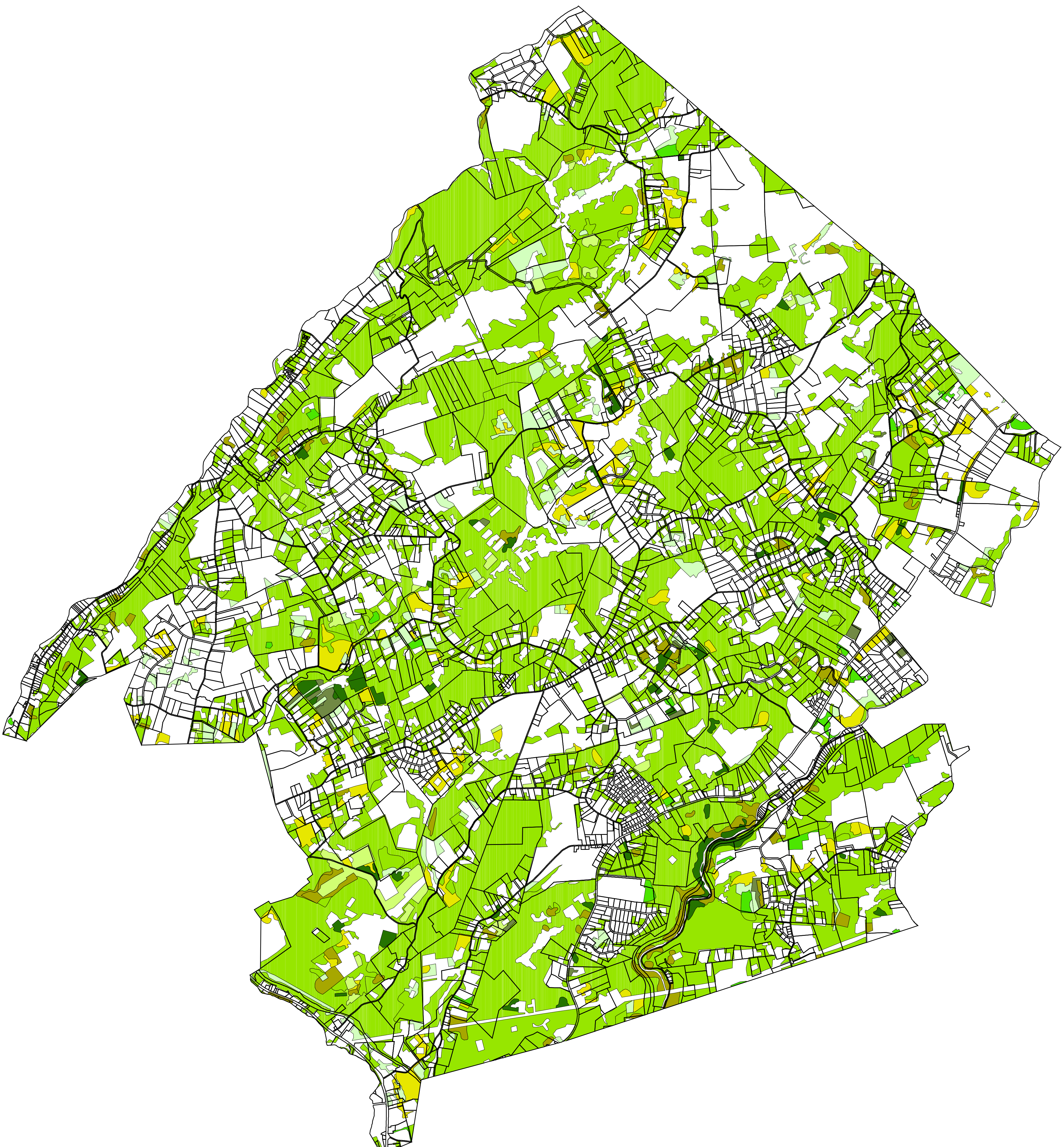
Figure 7
Forested Areas
Lebanon Township
August 2001



Legend

- Coniferous Brush and Shrubland
- Coniferous Forest
- Deciduous Brush and Shrubland
- Deciduous Forest
- Former Field, Brush Covered
- Mixed Deciduous/Coniferous Brush and Shrubland
- Mixed Forest
- Plantation

1 0 1 Miles

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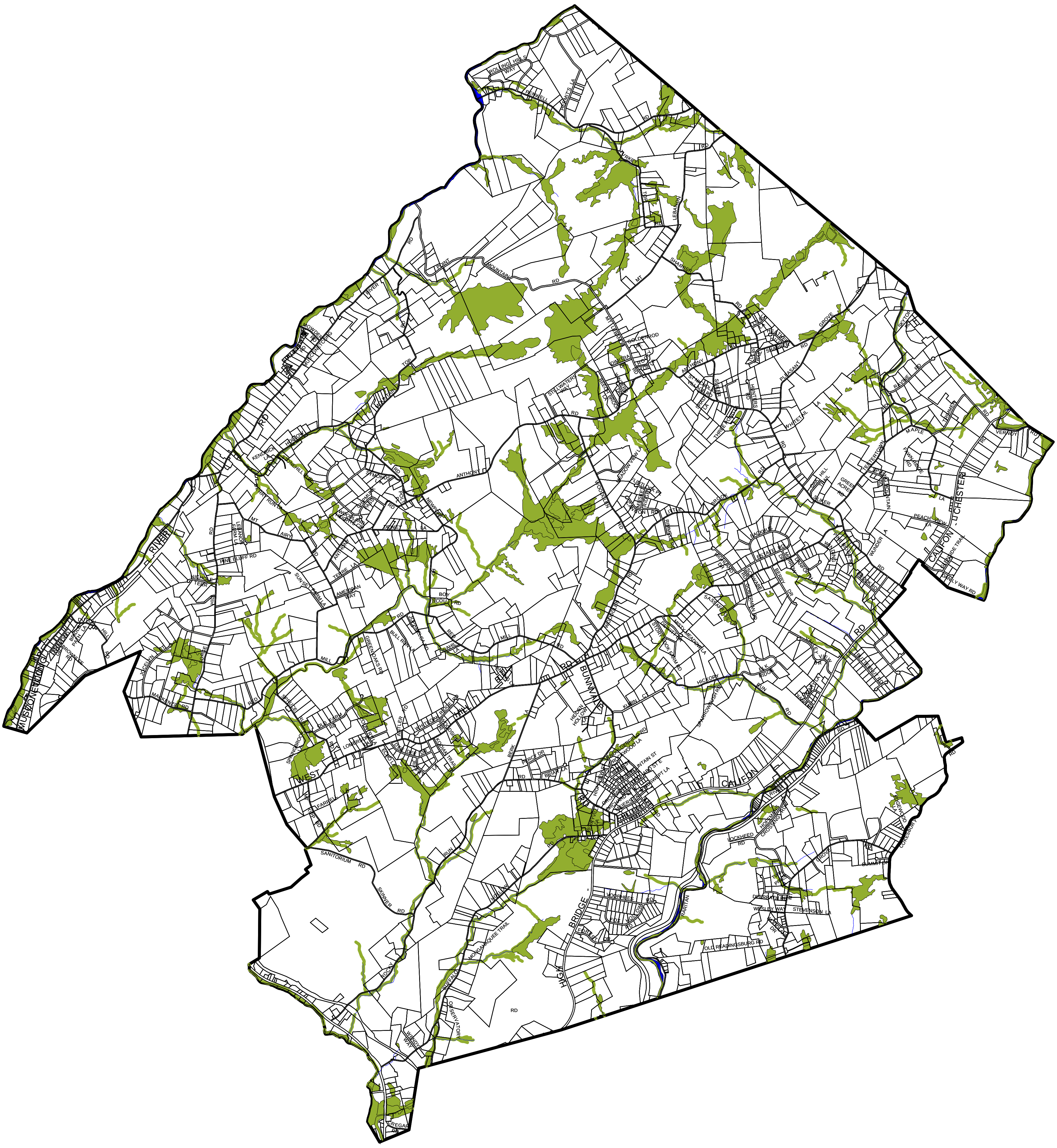
Figure 8
Wetlands
Lebanon Township
August 2001



Legend

Wetland Areas

Drainage Areas

Rivers and Streams

1 0.5 0 1 2 Miles

N W E S

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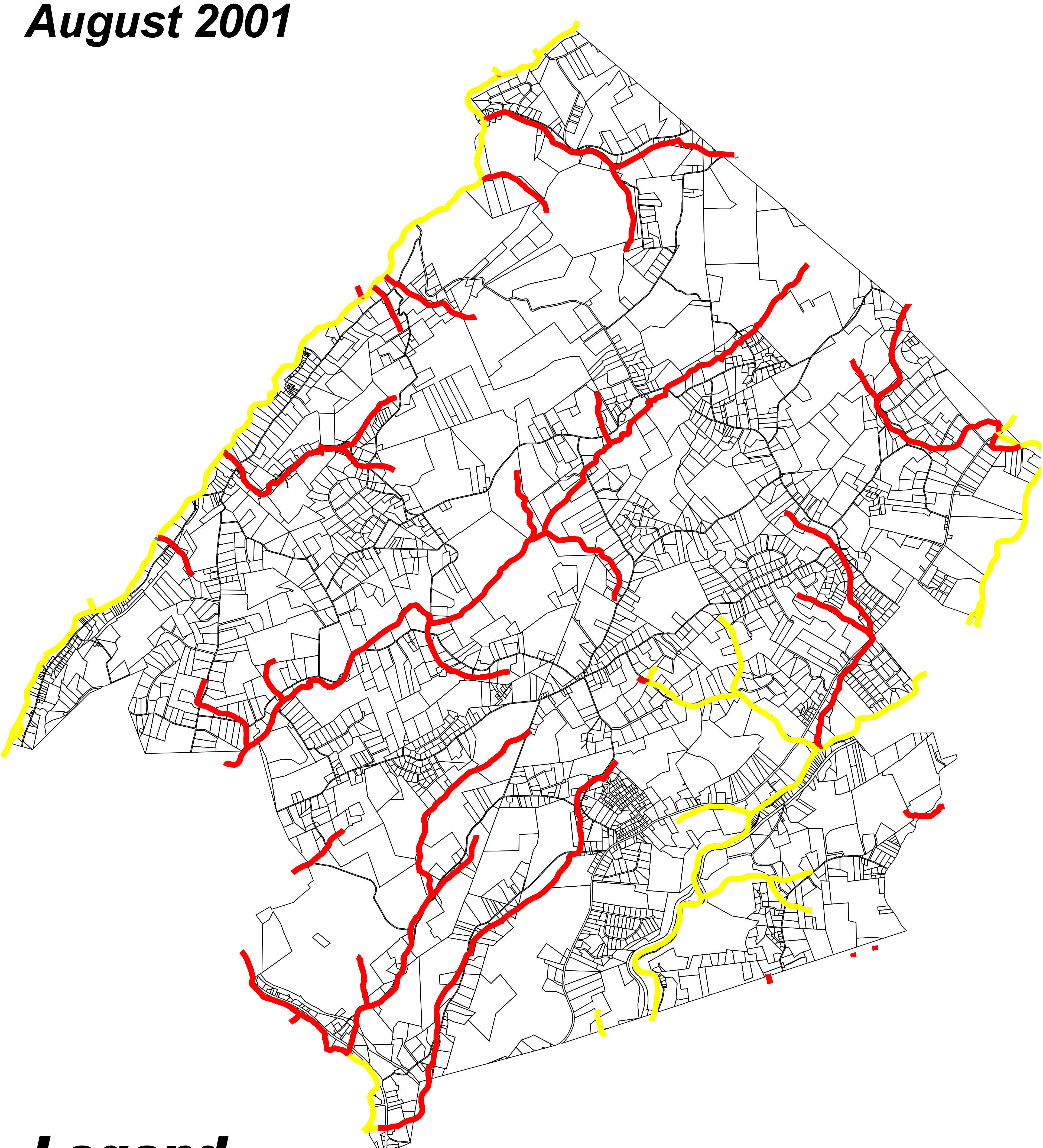
Figure 9
Trout Maintenance and Trout Production Designations Lebanon Township August 2001



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Trout Production

Trout Maintenance

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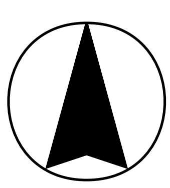

1 0 1 2 Miles

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908-782-0835
Data Sources:
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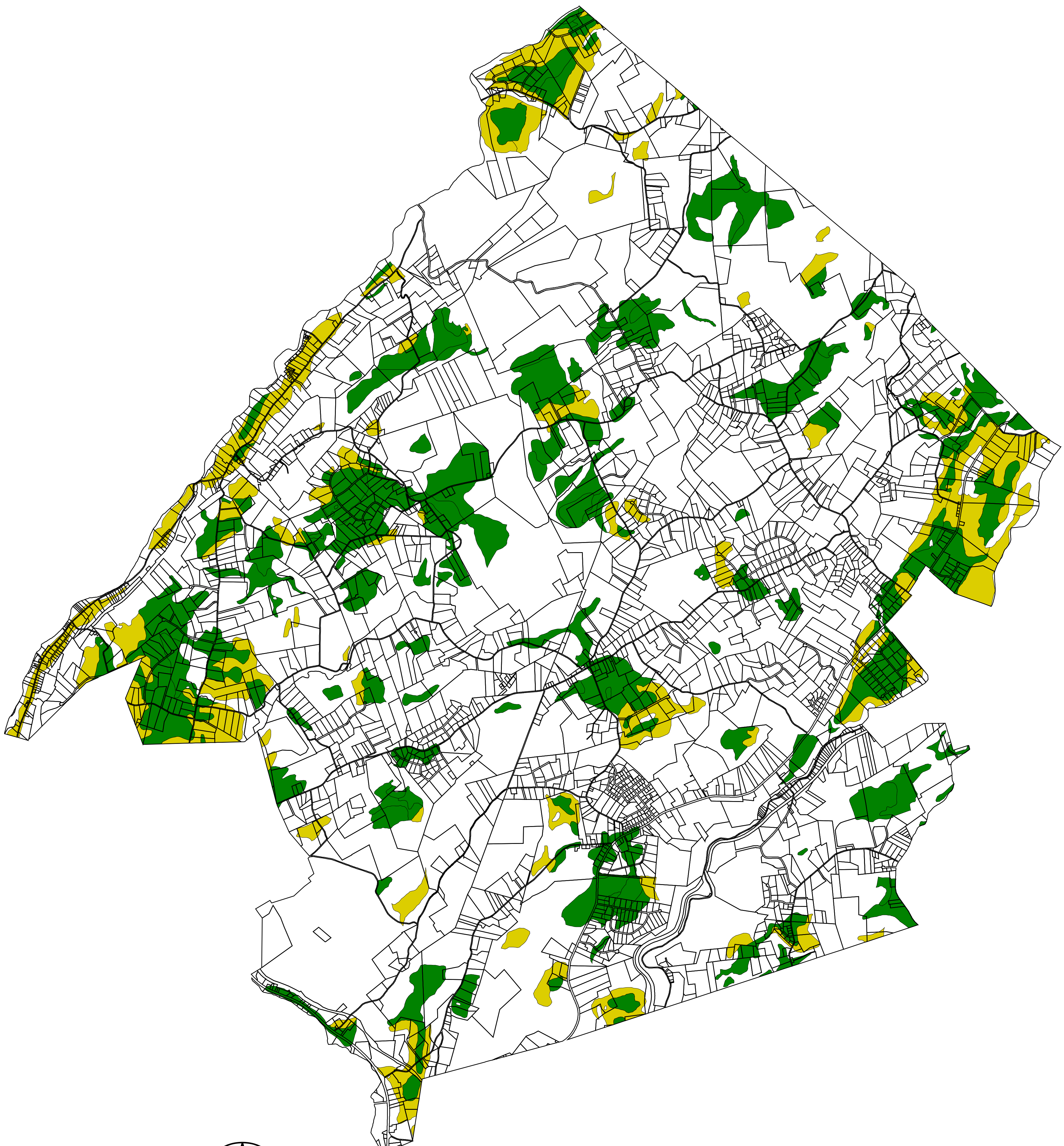
NJDEP

Figure 10
Prime and Statewide Important Agricultural Soils
Lebanon Township
August 2001



Legend

- Prime Soils
- Statewide Important Soils

1 0 1 2 Miles

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Data Sources:
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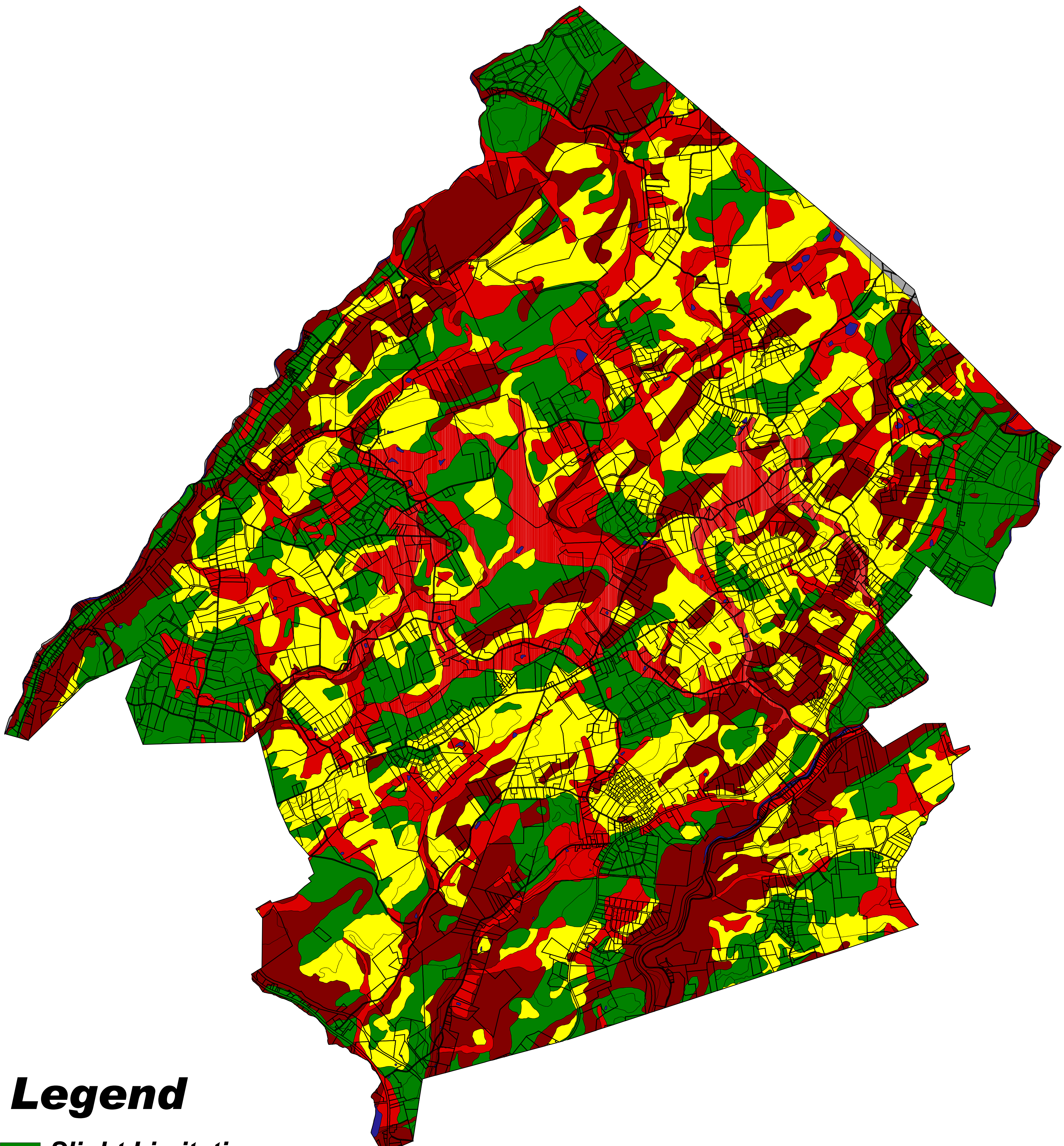
Hunterdon County Soil Survey - USDA

Figure 11
On-Site Septic Limitations
Lebanon Township
August 2001



Legend

- Slight Limitations
- Moderate Limitations
- Moderate to Severe Limitations
- Severe Limitations
- Unclassified
- Water
- No Data

1 0 1 Miles

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Data Sources:
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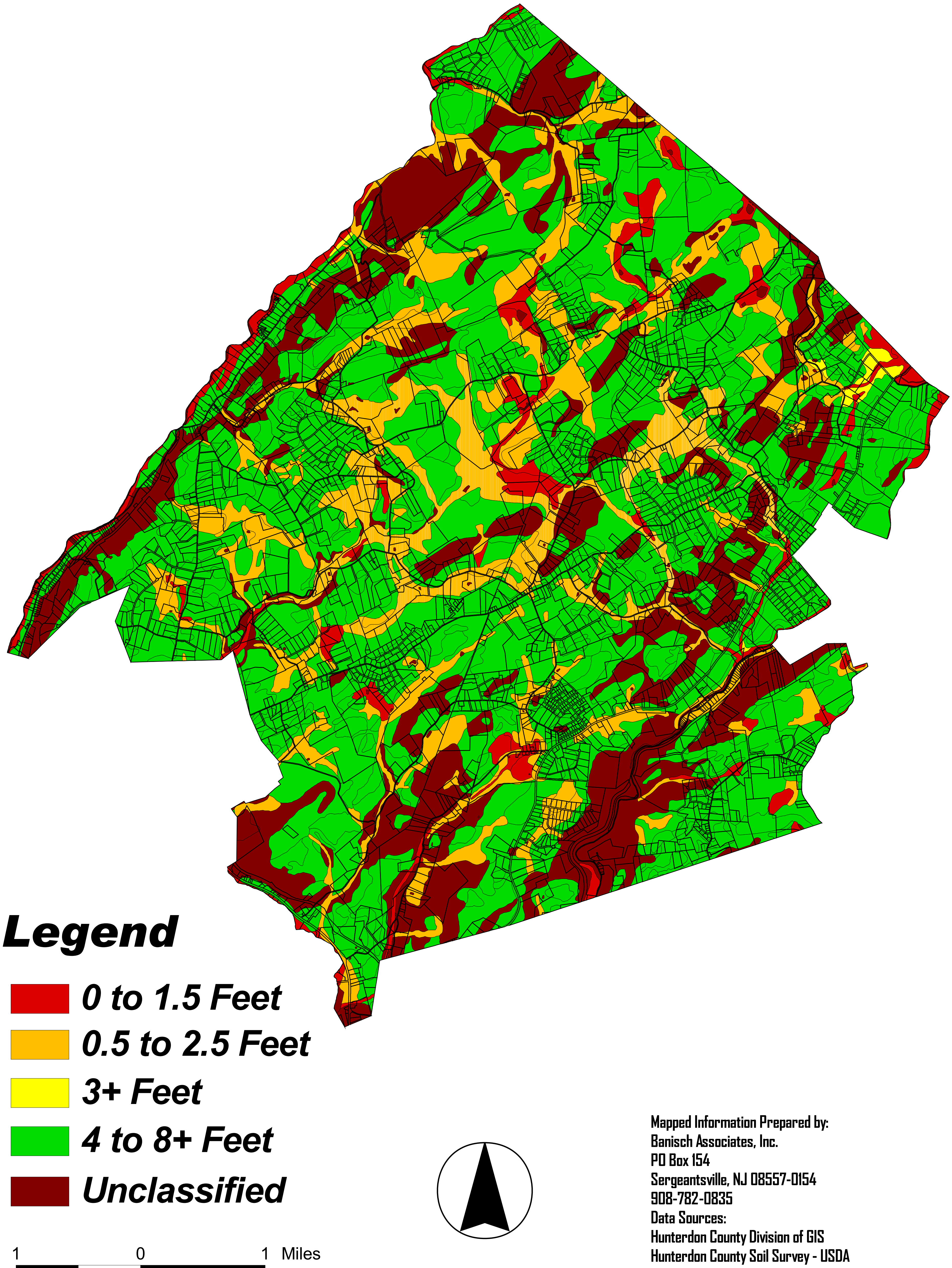
Hunterdon County Soil Survey - USDA

Figure 13
Depth to Seasonal High Water
Lebanon Township
August 2001



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Data Sources:
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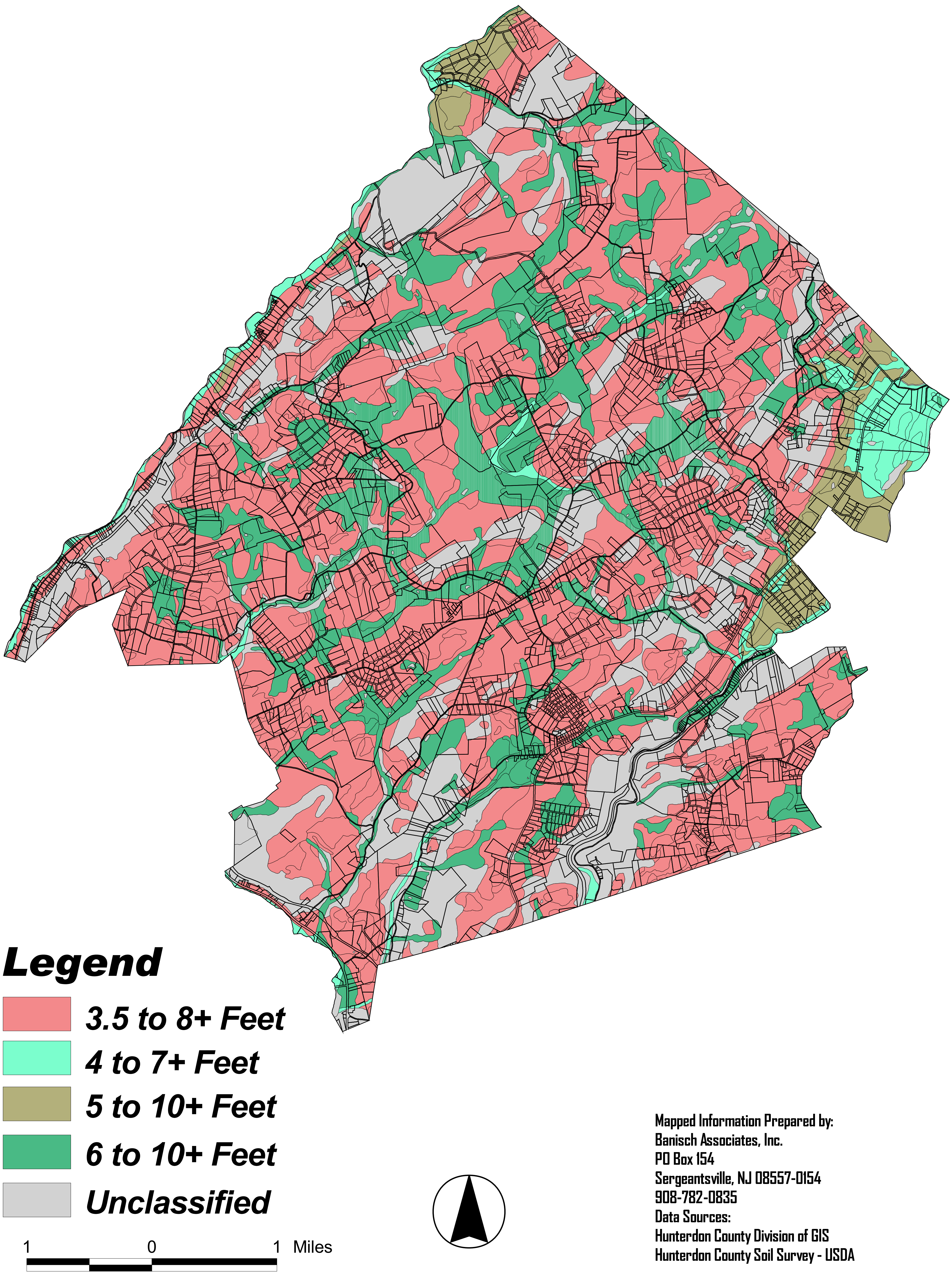
Figure 12
Depth to Bedrock
Lebanon Township
August 2001



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Hunterdon County Soil Survey - USDA

Review of Municipal, County and State Plans and District Solid Waste Management Plan

The Municipal Land Use Law (MLUL) requires that a municipal Master Plan include a statement concerning the relationship of the Plan to the plans of contiguous municipalities, the master plan of the county in which the municipality is located, the State Development and Redevelopment Plan (SDRP), and the district solid waste management plan of the County (N.J.S.A. 40:55D-28d.). The purpose of this analysis is to ensure that the general welfare of adjoining municipalities, the County and the State as a whole is addressed in the local planning process. Towards this end, this review of other agency plans addresses the plans of adjoining municipalities, Hunterdon County and the State of New Jersey.

Plans of Contiguous Municipalities

Lebanon Township's adjoining municipalities include Washington Township, Morris County to the northeast; Washington and Mansfield Townships, Warren County to the northwest; the Boroughs of Glen Gardner and Hampton, and the Townships of Bethlehem and Union, Hunterdon County to the southwest; Califon and High Bridge Boroughs, Hunterdon County to the south; and, Tewksbury Township and Califon Borough, Hunterdon County to the east.

Washington Township, Morris County

Lebanon Township shares its northeastern border with Washington Township along the Hunterdon/Morris County line. The common boundary with Washington Township includes several low-density residential districts with minimum lot sizes ranging from 80,000 square feet in the R-2 district to 200,000 square feet in the R-5 district, which are contiguous with Lebanon's lower density residential districts.

Mansfield and Washington Townships, Warren County

Lebanon shares a common border with Mansfield Township from Butlers Park Road to ¼ mile north of Stephensburg Road. The adjacent district in Mansfield along this border includes single-family residential with minimum lot sizes ranging from ½ acre to 1-acre, while lower density residential districts are found in Lebanon Township. South of Butlers Road to Route 31 Lebanon shares a border with Washington Township, where a majority of the adjacent district in Washington Township is Rural Residential, opposite a mixture of medium and lower density residential districts in Lebanon. This district permits low density residential on 4-acre lots. A small portion of Washington's Office Commercial district is located west of Lebanon's B-1 neighborhood commercial district.

Hampton Borough, Hunterdon County

The common boundary with Hampton Borough includes a Highway Commercial district from Route 31 to Route 645 where the district changes to the R-2 Residential district and lot sizes of 2 acres are required for conventional single-family development. Moving south along this border the district changes to R-1/2B Residential which permits high density residential on ½ acre lots, which is contiguous with Lebanon's R-1 ½ district developed to identify the higher density nodes.

Glen Gardner Borough, Hunterdon County

To the southwest, Lebanon Township abuts a small Industrial, Office and Research district in Glen Gardner Borough where the land use plan supports light manufacturing, office and research uses. South from Forge Hill Road to Route 628 the adjacent land use changes to Rural Residential (RR) where the intent of the district is to maintain the character of the surrounding area by establishing rural residential densities. The RR district in Glen Gardner Borough permits conventional single-family dwellings on 3-acre minimum lots. The districts in Glen Gardner are opposite lower density residential districts in Lebanon Township.

Moving south from Route 628 to Sanatorium Road the Township abuts the Borough's Conservation Management district intended to maintain environmental protection and open space standards. Single family residential is permitted in harmony with the protection of natural features. The minimum lot size permitted for residential lots is 5 acres. The Conservation Management district also permits performance and cluster subdivisions with a maximum open space component and a minimum overall tract size. This district corresponds to similar districts in Lebanon Township.

The Borough includes another small Industrial, Office and Research district contiguous with Lebanon's Industrial district before changing to Village Residential, which is intended to create a village mix of single-family and two-family homes. The average density in this district is 4 units per acre.

Bethlehem Township, Hunterdon County

The common boundary with Bethlehem Township includes a low-density mountain residential district where 3-acre minimum lots are permitted. The 1999 Master Plan Land Use Plan Element recommended that the minimum lot size be enlarged to five acres in this district. The adjoining district in Lebanon Township is highway commercial.

Union Township, Hunterdon County

Lebanon shares a common boundary with Union Township south of Route 31. The adjacent land use districts in Union Township include Watershed Management, Institutional and Parkland districts, which permits agricultural, institutional and forestry uses on lots ranging from 5 acres in the Parkland and Institutional districts to 9 acres in the Watershed Management. The Watershed Management district permits single-family dwellings on 9-acre lots. These districts are adjacent to Lebanon's highway business district along Route 31.

Borough of High Bridge, Hunterdon County

A small portion of Lebanon's highway business district abuts the Commercial district in the Borough of High Bridge where commercial uses not detrimental to downtown businesses are permitted. The district permits larger business uses including manufacturing, warehousing and office, which are in appropriate to the downtown area. The remaining common boundary of High Bridge Borough permits a mixture of residential densities ranging from 7,500 square feet in the R-4 district to 105,000 square feet in the R-1 district. These districts are adjacent to Lebanon's Resource Conservation district.

Clinton Township, Hunterdon County

The majority of Lebanon's southern border, which consists of a lower density residential district, abuts Clinton Township's single-family residential (R-1) district where the minimum lot size for a single-family dwelling unit is 5 acres. Where Route 31 enters the Township the adjacent land use plan includes an office building district, which permits a broad range of development opportunities including, clubs, lodges, banks and professional office for business, administrative and professional purposes. Clinton Township's office building district abuts Lebanon Township's highway commercial district.

Tewksbury Township, Hunterdon County

The majority of Lebanon Township's southeastern border, which include only residential districts, abuts Tewksbury Township's Rural (R-3) district where agriculture and single family dwellings are permitted on lots 3 acres or greater. Tewksbury includes two small Village Residential districts along Lebanon's border, which were established to recognize small enclaves of existing clusters of older homes. The minimum lot size for new dwellings in the Village Residential district is 1.5 acres.

Califon Borough, Hunterdon County

The Township shares a border with Califon Borough where a variety of uses are permitted in both municipalities. The adjacent land use districts include the Highway Business district, which permits a variety of commercial, warehouse and professional office uses, and several single-family zoning districts ranging in density from minimum lots of 22,000 square feet in the medium residential district to 3 acres in the rural residential district.

In general, the plans of Lebanon Township's adjoining neighbors include a mix of residential and non-residential districts. For the most part, the character of the development and planning and zoning in adjoining municipalities conforms to that in Lebanon Township. However, where potential conflicts exist, as in cases of non-residential and abutting residential development, careful site planning and design can minimize most impacts.

Hunterdon County 1986 Master Plan

In accordance with the New Jersey County and Regional Planning Act of 1968 (N.J.S.A. 40:27-2) the Hunterdon County Planning Board prepared a Master Plan for the physical development of the County, entitled the Hunterdon County Growth Management Plan, 1986. The plan recognized that Hunterdon had become one of the fastest growing counties in the state. The plan established long-term land use goals and objectives to accommodate the diverse demands for future growth in Hunterdon County while retaining the rural and historic character and environmental quality of the county. Lebanon Township's Master Plan advances these same objectives in its guiding principles. The Plan designates all of Lebanon Township as a Rural Conservation Area, which is consistent with the Township's planning approach.

State Development and Redevelopment Plan

The New Jersey State Planning Act was signed into law over fifteen years ago, providing for the first State Plan ever formally adopted with input from New Jersey's counties, municipalities, and citizens. The State Planning Act of 1985 (NJSA 52:18A-196 et. seq.) recognized the intent of the legislature to provide for sound and integrated statewide planning in order to "conserve its natural resources, revitalize its urban centers, protect the quality of its environment, and provide needed housing and adequate public services at a reasonable cost while promoting beneficial economic growth, development, and renewal...."

The State Planning Act established a process (Cross-acceptance) that invited the active participation of state agencies, and County and local governments as well as concerned citizens and private interests. Among the guiding principles of the State Planning Act are "the provision of adequate and affordable housing in reasonable proximity to places of employment" and the recognition that "the preservation of natural resources and environmental quality is vital to the quality of life in New Jersey".

The State Planning Commission, created under the State Planning Act, was empowered to effectuate its goals by promoting coordination among state agencies and local government, providing technical assistance to local governments, developing recommendations for a more efficient and effective planning process and recommending to the Governor and Legislature such actions as would improve the efficiency or effectiveness of the planning process.

The Cross-acceptance process is a collaborative, participatory process by which state agencies and local governments join in statewide planning to achieve full public participation in the process and a consensus among all levels of government. For this reason, the State Development and Redevelopment Plan (SDRP) carries with it the weight of a long and detailed process of comparison of planning goals, negotiation of differences, and resolution of issues, allowing for a coordinated set of public policies which resonate around central themes. Additionally, N.J.S.A. 40:55D-28 (d) requires that municipal master plans include a statement indicating the relationship of the municipal master plan to the SDRP.

On March 1, 2001, the State Planning Commission adopted the Final State Plan. This document represents modifications that came about during cross-acceptance of the Preliminary State Development and Redevelopment Plan, which began in 1997 and came to a close in 1999.

While some of the policies and mapping in the Plan have changed, many have remained the same. What has also remained the same is the classification system that the State Planning Commission has used to map the entire State into appropriate "Planning Areas". The Planning Areas for Lebanon Township are shown on Figure 14.

Lebanon Township includes two Planning Area designations and a small area designated as Park, as identified in the State Plan Policy Map in the Final State Plan. They are Planning Area 4B, Rural/Environmentally Sensitive, and Planning Area 5, Environmentally Sensitive and Parkland.

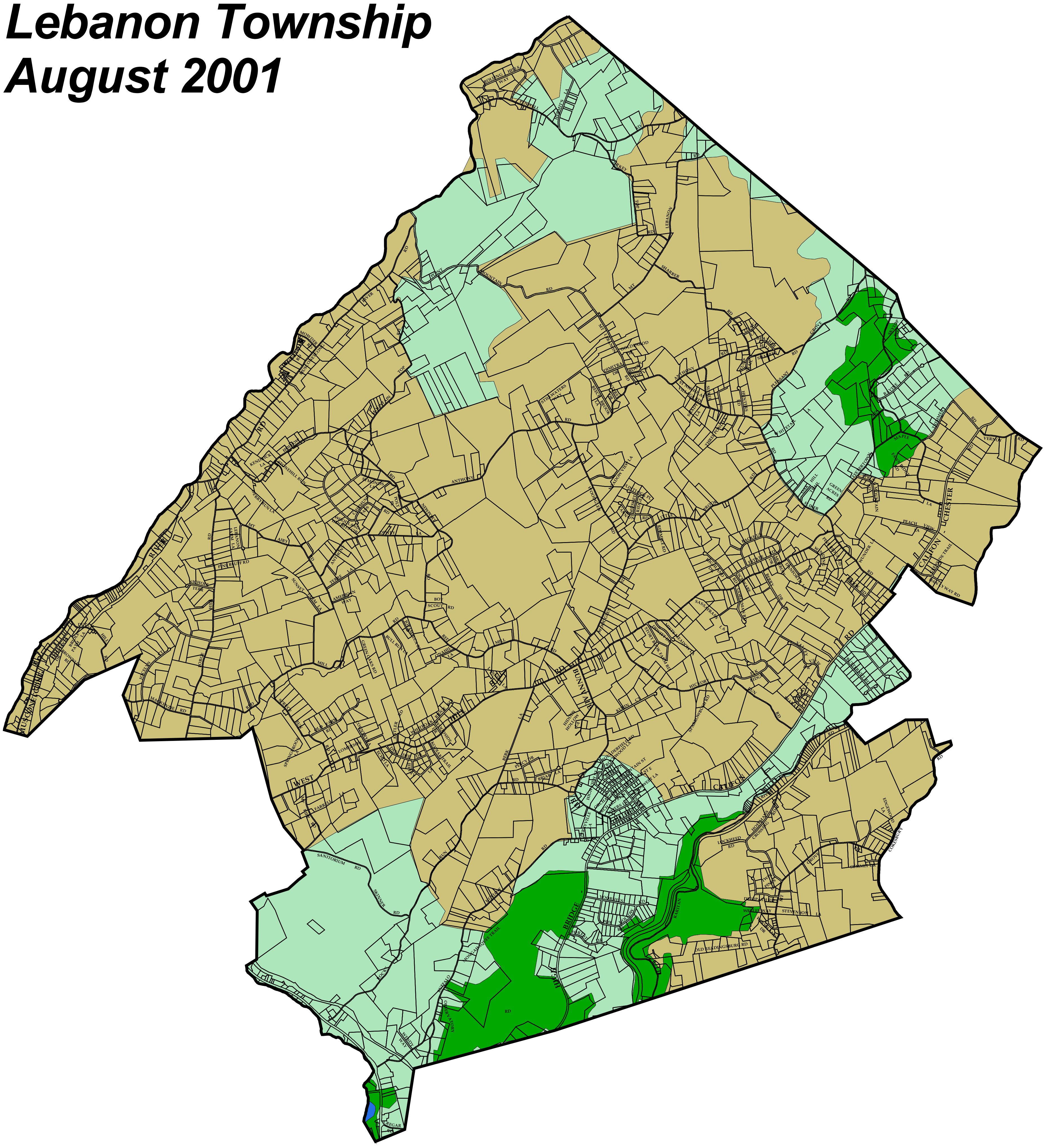
The significance of these Planning Area designations and the State Plan itself have been largely ceremonious to date, with no regulatory authority backing either. However, the State Plan has gained more clout as a regulatory tool amongst State agencies themselves over the past couple of years. Many state funding sources and discretionary awards have had State Plan compliance requirements built in, making use of the State Plan and its policies more attractive to municipalities throughout New Jersey.

Planning Area 4B represents lands in the State that have environmentally sensitive features, yet still possess agriculturally productive soils or may have a prevalence of farming as an industry. This is the case over most of the Township, which possesses unique forest resources that provide contiguous habitat for many threatened or endangered species, yet also possesses a number of viable farms or agriculturally based businesses. The challenge in this Planning Area is the continuation of agriculture as a viable business, through continued funding of farmland preservation efforts, while balancing environmental resource protection.

Planning Area 5 possesses many of the State's significant environmental resources, yet lacks the farming and productive soils found in Planning Area 4B. It is comprised mainly of land that has wetlands, forests, and steep slopes, yet may also possess scenic views and other valuable qualities as well. The portion of the Township that is categorized as Planning Area 5 is found in both the northern and southern areas.

Lebanon Township's Land Use Plan evolved in response to the Cross-acceptance process and State Development and Redevelopment Plan. Lebanon officials participated in Cross-acceptance in order to assess the implications of the basic principles which guide the State Plan. The goals of the Township's Master Plan, which articulate the Township's vision for its future, have been formulated in response to these basic principles.

Figure 14
Planning Areas
Lebanon Township
August 2001



Legend

Park

Water

PA-4B (Rural and Environmentally Sensitive Planning Area)

PA-5 (Environmentally Sensitive Planning Area)

1 0 1 2 Miles

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NJ Office of State Planning
NJDEP

Significantly, under the adopted SDRP, nearly 72% of the land in the Lebanon Township is classified PA-4B while the remaining 23% is classified PA-5 and 5% classified as Park.

The Rural/Environmentally Sensitive Planning Area (PA 4B) is characterized in the State Plan by:

- land currently in agriculture or natural resource production, or having a strong potential for production based on soil productivity for agriculture
- undeveloped wooded tracts, vacant lands and large contiguous tracts of agricultural lands, and other areas outside Centers predominantly served by rural two lane roads and individual wells and septic systems.

The intent of the SDRP for PA 4B seeks to:

- Maintain the Environs as large contiguous areas of farmland and other lands;
- Revitalize cities and towns;
- Accommodate growth in Centers;
- Promote a viable agricultural industry;
- Protect the character of existing, stable communities; and
- Confine programmed sewers and public water services to Centers.

The Environmentally Sensitive Planning Area (PA 5) is characterized in the State Plan by:

- high quality surface waters and their watersheds
- watersheds of potable water supply sources
- aquifer recharge areas
- valuable ecosystems and habitat for threatened and endangered species
- contiguous freshwater wetlands systems
- significant natural features or landscapes, including critical slope areas, ridge lines, important geological features and unique ecosystems.
- prime forested areas

The SDRP cites PA 5 as "highly vulnerable to damage of many sorts from new development…including fragmentation of landscapes, degradation of aquifers and potable water, habitat destruction, extinction of plant and animal species and destruction of other irreplaceable resources ." These environmental sensitivities prompted concern in the SDRP that "new development (in PA 5) has the potential to destroy the very characteristics that define the area."

The intent of the SDRP for PA 5 seeks to:

- protect environmental resources through the protection of large contiguous areas of land
- accommodate growth in Centers
- protect the character of existing stable communities
- confine sewers and programmed water services to centers
- revitalize cities and towns

According to the SDRP, these areas, along with Planning Area 5, "are not currently nor are they intended to be urban or suburban". The State Plan recommends protecting the rural character of the area by encouraging a pattern of development that is supportive of agriculture and other related economic development efforts that promote a stronger rural economy in the future while meeting the immediate needs of rural residents, and by identifying and preserving farmland and other open lands. The Plan also promotes policies that can protect and enhance the rural economy and agricultural industry, thereby maintaining a rural environment while also protecting valuable ecosystems or wildlife habitats.

The State Plan emphasizes that growth should be organized within existing or planned centers, and that the Environs, outlying areas of lower development intensity outside centers, should be protected from suburban sprawl. The State Plan does not include any designated centers in Lebanon, however, the list of proposed centers includes Long Valley, Penwell, New Hampton, Bunnvale and Woodglen.

In order to accommodate State Plan goals for both the Environs and central places, development needs to be realigned along smart growth principles. A push-pull relationship should evolve where growth is directed away from the Environs and into the cities and older suburbs, where redevelopment opportunities abound. The redevelopment vision of the State Plan cannot be realized unless the economic force behind sprawl is redirected toward these redevelopment opportunities.

The State Plan vision for New Jersey in 2020 sees diverse and thriving cities and towns with a desirable quality of life where reinvestment and public/private partnerships have reclaimed brownfield sites. At the same time, this 2020 vision foresees rural areas where limited growth has been accommodated "while maintaining the rural character and large contiguous areas of farmland so important to all the citizens of New Jersey" and where "farmland and other open lands have been preserved to ensure the future viability of agriculture and maintain a rural environment."

The State Plan is not mandatory; however, it is a comprehensive guide to land use planning for a better New Jersey built upon an inclusive cross-acceptance process, and the ultimate success of the endeavor is largely in municipal hands. Lebanon Township has incorporated local policies and strategies that respond to the basic premises, intent and purposes of the State Plan.

District Solid Waste Management Plan

Hunterdon County has adopted a Solid Waste Management Plan in accordance with the requirements of the State "Solid Waste Management Act". The Solid Waste Management Act established a comprehensive system for the regulation of solid waste collection, recycling and disposal. The Act authorizes Counties to develop and implement comprehensive solid waste management plans which meet the need of municipalities within the County.

In accordance with the County's Solid Waste Management Plan, curbside recycling occurs every two weeks, and residents can contract with private waste hauling companies for more frequent collections. Once a month the Township Municipal Building serves as a depot for recycling drop-offs. The Township also participates in hazardous waste collections, phone book recyling, used motor oil recycling and tree chipping programs. General solid waste collection is handled by private waste haulers on a contractual basis with individual property owners.

The development proposed in the Lebanon Township Master Plan is consistent with the intent of the District Solid Waste Management Plan in terms of recycling, solid waste collection and solid waste disposal and complies with all applicable state laws.

lepbmasterplan82001

2002 Farmland Preservation Plan Element

Farmland Preservation Plan Element

Township of Lebanon
November 2002

Prepared by:
The Lebanon Township Agricultural Advisory Committee and
the Lebanon Township Planning Board
InConsultation with:
Banisch Associates, Inc.

The Original of this document has been signed and sealed according to law.

Table Of Contents

List of Figures

List of Tables

"The nature of the farmland in Lebanon Township, in combination with its sensitive environmental resources (which include headwater streams to a water supply reservoir), dictates that creative preservation tactics be used."

Executive Summary

For a number of years, Lebanon Township has been at a disadvantage in the race to preserve farmland in Hunterdon County. Although it has many thriving agricultural operations nestled in its rolling hills, it failed to meet the greater criteria for inclusion in the County Farmland Preservation Program.

The arrival of updated technology now gives the County better ability to assess areas for inclusion in Agriculture Development Areas (ADA), the building block of its preservation efforts. Through its requirements, the County is seeking to build core areas of preserved farmland and agricultural districts, preserving an environment that will foster the continuation of agriculture for future generations. Lebanon Township, taking advantage of the County's use of technology, is seeking large scale expansion of ADA's in order to qualify more farms for cost share at the County and State level; inclusion in an ADA allows the Township to pay less than 20% of the cost of the development easement.

Lebanon Township will focus its farmland preservation efforts utilizing two means, the County Farmland Preservation Program (FPP) and a Planning Incentive Grant (PIG), the latter essentially authorized and awaiting adoption of this plan to initiate spending. The County Farmland Preservation Program utilizes an application process which scores farms in a combinatory fashion, aggregating scores in various categories and ranking applicants County-wide. The PIG authorizes funding in a project area and allows the Township to utilize a variety of methods to preserve farmland, including option agreements and installment purchases, both of which allow for maximization of funding.

Pasture on Mt. Lebanon Road

The nature of the farmland in Lebanon Township, in combination with its sensitive environmental resources (which include headwater streams to a water supply reservoir), dictates that creative preservation tactics be used. A number of farms have portions that are actively devoted to agriculture while the remainder is wooded. This combination diminishes a farm's ability to score highly in the County FPP. A unique approach to preservation will allow portions of farms which are actively producing to be preserved through farmland preservation while the remaining portion is preserved through some other means. Along with additional ADA's, this preservation technique will allow the Township to be more competitive and achieve both conservation and farmland preservation goals.

The recently formed Agricultural Advisory Committee will foster and implement the goals and objectives of this plan, including carrying out its recommendations. The Committee has played a key role in formulation of this plan and will work with members of the Township Committee and other relevant boards and commissions to preserve agriculture in the Township. Members of the Committee, being farmers of the community, will also continue to provide support and feedback as preservation efforts continue.

Introduction

Lebanon Township is a study in contrasts regarding agriculture. Some areas of the Township possess the pastoral landscapes of field crop and grazing land, tucked in fertile valleys and stream corridors. Other areas contain valuable resources associated with non-traditional agricultural activities such as timber harvesting, orchards and growth and sale of nursery stock.

Lebanon Township is poised at the northern border of Hunterdon County and is part of the gateway to the New Jersey Highlands. In a county where central and southern municipalities are rich in agriculturally important soils and traditional forms of agriculture, the Township is not often categorized as a leader in agriculture. Yet the agriculture present is an important part of both the history and future of the Township, as effort to maintain the character of the community and the county has increased in recent years.

Competition for funding in the area of farmland preservation is keen and Lebanon is at a disadvantage in the ranking system due to its emphasis on agricultural soils. In addition, many of the agriculturally significant soils present in the Township have been permanently lost to development. With little in the way of infrastructure for wastewater management and an array of valuable resources to protect, prime farmland turns into the most appropriate land for development, consumed by residences and likely never to return to agricultural production.

Livestock grazing a farm on Trimmer Road.

Through this Farmland Preservation Plan Element, the Township is seeking to identify agricultural resources and focus efforts and funding opportunities to ensure that farming, both traditional and non-traditional, has a continued place in the community. Land preservation efforts will strive to preserve or take option on as much land as possible, utilizing local funding to leverage available funding from the county and state.

This farmland preservation plan is prepared pursuant to Paragraph (13) of section 19 of P.L. 1975, c.291(C.40:55D-28). This section and N.J.A.C. 2:76-17.6 provide that a farmland preservation plan element shall include:

1. An inventory of farm properties in the entire municipality and a map illustrating significant areas of agricultural lands;

2. A detailed statement showing that municipal plans and ordinances support and promote agriculture as a business; and
3. A plan for preserving as much farmland as possible in the short-term by leveraging monies made available by the Garden State Preservation Trust Act, N.J.S.A. 13:8-1 et seq., P.L. 1999, c. 152 through a variety of mechanisms including but not limited to utilizing:
   i. Option agreements;
   ii. Installment purchases; and
   iii. Encouraging donations for permanent development easements.
4. A statement of farming trends, characterizing the type(s) of agricultural production in the municipality; and
5. A discussion of plans to develop the agricultural industry in the municipality.

"Lebanon Township has 8,589 acres which qualify for reduced assessment under the farmland assessment act."

Inventory of Farm Properties

Lebanon Township has 8,589 acres which qualify for reduced assessment under the farmland assessment act. These properties are listed as class "3B" with the Hunterdon County Board of Taxation. Table 2, found in the Appendix, lists farm assessed properties and categorizes them as listed in the January 2002 tax information. Figure 1 illustrates the location of these properties throughout the Township along with current preservation applications and preserved farmland.

Farm equipment in a field on Maple Lane.

Municipal Plans and Ordinances and Support for Agriculture as a Business

Although Lebanon Township contains a mix of traditional and non-traditional farming operations, the Township has always been supportive of agriculture as a business and means of making a living. Agriculture provides a primary or secondary source of income for a number of Township residents while also lending to the rural character that many enjoy. As such, the Township has been supportive of agriculture through its planning activities and regulations.

Master Plans

<u>Lebanon Township Master Plan – 1979</u>

The Township's 1979 Master Plan, through the Land Use Plan Element and the goals and objectives, indicated that agriculture was an important part of the character and lifestyle of the Township that required efforts to preserve. *"Farming and agriculture should be encouraged and the Master Plan should reflect the community's efforts to preserve active and viable farms in the Township and return fallow land to farming activities".*

Agriculture was a primary consideration in the Land Use Plan Element as well. *"One of the development objectives of the Master Plan is to preserve the Township's farms."*

<u>Lebanon Township Master Plan – 1991</u>

The 1991 Master Plan began to detail the rural agricultural lifestyle and extol the virtues of the Township as a haven for it. *"Lebanon Township is a rural agricultural community filled with beautiful rolling hills, largely wooded or being farmed, laced with streams and brooks and dotted with ponds. It is uniquely suited to residential and farm use for those who prefer a rural agricultural lifestyle amid the beauties of nature."* The introductory section of the Master Plan continued by detailing the two principal concerns of the Township Committee and its Planning Boards, one of which was *"…the preservation of a rural agricultural community and the farms that are an essential part of its lifestyle."*

The Master Plan continued in the goals and objectives stating *"Farming and agriculture should be encouraged and the "Right to Farm" should be jealously guarded. Opportunities should be provided for the preservation of existing farms and the return of fallow land to farming."*

<u>*Lebanon Township Master Plan – 2001*</u>

The Township continued its support for the rural agricultural lifestyle in the 2001 Master Plan, while also detailing heightened threats to the continuation of agriculture brought on by increased development pressure. Among the guiding principles of the plan was *"Farming and agriculture should be encouraged and promoted"*. This simple statement set the stage for the more detailed goals and objectives and land use policies to support agriculture.

The Land Use and Management section of the goals and objectives included the goal of providing *"a future land use pattern that preserves large contiguous areas of farmland and other open lands…"*. Also included, for the first time in a Master Plan document, were specific goals and objectives related to agriculture which included:

- To encourage the preservation of agriculture through proactive planning where there are suitable conditions for the continued operation and maintenance of agricultural uses.
- To preserve a large contiguous land base to assure that agriculture remains a viable, permanent land use.
- To coordinate agricultural preservation activities with the State Agriculture Development Committee (SADC), Hunterdon County Agricultural Development Board and other open space preservation activities in the Township.
- To continue to seek the expansion and preservation of Agricultural Development Areas.
- To recognize agriculture as a significant economic industry in the community and to encourage economic opportunities in this industry.
- To provide financial incentives, financing mechanisms and enhanced opportunities for agricultural businesses that assist in maintaining agriculture as a viable economic activity.
- To encourage compatibility between agricultural operations and neighboring non-agricultural development through the right-to-farm ordinance.

The Land Use Plan Element detailed the means to carry out these goals and objectives and provided a more detailed rationale for doing so. The preservation of agriculture was woven into an overarching need to protect lands in the Township as valuable headwaters for a critical water supply area. The Resource Conservation (RC) district was suggested as a means to achieve preservation needs while also responding *"…..to the goals of conserving significant elements of the rural and agricultural countryside. The scenic vistas, wooded hillsides, agricultural fields and historic settlement patterns create the rural character that pervades much of Lebanon Township"*.

Suburban development, often contrary to agricultural goals and destructive to the rural landscape, was to be addressed with the adoption of land use regulations for the proposed RC district. In

"*By affording protection to resources through the Master Plan and development regulations, the Township has created an environment hospitable to the continuation of agriculture as a means to subsist.*"

addition to achieving resource protection goals, the intent was to provide an environment for farming that limited potential incompatibility between residential development and agricultural operations. Protection of water resources through lower development densities would also play a critical role in ensuring water availability for farm operations in an era where operations have become more intensive and entrepreneurial.

By affording protection to resources through the Master Plan and development regulations, the Township has created an environment hospitable to the continuation of agriculture as a means to subsist. A secondary benefit is the provision of an environment that exhibits rural agricultural resources, which makes for a pleasing community character.

The 2001 Master Plan also noted the Township's regional position and access to surrounding infrastructure. The existence of dense population centers both within and outside of Hunterdon County puts farmers in a potentially beneficial position. Goods can easily be transported to market in higher density areas of central and western New Jersey. These potential markets also happen to be in some of the most economically prosperous areas of the State, accessible by Interstate and State highway in less than one hour.

Right to Farm

While the Master Plan spells out the goals and objectives and general policies of the Township, the Land Development Chapters regulate development activities. Included in these regulations is a Right-to-Farm section, 18-3.10. This portion of the ordinance specifies that agriculture is a permitted use in all zones, notwithstanding specified and prohibited uses set forth elsewhere, provided that the owner is eligible for reduced taxation under the Farmland Assessment Act of 1964. In addition, the operation must conform to the management practices recommended by the State Agriculture Development Committee (SADC) and all state and federal laws, while also not posing a direct threat to public health and safety.

Rights under this provision of the zoning regulations are extended to allow production of crops, trees and forest products, livestock, and poultry and other items described in the Standard Industrial Classification (SIC) for agriculture, forestry, fishing and trapping. This provides protection for a broad range of activities related to general agriculture.

Under Right-to-Farm, those engaged in agriculture are protected from nuisance complaints which may arise from the normal operations of a farm or agricultural business, which can produce noise, odor, dust and fumes. Under this section of the development regulations, each deed of conveyance in the Township must contain the following statement:

> *"The Township of Lebanon acknowledges that a substantial quantity of land is devoted to active agricultural uses and further acknowledges that right of that landowner to continue to farm. Therefore, the grantee, his heirs and assigns are hereby on notice that the adjoining land or lands in the vicinity are actively being farmed and the other farmland owner has the continued right to farm under the provisions of subsection 18-3.10 of the Zoning Chapter of the Revised Ordinance of the Township of Lebanon."*

Agricultural Advisory Committee

In 2002, the Township Committee created an Agricultural Advisory Committee. The Committee will be responsible for assessing the character of agriculture in Lebanon and recommending future actions that the Township may take to further agricultural retention and farmland preservation.

The Agricultural Advisory Committee, comprised of three members, meets monthly. To date, the Committee has reviewed the information to be contained in the Farmland Preservation Plan Element, begun formulating ways to promote agriculture as a business, discussed means to supplement farm income with additional activities (both agricultural and non-agricultural), assessed potential requests to the CADB for additional Agriculture Development Areas and reviewed potential project areas for future Planning Incentive Grant Applications. Still in its formative stages, the Committee has taken on a great number of tasks and processed a large amount of information. The recommendations they have in the above areas will provide the Township a firm basis for continuing agriculture as well as a valuable resource for future endeavors.

Lebanon Township Agricultural Advisory Committee

Al Nagie - Chair
Adam Ambielli
Gary Milkowski
Eileen Swan - Secretary

"Through the Agricultural Advisory Committee, the Township will continue to assess other areas for inclusion in ADA's, as this is a basic requirement of the County PDR Program."

The Agricultural Advisory Committee plays a vital role in the Farmland Preservation Plan (FPP) and preservation efforts in the future. Prior to adoption of the FPP by the Planning Board, the Committee will formulate and review the recommendations to be included in the Plan. This will ensure consistency with sentiment of the agricultural community and produce viable means to aid farmers. The Committee will also be a conduit to the agricultural community once the plan is adopted. They can act as a valuable resource and intermediary, assisting in carrying out the initiatives outlined in the FPP.

<u>Farmland Preservation in Lebanon Township</u>

Lebanon Township's participation in farmland preservation has increased markedly in the last few years, with its first farm preserved in May of 2002. Two farms are also enrolled in the Municipally Approved Farmland Preservation Program (MAFPP). Additional applications for farms in the northern part of the Township have been filed, which are depicted in Figure 2 along with the preserved Nagie farm on County Route 513 outside of Califon. A Planning Incentive Grant (PIG) application has been submitted to the County, to be forwarded to the State Agriculture Development Committee upon adoption of this Farmland Preservation Plan. The PIG applicants are depicted on Figure 2.

A corn field on Mt. Lebanon Road.

A large part of the Township's increased farmland preservation activity has been through participation in the County program. Lacking in the core elements that the County program seeks, Lebanon Township has been at a disadvantage. Recently, the Township was successful in convincing the CADB to create additional ADA's in areas of active farms, which will aid in cost sharing ability.

Through the Agricultural Advisory Committee, the Township will continue to assess other areas for inclusion in ADA's, as this is a basic requirement of the County PDR Program. Once the basic elements are in place, applicants can be solicited.

Hunterdon County Agriculture Development Board

The Hunterdon County Agriculture Development Board (CADB) was created in 1981 by the Board of Chosen Freeholders and oversees the State Agriculture Retention and Development Program within Hunterdon County. The CADB provides a structure for determining cost sharing between the County, State and municipalities in the Farmland Preservation Program. Additionally, they provide a forum for disputes between farmers and landowners in right-to-farm issues, monitor activities on preserved farms and formulate general agricultural policy for the region at large.

Hunterdon County continues to be a leader in the area of agriculture, both in production of crops and goods and in the preservation of farmland. The County has over 160,000 farm assessed acres, with an average farm size of 80 acres according to the 1997 Census of Agriculture. To date, Hunterdon County and its municipalities have permanently preserved over 9,000 acres of agriculturally viable land through the Farmland Preservation Program.

Hunterdon County Farmland Preservation Plan

In addition to overseeing the Farmland Preservation Program, the CADB and its staff (County Planning Department) are responsible for planning efforts related to agriculture within the County. To this end, they have adopted a Farmland Preservation Plan containing supporting goals and objectives. Their adopted mission of the CADB is to: *"Promote the present and future of Hunterdon County agriculture by preserving agricultural land and by promoting public education and agricultural viability."* Program objectives include the following:

- Create critical masses of preserved farmland
- Preserve farms characterized by soils of prime and statewide importance
- Give priority to farms with implemented soil conservation plans
- Coordinate CADB preservation efforts with State Agriculture Development Committee (SADC), municipal, and nonprofit organization farmland preservation efforts
- Promote the education of farmers, government officials, and the public about farmland preservation, the Right to Farm Act, and other pertinent agricultural matters
- Work with Municipal, County, and State agencies and nonprofit organizations to encourage tourism
- Promote agribusiness opportunities through education and advocacy
- Promote soil and water stewardship on preserved farms by requiring an implemented soil conservation plan that is periodically updated

The structure of farmland preservation and planning in Hunterdon County is based on the Agriculture Development Area (ADA) and the agricultural district. ADA's are areas identified by the CADB that contain a mass of prime and statewide important soils and contain active and productive agricultural operations. The original mapping of ADA's in Hunterdon County was undertaken in 1983 and based on a study produced by the Middlesex-Somerset-Mercer Regional Council (MSM). Agricultural districts are areas containing farms that are either enrolled in or applying to the Farmland

Preservation Program that are within 1 mile of each other. Districts must contain 250 acres and are aimed at preserving critical masses of farmland rather than individual scattered farms.

The Hunterdon County Farmland Preservation Plan has identified the county's preservation goals, as required by the State. These goals were established by the CADB in 1999 and reflect a substantial acreage; an acreage unlikely to be achieved in the past but somewhat more realistic with the passage of the Garden State Preservation Trust Fund. Table 1 lists the CADB preservation goals to January of 2010.

Table 1
Hunterdon County Farmland Preservation Goals

Year	Preserved Acreage
January 2001	12,000
January 2002	16,000
January 2003	20,000
January 2004	24,000
January 2005	28,000
January 2006	32,000
January 2007	36,000
January 2008	40,000
January 2009	45,000
January 2010	50,000

Hunterdon County Farmland Preservation Program

The CADB also oversees the Farmland Preservation Program (FPP) for Hunterdon County. Each year and potentially utilizing two funding rounds per year, the CADB accepts applications for the County FPP. This program is a Purchase of Development Rights (PDR) program and provides a structure for municipalities, the State and County to share the costs of retiring development rights on farms.

The minimum eligibility requirements for the PDR program are that a farm be located in an Agricultural Development Area (ADA) and an agricultural district, is a minimum of 40 acres and is predominantly tillable farmland; farms with more than 50% woodlands are ineligible.
The CADB ranks applications it receives through a system of points, achieved for ratings in the amount of agricultural soils present, amount of acreage in active production and proximity to adjacent preserved farms. Landowners can be given additional priority if they "bid down" the value of their development easement, taking an amount of money less than the appraised value of the easement.

A November 1998 ballot question (approved by a 2-1 margin) created the Garden State Preservation Trust Act of 1999, which provided an infusion of funds to open space and farmland preservation programs across the state. The Act provided $98 million per year for 10 years dedicated to

"Planning Area 4-B includes areas supportive of agriculture that are simultaneously characterized by valuable ecosystems or habitat for threatened and endangered wildlife."

preservation efforts. The Garden State Preservation Trust, a nine member board created by the Act, receives and considers funding proposals from the DEP and SADC at least twice a year. Where the SADC traditionally had $20 million each year for farmland preservation activities, the Trust has provided some $55 to $60 million per year

The voters of Hunterdon County approved a tax of 3 cents per $100 of assessed value in November of 1999, providing funding for farmland and open space preservation. This tax supplements capital monies already committed annually by the Freeholders. This tax funding, along with the additional funding from the Garden State Preservation Trust Act, provides Hunterdon County and its municipalities with the ability to preserve more acreage than ever before.

The Farmland Preservation program provides a cost sharing mechanism for purchase of development easements where the state assumes the majority of the expense. In the traditional average cost sharing structure, the State assumes 65% of the easement cost and the municipality and the county assume 17.5% each. Once the per-acre certified value reaches $10,000 however, the state assumes less of the responsibility and the municipality must assume more. Thus, areas where land values are high, the municipality will be responsible for a greater portion of the easement purchase.

State Development and Redevelopment Plan Agriculture Policies

The State Development and Redevelopment Plan (SDRP), adopted in March 2001 by the New Jersey State Planning Commission, designates the following Planning Areas (PA) in Lebanon Township, depicted on Figure 3:

PA-4B *Rural/Environmentally Sensitive Planning Area*
PA-5 *Environmentally Sensitive Planning Area*

The PA-4B designation is indicative of the dichotomous nature of the Township's resources; a combination of rural agricultural and environmentally sensitive lands. Planning Area 4-B includes areas supportive of agriculture that are simultaneously characterized by valuable ecosystems or habitat for threatened and endangered wildlife. PA-4B occurs over 71.8% of the Township (14,536 acres) and includes all of the valuable agricultural resources of Lebanon, essentially the core of the Township and the northern fringe areas bordering Morris County.

Planning Area 5, which covers 4,616 acres in the Township (22.8%), includes lands containing one or more environmentally sensitive features. Among these are habitats for wildlife and threatened and endangered species, scenic vistas, unique geologic features, watersheds for water supply areas, trout production streams and others. The South Branch of the Raritan River corridor, the Point Mountain area, an area east of Pleasant Grove Road and the area south of Sanitorium Road carry the PA-5 designation. Many of these areas are permanently preserved as park areas.

The SDRP advances numerous statewide policies to support the long-term survival and health of the agricultural industry in New Jersey, many of which are consistent with Lebanon's objectives to preserve farmland, retain and diversify agricultural land uses in the community, and enhance the viability of the Township's agricultural economy. These policies have been reproduced below as they appear in the SDRP.

SDRP Statewide Policies

"Promote and preserve the agricultural industry and retain farmland by coordinating planning and innovative land conservation techniques to protect agricultural viability while accommodating beneficial development and economic growth necessary to enhance agricultural vitality and by educating residents on the benefits and the special needs of agriculture."

Sustainable Agriculture and Comprehensive Planning

Policy 1 Agricultural Land Retention Program Priorities
Funds for farmland retention should be given priority in the following order, unless a county or municipal farmland preservation plan has been prepared and approved by the State Agriculture Development Committee (in which case, priority shall be based on said plan):

(1) Rural Planning Area;
(2) Fringe and Environmentally Sensitive Planning Areas;
(3) Metropolitan and Suburban Planning Areas.

Policy 2 Preservation of the Agricultural Land Base
Consider the expenditure of public funds for preservation of farmland as an investment in a public capital asset (i.e. farmland as an item of infrastructure) and thereby emphasize the public's interest in maintaining long-term agricultural viability.

Policy 3 Coordinated Planning
Coordinate planning efforts of all levels of government to ensure that policies and programs promote agriculture.

Policy 4 New Development
Plan and locate new development to avoid negative impacts on agriculture.

Policy 5 Innovative Planning and Design Techniques
Encourage creative land planning and design through tools such as clustering, phasing, equity insurance and density transfers, purchase and donation of development rights, agricultural enterprise zones and districts and the provision of self-contained community wastewater treatment systems to

serve Centers, to accommodate future growth in ways that maintain the viability of agriculture as an industry, and to achieve the Policy Objectives of the Planning Area while avoiding conflict with agricultural uses.

Policy 6 Agricultural Water Needs

Include consideration of the water needs of the agricultural industry in water supply planning at all levels of government.

Agriculture and Economic Development

Policy 7 Provision of Capital Facilities

Provide adequate capital facilities including grain storage and food processing facilities to enhance agriculture in rural areas.

Policy 8 Access to Capital

Improve access to capital funds, including rural revolving loan funds and rural venture capital networks, operating funds and portfolios that reduce the reliance on land as an asset for collateral or retirement.

Policy 9 Enhancing the Agricultural Industry

Promote economic development that supports the agricultural industry on local, county and statewide levels.

Policy 10 Diversify the Rural Economy

Promote beneficial economic growth that recognizes the need to provide the essential facilities and infrastructure to diversify the rural economy. Provide opportunities for business expansion, off-farm employment, on-farm income generating enterprises such as agricultural-related educational or recreational activities and environmental activities such as leaf composting.

Policy 11 Enhance Agricultural Marketing

Enhance marketing programs to promote the sale of New Jersey agricultural products.

Policy 12 Simplify the Regulatory Process

Adapt the permitting, licensing and land use planning and regulation processes to be sensitive to agricultural needs to enhance the industry and to facilitate new agricultural development.

Policy 13 Local Ordinances and Building Codes Sensitive to Agricultural Use

Promulgate local ordinances and state building code and fee criteria which are sensitive to the special purposes of agricultural construction and seasonal use.

Policy 14 Right to Farm

Coordinate actions of state and local government to encourage the maintenance of agricultural production by protecting farm operations from interference and nuisance actions when recognized methods or practices are applied and to ensure that the numerous social, economic and environmental benefits of agriculture serves the best interests of all citizens in the state.

Policy 15 Aquaculture

Aquaculture is recognized as an agricultural activity.

Agriculture and Environmental Protection

Policy 16 Promote Agricultural Management Practices
Encourage the use of agricultural management practices to ensure sustainable and profitable farming while protecting natural resources.
Policy 17 Incorporate Agricultural Land in Recycling of Organic Materials
Use appropriate agricultural lands for the recycling of non-farm generated biodegradable and organic materials.

Human Resources

Policy 18 Housing Supply and Financing
Use federal and State funding to expand the supply of decent, safe and reasonably priced housing that will benefit those employed in agriculture.
Policy 19 Vocational and Technical Training
Create and expand access to training and technical assistance for agriculture and agriculture-related businesses.
Policy 20 Agricultural Education
Create and expand agricultural education and leadership opportunities through basic skills training, and vocational and entrepreneurial training on the secondary, county college and university levels.
Policy 21 Encourage Young and First Time Farmers
Coordinate federal, state and local financial incentives and tax and regulatory policies to encourage more individuals to enter agricultural business.
Policy 22 Promote the Value of Agriculture
Educate New Jersey residents on the economic and environmental value of sustainable agriculture in New Jersey and its important contribution to the State's quality of life.
Policy 23 Agro-tourism and Eco-tourism
Expand opportunities for agro-tourism and eco-tourism

The policies and recommendations of the State Development and Redevelopment Plan are meant to be considered in local planning initiatives, including planning for farmland preservation, a key element of agricultural retention. Many of the policies above are woven into the Township's planning policies, providing beneficial regional perspective on agriculture while also making them a reality at the local level.

Lebanon Township's Agricultural Setting

Lebanon Township has just over 6,000 acres of prime and statewide important soils, as categorized by the State Agricultural Development Committee (SADC) and depicted in Figure 4. This represents 30% of the Township's total acreage. Interestingly, approximately 41% of the Township qualifies for reduced tax payments under the Farmland Assessment Act, indicating that agriculture extends well beyond the boundaries of rich agricultural soils.

In a county where agriculture continues on a declining trend, Lebanon Township has seen an increase in total agricultural use, from 8,735 acres in 1987 to 9,423 acres in 1997. Table One presents the remainder of the "Agricultural Production Units" for the Township from the 1987 and 1997 Agricultural Censuses. Highlights from this data include:

- Total acreage harvested increased by 3.2% to 2,946 acres
- The acreage devoted to alfalfa hay decreased 47% from 465 to 242 acres
- Acreage devoted to trees and shrubs increased 143% from 14 to 34 acres while total nursery acreage increased from 119 to 192, up 61%
- Total number of beef cattle and young dairy cattle were up 13% and 13%, from 562 to 637 head and 207 to 235, respectively
- Meat chicken, egg chicken and turkey numbers declined 87%, 13% and 96%
- Fuel wood production decreased by 31%
- Board feet of timber increased 186% from 90,768 to 260,326

"In a county where agriculture continues on a declining trend, Lebanon Township has seen an increase in total agricultural use, from 8,735 acres in 1987 to 9,423 acres in 1997."

A crop of corn on Anthony Road.

Improving the Climate for Agriculture as a Business

Municipalities can be proactive in improving the economic viability of agriculture by understanding agricultural trends and the dynamics of emerging agri-business. Planning and zoning can enhance opportunities and minimize deterrents to agricultural retention. Lebanon should continue to expand its range of agricultural support strategies, including the following:

1. Promote participation in the 8-year Municipally Approved Farmland Preservation Program. The 8-year program can be established by municipal ordinance and approved by the

CADB. Participation in the 8-year program increases a landowner's eligibility for easement purchase, protects the landowner from eminent domain and provides access to soil and water conservation funds, which can improve the agricultural viability of lands. Establishment of an 8-year program also demonstrates the Township's support for the agricultural community, and offers an opportunity for smaller farms to combine and participate in this program.

2. Agriculture enhances the rural character of Lebanon Township and attracts seasonal visitors to the area. The beneficial aspects of tourism, which can support agriculture and be supported by agricultural sales and activities, should be explored. One means to achieve this is by allowing Bed-and-Breakfasts on farm parcels, encouraging the creation of accommodations in the countryside and helping to build the rural economy.

3. The Township will assess reducing costs of building permits for structures associated with agricultural use. This allows farmers to construct necessary facilities without the high costs associated with permitting.

4. The Township should assess the potential for offering reduced tax assessments on agricultural buildings. In combination with reduced permitting fees, this relieves farmers of potentially high costs associated with construction, which can impact the ability to farm profitably.

5. Land use regulations should be reviewed and updated to minimize deterrents to agricultural activity, and provide increased opportunities for agricultural expansion. This may include expanded opportunities for direct marketing of locally grown produce which eliminates the middleman and makes agricultural activities more rewarding to the farmer. Creation of a farmer's market at Lebanon Memorial Park would provide a means for farmers to market their products locally at a greater profit margin than seeking regional markets.

6. Establishment of a separate "Agriculture" section in the Township Code can codify all regulations that affect farming in one place for ease of reference. This can minimize bureaucratic delays or uncertainty about regulations affecting farming.

"The Township will continue to develop strategies which will involve a series of farmland preservation techniques, including financing alternatives and other opportunities to retire development rights."

7. An outreach initiative should be developed to communicate directly with local farmers. This can provide a clearer understanding of agricultural trends and objectives, and farmers perceptions of current and future business opportunities. The Agricultural Advisory Committee can serve as a valuable resource in establishing this connection and would be vital to maintaining it. A quarterly forum could be developed for farmers to meet with the Committee and members of the Planning Board or Governing Body to ensure that the needs of the agricultural community are being met.

"The Agricultural Advisory Committee can serve as a valuable resource in establishing this connection and would be vital to maintaining it."

Hay fields on High Bridge - Califon Road.

"The delineation of focus areas and study of potential ADA additions is a proactive step for the Township, increasing the likelihood that farms can be enrolled in and successfully funded by the County PDR program."

Lebanon Township's Plan to Preserve Farmland

The Township has been aggressively engaged in farmland preservation initiatives over the last few years, culminating with the preservation of the Nagie farm in May of 2002. With limited land area available to meet the criteria of the Hunterdon County Agriculture Development Board requirements, specific areas of the Township have been focused on to attempt to acquire development easements.

The nature of the landscape in Lebanon presents unique opportunity to partner with outside agencies to achieve dual objectives; those related to agricultural retention and those related to open space preservation and conservation. Statewide water supply protection initiatives have created interest in preserving land in the Spruce Run watershed, which accounts for a major portion of the Township and many of the remaining large farm assessed parcels. Acquiring the development rights to these parcels utilizing available farmland preservation techniques is difficult, as a good portion of farms in this area are wooded. A good portion of many, however, have areas of active agriculture which are valuable in their current form. The Township is working with outside agencies in this area to create combinations of funding sources, including Green Acres and SADC monies, to preserve tracts in their best preservation use.

Pasture on Mountain Top Road.

The Township will continue to develop strategies which will involve a series of farmland preservation techniques, including financing alternatives and other opportunities to retire development rights. Among those recommended are the following:

- Option agreements provide an opportunity to reserve the right to acquire farmland at some time in the future. Such agreements can provide valuable assurances for both the Township and the property owner that preservation can and will occur at some time in the future, based on agreed pricing and terms.

- Installment purchases leverage public funds by extending the horizon for payment over a period of years. Rather than requiring a front-end commitment of cash to acquire all development rights at the outset, installment purchases allow the municipality and the owner to devise a payment strategy which meets their mutual objectives and needs.

- Donations of permanent development easements can be particularly valuable to both the farmland preservation effort and the landowners involved. Donations of all or part of the development rights can provide substantial Federal income tax deductions, particularly for high-income landowners. Such donations also offer estate tax benefits, reducing the estate taxes which frequently force the sale of farm properties in order to pay the tax. Property owners and the Township can structure donation plans which minimize the tax consequences to landowners and increase the effectiveness of farmland preservation funds.

- The Planning Incentive Grant (PIG) program allows municipalities to receive funding commitment for an aggregate of farms which are reasonably contiguous. A project area is delineated and submitted via application where once approved, funding can be used to acquire development rights to any farms in the project area. The PIG program promotes use of innovative funding approaches, including installment purchase, option agreements, donations and bargain sales. PIG applications must be approved by the County CADB to determine their cost sharing requirements and to verify that the application meets their criteria for funding.

The Township has already submitted a PIG application to the State, which is awaiting the adoption of this plan to begin implementation of funding. Figure 2 identifies the project area for this PIG application, along with preserved farms and current applications. The Township will continue to solicit landowners for preservation under this funding and will utilize, to the greatest extent practical, the innovative techniques above. This will allow for maximization of public dollars as well as the amount of land that can be preserved.

The Agricultural Advisory Committee has identified areas of the Township where farmland preservation efforts will be focused (see Figure 5). The delineation of these areas was based on prime and statewide important soils and the presence of viable agricultural operations. While some of the areas of focus are already in ADA's, Focus Areas 1 and 3 will require the creation of additional ADA's in order to accommodate potential preservation initiatives. These two Focus Areas and their potential inclusion in an ADA are reviewed in detail below, along with Focus Area 2, already in an ADA.

Focus Area 1, depicted on Figure 6, is located on the east and west sides of Mountain Top Road and north of Hollow Road and Anthony Road. There are a number of larger farm assessed parcels in this portion of the Township that are actively farmed, including a nursery operation and a number of fields which produce hay. There are also wooded areas that are interspersed, with a few residences found primarily near the frontage of roadways. Figure 6 depicts, in yellow, 819 acres of land that expands an existing ADA and creates a new one to encompass agricultural operations and prime and statewide important soils within this focus area. The new ADA contains approximately 284 acres of prime soils, 10 acres of statewide important soils and is less than 10% wooded. The expansion of the existing ADA is 319 acres and contains 63 acres of prime soils and 13 acres of statwide important soils. It is likely that agricultural operations will continue into the future in this area.

Focus Area 2, depicted in Figure 7, is located directly east and west of Califon-Chester Road. This area is already in an ADA and has one preserved farm in its southwest portion. A majority of the soils here are prime or statewide important and there are a number of existing agricultural operations including orchards, hay fields and field crops. With the Nagie preserved farm in this district, applications from this focus area will receive higher ranking in the density scoring for the County program. This area also contains scenic vistas which contribute immensely to the rural and agricultural character of the Township, making them a prized portion of the landscape.

Focus Area 3 is located north and west of Cokesbury Road just south of Califon Borough and east of the South Branch of the Raritan River, as depicted in Figure 8. The area outlined in yellow indicates 242 acres of land that can be added to an existing ADA which extends to the border of Lebanon and Tewksbury Townships. Less than 17% of the area depicted is wooded with approximately 50% of the soils being prime, making addition to the existing ADA to the east possible. Most of the area is active in hay production and given the viability of the land is likely to remain in agriculture.

Active farmland in Focus Area 1, a proposed ADA expansion.

Although not delineated as a specific focus area in this Plan, the area east of Mt. Lebanon Road is another part of the Township that is in an ADA and contains active agricultural operations. Applications have already been received on the Weeks and Tucker Farms (depicted on Figure 2) while the remainder of the area is the subject of a development application for 39 homes. Given these facts, the area was not delineated for future focus as initiatives are well underway, with funding of the applications likely.

The delineation of focus areas and study of potential ADA additions is a proactive step for the Township, increasing the likelihood that farms can be enrolled in and successfully funded by the County PDR program. The Agricultural Advisory Committee will formulate means to contact land owners in these focus areas and thus begin the process of preservation. Utilizing information on the variety of programs and funding schemes that are available, the Committee will compile and develop (as necessary) information to send to farmers and landowners in these focus areas to gauge interest in program participation.

Appendix

Table 2
Farmland Assessed Properties

Block	Lot	A Acres*	B Acres	Total Acres
000030000	000050000	0.00	16.04	16.04
000030000	000050002	0.00	2.56	2.56
000030000	000050021	0.00	0.63	0.63
000030000	000050022	0.00	1.03	1.03
000090000	000040001	1.00	6.07	7.07
000100000	000010000	0.00	37.28	37.28
000100000	000030000	2.83	63.56	66.39
000100000	000080000	0.00	48.70	56.20
000100000	000110000	0.00	22.50	22.50
000100000	000390000	3.00	79.02	82.02
000100000	000400000	0.00	63.92	63.92
000100000	000410000	0.00	58.32	58.32
000100000	000550000	0.00	3.83	3.83
000100000	000560000	1.00	7.39	8.39
000100000	000560001	0.00	90.02	90.02
000110000	000080000	0.93	5.00	5.93
000110000	000080004	0.93	5.00	5.93
000110000	000170000	1.00	5.38	6.38
000110000	000430000	1.00	5.87	6.87
000120000	000010000	0.00	63.59	63.59
000120000	000030000	2.00	12.91	14.91
000120000	000080000	0.00	9.54	9.54
000120000	000090000	0.00	6.87	7.87
000120000	000560000	0.00	44.71	90.42
000120000	000570000	0.00	11.21	11.21
000120000	000630001	0.00	5.12	5.12
000120000	000640000	0.00	32.50	32.50
000120000	000650000	0.00	8.61	8.61
000160000	000170000	0.50	9.12	9.62
000160000	000200000	0.00	81.12	87.12
000160000	000660000	0.00	38.40	38.40
000160000	000670000	0.00	14.50	14.50
000170000	000030000	1.50	7.66	9.16
000170000	000030001	1.50	8.47	9.97
000170000	000090000	2.00	41.01	43.01
000170000	000100000	0.00	23.47	23.47
000170000	000110000	0.00	6.06	6.06
000170000	000280000	0.00	3.14	3.14
000170000	000290000	2.00	91.00	93.00
000170000	000310000	0.00	3.00	3.00
000170000	000320000	0.00	21.54	21.54
000180000	000010000	0.00	15.88	15.88
000180000	000060000	1.00	7.23	8.23
000180000	000090000	0.00	7.65	7.65
000180000	000110000	0.00	5.25	6.25

Block	Lot	A Acres*	B Acres	Total Acres
000180000	000180000	0.00	4.30	4.30
000180000	000200000	0.00	4.85	4.85
000180000	000220000	0.00	11.00	11.00
000180000	000230000	0.00	16.15	16.15
000180000	000250000	0.00	2.30	2.30
000180000	000280000	1.00	66.31	67.31
000180000	000290000	1.00	17.61	18.61
000180000	000440000	0.00	93.82	93.82
000180000	000440001	1.00	6.67	7.67
000180000	000440002	1.00	5.63	6.63
000180000	000470000	3.00	72.83	75.83
000180000	000470001	0.00	30.22	30.22
000180000	000490001	1.50	13.40	14.90
000180000	000490003	1.00	36.72	37.72
000210000	000060000	0.00	35.96	35.96
000210000	000330000	0.00	12.00	14.85
000240000	000020000	3.30	76.70	80.00
000240000	000030000	0.50	11.39	11.89
000240000	000050001	0.00	12.84	16.84
000240000	000050011	2.92	6.00	8.92
000240000	000080000	1.00	15.27	16.27
000240000	000080001	0.56	1.30	1.86
000240000	000080002	2.00	7.68	9.68
000240000	000080005	1.00	4.64	5.64
000240000	000080006	0.00	1.58	1.58
000240000	000080007	0.00	1.60	1.60
000240000	000080008	0.00	1.56	1.56
000240000	000080011	0.00	1.52	1.52
000240000	000080012	0.00	2.18	2.18
000240000	000100000	1.00	9.03	10.03
000240000	000100001	0.00	27.71	27.71
000240000	000160000	1.00	29.21	30.21
000240000	000170000	1.00	51.95	52.95
000240000	000320000	4.00	35.38	39.38
000240000	000320001	0.00	75.40	75.40
000240000	000370000	32.69	31.69	64.38
000240000	000380000	2.50	2.50	5.00
000240000	000380002	0.00	4.50	5.60
000290000	000060003	0.00	6.21	6.21
000290000	000060005	0.00	5.02	5.02
000290000	000170000	0.00	27.23	27.23
000290000	000320000	1.00	31.54	32.54
000290000	000350000	0.00	52.50	52.50
000300000	000020000	4.83	73.00	77.83
000300000	000030000	0.00	53.50	55.00
000300000	000190000	4.50	22.31	26.81
000300000	000200000	3.00	80.71	83.71
000300000	000400000	0.00	0.48	0.48
000300000	000410000	2.00	113.91	115.91
000300000	000440000	0.50	9.80	10.30

Block	Lot	A Acres*	B Acres	Total Acres
000300000	000460000	4.70	73.70	78.40
000300000	000480000	1.00	45.25	46.25
000300000	000480001	1.00	4.22	5.22
000340000	000020000	0.00	58.16	58.16
000340000	000070000	1.00	36.39	37.39
000340000	000090000	1.00	37.54	38.54
000350000	000080000	0.00	15.49	15.49
000350000	000340000	1.00	12.68	13.68
000350000	000360000	1.00	18.80	19.80
000350000	000380000	2.00	26.27	28.27
000350000	000380001	0.00	8.54	9.54
000350000	000560000	1.00	14.60	15.60
000350000	000640000	0.00	8.50	8.50
000350000	000660000	0.00	7.20	7.20
000350000	000760001	1.00	16.30	17.30
000350000	000760003	1.86	9.89	11.75
000350000	000820000	0.00	5.00	5.00
000350000	000840000	0.75	3.76	4.51
000350000	000870000	1.00	100.48	101.48
000360000	000060000	1.00	36.60	37.60
000360000	000150000	0.80	10.50	11.30
000360000	000160000	1.00	10.90	11.90
000360000	000170000	1.00	54.50	55.50
000360000	000170002	0.00	5.03	5.03
000360000	000180000	1.00	26.13	27.13
000360000	000180003	11.90	22.50	34.40
000360000	000210000	0.00	7.94	7.94
000360000	000210001	0.00	2.19	2.19
000360000	000220000	0.00	36.12	36.12
000360000	000230000	0.00	89.57	89.57
000360000	000260000	0.00	58.44	58.44
000360000	000280000	1.73	301.21	302.94
000360000	000290002	3.01	7.01	10.02
000360000	000290003	2.00	35.18	37.18
000360000	000390000	1.00	56.60	57.60
000370000	000190000	2.50	112.56	115.06
000370000	000250000	2.00	26.78	28.78
000370000	000280000	1.50	8.25	9.75
000370000	000290000	1.00	6.32	7.32
000370000	000300000	1.00	5.00	6.00
000370000	000310000	1.00	8.94	9.94
000370000	000360000	0.70	12.75	13.45
000380000	000020000	2.91	23.00	25.91
000380000	000050005	0.50	9.52	10.02
000380000	000080000	0.00	30.00	30.00
000380000	000180001	0.00	5.23	6.23
000380000	000190001	1.00	14.48	15.48
000380000	000190002	0.00	6.70	7.70
000380000	000190003	0.00	18.00	19.96
000380000	000210000	1.50	39.22	40.72

Block	Lot	A Acres*	B Acres	Total Acres
000380000	000880000	1.00	21.48	22.48
000380000	000880001	1.00	23.26	24.26
000380000	001030000	2.00	28.14	30.14
000380000	001040000	1.00	11.80	12.80
000380000	001060000	0.00	6.70	6.70
000380000	001060001	1.00	8.99	9.99
000400000	000050000	0.00	61.34	61.34
000400000	000050002	2.06	4.66	6.72
000400000	000100000	1.22	46.56	47.78
000400000	000130000	2.00	70.75	72.75
000400000	000230000	1.35	6.00	7.35
000410000	000020000	1.57	5.21	6.78
000410000	000020001	0.50	4.73	5.23
000410000	000100000	0.00	54.10	54.10
000410000	000110000	0.00	92.63	92.63
000410000	000110001	0.00	32.04	32.04
000410000	000110002	0.00	37.80	37.80
000410000	000130000	1.00	36.43	37.43
000420000	000020000	0.00	10.50	23.00
000430000	000010001	0.00	12.00	15.01
000430000	000020000	1.00	16.27	17.27
000430000	000020003	0.00	5.57	5.57
000430000	000020004	1.00	9.79	10.79
000430000	000020005	1.00	6.28	7.28
000430000	000020006	0.74	5.00	5.74
000430000	000040000	1.00	13.00	14.00
000440000	000190000	3.00	57.36	60.36
000440000	000210000	3.00	12.43	15.43
000440000	000230000	1.57	5.40	6.97
000460000	000150000	2.00	37.22	39.22
000460000	000170000	1.00	16.90	17.90
000460000	000240000	2.50	15.31	17.81
000460000	000240002	0.00	5.40	5.40
000460000	000270000	1.00	2.50	3.50
000460000	000290001	1.00	36.36	37.36
000460000	000290003	1.72	5.00	6.72
000460000	000290004	0.00	3.07	3.07
000460000	000290005	0.00	3.98	3.98
000460000	000310000	1.50	33.47	34.97
000460000	000330000	1.25	35.90	37.15
000480000	000010000	0.00	27.50	27.50
000490000	000010000	1.00	13.04	14.04
000490000	000020000	0.00	6.86	6.86
000490000	000040001	2.00	8.49	10.49
000490000	000460000	1.00	73.51	74.51
000490000	000490000	1.00	18.25	19.25
000490000	000720000	0.00	47.00	47.00
000490000	000750000	1.00	17.06	18.06
000490000	000780000	1.00	23.70	24.70
000490000	000820000	1.00	6.36	7.36

Block	Lot	A Acres*	B Acres	Total Acres
000490000	000890000	0.00	76.41	76.41
000500000	000020000	0.00	6.82	6.82
000500000	000090000	1.00	22.86	23.86
000500000	000100000	0.00	67.50	67.50
000500000	000120000	1.00	100.27	101.27
000500000	000180000	0.50	17.45	17.95
000510000	000010000	2.00	91.58	93.58
000510000	000050000	0.00	12.50	12.50
000510000	000060000	0.60	151.16	151.76
000510000	000060001	0.00	25.11	25.11
000510000	000070000	0.00	16.50	16.50
000510000	000080000	0.00	3.70	3.70
000510000	000090000	8.00	204.52	212.52
000510000	000130000	0.00	45.00	223.53
000530000	000040000	6.70	21.00	27.70
000530000	000120000	0.00	40.00	65.43
000530000	000170000	0.00	11.41	11.41
000530000	000180000	0.00	3.09	3.09
000530000	000190000	1.00	6.54	7.54
000530000	000190002	0.00	36.20	36.20
000540000	000180000	0.00	54.67	54.67
000540000	000190000	1.00	17.12	18.12
000540000	000230001	1.00	18.00	19.00
000550000	000010000	1.06	5.00	6.06
000560000	000100000	1.67	89.19	90.86
000560000	000100001	0.00	62.81	63.81
000560000	000130000	1.50	30.33	31.83
000560000	000130002	0.00	79.00	79.00
000560000	000140000	0.00	10.57	10.57
000560000	000140003	0.00	5.00	5.00
000560000	000140004	0.00	5.01	5.01
000560000	000140005	0.00	5.19	5.19
000560000	000140007	0.00	3.01	3.01
000560000	000140008	0.00	3.00	3.00
000560000	000140009	0.00	3.00	3.00
000570000	000040000	0.00	2.80	2.80
000570000	000050002	0.00	12.37	12.37
000570000	000070000	0.00	3.00	3.00
000570000	000080000	0.00	12.54	12.54
000570000	000100000	0.00	6.21	6.21
000570000	000110000	0.00	121.26	121.26
000570000	000120000	0.00	57.00	57.00
000570000	000130000	0.00	104.27	104.27
000570000	000130001	0.00	11.23	11.23
000570000	000130002	0.00	5.00	5.00
000570000	000140000	3.26	10.50	13.76
000570000	000160000	0.00	9.65	20.30
000570000	000210001	1.50	13.43	14.93
000570000	000260000	1.00	2.84	3.84
000570000	000260001	0.00	5.55	5.55

Block	Lot	A Acres*	B Acres	Total Acres
000570000	000270000	1.25	101.49	102.74
000570000	000280000	0.00	22.24	22.24
000570000	000290000	1.87	80.43	82.30
000570000	000320000	2.00	92.66	94.66
000570000	000320001	2.00	21.49	23.49
000570000	000320002	0.00	6.91	6.91
000570000	000380000	2.00	58.75	60.75
000570000	000400000	1.00	60.00	61.00
000570000	000410000	0.00	5.21	5.21
000570000	000410001	0.00	6.73	6.73
000570000	000450000	0.00	10.30	10.30
000570000	000470000	0.00	115.10	115.10
000570000	000470001	0.50	7.65	8.15
000570000	000520000	0.00	12.73	12.73
000570000	000530000	0.00	8.82	8.82
000570000	000540000	0.00	11.78	11.78
000570000	000550001	0.00	12.30	12.30
000570000	000560000	0.00	10.36	10.36
000580000	000010000	0.00	21.50	21.50
000580000	000040000	0.00	7.00	7.00
000580000	000050001	1.00	7.01	8.01
000580000	000050002	0.80	5.40	6.20
000590000	000110000	0.00	22.42	22.42
000590000	000150000	0.00	2.50	2.50
000590000	000170000	0.00	21.58	21.58
000590000	000170001	0.00	0.34	0.34
000590000	000180000	0.00	33.70	33.70
000590000	000190000	2.34	4.00	6.34
000590000	000200000	0.00	10.30	10.30
000590000	000240000	1.50	7.70	9.20
000590000	000330000	0.00	10.36	10.36
000590000	000340000	1.00	34.51	35.51
000590000	000340002	1.00	57.88	58.88
000590000	000410000	1.00	2.16	3.16
000590000	000420000	0.00	2.88	2.88
000590000	000540000	3.00	13.50	16.50
000590000	000550000	0.00	4.50	4.50
000590000	000640000	4.20	5.86	10.06
000600000	000010000	0.00	5.33	5.33
000600000	000040000	0.00	2.10	2.10
000600000	000110000	1.56	5.00	6.56
000600000	000110001	1.09	5.00	6.09
000600000	000110003	1.00	4.00	5.00
000600000	000110004	0.00	5.00	5.00
000610000	000070000	1.33	18.00	19.33
000610000	000080000	1.50	39.59	41.09
000610000	000120000	0.00	1.79	1.79
000610000	000200000	1.00	26.84	27.84
000610000	000210000	0.00	12.10	12.10
000610000	000340000	1.00	8.83	9.83

Block	Lot	A Acres*	B Acres	Total Acres
000610000	000360000	1.00	15.89	16.89
000610000	000400000	0.00	21.70	21.70
000610000	000400001	2.01	3.00	5.01
000610000	000400002	1.00	9.73	10.73
000610000	000400003	1.00	20.37	21.37
000610000	000420000	0.94	2.76	3.70
000610000	000420001	0.50	1.74	2.24
000610001	000250000	0.00	7.08	7.08
000640000	000070000	2.00	4.67	6.67
000640000	000070001	0.00	1.51	1.51
000640000	000070002	0.00	1.50	1.50
000640000	000070003	1.50	4.53	6.03
000650000	000020000	0.00	6.04	6.04
000650000	000020004	1.25	6.55	7.80
000650000	000020005	0.00	5.25	5.25
000650000	000020006	0.00	6.54	6.54
000650000	000020007	0.00	5.54	5.54
000650000	000060000	1.00	13.26	14.26
000650000	000060001	0.00	6.17	7.17
000650000	000140000	3.00	37.53	40.53
000650000	000150000	0.00	5.00	15.18
000650000	000200001	4.00	17.72	21.72
000650000	000200002	1.00	5.85	6.85
000650000	000200003	1.00	50.57	51.57
000650000	000200004	0.00	6.28	6.28
000650000	000210000	0.00	5.53	5.53
000660000	000020000	1.00	12.40	13.40
000660000	000020004	0.00	5.03	5.03
000660000	000020005	0.00	5.03	5.03
000660000	000020006	0.00	5.36	5.36
000660000	000020007	0.00	5.38	5.38
000660000	000020008	0.00	17.49	17.49
000660000	000030000	0.00	8.16	8.16
000660000	000030003	1.00	15.61	16.61
000660000	000030004	1.00	8.22	9.22
000660000	000030006	0.00	6.51	7.51
000660000	000030007	2.40	26.69	29.09
000660000	000030008	2.00	44.21	46.21
000660000	000120007	0.00	5.23	5.23
000660000	000120008	1.00	4.30	5.30
000660000	000140000	1.00	15.20	16.20
000660000	000140003	1.00	15.20	16.20
000660000	000160000	4.70	71.74	76.44
000660000	000160001	5.00	13.00	18.00
000660000	000160002	1.60	3.50	5.10
000660000	000160003	1.00	4.04	5.04
000660000	000170000	0.76	5.00	5.76
000660000	000170001	3.26	5.00	8.26
000660000	000170003	0.00	9.80	9.80
000660000	000170004	1.37	6.00	7.37

Block	Lot	A Acres*	B Acres	Total Acres
000660000	000180000	1.00	10.74	11.74
000660000	000180001	0.00	5.44	5.44
000660000	000180002	0.00	5.22	5.22
000660000	000180003	0.00	6.10	6.10
000680000	000010000	0.00	37.02	37.02
000690000	000010000	1.00	6.59	7.59
000690000	000010006	0.00	30.89	30.89
000690000	000020002	0.93	5.15	6.08
000690000	000020004	1.71	5.00	6.71
000690000	000030000	5.00	90.52	95.52
000690000	000030001	0.00	5.28	5.28
000690000	000030002	0.00	6.25	6.25
000690000	000290000	0.00	46.60	46.60
000690000	000390000	0.00	3.69	3.69
000690000	000490000	1.00	41.60	42.60
000700000	000300000	2.30	5.00	7.30
000770000	000090002	1.00	5.00	6.00
		325.35	**8,589.06**	**9,233.33**

* Denotes portion of property containing a residence.

Table 3
Agricultural Production Units

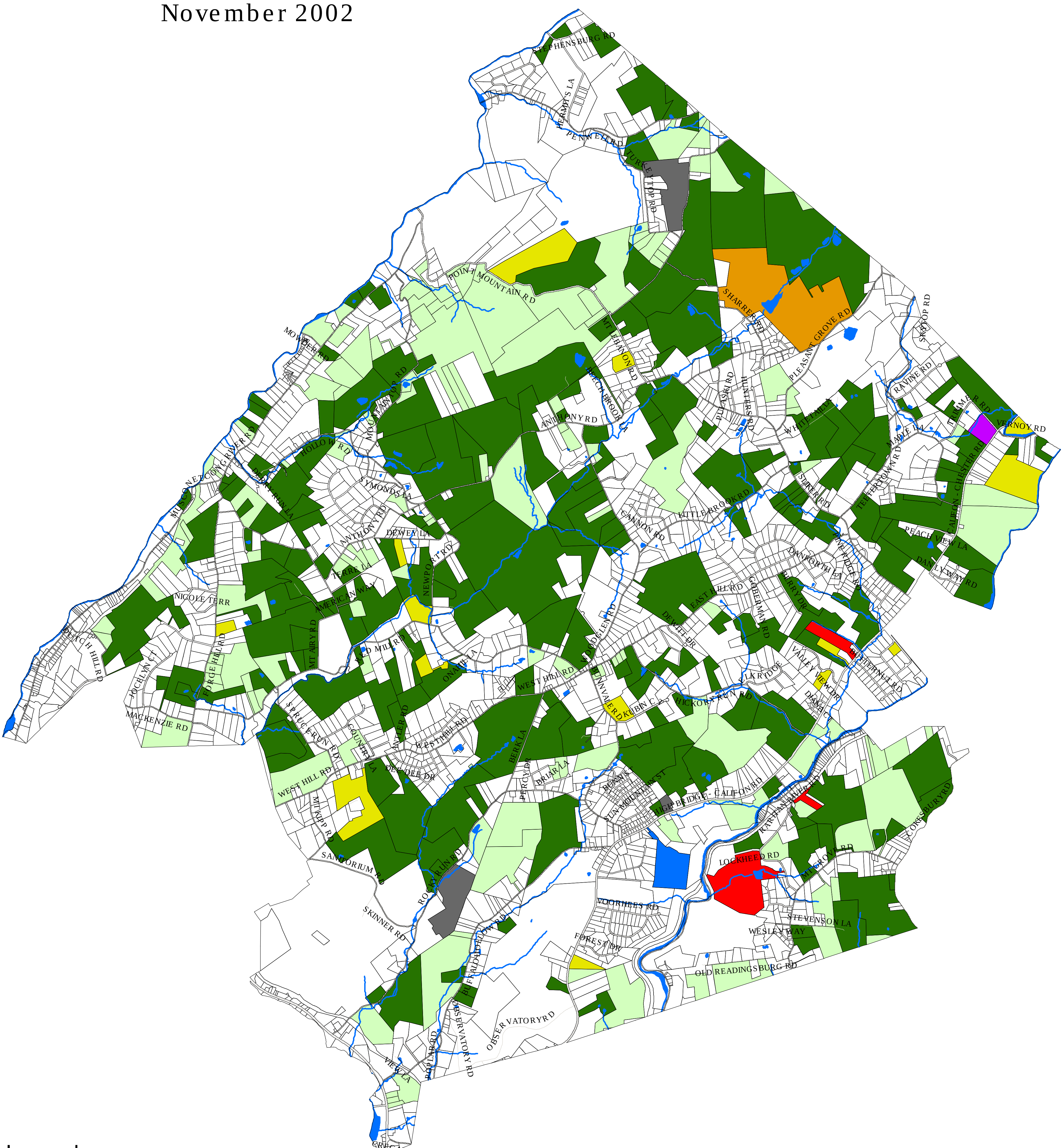
Crop	**1987**	**1997**	***Change***	***% Change***
Cropland Harvested	2,854	2,946	92	3.22
Cropland Pastured	449	356	-93	-20.71
Permanent Pasture	1,720	1,402	-318	-18.49
Unattached Woodland	886	3,105	2,219	250.45
Attached Woodland	2,828	1,543	-1,285	-45.44
Total Ag Use	8,735	9,423	688	7.88
Farmhouse	242	249	7	2.89
Other Non-Ag Land	471	84	-387	-82.17
Total Non Ag land	713	333	-380	-53.30
Total Acres All Land	9,450	9,756	306	3.24
Barley Grain	65	0	-65	-100.00
Corn Grain	514	415	-99	-19.26
Corn Silage	157	156	-1	-0.64
Alfalfa Hay	465	242	-223	-47.96
Other Hay	1,230	1,229	-1	-0.08
Oats Grain	57	0	-57	-100.00
Rye Grain	0	40	40	
Sorghum	3	28	25	833.33
Soybeans	24	40	16	66.67
Wheat	138	90	-48	-34.78
Other Crop Fields	44	5	-39	-88.64
Rye Cover	4	14	10	250.00
Other Cover	2	0	-2	-100.00
Apple Acres	56	52	-4	-7.14
Blueberry	1	1	0	0.00
Grape Acres	5	1	-4	-80.00
Peach Acres	55	58	3	5.45
Strawberry	1	0	-1	-100.00
Other Fruit	30	7	-23	-76.67
Bedding Plants	0	1	1	
Cut Flowers	10	0	-10	-100.00
Trees and Shrubs	14	34	20	142.86
Christmas Trees	95	157	62	65.26
Total Nursery	119	192	73	61.34
Beef Cattle	562	637	75	13.35
Mature Diary	219	106	-113	-51.60

Crop	**1987**	**1997**	***Change***	***% Change***
Young Dairy	207	235	28	13.53
Equine	187	194	7	3.74
Sheep	412	265	-147	-35.68
Swine	53	15	-38	-71.70
BeeHives	42	32	-10	-23.81
Ducks	106	35	-71	-66.98
Fur Animals	3	17	14	466.67
Goats	11	63	52	472.73
Meat Chickens	1,398	174	-1,224	-87.55
Egg Chickens	865	750	-115	-13.29
Turkeys	157	6	-151	-96.18
Other Livestock	11	17	6	54.55
Snap Beans	0	1	1	
Sweet Corn	1	1	0	0.00
Cucumbers	0	1	1	
Eggplants	0	1	1	
White Potato	1	1	0	0.00
Pumpkins	0	11	11	
Squash	0	2	2	
Tomatoes	1	1	0	0.00
Melons	0	1	1	
Mixed Vegetables	1	0	-1	-100.00
Other Vegetables	4	8	4	100.00
Pond Fish	8	3	-5	-62.50
Fuel Wood (cords)	871	600	-271	-31.11
Pulpwood (cords)	5	20	15	300.00
Timber (Bd. Ft.)	90,768	260,326	169,558	186.80
State Woodland	131	0	-131	-100.00
Private Woodland	768	0	-768	-100.00
Government Program	230	190	-40	-17.39

Farmland Assessed Parcels

Figure 1

Township of Lebanon
Hunterdon County, New Jersey
November 2002



Legend

- Streams and Rivers
- Vacant, Portion Farm Assessed
- Residential, Portion Farm Assessed
- Charitable, Portion Farm Assessed
- Government, Portion Farm Assessed
- Commercial, Portion Farm Assessed
- Industrial, Portion Farm Assessed
- Farm Regular, Farm Qualified
- Farm Qualified

0 0.5 1 2 Miles

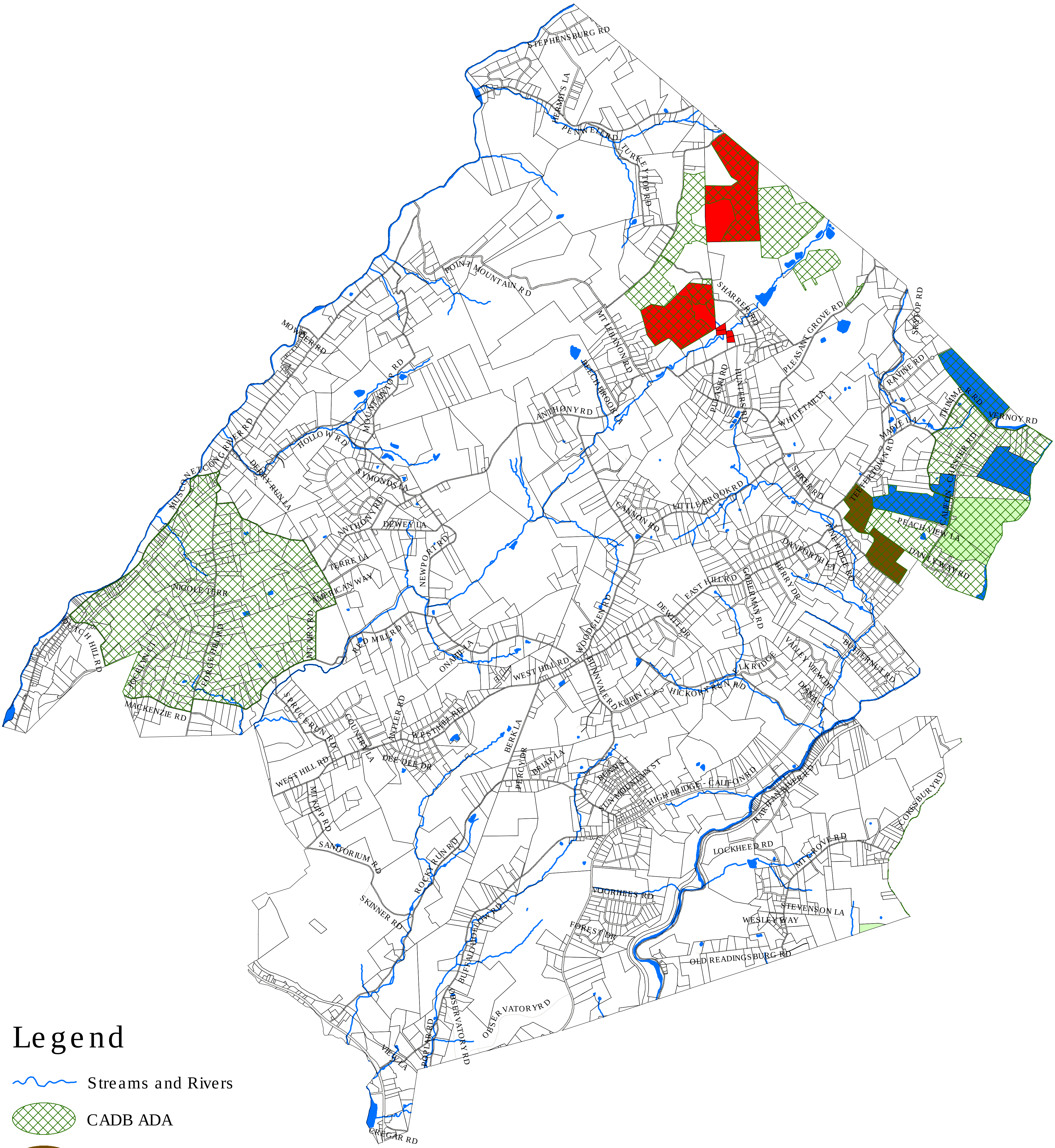
Data Sources:
Hunterdon County Division of GIS
Hunterdon County Planning Board

BANISCH
Associates, Inc.
Planning/Design
PO Box 154, Sergeantsville, New Jersey 08857
(908)782-0835/7636 fax banisch@earthlink.net

Preserved Farms and Preservation Applications

Figure 2

Township of Lebanon
Hunterdon County, New Jersey
November 2002



Legend

- Streams and Rivers
- CADB ADA
- Preserved Farm
- Farmland Preservation Application
- Municipally Approved Farmland Preservation Program
- PIG Applicants

0 0.5 1 2 Miles

Data Sources:
Hunterdon County Division of GIS
Hunterdon County Planning Board

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Planning/Design
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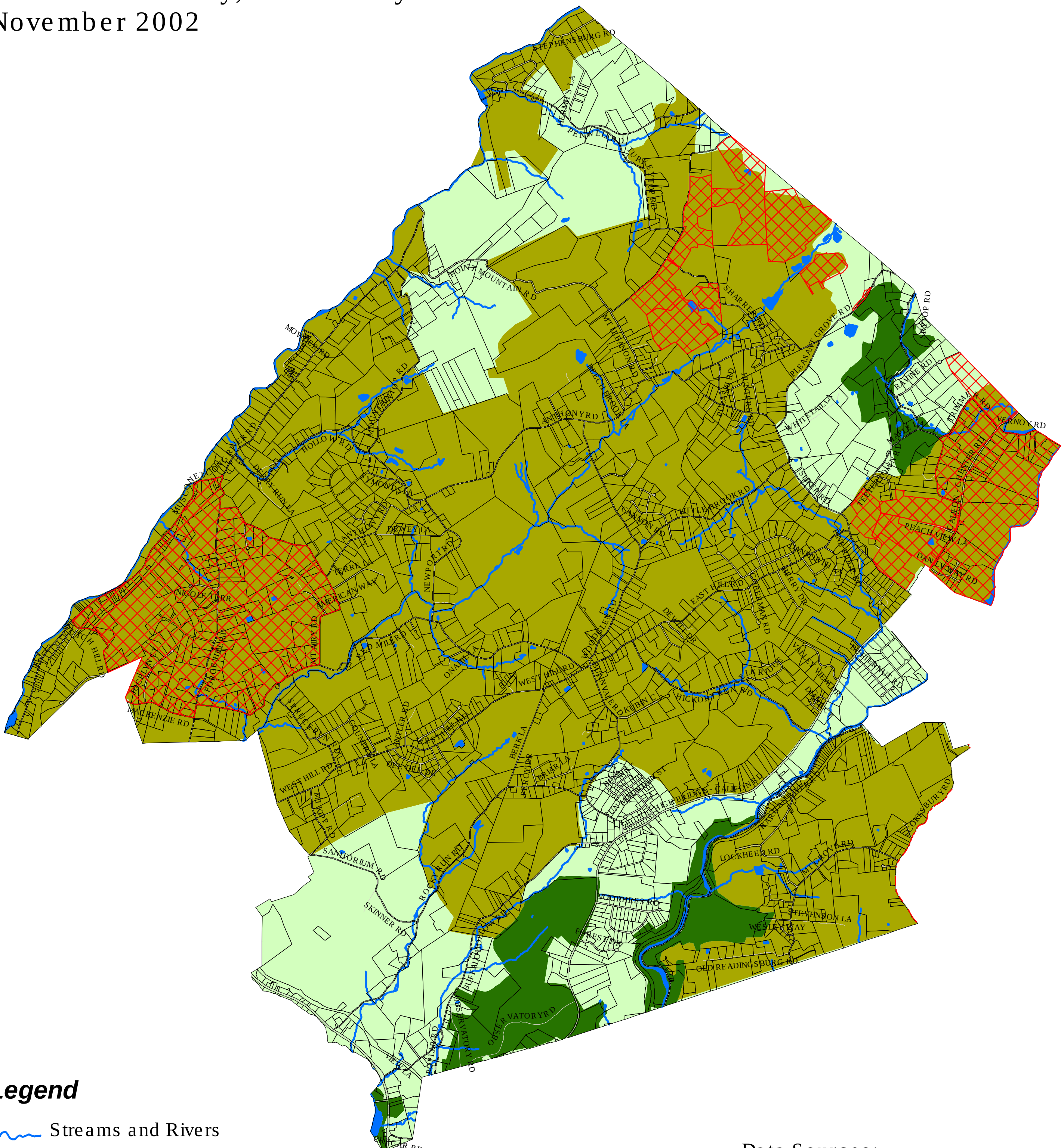
State Plan Policy Map

Figure 3

Township of Lebanon
Hunterdon County, New Jersey
November 2002



Legend

Streams and Rivers
Hunterdon CADB ADA
PA-4B
PA-5
Park
Water

Miles
0 0.5 1

Data Sources:
Hunterdon County Division of GIS
Hunterdon CADB
NJOSP

BANISCH
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Planning/Design
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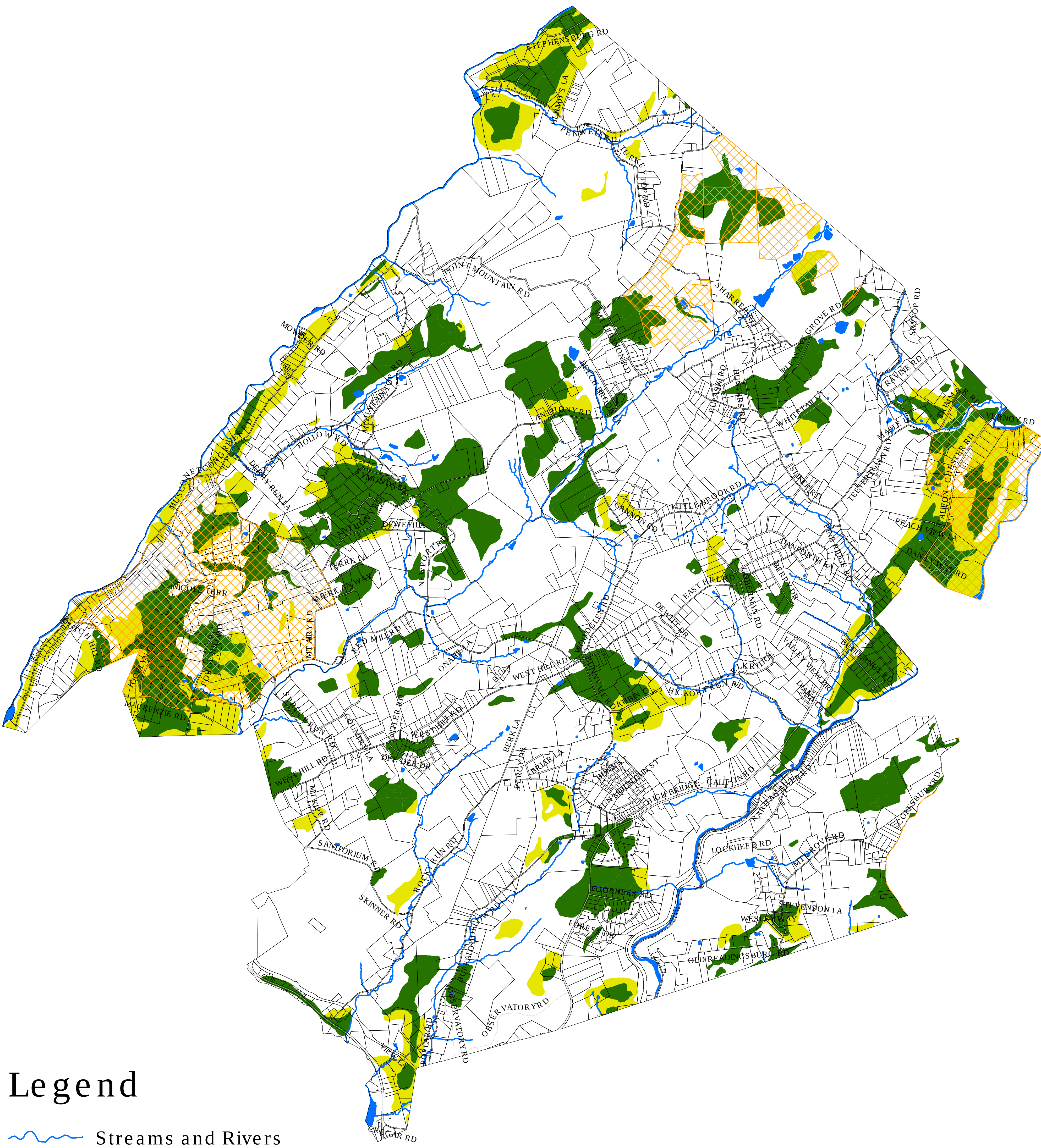
Figure 4

Prime and Statewide Important Soils and CADB ADA's

Township of Lebanon
Hunterdon County, New Jersey
September 2002



Legend

Streams and Rivers

CADB ADA

Prime Soil

Statewide Important Soil

0 0.5 1 2 Miles

Data Sources:
Hunterdon County Division of GIS
Hunterdon County Planning Board

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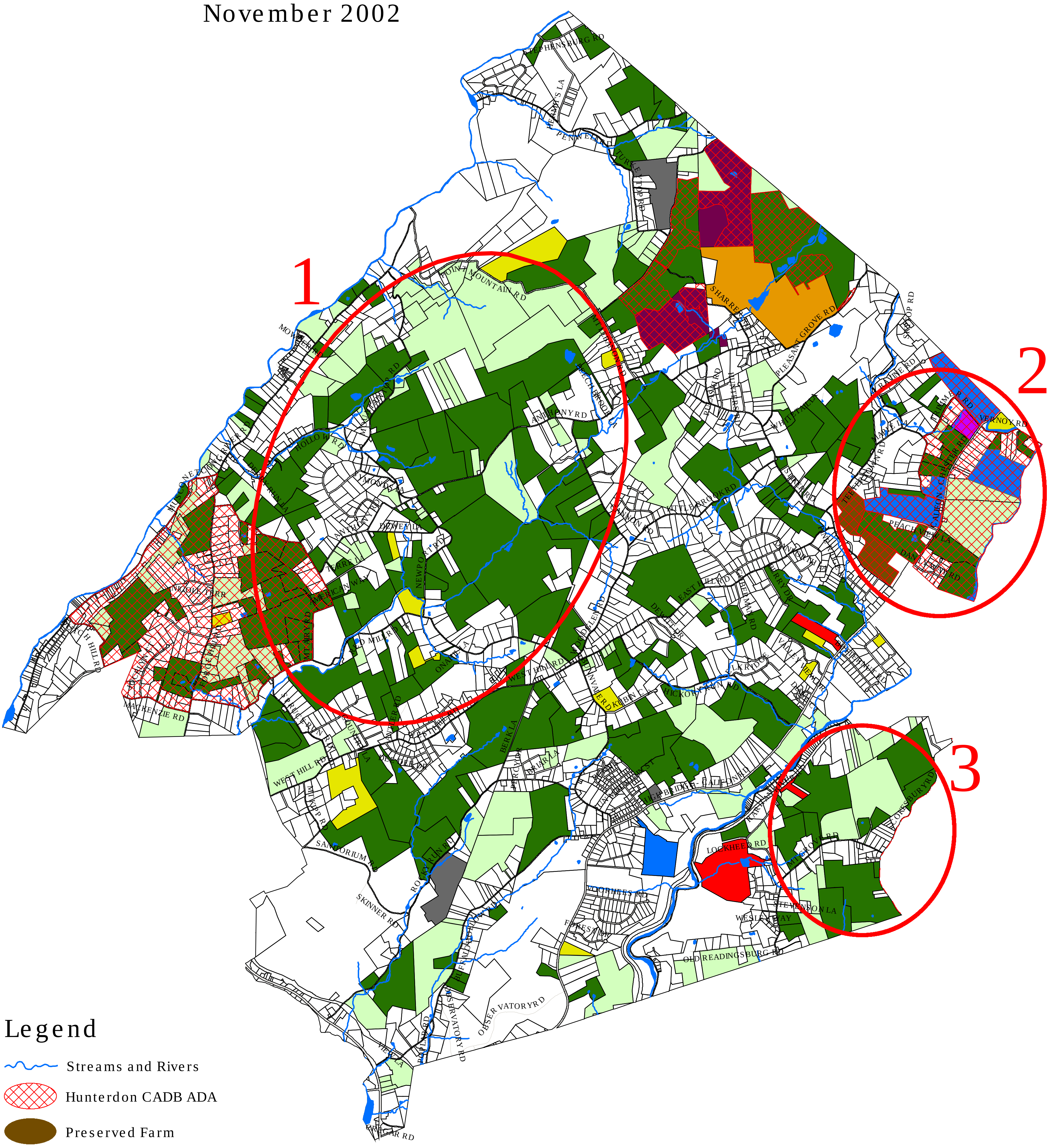
Farmland Preservation Focus Areas

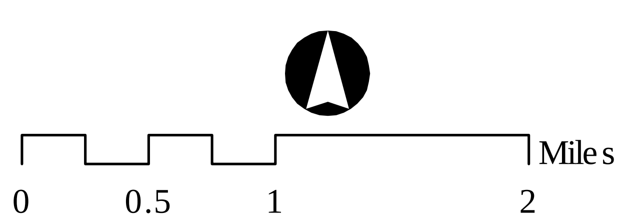
Figure 5

Township of Lebanon
Hunterdon County, New Jersey
November 2002



Legend

- Streams and Rivers
- Hunterdon CADB ADA
- Preserved Farm
- PIG Applicants
- Farmland Preservation Application
- Vacant, Portion Farm Assessed
- Residential, Portion Farm Assessed
- Charitable, Portion Farm Assessed
- Government, Portion Farm Assessed
- Commercial, Portion Farm Assessed
- Industrial, Portion Farm Assessed
- Farm Regular, Farm Qualified
- Farm Qualified



Data Sources:
Hunterdon County Division of GIS
Hunterdon County Planning Board

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Focus Area 1

Township of Lebanon
Hunterdon County, New Jersey
November 2002

Figure 6

Legend

Potential ADA Addition

Hunterdon CADB ADA

0 0.5 1 Miles

Data Sources:
Hunterdon County Division of GIS
Hunterdon CADB

BANISCH
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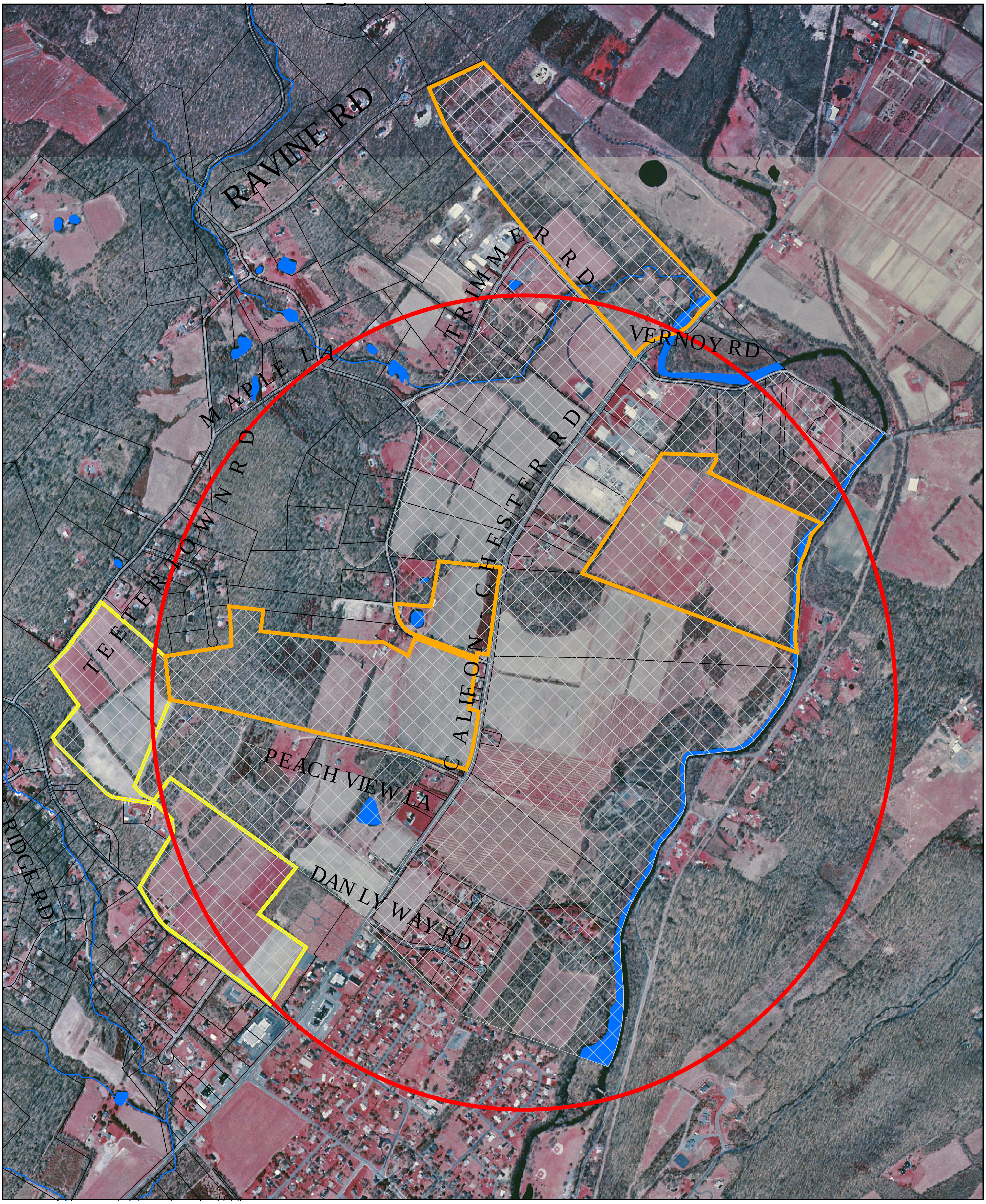
Focus Area 2

Figure 7

Township of Lebanon
Hunterdon County, New Jersey
November 2002



Legend

Hunterdon CADB ADA
Preserved Farm
PIG Applicants

0 0.25 0.5 Miles

Data Sources:
Hunterdon County Division of GIS
Hunterdon CADB

BANISCH
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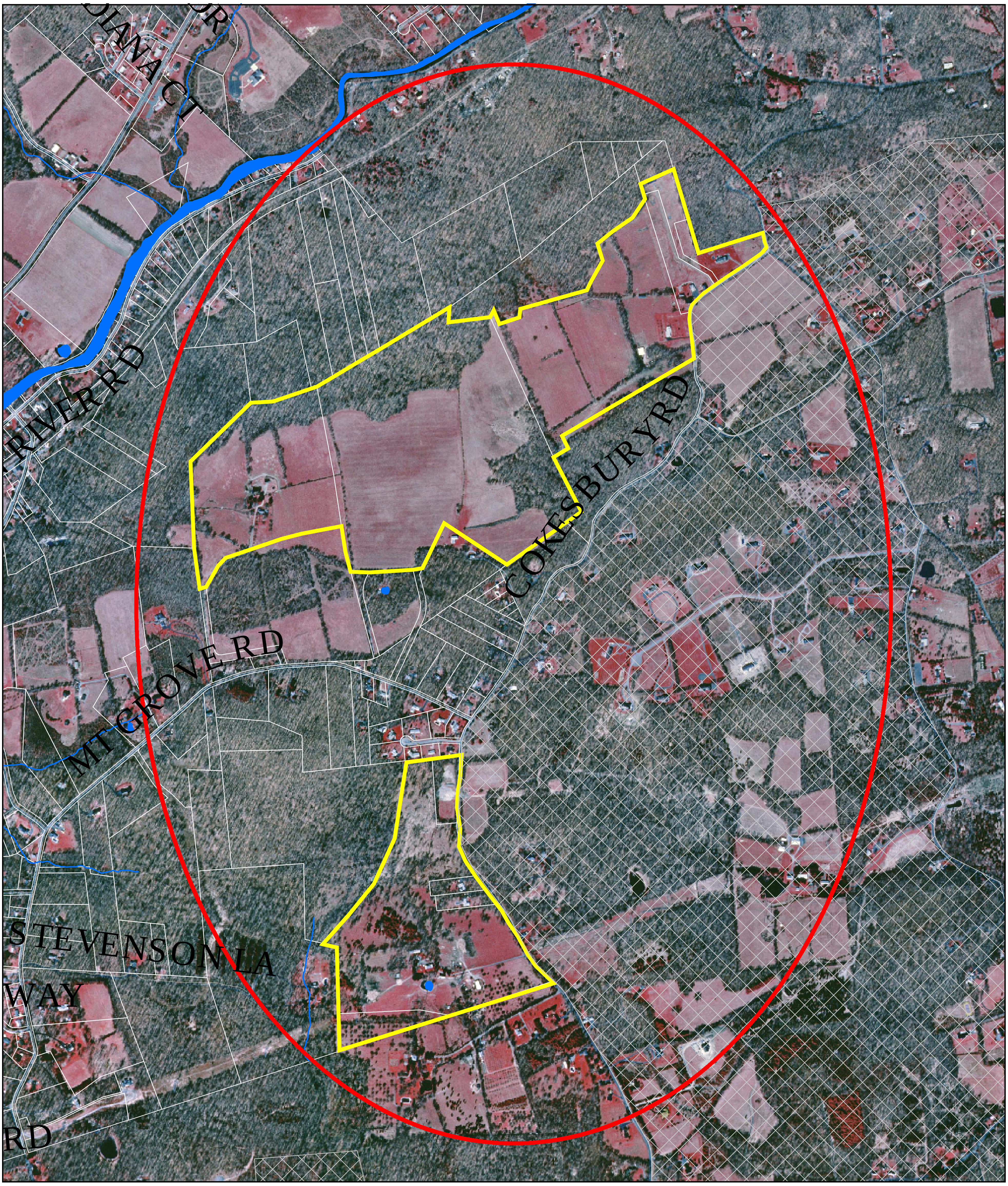
Focus Area 3

Figure 8

Township of Lebanon
Hunterdon County, New Jersey
November 2002



Legend

Potential ADA Addition

CADB ADA

Feet

0 500 1,000 2,000

Data Sources:
Hunterdon County Division of GIS
Hunterdon CADB

BANISCH
Associates, Inc.
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2002 Open Space and Recreation Plan Element

Open Space and Recreation Plan

Township of Lebanon

Hunterdon County, New Jersey

November 2002

Prepared by:

The Lebanon Township Planning Board

In Consultation with:

The Lebanon Township Environmental Commission

With the Assistance of:

Banisch Associates, Inc.

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banisch@earthlink.net

The original of this document has been signed and sealed in accordance with the law.

Table of Contents

List of Figures Located in the Appendix

Executive Summary

Lebanon Township is a myriad of landscapes, from rolling farmland to steep ravines. Its composition is varied and rich, representing some of the most sensitive environmental resources in Hunterdon County. Protection of these resources for future generations and wise management of inevitable growth has been the focus of a two year planning process that the Township has undertaken, culminating in the recent adoption of a new Master Plan.

One area not addressed in the 2001 Master Plan was the Recreation and Open Space Plan Element, although it was recommended in the 2000 Reexamination Report as part of a multi-phased planning project. This document seeks to expand on the recreation and open space goals of the Township, articulating a vision for both and determining how the Township can meet, and continue to meet in the future, the active and passive recreation needs of Township residents.

This Open Space and Recreation Plan places an emphasis on determining active recreation needs and allocation of funding for the construction of additional active recreation facilities to fill those needs. Facing a deficit of fields, recreation programs will likely be forced to turn participants away within the next two years. To date, the Township has allocated no money to the construction of planned facilities for Lebanon Township Memorial Park. Construction has been based on funding raised by community and civic groups.

In addition to completing the facilities currently planned for Lebanon Township Memorial Park, the Township must seek to construct additional athletic fields to meet the immediate recreation needs of residents. The most logical course of action is to utilize land that the Township already owns, limiting capital expense to construction costs and focusing the use of public expenditures. The Township may also need to seek additional land for athletic fields within the next three years, even with the construction of planned facilities at Lebanon Township Memorial Park and the immediate construction of additional fields elsewhere.

Lebanon Township has set a priority for acquisition with a focus on passive recreation sites. This type of recreation is most compatible with the protection of the resources present in the Township and dovetails neatly with both County and State open space preservation efforts in this region. Priority areas that the Township has identified also complement ongoing initiatives at the State level and will provide valuable partnering opportunities in the future. The Township is awaiting final approval of authorized funding under a State Green Acres Planning Incentive Grant, which will allow for acquisition of parcels for passive recreation.

Existing and potential partnerships with landowners and other government agencies is the best means for the Township to achieve its goals with respect to open space preservation. The Township will seek to advance a stewardship program in conjunction with its efforts to solicit landowner participation in the ongoing Green Acres grant funding that is authorized to the Township.

The Township has utilized an open planning process to ascertain the recreation needs of the community. Recreation providers in Lebanon were consulted to determine the current and potential future needs of programs currently underway. The Planning Board, Environmental Commission, Open Space Advisory Board and Township Committee each had representatives that aided in the creation of this plan, which included the determination of acquisition priorities. These acquisition priorities meet the general goals and objectives of these boards and committees as a whole.

The Township will hold two public hearings on this master plan element, at which input will be sought from the public. These public hearings will present the findings of the Open Space and Recreation Plan, which were already presented in draft to the Planning Board at a public meeting in May. The minutes from these public hearings, one with the Planning Board and one with the Township Committee, will be attached as an addendum to the Appendix of this plan.

The Planning Board must adopt the Open Space and Recreation Plan (OSRP) as an element of the Master Plan. The Township Committee must adopt the action plan, setting forth the intent to carry out spending consistent with the OSRP. Once adopted by both bodies, the OSRP will allow the Township to utilize funding from the Planning Incentive Grant (PIG) application that has been filed with the New Jersey Department of Environmental Protection Green Acres Program.

Funding from the PIG will allow the Township to meet its passive recreation needs within the next two years. The deficit of active recreation needs may require the allocation of public resources, as most funding available for active recreation facilities in the past at the State level has all but disappeared.

Goals and Policies

The Township of Lebanon, through the statement of goals and policies, is articulating its vision of open space and recreation. It is these goals and policies that will guide the development of an open space system, recreation programs and facilities and the provision of opportunities for residents to participate in outdoor recreation, both active and passive. These goals and policies should not be seen as the only defining framework for the Township's open space and recreation programs. Needs change and therefore perspective must remain fluid. A sudden influx of development or the arrival of needs not previously identified demands that the structure of the overall program remain unrestrained. The goals and policies listed below, however, can be viewed as the general guiding principles upon which this plan is founded.

- To promote the provision of appropriate and balanced public open space and recreational facilities through public action and the development review process.
- To establish and enhance recreational lands and public open space.
- To establish linkages of public spaces through the use of greenways, greenbelts, waterways, paths and bikeways.
- To promote threatened and endangered species habitat protection through the acquisition of passive recreation resources.
- To establish as the highest priority for public acquisition, areas of unique recreational, scenic or environmental value.
- To support and partner with State and County open space programs and ongoing acquisitions for their value to the goals of the community.
- To promote cultural activities which provide recreational opportunities for a broad spectrum of residents.
- To assess and provide opportunities for active and passive recreation to meet the needs of all Township citizens.
- To devise appropriate strategies for the public and private ownership and maintenance of open space and recreation lands.

- To establish, promote and support active recreation opportunities for the children of Lebanon Township.
- To encourage the continuation and expansion of non-profit camps for their valuable contribution to the recreation and open space resources of the Township.
- To maintain rural character through the acquisition of open space.
- To protect groundwater resources, including supply and quality, through acquisition of open space, to meet the demands of the Township and as a resource to the region.

Inventory

Although Lebanon Township itself does not own a vast inventory of recreation and open space lands, the Township contains a variety of recreational opportunities within its borders (Figure 4). A majority of these opportunities are State and County Parks geared primarily towards passive recreation activities. These facilities include Voorhees State Park, the Ken Lockwood Gorge Wildlife Management Area, the Point Mountain Section of the Musconetcong River Reservation, the Columbia Trail Section of the South Branch Reservation and the Teetertown Nature Preserve/Mountain Farm. Together, these facilities comprise 2,030 acres or 10.3% of the Township's total parcel acreage. These properties represent almost 90% of the recreation land available to Township residents.

Table 1 lists all of the recreation facilities and open space within Lebanon Township, including municipal, county, state, non-profit, private and Board of Education lands. Many of the state and county parks are comprised of more than one parcel, but are combined in this table for convenience. A detailed block and lot listing of the individual properties for each park is located in the appendix. Each facility and its amenities are described in detail after this table.

Table 1- Open Space System

Facility Name	Facility Type	Acreage
Valley View School	School	26.53
Woodglen School	School	19.76
Voorhees High School	School	55.49
Lebanon Township Municipal Building	Municipal Facilities	5.28
Cold Brook Preserve	Municipal Parks and Open Space	2.67
Mt. Grove Preserve	Municipal Parks and Open Space	3.04
Lebanon Township Memorial Park	Municipal Parks and Open Space	19.66
Route 31	Municipal Parks and Open Space	1.43
Rich	Municipal Parks and Open Space	17.22
Columbia Trail-South Branch Reservation	County Parks and Open Space	54.91
Point Mountain Section-Musconetcong River Reservation	County Parks and Open Space	682.10
Teetertown Nature Preserve/Mountain Farm	County Parks and Open Space	307.76
Union Furnace Nature Preserve	County Parks and Open Space	0.79
Ken Lockwood Gorge WMA	State Parks and Open Space	357.10
Musconetcong River WMA	State Parks and Open Space	67.76
Spruce Run Recreation Area	State Parks and Open Space	29.51
Voorhees State Park	State Parks and Open Space	575.11
Teetertown Nature Preserve	State Parks and Open Space	32.28
Total		**2,258.40**

Valley View School – Lebanon Township Board of Education

Valley View School is located on Califon-High Bridge Road (County Route 513) on the eastern edge of the Township bordering Califon. It is one of two elementary schools for Township children.

Valley View school has limited active recreation amenities associated with it, including a tot lot, two half basketball courts and two little league/softball fields which double as junior field hockey fields in the fall. These facilities are used for school children, but are also available to the LTAA during non-school hours during the week and on weekends.

Woodglen School – Lebanon Township Board of Education

Woodglen School is the other elementary school located in the Township and is situated on Bunnvale Road (County Route 628) across from Lebanon Township Memorial Park. It has limited active recreation resources that are available to school children during the day and to other residents and the LTAA at other times. The facilities at the Woodglen School include three little league/softball fields, a baseball field, two and a half basketball courts and a tot lot.

Voorhees High School – North Hunterdon Regional High School Board of Education

Voorhees High School is one of two regional high schools serving northern Hunterdon County. It is located on Califon-High Bridge Road (County Route 513) across from Voorhees State Park. Voorhees High School not only serves as an educational facility, but as an important link between Voorhees State Park on one side of Califon-High Bridge Road and Ken Lockwood Gorge Wildlife Management Area and the Columbia Trail on the other (see Figure 4).

Voorhees High School also has a number of active recreation facilities available to North Hunterdon students and the public, including Lebanon Township residents. These facilities consist of a football field, a track, one baseball field, one softball field, a practice field for baseball or softball, a lacrosse/soccer field, a general practice field, four tennis courts and a basketball court.

Lebanon Township Municipal Building – Township of Lebanon

The Lebanon Township Municipal Building, located on Bunnvale Road, is home to the Lebanon Township Police Department and the municipal government including the tax assessor, the planning board, the municipal clerk and other offices. Aside from a skating pond at the rear of the property, there are no recreational facilities on the municipal building lot at this time. It is, however, immediately adjacent to Lebanon Township Memorial Park with direct access to the park at the rear of the building.

Hollow Brook Preserve – Township of Lebanon

The Township owns three properties along Hollow Brook Road that are surrounded by the Teetertown Nature Preserve. These properties are small slivers totaling less than three acres and for all intent and purposes are part of Teetertown Nature Preserve.

Mt. Grove Preserve – Township of Lebanon

This Township property is located at the intersection of Mt. Grove Road and Deerpath Road. This Township is approximately three acres in size and is currently being held for conservation purposes.

Lebanon Township Memorial Park – Township of Lebanon

Lebanon Township Memorial Park represents the Township's first land purchase focused on filling the need for active recreation facilities. This property was acquired in 1997 and a development plan was subsequently created. The plan includes provisions for a picnic pavilion, soccer, football and baseball fields, volleyball courts, horseshoe pits and bocce ball courts.

To date, the pavilion has been constructed along with the volleyball court, bocce ball courts and parking facilities. As funding is available, the Township will continue to develop this active recreation park according to the comprehensive plan.

Route 31 – Township of Lebanon

This property is less than 1.5 acres and is located along Route 31 in the southern portion of the Township. Although it is adjacent to Hagedorn, the railroad line separates them and removes any real beneficial use of the property.

Rich – Township of Lebanon

The Rich tract is adjacent to Lebanon Township Memorial Park and across the street from Woodglen School on Bunnvale Road. This tract remains undeveloped at this time, but is uniquely suited for construction of playing fields.

Columbia Trail South Branch Reservation – County of Hunterdon

The South Branch Reservation is one of the most significant greenways in Hunterdon County, stretching almost continuously from the border of Morris County to the border of Somerset County, running along the South Branch of the Raritan River. While interrupted in places, it encompasses parts of the floodplain of the South Branch and provides a regional greenway and recreation resource.

In Lebanon Township, the Columbia Trail section is a corridor approximately 150 feet wide and 2.8 miles long running along the South Branch from the border of Califon Borough to the Lebanon Township border with High Bridge. In its northern third in the Township, the Columbia Trail is separated from the South Branch by residential lots. The southern two thirds, however, runs almost immediately adjacent to the river and is surrounded by the Ken Lockwood Gorge Wildlife Management Area.

The County permits a number of activities on the Columbia Trail Section of the South Branch Reservation, including mountain biking, cross country skiing, hiking, nature study, and picnicking. There is parking available at various points along the Columbia Trail as well as many scenic overlook opportunities.

Point Mountain Section Musconetcong River Reservation – County of Hunterdon

The Point Mountain Section of the Musconetcong River Reservation is located in the northwestern corner of the Township along the Musconetcong River. While parts of the reservation front on the river, a majority of the land holdings here stretch up to a mile from the Musconetcong. Including State owned properties in the Reservation, there are approximately 724 acres of passive recreation land available to the public.

The County permits a number of activities at Point Mountain, including mountain biking, horseback riding, canoeing, cross country skiing, fishing, hunting (by permit), nature study and picnicking. There are a number of picnic sites, an information board and a number of scenic overlook opportunities.

Teetertown Nature Preserve/Mountain Farm – County of Hunterdon

Teetertown Nature Preserve/Mountain Farm is located in the northeastern part of Lebanon Township on Pleasant Grove and Hollow Brook Roads. Including property owned by the Trust for Public Land, there is approximately 342 acres dedicated to both passive and active recreation activities.

Teetertown Nature Preserve has the most unique scenery in the Township. The ravine creates a haven isolated from the outside world, where the sound of running water drowns out all other ambient noise. The water races down adjacent to the Hollow Brook Road, where you can park your car and sit and listen to the babbling brook, hearing little else as you are surrounded on all sides by steep hillsides and massive boulders.

There are an abundance of activities one can take part in at Teetertown Nature Preserve/Mountain Farm, including softball, mountain biking, hiking, horseback riding, cross country skiing, fishing, hunting (by permit), nature study and camping. Teetertown Preserve has an information board, restrooms, scenic overlook opportunities and parking facilities available.

Union Furnace Nature Preserve – County of Hunterdon

Only a small portion of the Union Furnace Nature preserve is actually in Lebanon Township. This county park facility was the former home of the Union Furnace, a burgeoning industry of the late 1800's which met its final fate with the construction of Spruce Run Reservoir in the 1950's.

The preserve is a 95 acre property that adjoins the Spruce Run Reservoir and presents numerous passive recreation opportunities including fishing, hiking, hunting and nature study. The preserve is home to many forms of wildlife including shore birds.

Ken Lockwood Gorge WMA - State of New Jersey

Ken Lockwood Gorge Wildlife Management Area (WMA) is a mass of properties owned by the State of New Jersey. These properties are situated along the South Branch of the Raritan River and present recreation opportunities for both Township and State residents.

The primary focus of WMA's is passive recreation, with certain activities permitted. For Ken Lockwood Gorge, these include fishing, deer hunting, small game hunting, hiking and bird watching.

Musconetcong River WMA - State of New Jersey

The Musconetcong River Wildlife Management Area is comprised of a number of properties owned by the State of New Jersey situated along the Musconetcong River. The State owned properties are, in some places, contiguous to the County owned Point Mountain Section of the Musconetcong River. The State's primary focus with these properties, some positioned further downstream along the Musconetcong, is to provide riparian access for fishing and boating. Other permitted activities include deer hunting, small game hunting and bird watching.

Spruce Run Reservoir Recreation Area – State of New Jersey

Spruce Run Reservoir Recreation Area is a State owned water supply facility that doubles as an active and passive recreation opportunity for Township and State residents. Altogether, Spruce Run totals approximately 1,910 acres, with a small portion of that located in Lebanon Township.

Spruce Run Reservoir provides a number of recreational activities, including boating, camping, picnicking, canoeing, fishing, hiking, waterfowl hunting, swimming and bird watching.

Voorhees State Park – State of New Jersey

Voorhees State Park is located on County Route 513 across from Voorhees High School, stretching south into High Bridge Borough. It is approximately 632 acres and provides a range of activities including camping, picnicking, hiking, deer hunting, small game hunting, turkey hunting, cross country skiing and bird watching. The park also contains one little league/softball field and a lacrosse field, both of which are utilized exclusively by Voorhees High School.

Teetertown Nature Preserve – State of New Jersey

Teetertown Nature Preserve is located in the northern part of Lebanon Township and is managed by the Natural Lands Trust, a division of the New Jersey Department of Environmental Protection. Teetertown Nature Preserve is located in the vicinity of the County owned Teetertown Nature Preserve/Mountain Farm. Natural Lands Trust properties are generally held for conservation purposes only, with passive recreation activities such as hiking and bird watching permitted. Hunting and other types of "sport" activities are generally prohibited.

Many of the parks and facilities described above contain active recreation amenities that are utilized by Township residents and athletic organizations. These facilities are listed in Table 2. Not listed in Table 2 are some of the facilities located at Voorhees High School and those located at Voorhees State Park. A majority of these facilities are not available to the LTAA and other recreation providers and therefore cannot be considered when assessing need. Those facilities that are generally available to the public, such as tennis and basketball courts, are listed.

There are currently four athletic organizations that make use of fields within Lebanon, including the Lebanon Township Athletic Association (LTAA), the Lebanon Township Junior Field Hockey Program (LTJFHP), the North Hunterdon Stars (NHS) and the North Hunterdon Little League (NHLL). In addition to the LTAA and the LTJFHP, the Voorhees High School teams utilize facilities both on and off campus.

Table 2- Existing Active Recreation Facilities

Facility Type	Number
Baseball field	2
Softball/Little League field	5
T-ball field	2
Soccer (older children)	1
Soccer (younger children)	5
Field Hockey field	1
Basketball court	4.5
Football field	1
Track	1
Tennis court	4
Tot lot	5
Walking trail	2
Volleyball court	2
Horseshoe pit	3
Play field	1
Pavilion	2

Needs Analysis

There are a number of standards that can be utilized to determine the recreation lands and facilities needed to continue to meet the requirements of the various programs and users in the Township. The first is the Balanced Land Use Concept, endorsed by the New Jersey Department of Environmental Protection (NJDEP). The second is the survey method, where recreation providers, such as athletic associations, are polled on current enrollment and asked to present their outlook on potential future participation levels. The third is application of the standards contained in the National Recreation and Park Association (NRPA) “Park, Recreation, Open Space and Greenway Guidelines”, published in 1996.

The Balanced Land Use Concept, as outlined by the NJDEP, will be discussed and applied to the Township. The primary method utilized by the Township in its planning process, however, was the survey method. This will be the basis for assessing active recreation facility needs. Recreation providers, such as the athletic associations, have a fairly good grasp on the trends and needs that have evolved within their organizations. Looking at current enrollment and applying it to potential future population growth is the best way to ascertain additional facilities that may be required to continue to meet needs in the future. Applying a growth factor to programs will also assure that future demands due to increasing popularity can be met.

Use of national standards, such as those found in the NRPA guidelines, is difficult to employ in Lebanon Township. Applying the “one-size-fits-all approach” is especially difficult, given that the Township is largely rural, coupled with the existing nature of recreation facilities and programs. Generally speaking, the demand for active recreation programs and facilities is somewhat reduced and application of a “facility type/1,000 persons” is not beneficially applied. In addition, the validity of these population based standards has been questioned.

Active Recreation Facility Needs Analysis

The Survey Method and Results

Due to the limited number of organizations that undertake recreation activities in the Township, the survey method utilized to determine current and future trends was loosely structured. The Open Space Advisory Committee members made contact with the four organizations, explained the planning process, and solicited the necessary information. The information pertinent to the planning process included current enrollment, facilities currently utilized, and funding sources. After initial solicitation, follow up phone calls were conducted as necessary in order to gather additional information. A summary of this information is provided below, by organization.

Lebanon Township Athletic Association (LTAA)

The LTAA was founded around 1980 by a group of parents, wishing to provide non-competitive, active recreation opportunities for children. LTAA is the primary organization registering participants and scheduling games for the youth of Lebanon Township, also taking in registrants from Tewksbury and Califon. All money to cover costs (maintenance, insurance and uniforms) comes from registration fees. Currently, the LTAA fields participants for soccer, baseball, tee-ball and girls softball, for children ranging in ages from 5-14. Each program is described below, including an assessment of their potential future needs.

Soccer

The LTAA soccer program currently has approximately 350 children enrolled. They begin using fields around August 18th, with the season ending around October 30th. During this period, fields are utilized 6 days a week, with the option of Sunday as an extra practice day. Currently, the soccer program utilizes fields at the Woodglen School, where they are able to line 5 small fields for younger children and 1 large field for older children.

Given heavy usage throughout the fall, fields are generally in fair to poor condition. Another factor affecting field condition is use of these field areas for other sports such as field hockey, baseball and softball. This means heavy usage at all times of year except for winter and fields have little time to recover. This perpetuates poor field conditions and creates issues of safety and liability.

The soccer program has an immediate need for 3 additional fields, one for each of the three levels of soccer that the LTAA registers participants for. Enrollment has generally remained consistent in all of the LTAA programs, including soccer. Future residential growth is anticipated, however, and enrollment could increase in the next few years. This, along with the need to reduce the constant use of fields, bolsters the need to create additional fields.

Baseball

The LTAA baseball program is for youth in 2nd through 8th grade and currently has about 130 children participating. The baseball season runs from April 15th to June 15th, with fields utilized nearly 6 days a week. The baseball program makes use of fields at Woodglen School as well as Califon Park ballfields, outside of the Township. Additionally, the older boys have formed a traveling team, using the Woodglen School field for home games and practices.

Enrollment has generally remained steady over the last few years. With residential growth on the horizon, it is likely that slight increases will need to be accommodated over the next three to five years. With use of only three fields for practice and games, both the regular and travel teams have a need for an additional field.

Tee-Ball

The LTAA tee-ball program currently has about 90 children enrolled, with a season running from April 15th to June 15th. Tee-ball registers participants from Kindergarten and 1st grade. The tee-ball program makes use of fields at Valley View School and Califon School, the latter field being located outside the Township.

The tee-ball program utilizes fields at least six days a week, most times holding practice and games at Valley View School. Given the availability of only two fields, one of which is in poor condition, there exists a need to provide at least one more field and to undertake maintenance on one of the existing two.

Softball

LTAA also fields participants for the girl's softball program, which currently has about 150 participants ranging from 2nd to 8th grade. The season runs from April 15th to June 15th, with teams using the two softball fields at Woodglen School. The program uses fields 7 days a week, doubling up on practice nights due to a lack of fields.

The current number of fields (two) is inadequate for the current registration of the program. Taking this into consideration, along with potential future growth of the Township, there is a need for three additional fields. This would alleviate the doubling up of practice time and the constant 7 day per week use of the fields, which can contribute to deterioration and create potential liability concerns for participants.

Lebanon Township Junior Field Hockey Program (LTJFHP)

In 1999, a group of parents decided to create the LTJFHP to introduce the sport to their daughters. They set up an instructional league for 2nd through 6th graders, running from early August through mid-October. Currently, the program is funded by a $75 registration fee, which covers the cost of a uniform, insurance, referee fees and miscellaneous items such as mailings, field lining and participation awards. Coaches and coordinators volunteer their time to the Program.

During the first year of the program, approximately eight girls registered and made one team. During the second and third years of the program (2000 and 2001), there were 32 and 36 girls registered for a total of four teams. Word of mouth has been the primary means of promoting the program, with anticipation of 40 to 48 players for the 2002 season, requiring the need for 5 to 6 teams.

The LTJFHP currently lines two fields at Valley View School for use during practice and home games. Fields are 25 yards wide by 50 yards long and are placed end to end with 10 yards of separation between them. Practices are held two to three evenings a week, with games added in September. As the number of games increases, the number of practices is reduced. The program transitions into two games per week, with one on a weeknight and the other on a Sunday afternoon. There are a total of ten games played during the season.

Given the projected enrollment for the 2002 season, the program is in need of two additional junior field hockey fields for use this season. The success of the junior program has had an impact on the number of girls participating at the middle school and high school levels. Limited availability at these levels has created the potential to field teams for a recreational league for middle/high school girls, requiring full size fields that are 60 yards wide and 100 yards long. In addition to the need for additional fields, the program also requires use of portable sanitation facilities for players during games and practices.

North Hunterdon Little League (NHLL)

The North Hunterdon Little League is an independently organized baseball league for children ages 6 to 12. The league is funded by registration fees ranging from $100 to $160 and consists of 6 divisions including T-ball, Rookie, A, AA, AAA and Majors. NHLL utilizes a number of different fields and facilities, one of which is within Lebanon Township. Other fields are located in Clinton Town, High Bridge Borough and other communities in northern Hunterdon County.

The NHLL runs from April to June of each year, with All-Star teams potentially extending play into August. Games are scheduled Monday through Saturday with practices based on field availability. All-Star teams practice everyday from June 15th to August 1st and are active in tournament level play. Individuals participating in All-Star play in the

Majors (10 through 12 years old) play in tournaments, which keep them active through the end of August.

T-ball and Rookie divisions are instructional; non-competitive leagues for children ages 6 and 7. The remainder of the divisions organizes competitive play for children ages 8-12. Teams are coached and managed by parent volunteers and fields are maintained by the League utilizing registration fee dollars. The NHLL is independent of Township owned and maintained recreational facilities and monies.

North Hunterdon Stars (NHS)

The NHS is a traveling girl's softball team that makes use of the fields at Voorhees High School. The NHS season overlaps the school softball season, running into the summer. They make use of fields at Voorhees High School when not in use by the school team.

The addition of fields in the Township would not only benefit the LTAA softball program, but the NHS as well. It would provide more flexibility in practice and game times if the NHS were able to make use of Township facilities.

Other Children's Sports Activities

Another sport popular with the youth of Lebanon Township is lacrosse. Currently, the LTAA does not have a lacrosse league organized for children. With a number of children in the Township participating in lacrosse leagues organized in adjacent municipalities and popularity increasing, creation of such a league under the LTAA may be justified in the near future. Fortunately, lacrosse is played in the spring season and fields can be shared with soccer and field hockey programs.

In addition to organized league sports that children participate in, there are other unorganized sports which are popular among Township youth. These include "recreational" sports such as BMX biking, mountain biking, roller blading, roller hockey, skateboarding and many others. It is difficult to address the facility needs of these sports, as they are activities that many children commonly engage in intermittently. It is important, however, to recognize that any and all sporting activity, including those just mentioned, are an important part of children's lives. League sports provide children with structure and learning opportunities while the "recreational" sports mentioned above provide children with activities to occupy their time in a constructive manner.

While the popularity of biking, roller blading, skate boarding and roller hockey have continued to grow in the United States, many communities outlaw these activities in public places. This often occurs without providing alternative locations for children to undertake them. Parents in many communities, such as Readington and High Bridge, have recognized the importance of these sports in their children's lives and urged the creation of facilities where they can be undertaken. Municipalities are creating roller hockey courts and skateboard parks while designating areas where children can go to skate and bike without conflicting with public safety.

Adult Sports Leagues

In addition to the children's sports programs that are organized within the Township, there are adults that participate in recreational sports which utilize various Township facilities. It is therefore important to accommodate the needs of these users and programs as well.

The recreational sports that most adults participate in within the Township are loosely structured and are not necessarily organized into leagues. They are primarily organized by the participants and utilize facilities not utilized by the children's leagues. Sports played by adults in Lebanon Township include softball, volleyball, basketball and bocce ball. Other activities engaged in by adults utilizing Township facilities include walking, running, hiking, biking, frisbee, golf and track and field.

While adult participants are not major consumers of recreational facilities within Lebanon Township, it is important to note adults' use of these facilities. The potential exists in the future for adult leagues to be organized, taking recreational facility use and need to a higher level than that which currently exists. With little information available on the potential creation of leagues and participation levels, it is difficult to anticipate these needs.

Currently, there are no known conflicts between adult users and the facilities they require and those that are utilized by the children's recreational leagues. The nature of the sports undertaken by adults and those undertaken by children differ in scale and intensity and often adult facilities are not suitable for children and vice versa. It is likely that if adult leagues were to be organized that additional facilities would be required to accommodate them.

Lebanon Township, through the Municipal Land Use Law (MLUL), has a responsibility to provide recreation opportunities for its residents, both active and passive. Recreation should be provided in appropriate locations, with sufficient space to meet the needs of those that actively participate in recreation programs or may make use of recreation facilities. The Township has focused on the above agencies and groups as a means to determine the active recreation needs that it must fulfill.

Table 3 lists the needs of each of the respective sports that are organized by various agencies in the Township. These numbers represent the current needs that each program has identified. Future enrollment projections will be discussed later in this plan.

Table 3 - Required Active Recreation Facilities

Facility Type	Number
Baseball field	2
Softball/Little League field	4
T-ball field	1
Soccer (older children)	3
Soccer (younger children)	1
Field Hockey field	1
Junior Field Hockey field	2

Lebanon Township has a number of facilities that are proposed to be constructed in Lebanon Township Memorial Park. The construction of these facilities, however, has been subject to the availability of funds. Table 4 lists the facilities that are proposed for the park.

Table 4 - Proposed Recreation Facilities – Lebanon Township Memorial Park

Proposed Facility Type	**Number**
Softball/Little League field	1
Soccer field	1
Baseball field	1
Football field	1
Tennis court	3
Tot lot	1
Shuffleboard	3
Bocce ball court	2

Through the survey method, the Township has ascertained that there is an imminent need for additional recreation facilities. These needed facilities are in addition to those that are planned for Lebanon Township Memorial Park. Facilities constructed or to be constructed at the park have, to date, been limited by availability of funds. Given the proposed facilities for Lebanon Township Memorial Park, the number of necessary active recreation facilities can be reduced. Table 5 indicates required active recreation facilities, assuming that those planned for Lebanon Township Memorial Park are constructed. Table 5 can then be viewed as the Township's current active recreation needs assuming the Memorial Park facilities are built.

Table 5 - Required Active Recreation Facilities

Facility Type	Number
Baseball field	1
Softball/Little League field	3
T-ball field	1
Soccer (older children)	1
Soccer (younger children)	1
Field Hockey field	1
Junior Field Hockey field	2

A number of fields that are utilized by Township recreation providers are in poor condition, reducing assurance of the safety of children using them and increasing the liability of the programs they are enrolled in. Poor field condition can generally be attributed to constant use from spring to fall and overcrowding of facilities, with fields in use for practice and play six to seven days a week.

Residential growth through the horizon year of the plan (2008) will impact the needs of recreation programs within the Township. Future residential growth is anticipated, although no “large scale” projects are seen in the near future. Many of the development applications that have been reviewed by the planning board in past years have been small minor and major subdivisions between 2 and 18 lots. A recent application submitted to the planning board had 39 proposed lots; an application of extraordinary size for Lebanon composed of a conglomeration of individual parcels. In order to better assess the impact of future growth, analysis of population trends is necessary.

For the period of 1990 to 2000, there were 316 building permits issued for single family construction (not to include additions and renovations), according to the New Jersey State Data Center. Population growth for the same period, according to the 2000 Census, was 137 persons. These two figures present conflicting information in that 316 building permits would likely mean population growth of over 880 people at the Census given 2.79 persons per household. The important portion of the Township's population to focus on, however, is in the 5-14 year age group.

The 2000 Census indicated the number of persons per household was 2.79. Applying this figure to the 316 building permits issued yields growth of 881 people, or a rate of 88 people per year. Applying generalized figures from the 2000 Census, it can be argued that 15% of those people were children aged 5-14, the age ranges of children that participate in Township athletic programs. This would mean that roughly 13 children age 5-14 were added to the Township each year from 1990-2000 for a total of 130, a relatively small number.

Review of 1990 Census figures for the Township indicates that there were 747 children age 5-14. The 2000 Census indicates a total of 873 children ages 5-14, representing an addition of 126 children. Comparing this to the above, it would appear that the 2000 Census is on target for these age groups, with discrepancy in total population (1990-5,679 vs. 2000-5,816) likely represented by non-reporting in other age groups or demographic changes.

The population figures from the 2000 Census for the focus age group of 5-14 are deemed acceptable for use in assessing potential future growth in the Township's athletic programs. It is likely, based on the above analysis, that the discrepancy in the total population figure is explained by non-response in other cohorts. The 2000 Census represents the official statement of population and is therefore the best source to utilize in demographic analysis.

The LTAA has approximately 810 children that participate in all of its respective sports, with the LTJFHP fielding 40 to 48 children this year. Many children can be multi-sport athletes, participating in two sports that occur in different seasons, such as soccer and baseball or softball and field hockey. In order to assess potential growth in these programs due to residential growth, two assumptions have been made. The first assumption is that current participation levels are a given percentage of the current population, relying on the 2000 Census for current Township population in the focus age groups. Table 6, below, shows rates of participation based on information attained from the LTAA and the LTJFHP and application of a total population aged 5-14 of 903, by sex, extrapolated from the 2000 Census for the year 2002.

Table 6 - Program Participation Rates by Sport

Sport	# Children	%
Soccer (boys and girls)	350	38.8
Baseball (boys)	130	27.7
Softball (girls)	150	34.6
T-ball (boys and girls)	90	10.0
Field Hockey (girls)	40	9.2

The second assumption made is that participation level percentages will increase as programs become more popular. A reasonable percentage increase of 1% per year is applied to each of the program sports, in order to assure that additional children can be accommodated due to both increased program popularity and increased residential growth. In Table 7, this 1% is applied to a six year period of time in order to determine overall potential growth in each of the respective programs.

Table 7 - Anticipated Registration by Sport

Year	Girls Age 5-14	Boys Age 5-14	Soccer (boys and girls)	Baseball (boys)	Softball (girls)	T-ball (boys and girls)	Field Hockey (girls)
2002	433	470	350(38.8%)	130(27.7%)	150(34.6%)	90(10%)	40(9.2%)
2003	439	479	365(39.8%)	137(28.7%)	156(35.6%)	101(11%)	45(10.2%)
2004	445	488	380(40.8%)	145(29.7%)	163(36.6%)	112(12%)	50(11.2%)
2005	451	497	396(41.8%)	153(30.7%)	170(37.6%)	123(13%)	55(12.2%)
2006	457	506	412(42.8%	160(31.7%)	176(38.6%)	135(14%)	60(13.2%)
2007	463	515	428(43.8%)	168(32.7%)	183(39.6%)	147(15%)	66(14.2%)
2008	469	524	445(44.8%)	177(33.7%)	190(40.6%)	159(16%)	71(15.2%)

Given the above projections of enrollment by sport, it will be necessary for the Township to provide recreation facilities in addition to those listed in Table 5, which will serve immediate needs. In order to adequately address active recreation needs projected through 2008, the additional facilities shown in Table 8 will be required.

Table 8 - Additional Projected Required Recreation Facilities through 2008

Facility Type	Number
Baseball field	1
Softball/Little League field	2
T-Ball field	1
Soccer (younger children)	1
Junior Field Hockey field	1

It is reasonable to assume, given the nature of the Township and recent changes in land use policy, that residential growth will remain the same as that in the last decade. Table 9 can be viewed as the minimum number of facilities that the Township will have to provide by 2008 in order to meet total recreation demands of recreation programs operating within the Township.

Table 9 - Total Required Recreation Facilities through 2008

Facility Type	Number
Baseball field	2
Softball/Little League field	5
T-Ball field	2
Soccer (older children)	1
Soccer (younger children)	2
Field Hockey Field	1
Junior Field Hockey field	3

NJDEP Balanced Land Use Concept

The New Jersey Department of Environmental Protection endorses a theory known as the "Balanced Land Use Concept", which simply states that 3% of a municipality's developed or developable land should be set aside for recreational use within the community. Land deemed developable is exclusive of slopes greater than 12%, wetlands, federal, state and county lands along with other environmentally sensitive land that is not suitable for development.

In order to apply the "Balanced Land Use Concept" (BLUC) to Lebanon Township, a variety of data sources were consulted and analyzed using a Geographic Information System (GIS). Data sources utilized for this analysis included the NJDEP 1995 Land Use/Land Cover information, a United States Geological Survey Digital Elevation Model and the Open Space and Recreation Inventory. GIS analysis was undertaken to provide information for input into the BLUC, the results or which are found in Table 10.

Table 10 - Balanced Land Use Concept

Item	Area in Acres
Developable land in Township[1]	15,241.15
Steep Slopes (greater than 12%) in developable areas[2](subtract)	- 3,462.12
Developable land within County, State and Municipal Parks(subtract)	- 2,277.02
Developed land[3](add)	+ 3,366.16
Total Developed and Developable	**12,868.17**
3% of Total Developed and Developable	**386.05**

[1] NJDEP 1995 Land Use/Land Cover: agriculture, forest and barren land categories
[2] USGS DEM approximation of slopes greater than 12%
[3] NJDEP 1995 Land Use/Land Cover: urban category

The BLUC recommends that Lebanon Township have 386.05 acres of land set aside for recreation purposes, to include both active and passive recreation lands. Currently, the Township owns approximately 90.31 acres which could be applied toward this figure, leaving a deficit of 295.74 acres.

Application of the BLUC in Lebanon Township is difficult, due in large part to its low population density and limited budget. With 5,816 persons on a total of 20,257 acres, Lebanon's population density is only 183 persons per square mile. Comparatively, Lebanon Township has the sixth lowest population density in Hunterdon County and the sixty-sixth lowest in New Jersey. The most densely populated place in New Jersey is Guttenburg Town in Hudson County, with 56,012 persons per square mile. The least densely populated is Walpack Township in Sussex County, with 1.7 persons per square mile.

Lebanon Township is mostly residential in nature, with very few commercial and industrial businesses paying taxes. This imbalance creates a limited budget, where services must be scrutinized and costs are weighed against benefits. Not to say that providing recreation does not have benefit, but many of the higher priority items are those that more directly affect the health, safety and welfare of Township citizens.

With a substantial open space purchase, however, the Township could remedy its recreational land deficit identified by the BLUC. There are a number of large parcels on the Township's acquisition priorities map that with public access, could provide adequate passive recreation facilities. Additional active recreation facilities will also be required to serve the needs of the population through the year 2008, the life of this plan.

Passive Recreation Needs Analysis

The Balanced Land Use Concept (BLUC) is a fairly good target for the minimum amount of open space that a municipality should set aside for recreation purposes. As indicated before, the Township has a deficit of 296 acres under the BLUC. With ongoing programs at higher levels of government and the Township poised to initiate spending on the Planning Incentive Grant already submitted to the State, it is anticipated that this need will be filled within the next two years.

With the number of acres contained in County and State Parks within the Township, it is difficult to express a deficit of passive recreation lands. There is, however, a deficit of Township owned passive recreation land. Given the active recreation needs that have been expressed through this Plan, the Township will need to consider retaining a portion of one or more purchases as a set aside for future active recreation amenities such as playing fields. Given the projected shortage of such fields, each purchase should be assessed for the potential for construction of fields to benefit Township recreation programs organized by the LTAA and other recreation providers.

Resource Assessment

A crucial part of the Open Space and Recreation Plan for Lebanon Township is the identification of lands that have potential to provide recreation opportunities. The first part of this assessment will be to identify lands with potential to provide active recreation opportunities, as there is an immediate need to fill. The second part of the assessment will outline the Township's needs with respect to resource conservation and passive recreation sites.

The Township currently owns property adjacent to Lebanon Township Memorial Park, known as the Rich tract, Block 29, Lot 28. There is an identified need to construct active recreation facilities, consisting of various field types, in order to fulfill the immediate needs of recreation programs for the Lebanon Township Athletic Association and the Lebanon Township Junior Field Hockey Program. The Rich tract is uniquely suited to the construction of athletic fields, primarily due to its flat terrain and central location within the Township. It is unlikely that a more suitable piece of property with the same attributes will be found and purchased.

The Township may have to site a postal facility in the future and wishing to limit capital expenditure of funds for land acquisition with respect to the project, sees the Rich tract as the ideal site. At just over 17 acres, a postal facility and athletic fields can be constructed on the same property, making ideal complimentary uses with shared parking and access facilities.

With three acres excepted out of the total for a postal facility, the Rich tract could accommodate fields that would meet the immediate active recreation needs of the Township's athletic programs, listed in Table 5. This would include one baseball field, three little league/softball fields, a t-ball field, two junior field hockey fields, a soccer field and a junior soccer field. A conceptual field arrangement is depicted in Figure One in the Appendix.

There are additional active recreation needs identified in Table 8 that must be met through the construction of additional facilities. Since this need is projected for the future, it is reasonable for the Township to accommodate these within the next two to four years. Fulfilling these needs will mean the purchase of additional property for the construction of athletic fields. Given the facilities that could be constructed on the Rich tract, a parcel of similar size would accommodate the additional required facilities. This purchase could be accomplished in tandem with a passive recreation lands purchase, saving twenty or so acres for athletic field construction. In any event, the parcel or portion of a parcel should be centrally located in the Township, reasonably free of environmental constraints and agricultural in nature.

The Township should also approach the County Parks Department and Board of Chosen Freeholders as well as NJDEP in order to seek opportunities for construction of fields on other public lands. With a number of parcels already held by public entities, there are portions of existing parks that could accommodate active recreation facilities. The most likely County Park that could accommodate facilities is Teetertown Preserve/Mountain Farm.

With the current drought and ongoing issues of future water supply on the forefront of everyone's minds, a number of initiatives are underway to support the continued protection of existing water supplies. Protection has taken the form of land preservation programs, with a number of agencies partnering to protect headwaters. Lebanon Township is uniquely positioned in this respect, as all of the Township's tributary streams are headwaters.

The NJDEP will provide money in the future for acquisition of lands within water supply watersheds. The Spruce Run Reservoir watershed is limited in size and located in a largely rural area. This will allow NJDEP to purchase a reasonable amount of the remaining undeveloped land in the watershed, assuring water supply quality and quantity. This dovetails with the Township's goals of preserving land for benefit to the environment.

Working with the NJWSA and other State and County agencies, the Township has identified lands that are suitable for preservation, mainly as passive recreation and open space lands. Land of this type is compatible with the goals of this plan, as well as the goals of water supply and natural resource protection. The Township has gone through the process of identifying lands that they would prefer to see protected based on a number of principles including presence of critical environmental resources, development potential related to recreation facilities, linkage to existing open space parcels and residential development potential. These properties are identified in Figure 4, titled "Open Space System Map and Preservation Priorities".

Additional information recently released by the NJDEP has also provided justification for preservation initiatives, particularly in Lebanon Township. The New Jersey Landscape Project, initiated in 1993, was the beginning of a move to a landscape level approach for endangered species protection. With suburbanization and development occurring in all areas of the State, an increasing amount of habitat that could potentially support threatened and endangered species was being lost daily. This habitat includes the Township's acres of contiguous forest and high quality waters that drain into the Spruce Run Reservoir, the Musconetcong River and the South Branch of the Raritan River.

In order to address habitat loss, NJDEP's Endangered and Non-Game Species Program (ENSP) needed to grasp the extent and suitability of remaining resources in the State. To accomplish this, they partnered with the Center for Remote Sensing and Spatial Analysis (CRSSA) at Cook College, Rutgers University. Utilizing Land Sat Thematic Mapper satellite imagery, CRSSA mapped land cover for the entire State of New Jersey, broken down into 20 different habitat/land cover types. After generalized cover types were classified, detailed methodologies were developed to address the habitat suitability issues for each focus category, including beach/dunes, emergent landscapes, forested wetlands, forested areas and grasslands.

After reclassifying data based on standards developed for each category, the habitat data was intersected or combined with the Natural Heritage Program's Biological Conservation Database (BCD). This database is a Geographic Information System (GIS) coverage that provides information on the sighting of threatened and endangered species, based on the field work of ENSP scientists and sightings reported by members of the public. It is the most comprehensive data available in digital form on the location of threatened and endangered species.

The combination of these two data sets resulted in the data that is depicted in Figures 2 and 3. The Landscapes Program data provides users with scientifically sound, peer reviewed information on the location of critical habitat based on the conservation status of the species that are present. Habitats are ranked on a scale of 1 to 5, based on the following criteria:

Table 11 - NJ Landscape Program Ranking System

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 threatened or endangered species present

Lebanon Township is rich in habitat that is suitable to support populations of threatened and endangered species. Four of the five Landscape Project categories are represented in the Township including forested wetland, emergent, forest and grassland habitat. Most of these habitat types have documented presence of State threatened and endangered species as well as federally listed threatened and endangered species.

There are two primary areas of important habitat with the presence of federally listed threatened and endangered species in Lebanon. The first is in the central portion of the Township, stretching from the northern border with Washington Township in Morris County to Dewey Lane. Forested wetland and grassland habitat with the presence of federally listed threatened and endangered species stretch along the Spruce Run Creek and form the backbone of the lands that drain to the Spruce Run Reservoir. The second area with federally listed species is grassland habitat in the northeastern corner of the Township, running along the western side of County Route 513 from Sliker Road to the border of the Lebanon with Washington Township. This area is known as Lower Valley and is primarily farmland in hay production, land often uniquely suited to nesting and migrating birds, depending on times of harvest.

In addition to habitat with federally listed threatened and endangered species, there is an abundance of habitat in Lebanon with state threatened and endangered species documented. Much of the forest land in the Township, which is reasonably contiguous, is home to state threatened and endangered species. These forested lands coincide with a number of properties already preserved, ensuring their protection and availability as a resource into the future. There is also grassland habitat in the Township with the documented presence of state threatened and endangered species, including areas along the South Branch of the Raritan River in the eastern part of the Township, areas along the Musconetcong River in the western part of the Township and areas in the vicinity of Spruce Run Creek.

The Landscape Program data was intended to aid municipalities, County and State governments, conservation agencies and citizens in determining the extent of critical habitat within their respective jurisdictions and communities. After identifying critical habitat, a variety of means can be employed to protect it, including the following:

- Prioritizing open space acquisitions based on the presence of habitat for threatened and endangered species
- Adopting regulations aimed at protecting critical habitat
- Adopting management policies for open space that are consistent with protection of critical habitat
- Permitting flexibility in development techniques that can accommodate the protection of critical habitat
- Promoting land stewardship practices that are consistent with the protection of critical habitat

Lebanon Township has chosen to utilize the New Jersey Landscape Project data to further define priorities for preservation, in keeping with the goals and policies of this plan. Figures 2 and 3 show the Township's preservation priorities with the Landscape Project data overlain, indicating that many priorities that the Township has identified coincide with the presence of a variety of habitat types with both federal and state listed threatened and endangered species.

All the properties identified in Figure 4 represent opportunities to support a variety of conservation objectives, as outlined above. These include the protection of water supply watershed areas, the protection of habitat suitable for threatened and endangered species and the protection of scenic areas. The preservation of these lands will simultaneously provide opportunities for abundant passive recreation and the creation of a network of linked open space and recreation.

Action Plan

In order to carry out the objectives of this Open Space and Recreation Plan, a number of actions must be carried out by the Township and its officials. There is an immediate need for active recreation facilities that must be addressed for recreation programs to successfully continue. There is also a need to acquire lands to construct additional athletic fields by the year 2006, above and beyond those that can be constructed on the Rich tract. Additionally, a deficit of 296 acres of recreational land is apparent through application of the NJDEP Balanced Land Use Concept. To this end, the following actions should be undertaken:

1. Many of the active recreation facilities that are proposed for Lebanon Township Memorial Park remain unrealized. To date, no public monies have been expended to move the construction of these athletic fields from the planning phase into reality. The Township Committee could begin to appropriate funds for the construction of fields in order to meet the needs of the recreation providers in Lebanon.
2. The Rich tract, adjacent to Lebanon Township Memorial Park, is an ideal site for the construction of additional athletic fields. The Township will undertake detailed study of the site, determining costs associated with construction of the athletic fields conceptually depicted in Figure 1.
3. The Township will contact both the County and State and seek use of lands in existing park facilities for the potential construction of athletic fields. A potential opportunity has been identified in Teetertown Preserve/Mountain Farm.
4. The Township will continue to solicit landowner interest in participating in the Green Acres grant pursued by the Township. Letters have already gone out to most of the landowners with property depicted in Figure 4, with only two responses of no interest. The remainder of the landowners who responded indicated a willingness to consider or a willingness to participate in the Township's initiative to preserve land.

5. The Township will continue to partner with the County, State and New Jersey Water Supply Authority in preserving land. Fiscal resources available at these levels of government far outweigh those available to the Township. Partnering with these agencies and advancing the goals of this plan will assist in leveraging funds from these agencies, as the goals of this plan are closely aligned with their goals.
6. The Township will study the feasibility of hosting and assessing fees for field use. These fees could be used for field maintenance and construction of additional fields.
7. The Township will advance a stewardship and education program in conjunction with its preservation efforts. Even if landowners decide not to participate in the ongoing preservation program, they will be left with information that is critical to overall resource protection.

Implementation Approaches and Resources

A coordinated open space and recreation effort should integrate environmental protection strategies as core elements of the preservation effort. The Township will utilize this approach, as outlined in this plan. The programs and approaches outlined below represent a menu of implementation strategies which the Township will research in order to determine their merit and application in Lebanon's continued efforts.

a. *Open Space Tax*

Lebanon Township has an adopted Open Space Tax which generates two cents per one hundred dollars of assessed value. These revenues can be used to fund the acquisition of land for open space preservation and recreational purposes. The Open Space Tax generated $115,000 in 2001 and will generate approximately $138,000 in 2002, based on recent reevaluation of properties within the Township. In addition to increased revenue generated from the reevaluation, there is a question on the ballot in

November to increase the Open Space Tax to four cents per one hundred dollars of assessed value.

b. *New Jersey Department of Environmental Protection Green Acres Program*

In 1999 the State Legislature passed the Garden State Preservation Trust Fund, securing funding for a state-wide open space plan for New Jersey. In order to provide support to local governments who have adopted an open space tax and prepared an Open Space and Recreation Plan (OSRP), the Green Acres Program developed the Planning Incentive Grant (PIG). This program provides 50% matching grants to local governments for the acquisition of land for recreation and conservation purposes. To be eligible for funding, local governments must have a Green Acres approved OSRP, and either an open space tax, or an approved alternative funding source which is stable and sufficient, such as an annual tax levy.

The Township has an active program that is funded by a Green Acres PIG grant. They have made an initial round of solicitations to land owners in an effort to identify properties that could potentially be preserved. Lebanon will continue in this effort and negotiate with any willing landowner whose property meets the identified needs of this plan.

c. Hunterdon County Open Space Trust Fund

In 1999, the voters of Hunterdon County approved the creation of an open space tax in the amount of 3 cents per $100 of assessed value. In 2001, the tax generated $4,206,883.63 to be used by the County for various activities related to open space preservation.

There is a provision in the Open Space Trust Fund program which provides municipalities with the opportunity to recapture 10% of what its taxpayers contribute. For 2001, Lebanon Township taxpayers contributed $174,973.48, making the Township eligible to recapture $17,497.35. The money can be utilized on a yearly basis (for eligible projects) or can be rolled over and banked for a period up to five years. If not utilized with the 5 years, the money is then reallocated for County purposes.

d. The Environmental Infrastructure Trust Financing Program

This program provides low interest loans to municipalities, counties and authorities for clean water-related activities, including land acquisition when watershed management and water quality benefits are provided. With funding from both NJDEP and the NJ Environmental Infrastructure Trust, the program utilizes a Federal Priority System developed each year by NJDEP. Loans are made for 20-year terms at a blended interest rate (DEP - 0%, Infrastructure Trust - market interest or below).

e. National Recreational Trails Program

NJDEP provides financial assistance for developing and maintaining trails and trail facilities for non-motorized, motorized and multi-use purposes. The maximum grant award is $25,000, and projects are funded on an 80% federal share and 20% matching share basis.

f. Conservation Easements

Recreational land, both passive and active, can be made more accessible with access provided through conservation easements. Conservation easements typically encompass some desirable environmental resource, such as a stream, floodplain or steep slope area, and provide a measure of protection against development to that resource. Limited access permitted through conservation easements is a means to make certain lands more accessible to the public.

Access given through conservation easements can invade the privacy of the landowner who has dedicated the conservation easement. Access should be sought only in areas where the privacy and interests of the landowner can be insured and where potential trespass can be limited. Additionally, access through conservation easements should promote the creation of linked open space corridors, to create a network of open space that can be accessed by means other than automobile.

g. Partnering with Other Agencies

There are a number of agencies in Hunterdon County that are active in land preservation initiatives. The two most prominent are the County itself and the State of New Jersey. Both agencies have large parks and other land holdings in the Township and will likely continue to purchase land for both passive and active recreation facilities. The Township can work in concert with these two agencies in order to promote the preservation of key environmental resources identified in this plan and the Master Plan.

The New Jersey Water Supply Authority (NJWSA) is another agency active in land preservation efforts, working through NJDEP. Its programs specifically focus on the preservation of land adjacent to streams which feed water supply reservoirs, as most of the streams in the Township do. This provides a unique opportunity to partner with NJWSA to share resources and encourage the preservation of key tracts that meet the needs of both agencies.

Non-profit and watershed groups have also become active participants in land preservation. These groups can often provide leveraging funds to municipalities or other agencies and are critical to the overall process. There are few preservation deals made which don't involve at least one non-profit or watershed group whose project support was critical.

System Map

The Open Space System Map is depicted in Figure 4. This map includes existing open space lands at the municipal, county and state level and also depicts the Township's priorities for preservation. This map is a fluid representation of acquisition priorities and may change over the span of this plan to account for changing sentiment.

Public Participation and Planning Consistency

The process utilized by Lebanon Township to complete this plan involved input from a variety of sources including the Open Space Advisory Committee (consisting of members of the Township Committee, Environmental Commission and the Planning Board), the Planning Board itself and the public. The Open Space Advisory Committee met on a number of occasions to review information, discuss recreation needs and to review the action plan. The Planning Board reviewed and discussed the Open Space Plan at two meetings, which were open to the public; one meeting included a detailed presentation of the draft Plan, complete with findings and an action plan. Public discussion centered on findings with respect to recreation needs and application of the NJDEP Balanced Land Use Concept.

Public involvement in this Open Space and Recreation Plan extended to citizens responsible for the management of recreation programs within the Township, who were consulted to best determine recreation needs. In a township where many volunteers and citizens are often involved in a number of different functions and activities, this was seen as the most efficient means to obtain the information necessary to determine the future of various programs.

The Township will also hold the required two public meetings for the Open Space and Recreation Plan, giving other citizens not involved in the planning process opportunity to review this document and offer comment and input. Summaries of these two meetings will be attached to the Appendix to detail public sentiment on the Plan.

The Township, in developing this Open Space and Recreation Plan, has strived to achieve consistency with the Conservation and Land Use Plan elements of the master plan. The Conservation Element has identified many of the critical resources that are present in the Township and called for their preservation through a variety of means, wherever possible. The passive recreation acquisition, proposed in this plan to be carried out through the Township Planning Incentive Grant from Green Acres, will advance the goals of the Conservation Element of the Master Plan in an effective manner. It is the intent that this document will become the Recreation Plan Element of the Master Plan.

Appendix

Concept Plan
Rich Tract

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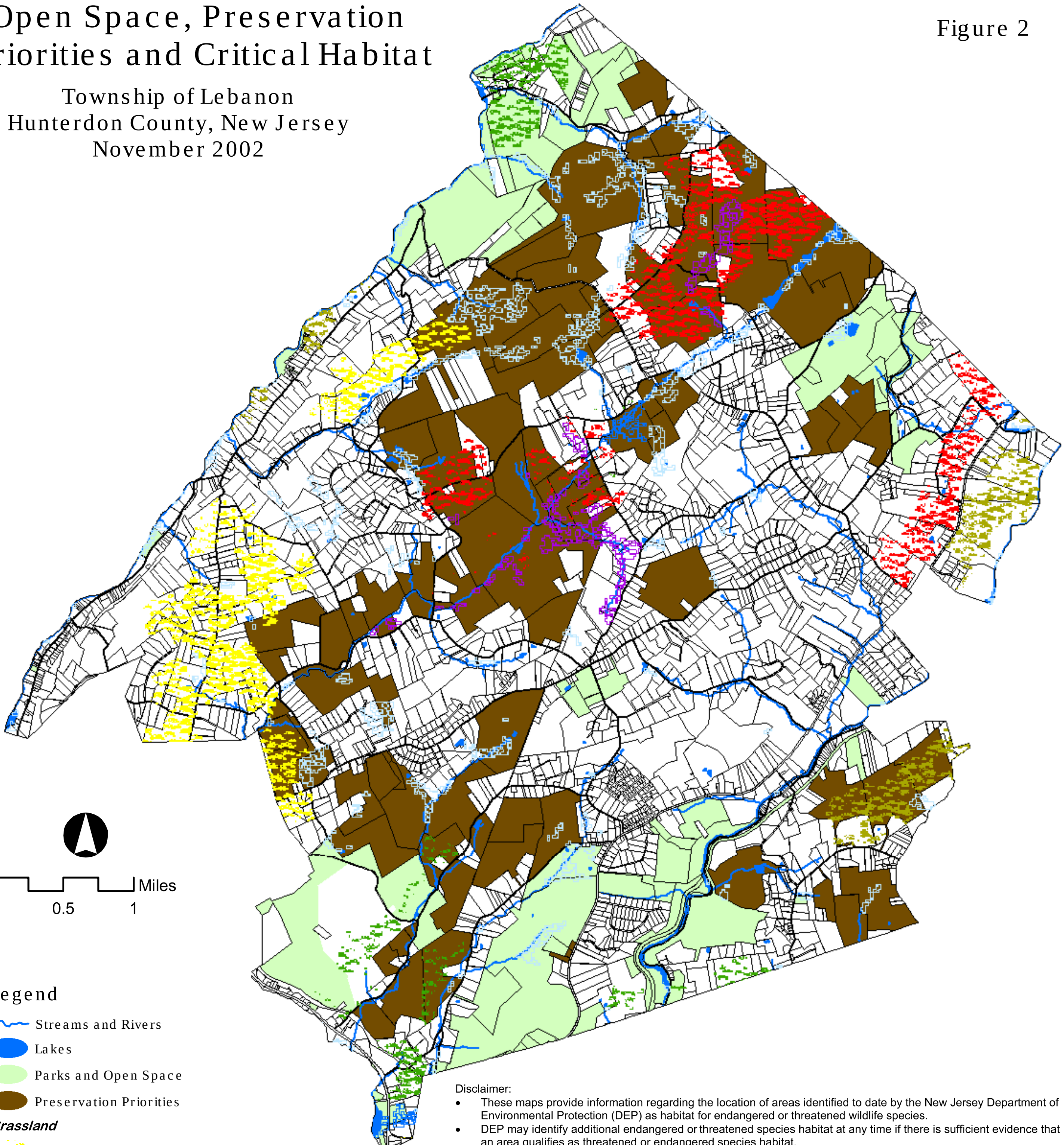
(908)782-0835/7636 fax banisch@earthlink.net

Open Space, Preservation Priorities and Critical Habitat

Township of Lebanon
Hunterdon County, New Jersey
November 2002

Figure 2



Miles
0 0.5 1

Legend

Streams and Rivers
Lakes
Parks and Open Space
Preservation Priorities

Grassland

Suitable Habitat - No Field Survey
Habitat with State Threatened Species
Habitat with State Endangered Species
Habitat with Federal Threatened and Endangered

Forested Wetlands

Suitable Habitat - No Field Survey
Habitat with State Threatened Species
Habitat with Federal Threatened and Endangered Species

Disclaimer:

- These maps provide information regarding the location of areas identified to date by the New Jersey Department of Environmental Protection (DEP) as habitat for endangered or threatened wildlife species.
- DEP may identify additional endangered or threatened species habitat at any time if there is sufficient evidence that an area qualifies as threatened or endangered species habitat.
- DEP may determine that an area shown on the maps as threatened or endangered wildlife habitat is not suitable for use as habitat. In that case, the area will no longer be classified as endangered or threatened species habitat.
- The maps will be updated periodically to reflect additional areas identified as threatened or endangered wildlife habitat, and to remove areas determined to be no longer suitable habitat for endangered or threatened wildlife.
- These maps show only areas identified as suitable habitat for threatened or endangered animal species, not threatened or endangered plant species. The DEP's method for identifying threatened or endangered plant species habitat can be found in the Department's Freshwater Wetlands Technical Manual, available from the Department's Office of Maps and Publications at (609) 777-1038.
- Any wetlands boundaries shown on these maps are approximate and are for guidance only. Therefore, these maps are not an accurate indication of whether DEP will classify an area as exceptional resource value wetland under the DEP's freshwater wetlands rules. To obtain a determination of whether or where wetlands are located on a property and the resource value classification of a wetland, contact the DEP and apply for a letter of interpretation under the freshwater wetlands rules, N.J.A.C. 7:7A-3.

Data Sources:
Hunterdon County Division of GIS
NJDEP ENSP

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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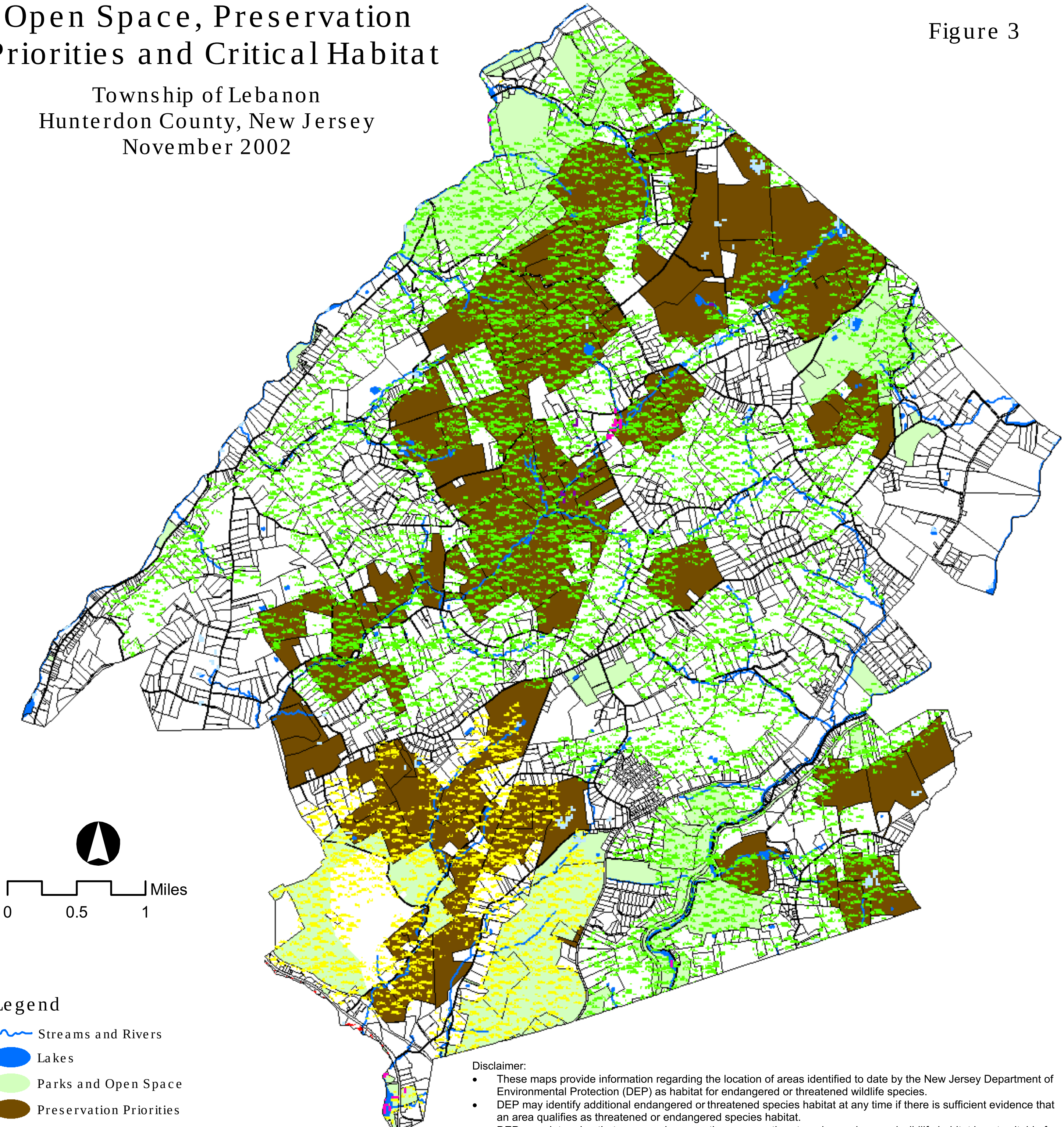
Open Space, Preservation Priorities and Critical Habitat

Figure 3

Township of Lebanon
Hunterdon County, New Jersey
November 2002



Legend

Streams and Rivers

Lakes

Parks and Open Space

Preservation Priorities

Forest

Habitat with State Threatened Species

Habitat with State Endangered Species

Habitat with Federal Threatened and Endangered Species

Emergent Landscapes

Suitable Habitat - No Field Survey

Habitat with State Threatened Species

Habitat with Federal Threatened and Endangered Species

Disclaimer:

- These maps provide information regarding the location of areas identified to date by the New Jersey Department of Environmental Protection (DEP) as habitat for endangered or threatened wildlife species.
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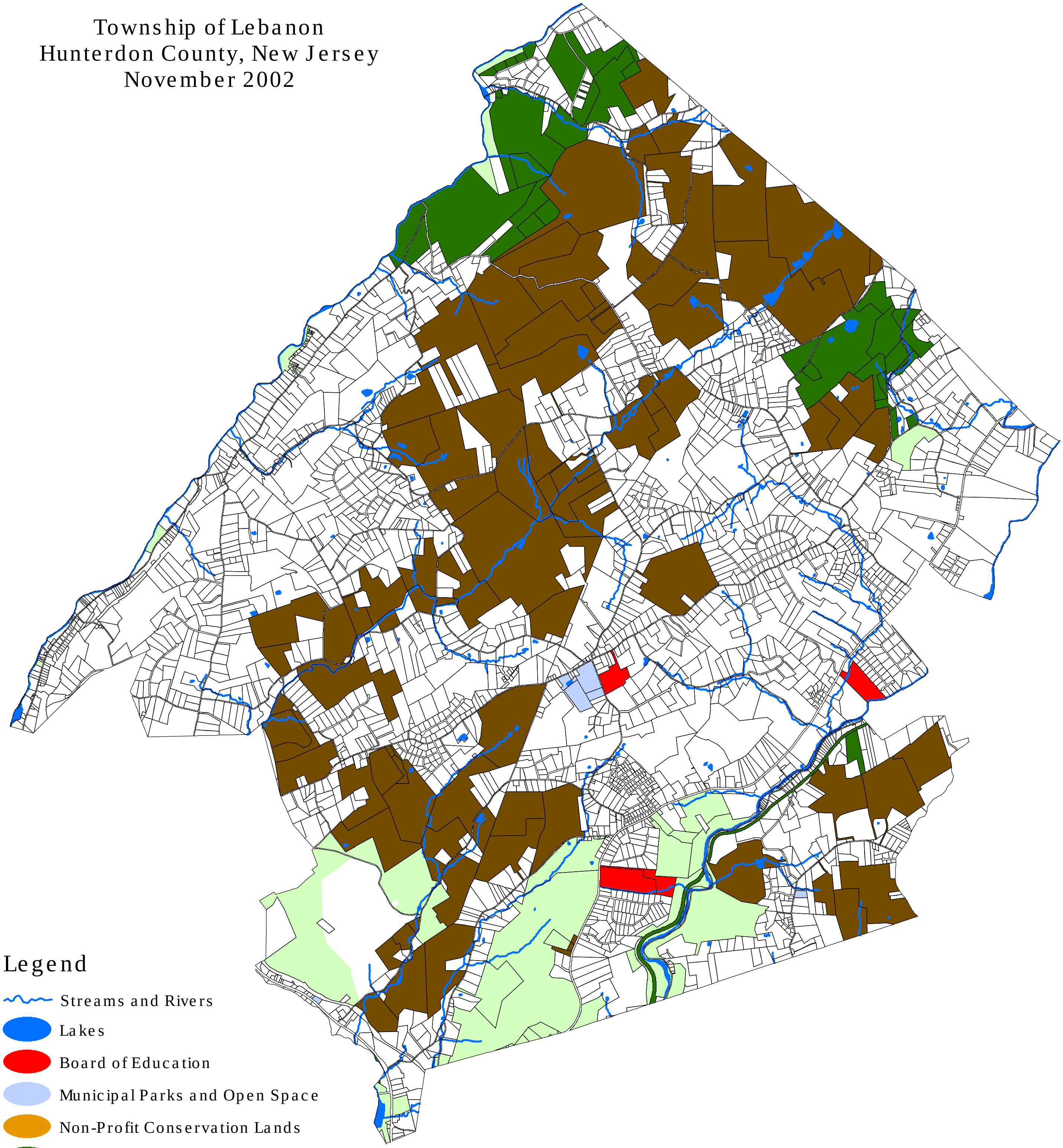
Open Space System Map and Preservation Priorities

Figure 4

Township of Lebanon
Hunterdon County, New Jersey
November 2002



Legend

Streams and Rivers
Lakes
Board of Education
Municipal Parks and Open Space
Non-Profit Conservation Lands
County Parkland
State Parks and Preserved Open Space
Private Open Space
Preservation Priorities

Miles
0 0.5 1 2

Data Sources:
Hunterdon County Division of GIS
Hunterdon County Planning Board
Lebanon Township

BANISCH
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Lebanon Township Open Space System

10/22/2002

Block	Lot	Category	Acreage	Name
00002000	00003000	State Parks and Preserved Open Space	17.42	Spruce Run Reservoir Recreation Area
00003000	00003000	State Parks and Preserved Open Space	9.28	Spruce Run Reservoir Recreation Area
00004000	00002000	State Parks and Preserved Open Space	2.81	Spruce Run Reservoir Recreation Area
00004000	00003000	County Parkland	0.19	Union Furnace Nature Preserve
00005000	00001001	State Parks and Preserved Open Space	1.36	Voorhees State Park
00007000	00001000	County Parkland	0.53	Union Furnace Nature Preserve
00007000	00002000	County Parkland	0.07	Union Furnace Nature Preserve
00008000	00004000	Municipal Parks and Open Space	1.43	Route 31
000090000	000070000	State Parks and Preserved Open Space	209.10	Hagadorn Preserve
000100000	000070000	State Parks and Preserved Open Space	104.16	Hagadorn Preserve
00011000	00001000	State Parks and Preserved Open Space	3.33	Voorhees State Park
00011000	00008003	State Parks and Preserved Open Space	56.69	Voorhees State Park
00011000	00024000	State Parks and Preserved Open Space	62.33	Voorhees State Park
00011000	00037000	State Parks and Preserved Open Space	408.91	Voorhees State Park
00011000	00038001	State Parks and Preserved Open Space	9.54	Voorhees State Park
00011000	00046000	State Parks and Preserved Open Space	8.47	Voorhees State Park
00011000	00047000	State Parks and Preserved Open Space	4.33	Voorhees State Park
00011000	00048000	State Parks and Preserved Open Space	2.19	Voorhees State Park
00011000	00049000	State Parks and Preserved Open Space	0.37	Voorhees State Park
00011000	00050000	State Parks and Preserved Open Space	0.14	Voorhees State Park
00011000	00051000	State Parks and Preserved Open Space	0.26	Voorhees State Park
00011000	00052000	State Parks and Preserved Open Space	0.03	Voorhees State Park

Lebanon Township Open Space System

10/22/2002

Block	Lot	Category	Acreage	Name
00012000	00002000	State Parks and Preserved Open Space	17.19	Voorhees State Park
00012000	00004000	State Parks and Preserved Open Space	5.89	Ken Lockwood Gorge WMA
00012000	00044000	Board of Education	17.46	Vorhees High School
00012000	00044001	Board of Education	38.03	Voorhees High School
00012000	00056001	State Parks and Preserved Open Space	7.69	Ken Lockwood Gorge WMA
00012000	00057001	State Parks and Preserved Open Space	6.48	Ken Lockwood Gorge WMA
00012000	00061000	State Parks and Preserved Open Space	43.11	Ken Lockwood Gorge WMA
00012000	00067000	State Parks and Preserved Open Space	38.09	Ken Lockwood Gorge WMA
00012000	00067001	State Parks and Preserved Open Space	31.17	Ken Lockwood Gorge WMA
000120000	000560000	State Parks and Preserved Open Space	44.75	Ken Lockwood Gorge WMA
00014000	00003000	State Parks and Preserved Open Space	35.96	Ken Lockwood Gorge WMA
00014000	00005000	State Parks and Preserved Open Space	4.53	Ken Lockwood Gorge WMA
00016000	00001000	State Parks and Preserved Open Space	13.36	Ken Lockwood Gorge WMA
00016000	00013000	State Parks and Preserved Open Space	126.08	Ken Lockwood Gorge WMA
00017000	00005000	Municipal Parks and Open Space	3.04	Mt. Grove Preserve
00018000	00016000	County Parkland	15.85	Columbia Trail - South Branch Reservation
00021000	00008000	Board of Education	26.53	Bunnvale School
00024000	00006000	Board of Education	19.46	Woodglen Elementary School
00024000	00009000	Board of Education	0.30	Woodglen Elementary School
00029000	00027000	Municipal Parks and Open Space	4.79	Lebanon Township Memorial Park
00029000	00028000	Municipal Parks and Open Space	17.22	Rich
00029000	00032001	Municipal Parks and Open Space	5.28	Lebanon Township Municipal Building

Lebanon Township Open Space System

10/22/2002

Block	Lot	Category	Acreage	Name
00029000	00032003	Municipal Parks and Open Space	14.87	Lebanon Township Memorial Park
00030000	000010000	State Parks and Preserved Open Space	30.88	Hagadorn Preserve
00040000	00039000	State Parks and Preserved Open Space	32.28	Teetertown Nature Preserve
00044000	00003000	County Parkland	6.71	Teetertown Nature Preserve/Mountain Farm
00044000	00004000	County Parkland	0.17	Teetertown Nature Preserve/Mountain Farm
00044000	00005000	County Parkland	14.75	Teetertown Nature Preserve/Mountain Farm
00044000	00024001	County Parkland	4.85	Teetertown Nature Preserve/Mountain Farm
00044000	00024003	Municipal Parks and Open Space	1.35	Cold Brook Preserve
00044000	00025000	County Parkland	1.96	Teetertown Nature Preserve/Mountain Farm
00044000	00026000	County Parkland	0.04	Teetertown Nature Preserve/Mountain Farm
00045000	00002000	County Parkland	3.95	Teetertown Nature Preserve/Mountain Farm
00045000	00004001	County Parkland	6.59	Teetertown Nature Preserve/Mountain Farm
00046000	00003000	County Parkland	5.26	Teetertown Nature Preserve/Mountain Farm
00046000	00004000	County Parkland	34.01	Teetertown Nature Preserve/Mountain Farm
00046000	00005000	County Parkland	14.29	Teetertown Nature Preserve/Mountain Farm
00046000	00006000	County Parkland	1.32	Teetertown Nature Preserve/Mountain Farm
00046000	00007000	Municipal Parks and Open Space	0.69	Cold Brook Preserve
00046000	00008000	County Parkland	0.99	Teetertown Nature Preserve/Mountain Farm
00046000	00009000	County Parkland	4.70	Teetertown Nature Preserve/Mountain Farm
00046000	00010000	Municipal Parks and Open Space	0.62	Cold Brook Preserve
00046000	00014000	County Parkland	4.39	Teetertown Nature Preserve/Mountain Farm
00046000	00014001	County Parkland	21.03	Teetertown Nature Preserve/Mountain Farm

Lebanon Township Open Space System

10/22/2002

Block	Lot	Category	Acreage	Name
00046000	00034000	County Parkland	133.20	Teetertown Nature Preserve/Mountain Farm
00046000	00034001	County Parkland	21.57	Teetertown Nature Preserve/Mountain Farm
00046000	00034002	County Parkland	6.59	Teetertown Nature Preserve/Mountain Farm
00048000	00027000	County Parkland	21.41	Teetertown Nature Preserve/Mountain Farm
00054000	00013000	County Parkland	18.23	Point Mountain Section - Musconetcong River Reservation
00054000	00014000	County Parkland	60.96	Point Mountain Section - Musconetcong River Reservation
00054000	00023000	County Parkland	40.44	Point Mountain Section - Musconetcong River Reservation
00056000	00001000	County Parkland	185.13	Point Mountain Section - Musconetcong River Reservation
00056000	00007000	County Parkland	42.94	Point Mountain Section - Musconetcong River Reservation
00056000	00008000	County Parkland	11.78	Point Mountain Section - Musconetcong River Reservation
00056000	00008001	County Parkland	12.12	Point Mountain Section - Musconetcong River Reservation
00056000	00021000	County Parkland	34.89	Point Mountain Section - Musconetcong River Reservation
00056000	00023000	County Parkland	131.26	Point Mountain Section - Musconetcong River Reservation
00056000	00023001	County Parkland	1.39	Point Mountain Section - Musconetcong River Reservation
00056000	00028000	County Parkland	28.79	Point Mountain Section - Musconetcong River Reservation
00056000	00030000	State Parks and Preserved Open Space	30.28	Musconetcong River WMA
00057000	00001000	County Parkland	19.29	Point Mountain Section - Musconetcong River Reservation
00058000	00006000	County Parkland	33.20	Point Mountain Section - Musconetcong River Reservation
00060000	00013000	State Parks and Preserved Open Space	14.07	Musconetcong River WMA
00060000	00044000	State Parks and Preserved Open Space	0.21	Musconetcong River WMA
00060000	00045000	State Parks and Preserved Open Space	0.14	Musconetcong River WMA
00060000	00046000	State Parks and Preserved Open Space	0.18	Musconetcong River WMA

Lebanon Township Open Space System

10/22/2002

Block	Lot	Category	Acreage	Name
00060000	00048000	State Parks and Preserved Open Space	0.41	Musconetcong River WMA
00060000	00049000	State Parks and Preserved Open Space	0.23	Musconetcong River WMA
00060000	00050000	State Parks and Preserved Open Space	0.14	Musconetcong River WMA
00060000	00057000	State Parks and Preserved Open Space	0.17	Musconetcong River WMA
00070000	00024001	State Parks and Preserved Open Space	8.42	Musconetcong River WMA
00072000	00014000	State Parks and Preserved Open Space	1.07	Musconetcong River WMA
00077000	00007002	State Parks and Preserved Open Space	12.45	Musconetcong River WMA
00077000	00007006	County Parkland	3.26	Point Mountain Section - Musconetcong River Reservation
00077000	00007007	County Parkland	3.05	Point Mountain Section - Musconetcong River Reservation
00077000	00007008	County Parkland	2.89	Point Mountain Section - Musconetcong River Reservation
00077000	00007009	County Parkland	2.79	Point Mountain Section - Musconetcong River Reservation
00077000	00007010	County Parkland	5.25	Point Mountain Section - Musconetcong River Reservation
00077000	00009000	County Parkland	44.47	Point Mountain Section - Musconetcong River Reservation
00300000	00001000	County Parkland	9.05	Columbia Trail - South Branch Reservation
00300000	00001000	County Parkland	10.58	Columbia Trail - South Branch Reservation
00300000	00002000	County Parkland	19.43	Columbia Trail - South Branch Reservation
Grand Total:			**2,602.53**	

Lebanon Townships Environmental Ordinance Inventory as listed within the Township of Lebanon Land Development Chapters (current through Ordinance No. 2002-15)					
Category	***Section***	***Issue***	***Ordinance No(s).***	***Page listed***	***Environmental Ordinance***
LAND USE PROCEDURES	17-6.2 Sketch Plats	Describes detailed standard Plat information (topography, wooded areas, easements,watercourses, etc…), as well as percolation tests, Soil logs, Environmental Inventory plan and hydrogeologic report required by the Planning Board for applications for development.	13-1977, S 6.1 1-1987, S I 18-1987, S 1 14-1990, SS 2; 4 16-2000, S 2 2001-32, S 2	1728- 1730.1	***Y***
LAND USE PROCEDURES	17-6.3 Plat Submitted for Preliminary Approval	Plat Sketch requirements such as it must be drawn by a licensed NJ Professional engineer or Land Surveyor. Should include on-site wetland delineations, acreage, sewers, drains, any proposed dedicated open space, etc..	13-1977, S 6.2 14-1990, S 3 16-2000, S 3 2001-32, S 3	1731-1734.1	***Y***
LAND USE PROCEDURES	17-6.4 Final Plat	Final Plat requirements and rules. This Plat submission requires Geologic data and GeoTechnical Evalualtion report.	12-1998, S 1	1735-1738.4	***Y***
LAND USE PROCEDURES	17-6.6 Environmental Inventory Plan	This inventory is required for minor and major subdivisions so that the Planning Board can make an informed decision concerning the potential environmental impact of the proposed development. (includes Wetlands delineation by a qualified expert with the Standards of the NJDEP (NJAC 7:7a-2.5)	16-2000, S 1	1738.4-1738.4c	***Y***
LAND USE PROCEDURES	17-6.7 Aquifer Test and Analysis	Describes the requirements for Aquifer testing for residential and nonresidential uses as it pertains to the application for development.	2001-32, S 1	1738-4c-1738.z.9	***Y***
LAND USE PROCEDURES	17-8.8.1 Aquifer Test and Analysis	Amends existing Aquifer test ordinance indicating that any new tests should conducted all identified procedures must be repeated or conducted anew.	2002-13		***Y***

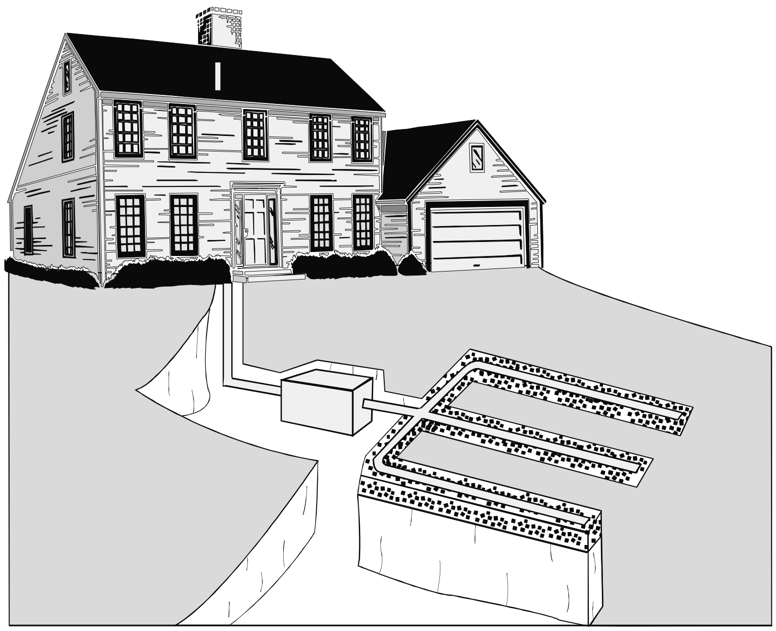
Lebanon Townships Environmental Ordinance Inventory as listed within the Township of Lebanon Land Development Chapters (current through Ordinance No. 2002-15)					
Category	***Section***	***Issue***	***Ordinance No(s).***	***Page listed***	***Environmental Ordinance***
IMPROVEMENTS	17-7.3 Site Conditions	Sites during construction must always be maintained in a safe and sanitary condition at all time. Existing trees and associated root systems must be protected. Litter must be removed. No Top soil must be removed unless approved by township	13-1977, S 7.2 5-1991, S 29	1739-1741	***Y***
IMPROVEMENTS	17-7.4 Improvements	Addresses the required improvements as it pertains to development in regards to Storm water, Sanitory Sewage Disposal, Vehicular/Pedestrian improvements, Natural improvements and Fire Protection systems.	13-1977, S 7.3 7-1984, S 10 2001-25, S 1	1741-1744.5	***Y***
IMPROVEMENTS	17-7.9 Off Tract Improvements	The Planning board shall require as "Condition of pre-liminary Plat Subdivision" that the developer pay their pro-rata share of the cost of providing necessary street, drainage, sewage and easement facilities outside the property limits….	3-1989, S I 13-1977, SS 7,8	1748-1753	***Y***
IMPROVEMENTS	17-8.1 General	Subdivider shall observe Development patterns of the Township…If the Master Plan or the official map provides for the reservation of designated streets, public drainageways, flood control basins or public areas, etc.. The planning board may require such streets, basins, etc.. be present on the Plat...	13-1977, S 8.0	1753-1755	***Y***
IMPROVEMENTS	17-8.5 Public Uses, Service Areas and Utility Placement	Addresses requirements for utility easements, drainage/conservation easements, prevention of topsoil removal, tree management and setback from Streams and other bodies of water…	13-1977, S 8.4 7-1984, S 13	1759-1761	***Y***

Lebanon Townships Environmental Ordinance Inventory as listed within the Township of Lebanon Land Development Chapters (current through Ordinance No. 2002-15)					
Category	***Section***	***Issue***	***Ordinance No(s).***	***Page listed***	***Environmental Ordinance***
IMPROVEMENTS	17-8.6 Conservation, Erosion and Sediment Control	Addresses measures to control erosion to meet the standards of Hunterdon county Soil Conservation District	13-1977, S 8.5	1762	***Y***
IMPROVEMENTS	17-8.7 Flood Plains	Flood Drainage Pervention shall apply to all subdivisions	13-1977 S 8.6	1762	***Y***
IMPROVEMENTS	17-8.9 Stream Corridor Protection	Stream corridors shall remain in their natural state….	30-2001, S 2	1762-1767	***Y***
ZONING	18-3.2 Detailed Provisions	Describes the designations of the Zoning Districts (Permitted Principal Use and Conditional use)	9-1981, A 3, S B 9-1994, S 1	1833-1834	***Y***
ZONING	18-3.4 thru 18-3.14 amended , new Section 18-3.14 Development Standards in Rural Agric. R-5 Zone	includes Section 18-3.6: Size of Lot of Seven and one-half acres in RC Zone and 5 acres in all other zoning districts	2002-04		***Y***
ZONING	18-3.4 Supplementary Zone District Regulations	Describes additional zoning regulations as they pertain to building, structures, yard, open space, land use, parking areas and lots..	15-1989 12-1989 9-1981, A 3, S D 19-1987, S 2 2-1988 10-1988 5-1991, SS 18-21 21-1991 8-1998, S 3 18-2000, S 4 2001-32, S 1	1834-1842.4	***Y***
ZONING	18-3.7 Regulations Governing Conditional Uses	Sites Conditions for Specific conditional uses such Animal Farms, Camps,Country Clubs, Recreational facilities, Drive-in Uses, Essential Service buildings and Home occupations.	9-1981, A 3 S G 12-1981 11-1983, S 6-8 27-1987, S 1-2 15-1990, S 3 4-1991, S 10 5-1991, S 22 8-1998, S 6	1849-1859	***Y***

Lebanon Townships Environmental Ordinance Inventory as listed within the Township of Lebanon Land Development Chapters (current through Ordinance No. 2002-15)					
Category	**Section**	**Issue**	**Ordinance No(s).**	**Page listed**	**Environmental Ordinance**
ZONING	18-3.10 Right-to-Farm	Addresses that any nuisances caused to others are offset by the benefits from farming. Each Deed of conveyance of land shall contain a 'Right to Farm Recital…	24-1989, S 1 12-1997, S 2	1864-1866	***Y***
ZONING	18-4.3 Regulation of Nuisance Elements	Addresses the determination of nuisance elements that applies to any structure or operation of any process or equipment such as smoke, ash, odors, solid waste, liquid waste, radiation, noise, vibration, glare and temperature change	9-1981, A 4 S C	1870	***Y***
ZONING	18-4.4 Standards to be Enforced.	Addresses the Standards to Enforce the nuisance elements as listed in section 18-4.3	9-1981, A 4 , S D	1871-1875	***Y***
ZONING	18-5.6 Design Standards and Required Site Improvements	Addresses the detailed layout of land requirements such as parking, water supply, drainage, sewage, delinieated floodways, grading, etc... for each site plan.	9-1981, A 5 S F 2001-25, S 2	1878-1880	***Y***
ZONING	18-5.7 Preliminary Site Plan detail.	Addresses the detailed requirements for each site plan from a scale and content perspective. A Environmental inventory plan and hydrogeologic report is also required.	9-1981, A 5 S G 11-1983, SS 9-11 16-2000, S 4 2001-32, S 4	1880-1883	***Y***
ZONING	18-5.19 Correction of Deficiencies Leading to Notice of Revocation	Addresses the applicant shall agree to correct the deficiencies and make any necessary land or structural modifications with board approval.	9-1981, A 5, S R	1888-1889	***Y***

Standards for Individual Subsurface Sewage Disposal Systems

State of New Jersey Administrative Code
N.J.A.C. 7:9A



ADOPTED AUGUST 15, 1999

New Jersey Department of Environmental Protection

Division of Water Quality
Bureau of Nonpoint Pollution Control

Table of Contents

Subchapter 1. General Provisions

7:9A-1.1 Purpose

(a) The purpose of this chapter is to:

1. Prevent pollution of the waters of the State that results from improper location, design, construction, installation, alteration, operation or maintenance of individual subsurface sewage disposal systems;
2. Provide standards for the proper location, design, construction, installation, alteration, repair and operation of individual subsurface sewage disposal systems;
3. Protect the public health and safety and the environment;
4. Protect potable water supplies; and
5. Safeguard fish and aquatic life and ecological values.

7:9A-1.2 Scope

(a) This chapter prescribes standards for the location, design, construction, installation, alteration, repair and operation of individual subsurface sewage disposal systems.

(b) Except as otherwise provided by N.J.S.A. 58:11-25, the following shall constitute the rules of the New Jersey Department of Environmental Protection and shall be regarded as uniform standards, in force throughout the State, governing individual subsurface sewage disposal systems.

7:9A-1.3 Construction of rules

(a) This chapter shall be liberally construed to permit the Department to discharge its statutory functions.

(b) All appendices attached to this chapter are incorporated into this chapter and are made a part hereof.

7:9A-1.4 Practice where rules do not govern

The Commissioner, or any other appropriate management employee within the Department, shall exercise his or her discretion in respect to any matters not governed by this chapter.

7:9A-1.5 Severability

If any provision of this chapter or the application thereof to any person or circumstance is held invalid, such invalidity shall not affect other provisions of this chapter, and to this end, the provisions of this chapter are declared to be severable.

7:9A-1.6 General prohibitions

(a) A person shall not install, construct, alter or repair an individual subsurface sewage disposal system without first obtaining the necessary permits, approvals or certifications as required by this chapter.

(b) An administrative authority shall not issue an approval, permit or certification for installation, construction, alteration, or repair of an individual subsurface sewage disposal system where such installation, construction, alteration or repair will violate or otherwise not be in compliance with the requirements of this chapter.

(c) The use of a subsurface sewage disposal system for more than one property is prohibited unless a treatment works approval or a NJPDES permit has been issued by the Department.

(d) Individual subsurface sewage disposal systems shall not be located, designed, constructed, installed, altered, repaired or operated in a manner that will allow the discharge of an effluent onto the surface of the ground or into any water course.

(e) The administrative authority shall not approve the construction or alteration of individual subsurface sewage disposal systems or other means of private sewage disposal where a sanitary sewer line is available within 100 feet of the property to be served. For the purpose of this subsection, an existing sanitary sewer line shall be considered to be available when the following conditions are met:

1. Connection of the facility to the sanitary sewer line may be accomplished without installing a pump station, blasting bedrock, acquiring an easement or right-of-way to cross an adjoining property, or crossing a watercourse, railway, major highway or other significant obstacle; and

2. The property to be served is located within the designated sewerage service area of the sewage treatment plant to which the sanitary sewer line is connected.

(f) The discharge of sanitary sewage or the effluent from any individual subsurface sewage disposal system into any abandoned well or any well constructed for the purpose of sanitary sewage disposal is prohibited. The administrative authority shall not approve the discharge of sanitary sewage or septic tank effluent into an existing well or the construction of a new well for the purpose of waste disposal.

(g) The construction or installation of cesspools is prohibited. Alterations, repairs, and/or corrections to cesspools shall, at a minimum, include placement of a septic tank sized in conformance with N.J.A.C. 7:9A-8.2 before the point of discharge into the cesspool.

(h) The administrative authority shall not approve the construction or installation of seepage pits except as provided by N.J.A.C. 7:9A-7.6.

(i) The discharge of industrial wastes into an individual subsurface sewage disposal system is prohibited unless such discharge has been authorized by a treatment works approval or a NJPDES permit issued by the Department.

(j) The administrative authority shall not approve the construction, installation or alteration of any individual subsurface sewage disposal system used for the discharge of industrial wastes.

7:9A-1.7 Penalties

Violation of any provision of this chapter shall be a violation of the New Jersey Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq., and the violator shall be subject to assessment of civil administrative penalties pursuant to the provisions of N.J.A.C. 7:14-8.

7:9A-1.8 Limitations

(a) The administrative authority shall not approve the installation, construction or alteration of an individual subsurface sewage disposal system unless the proposed system falls within the limits defined as follows:

1. A system serving one or more dwelling unit on one individual property where the total daily volume of sewage generated, calculated as prescribed in N.J.A.C. 7:9A-7.4, is no greater than 2,000 gallons per day and the type of waste discharged consists of sanitary sewage only; or

2. A system serving facilities other than one or more dwelling unit where the total daily volume of sewage generated, calculated as prescribed in N.J.A.C. 7:9A-7.4, is no greater than 2,000 gallons per day, the type of waste discharged consists of sanitary sewage only, and the system is connected to buildings, commercial units or other realty improvements on the same individual properties.

(b) When an individual subsurface sewage disposal system exceeds the limitations in (a) above, a treatment works approval issued by the Department will be required, except under the circumstances specified in N.J.A.C. 7:9A-3.3(f), and a NJPDES permit may also be required.

(c) In cases where the actual volume of sanitary sewage discharged from a facility will be reduced by use of water-saving plumbing fixtures, recycling of renovated wastewater, incineration or composting of wastes, evaporation of sewage effluent or any other process, the requirement for obtaining a treatment works approval and a NJPDES permit shall be based upon the design volume of sanitary sewage, calculated as prescribed in N.J.A.C. 7:9A-7.4, rather than the actual discharge volume as modified by water conservation or special treatment processes.

Subchapter 2. Definitions

7:9A-2.1 Definitions

The following words and terms, when used in this chapter, shall have the following meanings unless the context clearly indicates otherwise:

"A-horizon" means the uppermost mineral horizon in a normal soil profile. The upper part of the A-horizon is characterized by maximum accumulation of finely divided, dark colored organic residues, known as humus, which are intimately mixed with the mineral particles of the soil.

"Administrative authority" means the board of health having jurisdiction or its authorized agent acting on its behalf.

"Alteration" means any change in the physical configuration of an existing individual subsurface sewage disposal system or any of its component parts, including replacement, modification, addition or removal of system components such that there will be a change in the location, design, construction, installation, size, capacity, type or number of one or more components. The term "alter" shall be construed accordingly.

"Applicant" means the person who signs and submits an application to construct, install or alter an individual subsurface sewage disposal system.

"Approved" means accepted or acceptable under applicable specifications stated or cited in this chapter, or accepted as suitable for the proposed use under the procedures of this chapter. The word "approval" shall be construed accordingly.

"Approved engineering design" means the engineering plans and specifications for construction, installation or alteration of the individual subsurface sewage disposal system which have been reviewed and approved by the administrative authority.

"Artesian zone of saturation" means a zone of saturation which exists immediately below a hydraulically restrictive horizon, and which has an upper surface which is at a pressure greater than atmospheric, either seasonally or throughout the year.

"Authorized agent" means a licensed health officer, licensed professional engineer or first-grade sanitarian who is delegated to function within specified limits as the agent of the administrative authority.

"Bedrock" means any solid body of rock, with or without fractures, which is not underlain by soil or unconsolidated rock material.

"Bedroom" means any room within a dwelling unit, finished or unfinished, which may reasonably be expected to serve primarily as a bedroom or dormitory. The term bedroom shall be considered to include any room or rooms within an expansion attic.

"Blackwater" means any sanitary sewage generated within a residential, commercial or institutional facility which includes discharges from water closets, toilets, urinals or similar fixtures alone or in combination with other wastewater. Blackwater generally does not include laundry or kitchen wastewater.

"Building sewer" means the pipe extending from the outer wall of the building, or as defined in the State Uniform Construction Code, N.J.A.C. 5:23, to the septic tank or approved place of disposal other than a public sewer.

"Certificate of compliance" means a formal determination in writing by the administrative authority or its authorized agent that an individual subsurface sewage disposal system has been constructed, installed or altered in conformance with the requirements set forth in this chapter as well as any other applicable local ordinances.

"Cesspool" means a covered pit with open-jointed lining into which untreated sewage is discharged, the liquid portion of which is disposed of by leaching into the surrounding soil, the solids or sludge being retained within the pit.

"Chroma" means the relative purity or strength of a color, a quantity which decreases with increasing grayness. Chroma is one of the three variables of soil color as defined in the Munsell system of classification.

"Clay" means a particle size category consisting of mineral particles which are smaller than 0.002 millimeters in equivalent spherical diameter. Also, a soil textural class having more than 40 percent clay, less than 45 percent sand, and less than 40 percent silt, as shown in Figure 3 of Appendix A.

"Clay loam" means a soil textural class having 27 to 40 percent clay and 20 to 45 percent sand, as shown in Figure 3 of Appendix A.

"Commercial unit" means one or more buildings, or one or more rooms within a building, which will be occupied by a single individual, corporation, company, association, society, firm, partnership or joint stock company, and used for non-residential purposes. Within a commercial building, each room or suite of rooms having its own separate sanitary facilities as well as a separate entrance to the outside, or to a hallway, lobby, foyer or other common area, shall be considered to be a separate realty improvement, as defined in this section.

"Coarse fragment" means a rock fragment contained within the soil which is greater than two millimeters in equivalent spherical diameter or which is retained on a two millimeter sieve.

"Construct" means to build, install, fabricate or put together on-site one or more components of an individual subsurface sewage disposal system.

"Conventional disposal field installation" means a type of disposal field installation described in N.J.A.C. 7:9A-10.1(b)1.

"Cobble" means a coarse fragment which is rounded or subrounded in shape and which is between 76 millimeters (three inches) and 254 millimeters (10 inches) in diameter.

"County soil survey report" means a report prepared by the U.S. Department of Agriculture, Soil Conservation Service which includes maps showing the distribution of soil mapping units throughout a particular county together with narrative descriptions of the soil series shown and other information relating to the uses and properties of the various soil series.

"D-box" means a distribution box.

"Delineated stream" or "delineated floodplain" means a stream or flood plain for which the flood hazard areas have been officially specified by the State of New Jersey.

"Department" means the Department of Environmental Protection.

"Design permeability" means the permeability or percolation rate measured at the level of infiltration, as prescribed in N.J.A.C. 7:9A-6. For the purpose of this chapter, a percolation rate measured at the level of infiltration, though not a true measurement of permeability, may be considered to be a form of design permeability.

"Direct supervision" means control over and direction of work carried out by others with full knowledge of and responsibility for such work.

"Disposal bed" means an individual subsurface sewage disposal system component consisting of a closed excavation made within soil or fill material to contain filter material in which two or more distribution laterals have been placed for the disposal of septic tank effluent.

"Disposal field" means a disposal bed or a group of one or more disposal trenches. The perimeter of the disposal field corresponds to the perimeter of the disposal bed, or a line circumscribing the outermost edges of the outermost disposal trenches and including the area between the disposal trenches.

"Disposal trench" means an individual subsurface sewage disposal system component of a covered excavation made within soil or fill material to contain filter material in which a single distribution lateral has been placed for the disposal of septic tank effluent.

"Distribution box" means a water-tight structure which receives sanitary sewage effluent from a septic tank and distributes such sewage effluent in equal portions to two or more pipelines leading to the disposal field.

"Distribution lateral" means a perforated pipe or one of several perforated pipes used to carry and distribute septic tank effluent throughout the disposal field. The term "distribution line" is equivalent in meaning.

"Distribution network" means two or more inter-connected distribution laterals.

"Disturbed ground" means any site or portion of a site which has been modified in its suitability for absorption or disposal of septic tank effluent, or its ability to physically support the system components, as a result of activities carried out by man other than those specified in the approved engineering design. Except for artificial drainage, ground disturbed only for cultivation or related agricultural activities, shall not be considered disturbed ground. Disturbed ground includes those conditions set forth in N.J.A.C. 7:9A-5.10(b).

"Dosing tank" means a water-tight receptacle located between the septic tank and the disposal field, equipped with a siphon or pump, and designed to store and deliver doses of septic tank effluent to the disposal field.

"Dry well" means a covered pit with open-jointed lining through which drainage from roofs, basement floors or areaways may seep into the surrounding soil.

"Dwelling unit" means any building or portion of a building, permanent or temporary in nature, used or proposed to be used as a residence either seasonally or throughout the year.

"Encroachment line" means a line encompassing the channel of a natural stream and portions of the 100-year flood plain adjoining the channel which are reasonably required to carry and discharge the flood water or flood flow of any natural stream. It is approximately equal to the floodway line along delineated streams.

"Equivalent spherical diameter" of a particle means the diameter of a sphere which has a volume equal to the volume of the particle.

"Excessively coarse horizon" means a horizon of limited thickness within the soil profile which provides inadequate treatment of septic tank effluent due to a high coarse fragment content, excessively coarse texture and/or excessively rapid permeability.

"Excessively coarse substratum" means a substratum below the soil profile which extends beyond the depth of soil profile pits and borings and which provides inadequate treatment of septic tank effluent due to a high coarse fragment content, excessively coarse texture and/or excessively rapid permeability.

"Existing ground surface" means the natural surface of the ground at the site of a proposed individual subsurface sewage disposal system after the completion of re-grading in accordance with an approved engineering design.

"Expansion attic" means that part of a dwelling unit left unfinished but which is capable of being finished as a bedroom or bedrooms and which is accessible by permanent stairways or designed so that stairways can be installed.

"Experimental system" means an individual subsurface sewage disposal system which does not conform in location, design, construction or installation to standard engineering practice as set forth in this chapter.

"Extremely firm consistence" means a type of soil consistence which is described in N.J.A.C. 7:9A-5.3(h).

"Fill material" means any soil, rock or other material which is placed within an excavation or over the pre-existing surface of the ground. The term "fill" is equivalent in meaning.

"Filter material" means washed gravel or crushed stone, free of fines such as dust, ashes or clay, and meeting the size requirements of N.J.A.C. 7:9A-10.3(e)2 or 10.7(f).

"Finished grade" means the surface of the ground after completion of final grading.

"Firm consistence" means a type of soil consistence which is described in N.J.A.C. 7:9A-5.3(h).

"Flood fringe" means that portion of the flood hazard area not designated as the floodway. See N.J.A.C. 7:13.

"Flood hazard area" means the floodway and the flood fringe area of a delineated stream. See also N.J.A.C. 7:13.

"Floodway" means the channel of a natural stream and portions of the flood hazard area adjoining the channel which are reasonably required to carry and discharge the flood water or flood flow of any natural stream. See also N.J.A.C. 7:13.

"Footing drain" means a subsurface drain installed below the foundation of a building to prevent the accumulation of surface and ground water below the foundation of the building.

"Fractured rock substratum" means a rock substratum which contains an adequate number of open and inter-connected fractures to allow unimpeded absorption of applied wastewater and transmission of this wastewater away from the disposal area.

"Gal/day" or "gpd" means U.S. gallons per day, which is a measure of rate of flow or hydraulic loading.

"Gravel" means a rounded or subrounded coarse fragment which is between two millimeters (0.1 inches) and 76 millimeters (three inches) in diameter.

"Gravity dosing" means a type of effluent distribution which is defined in N.J.A.C. 7:9A-9.1(a)2.

"Gravity flow" means a type of effluent distribution which is defined in N.J.A.C. 7:9A-9.1(a)1.

"Grease trap" means a device in which the grease present in sanitary sewage is intercepted, congealed by cooling, accumulated and stored for pump-out and disposal.

"Greywater" means that portion of the sanitary sewage generated within a residential, commercial or institutional facility which does not include discharges from water closets or urinals.

"Ground water" means water below the land surface in a zone of saturation.

"Hard consistence" means a type of soil consistence which is described in N.J.A.C. 7:9A-5.3(h).

"Health Officer" means an individual licensed as such pursuant to N.J.S.A. 26:1A-41.

"Holding tank" means a closed water-tight structure designed and operated in such a manner as to receive and store sanitary sewage or septic tank effluent but not to discharge sanitary sewage or septic tank effluent to the surface or ground water or onto the surface of the land.

"Hue" means the dominant spectral color, one of the three variables of soil color defined within the Munsell system of classification.

"Hydraulically restrictive horizon" means a horizon within the soil profile which slows or prevents the downward or lateral movement of water and which is underlain by permeable soil horizons or substrata. Any soil horizon which has a saturated permeability less than 0.2 inch per hour or a percolation rate slower than 60 minutes per inch is hydraulically restrictive.

"Hydraulically restrictive substratum" means a substratum below the soil profile which slows or prevents the downward or lateral movement of water and which extends beyond the depth of profile pits or borings or to a massive substratum. A substratum which has a saturated permeability less than 0.2 inch per hour or a percolation rate slower than 60 minutes per inch is hydraulically restrictive.

"Individual subsurface sewage disposal system" means a system for disposal of sanitary sewage into the ground which is designed and constructed to treat sanitary sewage in a manner that will retain most of the settleable solids in a septic tank and to discharge the liquid effluent to a disposal field. The term "system" is equivalent in meaning.

"Industrial wastes" means solid or liquid wastes resulting from processes employed in industrial establishments or in any commercial establishment engaged in processes which use or generate any of the pollutants or any substance containing any of the pollutants regulated under section 307(a), (b), or (c) of the Federal Clean Water Act of 1977, 33 U.S.C. • • 1251 et seq., and the regulations promulgated pursuant thereto and any amendments thereto.

"Infiltrative surface" means the interface or contact between the filter material and the soil or fill at the bottom and sidewalls of the disposal bed or each individual disposal trench.

"Install" means to assemble, put in place or connect components of an individual subsurface sewage disposal system in a manner that will permit their use by the occupants of the realty improvement served.

"Interceptor drain" means a subsurface drain designed and constructed to intercept laterally moving perched ground water.

"Invert" means the floor, bottom or lowest portion of the internal cross-section of a closed conduit, used with reference to pipes or fittings conveying sanitary sewage.

"Level of infiltration" means the elevation of the horizontal interface or contact between the filter material and the soil or fill material at the bottom of the filter material.

"Limiting zone" means any horizon or combination of horizons within the soil profile, or any substratum or combination of substrata below the soil profile, which limits the ability of the soil to provide treatment and/or disposal of septic tank effluent. Limiting zones include rock substrata, hydraulically restrictive horizons and substrata, excessively coarse horizons and substrata, perched and regional zones of saturation. Criteria for recognition of limiting zones are given in N.J.A.C. 7:9A-5.5 through 5.9.

"Loamy sand" means a soil textural class, as shown in Figure 3 of Appendix A, that has a maximum of 85 to 90 percent sand with a percentage of silt plus 1.5 times the percentage of clay not in excess of 15; or a minimum of 70 to 85 percent sand with a percentage of silt plus 1.5 times the percentage of clay not in excess of 30.

"Lower plastic limit" means the moisture content corresponding to the transition between the plastic and semi-solid states of soil consistency. This corresponds to the lowest soil moisture content at which the soil can be molded in the fingers to form a rod or wire, one-eighth of an inch in thickness, without crumbling.

"Malfunctioning system" means an individual sewage disposal system which pollutes ground or surface waters or which creates a nuisance or hazard to public health or safety or the environment and includes, but is not limited to, the situations described in N.J.A.C. 7:9A-3.4.

"Massive rock substratum" means a rock substratum which does not contain an adequate number of open and inter-connected fractures to allow unimpeded absorption of applied wastewater and transmission of this wastewater away from the disposal area.

"Massive structure" means one of the soil structural classes which is described in N.J.A.C. 7:9A-5.3(h).

"Mottling" means a color pattern observed in soil consisting of blotches or spots of contrasting color. The term "mottle" refers to an individual blotch or spot. Mottling is an indication of seasonal or periodic and recurrent saturation.

"Mounded disposal field installation" means a type of disposal field installation which is described at N.J.A.C. 7:9A-10.1(b)4.

"Mounded soil replacement disposal field installation" means a type of disposal field installation which is described at N.J.A.C. 7:9A-10.1(b)5.

"Munsell system" means a system of classifying soil color consisting of an alpha-numeric designation for hue, value and chroma, such as "7.5 YR 6/2", together with a descriptive color name, such as "strong brown".

"NJPDES permit" means a permit issued by the Department pursuant to the authority of the Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq., and N.J.A.C. 7:14A for a discharge of pollutants.

"NJPDES" means the New Jersey Pollutant Discharge Elimination System as set forth in N.J.S.A. 58:10A-1 et seq. and in N.J.A.C. 7:14A.

"O-horizon" means a surface horizon, occurring above the A-horizon in some soils, which is composed primarily of undecomposed or partially decomposed plant remains which have not been incorporated into the mineral soil.

"One hundred year flood plain" means the area inundated by the 100-year flood. A 100-year flood is estimated to have a one percent chance, or one chance in 100, of being equaled or exceeded in any one year. See also N.J.A.C. 7:13.

"Operate" means to use or convey a building or facility served by an individual subsurface sewage disposal system or to own a building or facility where such use or occupation exists.

"Perched zone of saturation" means a zone of saturation which occurs immediately above a hydraulically restrictive horizon and which is underlain by permeable horizons or substrata which are not permanently or seasonally saturated.

"Percolation rate" means the rate of fall of water measured in a test hole as prescribed in N.J.A.C. 7:9A-6.4.

"Permeability" means the rate at which water moves through a unit area of soil or rock material at hydraulic gradient of one, determined as prescribed in N.J.A.C. 7:9A-6.2, 6.3, 6.5 or 6.6.

"Permeable" means having a permeability of 0.2 inches per hour or faster or a percolation rate of 60 minutes per inch or faster. The terms "permeable soil", "permeable rock" and "permeable fill" shall be construed accordingly.

"Permit" means a written approval issued by the administrative authority or the Department for the construction, installation, alteration or operation of an individual subsurface sewage disposal system.

"Person" means an individual, corporation, company, association, society, firm, partnership and joint stock company as well as the State and any political subdivision thereof.

"Piezometer" means a device consisting of a length of metal or plastic pipe, open at the bottom or perforated within a specified interval, and used for the determination of depth to water, permeability or hydraulic head within a specific soil horizon or substratum.

"Platy structure" means one of the soil structural classes described in N.J.A.C. 7:9A-5.3(g).

"Practice of engineering" means any professional service or creative work requiring engineering education, training, and experience and the application of special knowledge of the mathematical, physical and engineering sciences to such professional services or creative work as consultation, investigation, evaluation, planning, design or general supervision of construction or operation for the purpose of assuring compliance with plans, specification and design in connection with any public or private engineering or industrial project.

"Pre-existing natural ground surface" means the former level of the ground surface in an area of disturbed ground prior to the disturbance.

"Pressure dosing" means a type of effluent distribution which is described in N.J.A.C. 7:9A-9.1.

"Pre-treatment unit" means a septic tank or a grease trap.

"Professional engineer" means a person licensed to practice professional engineering in this State pursuant to N.J.S.A. 48:8-27 et seq.

"Realty improvement" means any proposed new residence, commercial building or other premises (including, but not limited to, condominiums, garden apartments, town houses, mobile homes, stores, office buildings, restaurants, hotels and so forth) not served by an approved water supply and approved sewerage system, the useful occupancy of which will require the installation or erection of a water supply system or sewerage facilities. Each dwelling unit in a proposed multiple-family dwelling or each commercial unit in a commercial building shall be construed to be a separate realty improvement.

"Regional zone of saturation" means a zone of saturation which extends vertically without interruption below the depth of soil borings and profile pits.

“Registered Environmental Health Specialist” means an individual licensed as such pursuant to N.J.S.A. 26:1A-41.

"Re-grading" means modification of a land slope by cutting and filling with the native soil or re-distribution of the native soil which is present at the site.

"Repair" means to fix, refurbish or replace one or more components of an individual subsurface sewage disposal system in a manner that will restore, preserve and not change the original location, design, construction and installation, size, capacity, type, or number of the components of the system.

"Replicate" means one of two or more soil samples or tests taken at the same location (within five feet of each other), and depth, within the same soil horizon or substratum. In the case of fill material, replicate tests are tests performed on sub-samples of the same bulk sample packed to the same bulk density.

"Reservoir" means a surface water body used to store a public drinking water supply or any portion of a tributary water course within one mile upstream of such a surface water body.

"Restricted chemical material" means any chemical material which contains concentrations in excess of one part per hundred, by weight of any halogenated hydrocarbon chemical, aliphatic or aromatic, including, but not limited to, trichloroethane, trichloroethylene, tetrachloroethylene, methylene chloride, halogenated benzenes and carbon tetrachloride; any aromatic hydrocarbon chemical, including, but not limited to, benzene, toluene and napthalene; any phenol derivative in which a hydroxy group and two or more halogen atoms are bonded directly to a six-carbon aromatic ring, including, but not limited to, trichlorophenol or pentachlorophenol; or acrolein, acrylonitrile, or benzidine. Restricted chemical material does not, however, include any chemical material which is biodegradable and not a significant source of contamination of the ground waters of the State.

"Rock substratum" means a solid and continuous body of rock, with or without fractures, or a weathered or broken body of rock fragments overlying a solid body of rock, where more than 50 percent by volume of the rock fragments are greater than two millimeters in diameter or large enough to be retained on a two millimeter sieve.

"Sand" means a particle size category consisting of mineral particles which are between 0.05 and 2.0 millimeters in equivalent spherical diameter. Also, a soil textural class having 85 percent or more of sand and a content of silt and clay such that the percentage of silt plus 1.5 times the percentage of clay does not exceed 15, as shown in Figure 3 of Appendix A.

"Sandy clay" means a soil textural class having 35 percent or more of clay and 45 percent or more of sand, as shown in Figure 3 of Appendix A.

"Sanitary sewage" means any liquid waste containing animal or vegetable matter in suspension or solution, or the water carried wastes resulting from the discharge of water closets, laundry tubs, washing machines, sinks, dishwashers, or any other source of water carried wastes of human origin or containing putrescible material. This term specifically excludes industrial, hazardous or toxic wastes and materials.

"Scum" means a mass of sewage solids floating at the surface of sewage and buoyed up by entrained gas, grease, or other substances. The term "scum layer" shall be construed accordingly.

"Seasonally high water table" means the upper limit of the shallowest zone of saturation which occurs in the soil, identified as prescribed in N.J.A.C. 7:9A-5.8.

"Seepage pit" means a covered pit with open-jointed lining through which septic tank effluent may seep into the surrounding soil.

"Septic tank" means a water-tight receptacle which receives the discharge of sanitary sewage from a building sewer or part thereof, and is designed and constructed so as to permit settling of settleable solids from the liquid, partial digestion of the organic matter, and discharge of the liquid portion into a disposal field or seepage pit.

"Septic tank effluent" means the primary treated wastewater or sewage discharged through the outlet of a septic tank. The term "effluent" is equivalent in meaning.

"Serial distribution" means a method of distributing septic tank effluent between a series of disposal trenches so that each successive trench receives effluent only after the preceding trenches have become full to overflowing.

"Sewage system cleaner" means any solid or liquid material intended or used primarily for the purpose of cleaning, treating, degreasing, unclogging, disinfecting or deodorizing any part of a sewage system but excluding those liquid or solid products intended or used primarily for manual cleaning, scouring, treating, deodorizing or disinfecting the surface of common plumbing fixtures.

"Sewage system" means any part of a wastewater disposal system, including but not limited to all toilets, piping, drains, sewers, septic tanks, grease traps, distribution boxes, dosing tanks, disposal tanks, disposal fields, seepage pits, cesspools or dry wells.

"Silt" means a particle size category consisting of mineral particles which are between 0.002 and 0.05 millimeters in equivalent spherical diameter. It also means a soil textural class having 80 percent or more of silt and 12 percent or less of clay, as shown in Figure 3 of Appendix A.

"Silty clay" means a soil textural class having 40 percent or more of clay and 40 percent or more of silt, as shown in Figure 3 of Appendix A.

"Silty clay loam" means a soil textural class having 27 to 40 percent of clay and less than 20 percent of sand, as shown in Figure 3 of Appendix A.

"Silt loam" means a soil textural class having 50 percent or more of silt and 12 to 27 percent of clay; or 50 to 80 percent of silt and less than 12 percent of clay, as shown in Figure 3 of Appendix A.

"Single grain structure" means one of the soil structural classes which are described in N.J.A.C. 7:9A-5.3(h).

"Sink hole" means a topographic depression the origin of which may be attributed to the dissolution and collapse of underlying limestone or dolomite bedrock.

"Sludge" means a relatively dense suspension of sewage solids which settle to the bottom of a septic tank, are relatively resistant to biological decomposition, and which collect in the septic tank over a period of time. The term "sludge layer" shall be construed accordingly.

"Soil" means any naturally occurring unconsolidated body of mineral and organic particles derived from the weathering in place of consolidated rock or unconsolidated mineral deposits and the decay of living organisms.

"Soil aggregate" means a naturally occurring unit of soil structure consisting of particles of sand, silt, clay, organic matter, and coarse fragments held together by the natural cohesion of the soil.

"Soil color" means the soil color name and Munsell color designation determined by comparison of the moist soil with color chips contained in a Munsell soil color book.

"Soil consistence" means the resistance of a soil aggregate or clod to being crushed between the fingers or broken by the hands. Terms for describing soil consistence described are in N.J.A.C. 7:9A-5.3(h).

"Soil horizon" means a layer within a soil profile differing from layers of soil above and below it in one or more of the soil morphological characteristics including color, texture, coarse fragment content, structure, consistence and mottling.

"Soil log" means a description of the soil profile which includes the depth, thickness, color, texture, coarse fragment content, mottling, structure and consistence of each soil horizon or substratum.

"Soil mapping unit" means an area outlined on a map in a County Soil Survey Report and marked with a letter symbol designating a soil phase, a complex of two or more soil phases, or some other descriptive term where no soil type has been identified.

"Soil material" means soil as well as any naturally occurring unconsolidated mineral deposit which is not a rock substratum.

"Soil phase" means a specific type of soil which is mapped by the Soil Conservation Service and which belongs to a soil series described within the County Soil Survey Report.

"Soil profile" means a vertical cross-section of undisturbed soil showing the characteristic horizontal layers or horizons of the soil which have formed as a result of the combined effects of parent material, topography, climate, biological activity and time.

"Soil profile pit" means an excavation made for the purpose of exposing a soil profile which is to be described.

"Soil replacement disposal field installation" means a disposal field installed as prescribed in N.J.A.C. 7:9A-10.1(b)2 and 3.

"Soil series" means a grouping of soil types possessing a specific range of soil profile characteristics which are described within the County Soil Survey Report. Each soil series may consist of several "soil phases" which may differ in slope, texture of the surface horizon or stoniness.

"Soil structural class" means one of the shape classes of soil structure described in N.J.A.C. 7:9A-5.3(g).

"Soil structure" means the naturally occurring arrangement, within a soil horizon, of sand, silt and clay particles, coarse fragments and organic matter, which are held together in clusters or aggregates of similar shape and size.

"Soil texture" means the relative proportions of sand, silt and clay in that portion of the soil which passes through a sieve with two millimeter openings.

"Soil textural class" means one of the classes of soil texture defined within the USDA system of classification. (Soil Survey Manual, Agricultural Handbook No. 18, U.S.D.A. Soil Conservation Service 1962.)

"Soil suitability class" means one of the classes of soil suitability with regard to the installation of an individual subsurface sewage disposal system which are defined based upon the type and depth of limiting zones present, as prescribed in N.J.A.C. 7:9A-5.4.

"Special ordinance" means an ordinance which sets requirements for the location, design, construction, alteration or use of individual subsurface sewage disposal systems which differ from the requirements of this chapter.

"Static water level" means the depth below the ground surface or the elevation with respect to some reference level, of the water level observed within a soil profile pit or boring, or within a piezometer, after this level has stabilized or become relatively constant with the passage of time.

"Stone" means a coarse fragment which is rounded or subrounded in shape and greater than 254 millimeters (10 inches) in diameter.

"Subsurface drain" means any open pipe, layer of gravel, stone or coarse sand, or any combination of these elements placed below the surface of the ground and designed or constructed in such a manner as to allow movement of ground water into any surface water body, water course or onto the surface of the ground.

"Substratum" means a layer of soil or rock material present below the soil profile and extending beyond the depth of soil borings or profile pits.

"Suitable soil" means unsaturated soil, above the seasonally high water table, which contains less than 50 percent by volume of coarse fragments and which has a permeability between 0.2 and 0.2 inches per hour or a percolation rate between three and 60 minutes per inch.

"Suitable fill" means fill material which meets the requirements of N.J.A.C. 7:9A-10.1(f).

"Surface water" means any waters of the State which are not ground water.

"System" is an abbreviated designation for "individual subsurface sewage disposal system" and is equivalent in meaning.

"Test replicate" means one of two or more soil tests performed using the same procedure on each of several soil samples taken within the same soil horizon and at the same location within the proposed disposal field. The term "replicate sample" shall be construed accordingly.

"Textural analysis" means the determination of soil texture by means of a hydrometer analysis and a sieve analysis.

"Treatment works approval" means a permit issued by the Department pursuant to N.J.A.C. 7:14A-12.3 for a subsurface sewage disposal system which is beyond the scope or not in strict conformance with the requirements of this chapter.

"Undisturbed soil sample" means a soil sample in which the natural soil structure, porosity and cohesion are preserved intact, and in which the only cracks or planes of separation evident are those occurring naturally between soil aggregates.

"Value" means the relative lightness or intensity of a color, one of the three variables of soil color defined within the Munsell system of classification.

"Very firm consistence" means a type of soil consistence which is described in N.J.A.C. 7:9A-5.3(h).

"Very hard consistence" means a type of soil consistence which is described in N.J.A.C. 7:9A-5.3(h).

"Volume of sanitary sewage" means the maximum volume of sanitary sewage which may reasonably be expected to be discharged from a residential, commercial or institutional facility on any day of operation, determined as prescribed in N.J.A.C. 7:9A-7.4 and expressed in gallons per day. The volume of sanitary sewage shall not be considered as an average daily flow, but shall incorporate a factor of safety over and above the average daily flow which is adequate to accommodate peak sewage flows or facilities which discharge greater than the average volumes of sanitary sewage either occasionally or on a regular basis. The use of water saving devices shall not be used as a basis for reducing estimates of the volume of sanitary sewage.

"Water course" means any stream or surface water body, or any ditch or subsurface drain that will permit drainage into a surface water body. This term does not include swales or roadside ditches which convey only direct runoff from storms or snow melting, and storm sewers designed and constructed in a manner that will prevent infiltration of ground water into the pipe or lateral movement of ground water through the excavation in which the pipe has been laid.

"Waters of the State" means the ocean and its estuaries, all springs, streams and bodies of surface and ground water, whether natural or artificial, within the boundaries of this State or subject to its jurisdiction.

"Water table" means the upper surface of a zone of saturation.

"Well" means a bored, drilled or driven shaft, or a dug hole, which extends below the seasonally high water table and which has a depth which is greater than its largest surface dimension.

"Wetland" means any area inundated or saturated by surface or ground water at a frequency or duration sufficient to support, and which under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation. Wetlands generally include swamps, marshes, bogs and similar areas.

"U.S.D.A. system of classification" means the system of classifying soil texture used by the United States Department of Agriculture which defines 12 soil textural classes based upon the weight percentages of sand, silt and clay in that portion of the soil which passes through a sieve with two millimeter openings. The soil textural classes are shown graphically on the soil textural triangle, Figure 3 of Appendix A.

"Zone of disposal" means the permeable layers of soil or rock material below the zone of treatment which permit downward movement of the septic tank effluent and lateral movement of this effluent away from the area of the disposal field.

"Zone of treatment" means the upper four feet of suitable soil or fill material, below the level of infiltration, which remove pollutants from the septic tank effluent by processes which include physical filtration of bacteria, adsorption of viruses and bacteria by clay and organic matter, biological destruction of pathogens by soil microorganisms, chemical fixation or precipitation of phosphorous, bio-chemical transformations of nitrogen compounds and biological assimilation of phosphorous and nitrogen.

"Zone of saturation" means a layer within or below the soil profile which is saturated with ground water either seasonally or throughout the year.

Subchapter 3. Administration

7:9A-3.1 Ordinances

(a) The administrative authority may adopt this chapter by reference as allowed by N.J.S.A. 26:3-69 to 69.6.
(b) For the purpose of this chapter, the term "special ordinance" means any ordinance which differs in any detail from this chapter. Within 10 days after adoption of a special ordinance, the administrative authority shall forward to the Department a copy of the ordinance together with a written statement in which all provisions which differ from this chapter are identified, the reasons for the differences are explained and all

supporting facts and data are provided. Where requirements differing from the requirements of this chapter are proposed in order to conform with the requirements of the Pinelands Comprehensive Management Plan, the appropriate section(s) of the Plan shall be cited.

(c) The administrative authority shall not adopt an ordinance which is less stringent than this chapter.

7:9A-3.2 New system design approvals

(a) All aspects of the location, design, construction, installation, operation, alteration and repair of individual subsurface sewage disposal systems shall comply with the requirements of these standards.

(b) Designs for individual subsurface sewage disposal systems approved by the administrative authority prior to January 1, 1990 may be installed and certified pursuant to the rules in effect at the time of the approval. Such approvals may be valid for up to five years following January 1, 1990 provided that the following conditions are met:

1. That any modifications to the approved engineering design plans involving location, design, construction and installation of components specific to the individual subsurface sewage disposal system are limited to those which are necessary to address specific soil or site limitations encountered during construction but not previously identified in the approved engineering design plans; and
2. That the period for which such approvals are valid is not limited by any ordinances adopted by the administrative authority.

7:9A-3.3 Existing systems

(a) The use of systems in existence prior to the effective date of this chapter may be continued without change provided that these systems were located, designed, constructed and installed in conformance with the standards in effect at the time when they were installed and provided that such systems are not malfunctioning.

(b) When an expansion or a change in use of a commercial building or facility served by an existing individual subsurface sewage disposal system is proposed and such expansion or change will result in an increase in the volume of sanitary sewage (determined as prescribed at N.J.A.C. 7:9A-7.4) or a change in the type of wastes discharged (see N.J.A.C. 7:9A-7.3), the administrative authority shall not approve such an expansion or change unless all of the following conditions are satisfied:

1. All aspects of the location, design, construction, installation and operation of the existing system are in conformance with the requirements of this chapter or are altered so that they will be in conformance with the requirements of this chapter;
2. The expansion or change of use of the building or facility served will not exceed the design capacity of the existing system; and
3. It is demonstrated to the satisfaction of the administrative authority that the existing system is not malfunctioning.

(c) When an expansion or a change in use of a residential dwelling served by an existing individual subsurface sewage disposal system is proposed and such an expansion or change will exceed 100 square feet of habitable living space (as defined in the New Jersey Uniform Construction Code, N.J.A.C. 5:23) and such expansion or change will result in an increase in the volume of sanitary sewage (determined as prescribed at N.J.A.C. 7:9A-7.4) or will result in a change in the type of wastes discharged (see N.J.A.C. 7:9A-7.3), the administrative authority shall not approve such an expansion or change unless all of the following conditions are satisfied:

1. All aspects of the location, design, construction, installation and operation of the existing system are in conformance with the requirements of this chapter or are altered so that they will be in conformance with the requirements of this chapter;
2. The expansion or change of use of the dwelling served does not increase the design flow of the dwelling beyond the design capacity of the existing system; and

3. It is demonstrated to the satisfaction of the administrative authority that the existing system is not malfunctioning.

(d) Alterations made to a system for reasons other than a change of use or expansion as described in (b) and (c) above may be approved by the administrative authority provided that both of the following conditions are met:

1. If the scope of the alteration is such that it constitutes the practice of professional engineering according to N.J.S.A. 45:8 and the rules adopted pursuant to same, then such alterations shall be made in conformance with plans and specifications signed and sealed by a licensed professional engineer; and
2. Alterations are made in such a way that those components of the system altered are in conformance with the requirements of this chapter or are closer to being in conformance with this chapter than the original components prior to the alteration.

(e) When alterations are made to correct a malfunctioning system, the alterations shall be made in conformance with (d) above and in a manner that will eliminate the cause of the malfunction and which, with proper operation and maintenance, will not result in future malfunctions.

(f) Alterations to existing malfunctioning subsurface sewage disposal systems, which are regulated under N.J.A.C. 7:14A-7, may be approved by the administrative authority, provided the design flow of the system is less than or equal to 2,000 gpd. A Treatment Works Approval shall be obtained from the Department for the alteration to any existing malfunctioning subsurface sewage disposal system with a design flow greater than 2,000 gpd.

(g) Repairs may be made in the same manner as in the original system, with the exception of cesspools which shall be corrected as prescribed at N.J.A.C. 7:9A-1.6(g), provided that all repairs are approved by the administrative authority.

(h) A person who discharges industrial wastes by means of an existing subsurface sewage disposal system and who has not already applied to the Department for a NJPDES permit shall apply immediately.

(i) A person who discharges sanitary wastes by means of an existing subsurface disposal system, as defined in N.J.A.C. 7:14A-8.1(b)1iv, and who has not already applied to the Department for a NJPDES permit shall apply immediately.

7:9A-3.4 Malfunctioning systems

(a) Indications that an individual subsurface sewage disposal system is malfunctioning include but are not limited to the following:

1. Contamination of nearby wells or surface water bodies by sewage or effluent as indicated by the presence of fecal bacteria where the ratio of fecal coliform to fecal streptococci is four or greater;
2. Ponding or breakout of sewage or effluent onto the surface of the ground;
3. Seepage of sewage or effluent into portions of buildings below ground; or
4. Back-up of sewage into the building served which is not caused by a physical blockage of the internal plumbing.

(b) When an individual subsurface sewage disposal system has been determined to be malfunctioning, the owner shall take immediate steps to correct the malfunction. When it becomes necessary to repair or replace one or more system components or to make alterations to the system, all of the following requirements shall be met:

1. The owner or owner's agent shall notify the administrative authority or its authorized agent immediately upon detection of a malfunctioning system. The owner shall obtain prior approval from the administrative authority or its authorized agent for any repairs or alterations made.
2. Alterations made to correct a malfunctioning system shall meet the requirements of N.J.A.C. 7:9A-3.3(c). In cases where the alteration does not involve the practice of engineering as defined by N.J.S.A. 45:8-28(b), the administrative authority or its authorized agent may approve plans and specifications prepared by a septic system installer rather than a licensed professional engineer.

3. When the malfunction involves continuous discharge of sewage or septic tank effluent onto the surface of the ground or into a watercourse, the use of the system shall cease until repairs or alterations have been completed in a manner which is satisfactory to the administrative authority. In such cases, the administrative authority may permit continued occupation of the building served provided that further surface discharge of sewage or septic tank effluent is prevented by installation of a holding tank or use of an existing septic system component as a holding tank. The latter may be accomplished by pumping-out the septic tank, dosing tank, seepage pit or other system component at an adequate frequency to prevent overflow.

(c) The administrative authority may, under certain circumstances, approve as a last resort, the permanent use of a holding tank to correct the problem of a malfunctioning system which cannot be repaired or altered in a satisfactory manner. Such approval may be granted by the administrative authority only if prior written approval has been granted by the Department and one of the following criteria is met:

1. The malfunctioning system serves a single family dwelling or other facility falling within the limitations set forth in N.J.A.C. 7:9-A1.8 and the system was constructed prior to the effective date of this chapter; or

2. The malfunctioning system serves a facility which exceeds the limitations set forth in N.J.A.C. 7:9A-1.8 but was constructed prior to March 6, 1981, the effective date of the NJPDES rules (N.J.A.C. 7:14A).

(d) The Department and the administrative authority may approve the permanent use of a holding tank to correct the problem of a malfunctioning system only when all of the following facts have been established to the satisfaction of the administrative authority and the Department:

1. The present malfunctioning system poses a threat or a potential threat to ground or surface water quality or public health or safety or the environment;

2. Due to site conditions, lot configuration, financial circumstances or other constraints, repair, or alteration of the system in a manner that will eliminate the cause of the malfunction is not feasible;

3. Public sewers are by practical means not available;

4. Reduction of disposal field hydraulic loading by means of water-saving plumbing fixtures will not correct the malfunction; and

5. Assurances are given that the holding tank will be emptied and the contents disposed of in a manner which complies with all applicable local, State and Federal ordinances, statutes and regulations. As a means of confirmation, the owner of the system shall install a water meter and shall submit to the administrative authority on a quarterly basis, evidence of dates and quantities of sewage removed, name of person(s) or firm(s) contracted to remove the sewage, the name of the facility(s) to which the sewage is taken, as well as any other evidence or information which is requested by the administrative authority.

7:9A-3.5 Permit to construct or alter

(a) A person shall not construct, install or alter an individual subsurface sewage disposal system until the administrative authority or its authorized agent has issued a permit for such construction, installation or alteration.

(b) The administrative authority or its authorized agent shall not issue a permit to construct, install or alter an individual subsurface sewage disposal system until an application has been submitted as prescribed in (c) below and, based upon a review of the application submitted, the location and design of the proposed system are found by the administrative authority or its authorized agent to be in conformance with the requirements of this chapter.

(c) The applicant shall submit a complete, accurate and properly executed application to the administrative authority. All soil logs, soil testing data, design data and calculations, plans and specifications, and other information submitted in connection with the subsurface sewage disposal system design shall be signed and sealed by a licensed professional engineer except where N.J.A.C. 7:9A-3.3(d)1 allows otherwise. The application shall include the following information:

1. Key maps showing the approximate boundaries of the lot on a U.S. Geological Survey (U.S.G.S.) topographic quadrangle or other accurate map and on a U.S.D.A. soil survey map, which is available from the Soil Conservation Service ("SCS"). A good quality photo-copy reproduction of the U.S.G.S. quadrangle or U.S.D.A. soil survey map may be used for this purpose. The requirement for a soil survey map does not apply to Essex or Hudson counties, where no modern soil survey is currently available;

2. A site plan, prepared in accordance with N.J.A.C. 13:40-7 and drawn at a scale adequate to depict clearly the following features within a 150 foot radius around the proposed system:

i. Location of all components of the proposed system including, but not limited to, septic tanks, grease traps, dosing tanks, distribution boxes, distribution laterals, disposal fields, interceptor drains and seepage pits;

ii. Boundaries of lot;

iii. Locations of existing and proposed buildings roadways, subsurface drains, wells and disposal areas on same lot and on adjacent lots;

iv. Existing and finished grade topography (two foot contour interval) using absolute elevations or relative elevations referenced to a permanent bench-mark;

v. Location of all surface water bodies, natural and artificial, and all springs or areas of ground water seepage;

vi. Location of existing and proposed surface water diversions;

vii. Location of all outcrops of bedrock;

viii. Conformance with setback requirements as required in N.J.A.C. 7:9A-4.3;

ix. Location of all soil profile pits, soil borings and permeability tests;

x. Location of stream encroachment boundaries for streams within the near vicinity of the site; and

xi. State approved boundaries of any wetland areas or transition areas within the boundaries of the property or within 150 feet of the area of the proposed system. Alternatively, the applicant may submit evidence of compliance with the requirements of N.J.A.C. 7:7A as provided pursuant to N.J.A.C. 7:9A-4.7(b) or (c).

3. Soil logs prepared as prescribed in N.J.A.C. 7:9A-5.3;

4. Soil suitability class(es) determined as prescribed in N.J.A.C. 7:9A-5.4;

5. Results of permeability tests performed as prescribed in N.J.A.C. 7:9A-6, including all test data and calculations;

6. Maximum expected daily volume of sanitary sewage and method of calculation;

7. Detailed engineering plans and specifications for all components of the systems; and

8. All data and calculations used in the design of the sewage system.

(d) Applications shall be made using standard forms provided in Appendix B of this chapter or forms provided by the administrative authority which contain all of the information required on the standard forms in Appendix B. The administrative authority or its authorized agent may require additional data or the completion by the applicant of additional application forms.

7:9A-3.6 Witnessing of soil evaluation and testing

(a) The administrative authority or its authorized agent shall witness the excavation of soil profile pits and borings, in-situ permeability testing or soil sample collection and any other site evaluation procedure relied upon in the design or location of the system. The administrative authority or its authorized agent may require a maximum of 15 business days prior to written notice for the purpose of witnessing of soil evaluation or testing procedures.

(b) The administrative authority may waive the requirements for witnessing of soil evaluation or testing procedures which are identified in (a) above. Failure of the administrative authority or its authorized agent to be present when 15 business days prior written notice has been given shall be construed to be a waiver of the witnessing requirements.

7:9A-3.7 Modification of plans

(a) Modification of plans or specifications for an individual subsurface sewage disposal system made subsequent to approval of the plans shall not be carried out unless the revisions are in conformance with the requirements of this chapter and noted on a revised set of plans which have been signed, sealed and dated by a licensed professional engineer and approved by the administrative authority or its authorized agent.
(b) Any modification to plans or specifications made without approval of the administrative authority shall render the original approval null and void and a new application shall be required.
(c) The administrative authority or its authorized agent may require the revision of plans or specifications as it deems necessary if conditions found prior to or during construction warrant such change in order to obtain conformance with the provisions of this chapter.

7:9A-3.8 Pinelands area approvals

The administrative authority shall not approve an application to construct, install or alter an individual subsurface sewage disposal system within the Pinelands area (as defined in N.J.S.A. 13:18A-1 et seq.) until the Pinelands Commission has issued a Notice of Filing, Certificate of Compliance, Certificate of Filing, development approval, or a written statement that no approval from the Pinelands Commission is required. All approvals issued by the administrative authority shall be consistent with the requirements of N.J.A.C. 7:50-5 and 6, and shall be reported to the Pinelands Commission in accordance with N.J.A.C. 7:50-4.

7:9A-3.9 Treatment works approval

(a) A treatment works approval issued by the Department is required for any subsurface sewage disposal system other than a system serving a single dwelling unit, building, commercial unit or other realty improvement, located on a single property, generating less than 2000 gpd of sanitary sewage only, which is designed, constructed and operated in conformance with this chapter.
(b) Whenever a proposed subsurface sewage disposal system meets any of the following criteria, the administrative authority shall direct the applicant to apply to the Department for a treatment works approval.

1. The system will exceed any of the limitations set forth in N.J.A.C. 7:9A-1.8;
2. The design or construction of one or more components of the system will not be in conformance with this chapter;
3. The system utilizes unproven technology or is otherwise experimental in nature, so that adequate functioning of the system will depend upon the installation, operation or maintenance of components or treatment processes not provided for in this chapter;
4. The system is designed to provide wastewater treatment in order to meet effluent discharge limitations or ground and surface water quality standards as prescribed by applicable State or Federal regulations or statutes; or
5. Sewage will not flow by gravity from the realty improvement to the septic tank.

(c) Applications for treatment works approval shall be made on forms available from the Department and shall be accompanied by the required application fee. Application forms and instructions regarding administrative and technical submission requirements may be obtained by contacting the Department at the following address:

Department of Environmental Protection
Division of Water Quality
Bureau of Nonpoint Pollution Control
PO Box 029
Trenton, N.J. 08625

7:9A-3.10 NJPDES permits

(a) Individual subsurface sewage disposal systems which serve single family dwelling units and which are located, designed, constructed, installed, altered, repaired and operated in conformance with the

requirements set forth in these standards are exempt from NJPDES permit requirements in accordance with N.J.A.C. 7:14A-8.5(b)1.
(b) Subsurface sewage disposal systems which serve facilities other than single family dwelling units and which are located, designed, constructed, installed, altered, repaired and operated in conformance with the requirements set forth in this chapter, and N.J.S.A. 58:11-43 et seq. where these restrictions are applicable, are authorized by rule.
(c) When the proposed system does not fall into either of the categories outlined in (a) or (b) above, the administrative authority shall direct the applicant to apply to the Department for a NJPDES permit.

7:9A-3.11 Experimental systems

The Department encourages the development and use of new technologies which may improve the treatment of sanitary sewage prior to discharge or allow environmentally safe disposal of sanitary sewage in areas where standard sewage disposal systems might not function adequately. Where the design, location, construction or installation of the system or any of its components does not conform to this chapter, the administrative authority shall direct the applicant to apply to the Department for a treatment works approval. Depending upon the volume and quality of the wastewater discharged, a NJPDES permit may also be required.

7:9A-3.12 Holding tanks

(a) The administrative authority may approve the use of a sewage holding tank in lieu of an individual subsurface sewage disposal system, as a temporary means of waste disposal, for a period not to exceed 180 days, where alteration or repair of an existing system is being implemented as approved by the administrative authority.
(b) The administrative authority may approve permanent use of a holding tank in the case of a malfunctioning system, subject to approval by the Department, as allowed in N.J.A.C. 7:9A-3.4(c).

7:9A-3.13 Certificate of compliance

(a) Prior to issuance of a certificate of compliance, the administrative authority or its authorized agent shall make sufficient inspections during the course of construction and installation or alteration of the individual subsurface sewage disposal system to determine that the system has been located, constructed and installed or altered in compliance with the requirements of this chapter and the approved engineering design. Alternatively, the administrative authority may issue a certificate of compliance if a licensed professional engineer submits to the administrative authority, a statement in writing, signed and sealed by him or her that the said system has been located, constructed, installed or altered in compliance with the requirements of these standards and the approved engineering design.
(b) The administrative authority or authorized agent may require additional permeability tests to be conducted, the disposal field excavation to be deepened, fill material to be added or other changes to be made in the installation of the system if, during the course of excavation, soil limitations not identified previously are discovered. Such changes shall be made as prescribed in N.J.A.C. 7:9A-3.7.
(c) A component of an individual subsurface sewage disposal system shall not be backfilled or otherwise concealed from view until a final inspection has been conducted by the administrative authority or its authorized agent, or a licensed professional engineer, and permission has been granted by the administrative authority to backfill the system. Any component of the system which has been covered without such permission shall be uncovered upon the order of the administrative authority or its authorized agent.
(d) A person shall not commence operation or use of an individual subsurface sewage disposal system until a certificate has been issued by the administrative authority or its authorized agent indicating that said system has been located, constructed, installed or altered in compliance with this chapter. The issuance of a certificate of compliance shall constitute only certification that the individual subsurface sewage disposal system has been constructed, located, installed or altered in conformance with this chapter. It shall not be

construed as a guarantee that the system will function satisfactorily, nor shall it in any way restrict the powers or responsibilities of the administrative authority or the Department in the enforcement of any law or ordinance relating to public health and safety or environmental protection.

(e) The administrative authority or its authorized agent shall give to the building inspector or similar official of the municipality who is responsible for the issuance of occupancy permits a copy of the certificate of compliance.

7:9A-3.14 Notification of proper operation and maintenance practices

(a) The administrative authority shall notify each property owner issued approval for the design, construction, installation, alteration or repair of an individual subsurface sewage disposal system after January 1, 1990 of the proper operation and maintenance practices.

(b) Written notification of the proper operation and maintenance practices shall initially be issued to the applicant with the approval for the location, design, construction, installation, alteration or repair of the individual subsurface sewage disposal system and reissued on a triennial basis to the present property owner. For approvals issued before June 21, 1993, the notification shall be accomplished by December 21, 1993 and reissued on a triennial basis, thereafter.

(c) The written notification shall inform the present property owner how to properly operate and maintain an individual subsurface sewage disposal system. A mass mailing to all property owners who have individual subsurface sewage disposal systems is an acceptable method of notice. The notice shall include, at a minimum:

1. A general outline of how an individual subsurface sewage disposal system works and the potential impact of improper operation and maintenance on system performance, ground and surface water quality, and public health;
2. The recommended frequency of septic tank and grease trap pumping to prevent over-accumulation of solids, and methodology for inspection to determine whether pumping is necessary;
3. A list of materials containing toxic substances which are prohibited from being disposed of into an individual subsurface sewage disposal system;
4. A list of inert or non-biodegradable substances which should not be disposed of within an individual subsurface sewage disposal system;
5. Proper practices for maintaining the area reserved for sewage disposal;
6. Impacts upon system performance resulting from excessive water use; and
7. Warning signs of poor system performance or malfunction and recommended or required corrective measures.

(d) The written notification may be developed by the administrative authority, or the administrative authority may distribute copies of an operation and maintenance manual made available by the Department.

7:9A-3.15 Records

(a) The administrative authority or its authorized agent shall maintain records and shall keep on file copies of the following documents:

1. Applications and plans and specifications for the construction, installation or alteration of individual subsurface sewage disposal systems, including all forms and data submitted by the applicant;
2. Permits issued for the construction, installation or alteration of individual subsurface sewage disposal systems;
3. Modifications to plans made subsequent to the issuance of a permit to construct, install or alter individual subsurface sewage disposal systems;
4. Reports of construction inspections made prior to issuance of a certificate of compliance for an individual subsurface sewage disposal system;
5. Certificates of compliance issued for individual subsurface sewage disposal systems;

6. Inspection reports, plans and specifications for repair or alteration of malfunctioning individual subsurface sewage disposal systems or components of malfunctioning systems.

(b) Files containing records or documents listed in (a) above shall be available upon request for inspection by personnel of the Department.

(c) The administrative authority or its administrative agent shall maintain records until such time as the realty improvement served by the proposed or existing subsurface sewage disposal system is removed or connected to a public sewer.

7:9A-3.16 Reserved.

7:9A-3.17 Registration of personnel

(a) The Department will establish a voluntary registration program for individuals involved in subsurface sewage disposal system site evaluation, design, construction, inspection and regulation. The purpose of the registration will be to provide a means for the Department to disseminate technical information and training to professional engineers, health officers, registered environmental health specialists, soil scientists, contractors, septic tank pumpers and other individuals involved in implementation of these standards.

(b) Individuals wishing to be registered shall contact the Department in writing and indicate the categories for which registration is sought. Registration categories shall be as follows:

1. The "septic system enforcement officer" category includes licensed professional engineers, licensed health officers or licensed registered environmental health specialists, acting as the authorized agent for the administrative authority, who approve, permit, certify or license the construction, installation, alteration, repair or operation of individual subsurface sewage disposal systems or who review engineering plans, witness site evaluation and testing, inspect construction or make any determinations relied upon for the granting of such approvals, permits, certifications or licenses.
2. The "site evaluator" category includes licensed professional engineers, licensed health officers, licensed registered environmental health specialists or soil scientists who perform site evaluation, soil evaluation or soil testing as prescribed in N.J.A.C. 7:9A-4, 5 and 6.
3. The "septic system designer" category includes licensed professional engineers who prepare engineering plans and specifications for the construction or alteration of individual subsurface sewage disposal systems.
4. The "septic system installer" category includes persons who construct, install or alter individual subsurface sewage disposal systems in accordance with approved engineering plans and specifications or who repair systems as allowed in N.J.A.C. 7:9A-3.3(d).
5. The "septic system inspector" category includes solid waste haulers registered with the Department in accordance with N.J.A.C. 7:26-3, licensed professional engineers, licensed health officers or licensed registered environmental health specialists who perform inspections of individual subsurface sewage disposal systems as required in N.J.A.C. 7:9A-12.2.

7:9A-3.18 Additional requirements for certification of sewerage facilities serving subdivisions involving more than 10 realty improvements

(a) Applications for certification by the administrative authority, pursuant to N.J.S.A. 58:11-25, of sewerage facilities serving subdivisions, regardless of the number of realty improvements involved, shall contain the basic information required in N.J.A.C. 7:9A-3.5(c) for each individual realty improvement contained in the subdivision. Where more than 10 realty improvements are involved, additional information is required as set forth in (c) below.

(b) Where 50 or more realty improvements are involved, two separate certifications are required. The first of these is a water quality standards related certification issued by the Department pursuant to N.J.S.A. 58:11-25.1, prior to planning board approval, as prescribed in (d) below. The second of these is a design and construction certification, issued by the administrative authority pursuant to N.J.S.A. 58:11-25, prior to issuance of building permits and reviewed by the Department and the administrative authority simultaneously, as prescribed in (f) below.

(c) For certifications pursuant to N.J.S.A. 58:11-25, of sewerage facilities proposed to serve subdivisions consisting of more than 10 realty improvements, the following information is required in addition to the information required by N.J.A.C. 7:9A-3.5(c). This additional information shall be provided on a general site plan of the subdivision, signed and sealed by a licensed land surveyor:

1. Lots with their dimensions and acreage;
2. Contours of existing topography (at an appropriate contour interval) using absolute elevations or relative elevations referenced to a permanent bench-mark;
3. Drainage right of way and any contemplated diversion thereof;
4. Location of all existing and proposed water supply wells within 500 feet from the boundaries of the subdivisions;
5. Streams and surface water bodies;
6. Existing and proposed storm sewers and subsurface drains;
7. Above and below ground power transmission lines, gas pipe lines and associated right-of-ways:
8. Location of all stream encroachment boundaries and 100-year flood plain boundaries which fall within the boundaries of the subdivision;
9. Location of all State approved wetlands or transition area delineation lines which fall within the boundaries of the subdivision;
10. Location of all profile pits, soil borings, permeability or percolation tests made within the area of the subdivision; and
11. Boundaries of all soil types or mapping units, obtained from detailed onsite soil investigations or transferred from USDA County Soil Survey Report.

(d) No subdivision approval shall be granted by any municipal or other authority in the State to cover 50 or more realty improvements, or less than 50 where the subdivision extends into an adjoining municipality or municipalities and will, in the aggregate, cover 50 or more realty improvements, until the Department has certified that the proposed sewerage facilities for realty improvements comply with applicable State standards.

(e) (Reserved)

(f) Copies of all applications and accompanying engineering data for certifications submitted under N.J.S.A. 58:11-25 to cover 50 or more realty improvements shall be filed with or mailed to the Department on the date the application is made to the administrative authority.

(g) Copies of all certifications issued by administrative authorities under N.J.S.A. 58:11-25 covering 50 or more realty improvements shall be mailed to the Department by the administrative authority issuing the same on the date of issue.

(h) In cases where preliminary determination by the administrative authority regarding the acceptability of the proposed sewage disposal systems may be required prior to the granting of subdivision approval by the planning board or other municipal agency, such determinations may be made based upon the type of disposal field installations proposed and the soil suitability classification determined by use of Soil Conservation Service soil survey maps in conjunction with Appendix D of this chapter. Alternatively, onsite soil evaluation consisting of soil logs and permeability tests may be required. Where onsite soil evaluation is required, a minimum of one soil log for every five acres or fraction thereof shall be sufficient provided that at least one soil log is provided for every soil series present within the area of the subdivision as shown on Soil Conservation Service soil survey maps. The number of permeability tests required shall be a minimum of one test for every five acres or fraction thereof.

7:9-3.19 Entry and inspection

The administrative authority and its agent and the Department shall have power to make, or cause to be made, such inspections and tests as may be necessary to enforce these standards and they and their authorized representatives shall at all times have the right to enter upon lands of realty improvements for these purposes. The system owner shall not refuse, prevent or otherwise prohibit such tests and inspections to determine compliance with this chapter.

7:9A-3.20 Hearing procedures

In case any certification is denied by the administrative authority, a hearing shall be held thereon before the administrative authority within 15 days after request therefor is made by the applicant. Upon such hearing, the administrative authority shall affirm, alter or rescind its previous determination and take action accordingly within 15 days after the date of such hearing.

Subchapter 4 Site Evaluation and System Location

7:9A-4.1 General provisions for site evaluation and system location

(a) Selection of a location for each individual subsurface sewage disposal system shall be based upon evaluation of all site characteristics which may affect the functioning of the system. Site characteristics to be evaluated shall include, but may not be limited to, minimum required separation distances as prescribed in N.J.A.C. 7:9A-4.3, slope, surface drainage and flood potential.

(b) A site plan shall be required as part of each application and shall, as a minimum, provide the information outlined in N.J.A.C. 7:9A-3.5(c)2.

7:9A-4.2 Location generally

(a) The location and installation of each individual subsurface sewage disposal system and every part thereof shall be such that with reasonable maintenance, as required by N.J.A.C. 7:9A-12, it will function in a satisfactory manner and will not create a nuisance or source of foulness, pose a threat to public health or safety or the environment, or otherwise adversely affect the quality of surface water or groundwater.

(b) Individual subsurface sewage disposal systems shall not be located in such a manner that their functioning may be adversely affected by the following features unless the design adequately addresses the special limitations associated with these features and complies with all applicable local, State and Federal laws, regulations and ordinances.

1. Bedrock outcrops or areas with excessive stones;
2. Sink-holes;
3. Steep slopes showing signs of unstable soil such as landslide scars, slump blocks, fence posts or lower trunks of trees bending downslope;
4. Bare eroded ground, denuded of vegetation, or with deep wheel ruts;
5. Highly disturbed ground indicated by such features as remnants of foundations or pavements, buried building debris or buried plant remains;
6. Sand dunes;
7. Mine spoils, borrow pits, dumps or landfills;
8. Low-lying coastal areas exhibiting signs of tidal inundation or tidal marsh vegetation such as cordgrass (Spartina alterniflora), salt-meadow grass (Spartina patens) or spike grass (Disticlis spicata);
9. Low-lying inland areas showing signs of ponding or freshwater wetland vegetation such as skunk cabbage (Symplocarpus foetidus), tussock sedge (Carex stricta), cat-tails (Typha spp.), alders (Alnus spp.), or white cedar (Chamaecyparis thyoides); and
10. Flat low-lying areas adjoining streams.

7:9A-4.3 Distances

The minimum separation distance between the various components of the system and the other features listed shall conform with Table 4.3 below. The location of a new well must be in conformance with the requirements of N.J.A.C. 7:10-12.**12**.

Table 4.3 Minimum Required Separation Distances (feet)

Component	Reservoir, Well or Suction Line	Water Service Line, Pressure	Water Course[1]	Occupied Building	Property Line	Disposal Field	Existing Seepage Pit or Cesspool	In-ground Swim-ming pool
Building Sewer	25[2]	5	-	-	-	-	-	-
Septic Tank	50[2]	10	25[2,5]	10[6]	5	-	-	10
D-Box	50[2]	10	25[2,5]	10	5	-	-	10
Disposal Field[11]	100[2,4]	10	50[2,3,5]	25[7]	10	50[8]	50	20
Seepage Pit[9]	150/100[2,13]	25	100[2,5]	50[7]	20	50	50[10]	30
Dry Well	50	-	-	-	-	50	50	-

(1) Includes subsurface drains with an above-ground or surface water outlet.
(2) Where excessively coarse soils or fractured rock substrata are encountered, these distances may be increased by the administrative authority.
(3) This distance may be decreased only in the case of an interceptor drain as allowed in N.J.A.C. 7:9A-10.7(d).
(4) This distance may be decreased by the administrative authority to a minimum of 50 feet only when the well is provided with a water-tight casing to a depth of 50 feet of more, and where the casing is sealed into an impervious stratum which separates the water-bearing stratum from the layer of soil used for sewage disposal. N.J.A.C. 7:10-12.13 shall govern whenever the well under consideration has been installed after July 13, 1979.
(5) These distances may be reduced by one-half if the water course is a footing drain with an invert elevation higher than the bottom of the disposal field or more than four feet above the level of the seasonally high water table.
(6) May be reduced to five feet with special approval of the administrative authority.
(7) May be reduced to 15 feet from disposal field and 30 feet from seepage pit for portions of the building constructed either on a slab foundation or over a continuous dust cap which is at or above natural or finished grade, whichever is higher only.
(8) This distance applies to disposal fields serving separate realty improvements but not to disposal fields which are part of a split system serving a single realty improvement.
(9) Applies only to seepage pits allowed as prescribed in N.J.A.C. 7:9A-7.6.
(10) In no case shall the distance be less than three times the pit diameter.
(11) These distances shall be measured from the outermost margin of the disposal bed or trench in the case of conventional and soil replacement bottom-lined installations, from the outermost lateral extension of suitable fill in the case of soil replacement fill-enclosed and mounded soil replacement installations, or the edge of the required lateral suitable fill extension in the case of mounded installations.
(12) For the purposes of this section, the setback distance for a water course shall apply to a stormwater management basin. The setback distance from a stormwater management basin shall be measured from the elevation contour that is coincident with the high water mark.
(13) The setback distance from a seepage pit shall be 150 feet from a well and 100 feet from a suction line.

7:9A-4.4 Slope

(a) The disposal field or seepage pit shall not be located in an area where the slope is greater than 25 percent.
(b) Where the slope is greater than 10 percent, no disposal field or seepage pit shall be placed less than 50 feet upslope of any bedrock outcrop where signs of ground water seepage can be detected.
(c) Modification of slopes by re-grading shall meet the requirements of N.J.A.C. 7:9A-10.3(b).

7:9A-4.5 Surface drainage

(a) No disposal area shall be placed within a topographical depression or in any area where surface runoff or ground water is likely to accumulate unless measures adequate to address these limitations are incorporated in the approved engineering design and implemented when the system is constructed.
(b) The use of swales to divert surface run-off away from the disposal field shall be carried out only as prescribed within the engineering design which has been approved by the administrative authority.
7:9A-4.6 Surface flooding
(a) No part of a subsurface sewage disposal system shall be constructed in ground subject to surface flooding. For the purposes of this chapter, a site shall be considered to be subject to surface flooding when any of the criteria given in (b) below are satisfied. This determination shall be made whenever the proposed site is located adjacent to a stream or coastline, and the distance and relative elevation of the site with respect to the stream or sea level are such that it is reasonable to expect that the site may be subject to flooding as a result of stream overflow, tides or ocean waves.
(b) For the purpose of compliance with (a) above, a site shall be considered subject to flooding whenever any of the following criteria are met:
1. Flooding is observed during a site inspection made by the administrative authority or its agent or the administrative authority has records or knowledge of past flooding at the site or in adjacent contiguous areas; or
2. Maps contained in a Soil Conservation Service County Soil Survey Report indicate the presence of one or more of the following soil types:

Alluvial Land	Muck Shallow Over Clay
Atsion Tide Flooded	Muck Shallow Over Loam
Berryland	Mullica Loamy Substratum
Berryland-Othello Complex	Parsippany
Bowmansville	Plummer
Carlisle Muck	Pompton Fine Sandy Loam
Colemantown	Pope High Bottom
Colemantown-Matlock	Portsmouth Thin Surface Variant
Fluvaquents	Preakness
Fredon	Raritan
Humaquepts Flooded	Rowland
Manahawkin	Sloan and Wayland
Middlebury	Tioga

i. Where the accuracy of the Soil Survey Report mapping is questioned, the soil series actually present at the site shall be identified by comparing the soil profile characteristics observed in a soil profile pit with the range of soil profile characteristics given in the County Soil Survey Report for a particular soil series.
(c) When fill material is proposed to elevate the ground surface above the level which is subject to flooding, the requirements and restrictions of (d) below as well as the requirements and restrictions of N.J.A.C. 7:9A-10.3(b) shall apply.
(d) Development within a flood plain area is subject to the restrictions and requirements of the Flood Hazard Area Rules N.J.A.C. 7:13. N.J.A.C. 7:13 prohibits the construction of an individual subsurface disposal system within the floodway of a delineated stream or within the encroachment line of a non-delineated stream and may require a stream encroachment permit for the construction of a system within the flood fringe of a delineated stream or the area between the encroachment lines and the boundary of the 100 year flood plain of a non-delineated stream.
(e) The criteria for delineation of flood hazard areas used in the Flood Hazard Area Rules, N.J.A.C. 7:13, are different from the criteria used in this chapter for identification of areas subject to flooding. Consequently, a site which does not meet the criteria given in (b) above may still be subject to N.J.A.C. 7:13. It is the responsibility of the applicant to comply with all applicable requirements of N.J.A.C. 7:13 regardless of whether the site of the

proposed individual subsurface sewage disposal system meets the criteria given in (b) above. Compliance with this or any other provision of this chapter does not exempt the applicant from compliance with the requirements of N.J.A.C. 7:13.

7:9A-4.7 Freshwater wetlands

(a) As part of the initial site evaluation process, prior to selection of a site for a proposed subsurface sewage disposal system, the applicant shall take into consideration the possible presence of freshwater wetlands which are protected by the Freshwater Wetlands Protection Act, N.J.S.A. 13:9B-1 et seq., and the rules promulgated pursuant thereto, N.J.A.C. 7:7A. In cases where available information submitted as part of the application requirements for approval under this chapter indicate the potential presence of a freshwater wetlands within the proposed area of disturbance, the administrative authority shall require evidence that the applicant has complied with applicable regulations. This evidence shall meet the requirements of (c) below and shall be required whenever the criteria given in (b) below are satisfied. This section shall not apply to projects located within areas under the jurisdiction of the Pinelands Commission pursuant to N.J.S.A. 13:18A-1 et seq. and areas under the jurisdiction of the Hackensack Meadowlands Development Commission pursuant to N.J.S.A. 13:17-1 et seq.

(b) For the purpose of compliance with (a) above, the proposed site of a subsurface sewage disposal system shall be tentatively considered to be located within a potential freshwater wetland whenever any of the following criteria are met:

1. Surface ponding is observed, or the vegetation, topography or relative elevation with respect to adjacent surface water bodies is such as to indicate the likelihood of periodic or seasonal surface ponding;

2. Soil profile evaluation carried out as prescribed in N.J.A.C. 7:9A-5 indicates a seasonally high water table at a depth shallower than 1.5 feet below the existing ground surface; or

3. Maps contained in a Soil Conservation Service County Soil Survey Report indicate the presence of one or more of the following soil types:

Abbottstown	Manahawkin
Adrian	Marsh
Albia	Matlock
Alluvial Land	Muck
Amwell	Mullica
Atherton	Norwich
Atsion	Othello
Bayboro	Parsippany
Berryland	Pasquotank
Bibb	Passaic (Parsippany variant)
Biddeford	Peat
Bowmansville	Plummer
Carlisle	Pocomoke
Chalfont	Portsmouth
Chippewa	Preakness
Cokesbury	Raynham
Colemantown	Reaville (wet variant)
Croton	Ridgebury
Doylestown	Rowland
Elkton	Shrewsbury
Fallsington	Sloan
Fluvaquents	St. Johns
Fredon	Sulfaquents
Fresh Water Marsh	Sulfihemists
Haledon (wet variant)	Swamp
Halsey	Tidal Marsh

Hammonton	Turbotville
Humaquepts	Venango (Albia)
Keansburg	Wallkill
Klej	Watchung
Lamington	Wayland
Lenoir	Weeksville
Leon	Whippany
Livingston	Whitman
Lyons	Unnamed

i. In addition to the soil types listed above, wet phases of soils classified by the Soil Conservation Service as somewhat poorly drained may also indicate the presence of a freshwater wetland.
ii. Where the accuracy of the Soil Survey Report mapping is questioned, the soil series actually present at the site shall be identified by comparing the soil profile characteristics observed in a soil profile pit with the range of soil profile characteristics given in the County Soil Survey Report for a particular soil series.
(c) Evidence that the applicant has complied with applicable State freshwater wetland rules shall consist of any of the following documents:
1. A "letter of interpretation" issued by the Department, indicating that the proposed development is not located in wetlands, waters or transition areas;
2. A freshwater wetlands statewide general or individual permit, or a transition area waiver, issued by the Department for the wetlands or transition area aspects of the proposed development; or
3. A written determination from the Department that the proposed development is not subject to regulation under the Freshwater Wetlands Protection Act.
(d) Use of the criteria given in (b) above to identify the presence of a potential freshwater wetland does not constitute an official freshwater wetlands delineation by the Department's "three-parameter approach" in accordance with N.J.A.C. 7:7A. As a result, sites which do not meet these criteria may still be subject to regulation under N.J.A.C. 7:7A or other Federal, State or local laws. The applicant shall contact the appropriate agencies and comply with all applicable statutes or regulations or ordinances.
7:9A-4.8 Area reserved for sewage disposal
The area used for sewage disposal shall be selected and maintained so that it is free from encroachments by driveways, accessory buildings, additions to the main building, patios, decks and trees or shrubbery whose roots may cause clogging of any part of the system. The area of sewage disposal shall not be located under driveways, parking lots (paved or otherwise), accessory buildings, additions to main buildings or any other form of encroachment which may adversely affect the functioning of the system or interfere with system maintenance.

Subchapter 5. Determination of Soil Suitability

7:9A-5.1 General provisions for the determination of soil suitability

(a) When a site meeting the requirements of N.J.A.C. 7:9A-4 has been chosen for location of the proposed individual subsurface wastewater disposal system, the suitability of the soil for treatment and disposal of the effluent shall be determined as prescribed below. This determination shall be made based upon soil profile characteristics observed in soil profile pits and borings as prescribed in N.J.A.C. 7:9A-5.2, criteria for determination of soil suitability classes which are given in N.J.A.C. 7:9A-5.4, criteria for recognition of soil limiting zones which are given in N.J.A.C. 7:9A-5.5 through 5.9, as well as any other related data that may be required by the administrative authority.
(b) All soil evaluation procedures relied upon as a basis for the design of an individual subsurface sewage disposal system shall be carried out by or under the direct supervision of a licensed professional engineer.

7:9A-5.2 Requirements for soil profile pits and borings

(a) Soil profile pits shall be excavated at the site of each proposed disposal field for the purpose of determining the suitability and distribution of soil types present at the site. Partial substitution for soil profile pits may be made using soil borings as outlined in (b) below.

(b) A minimum of two profile pits are required for each disposal field. A minimum of three soil borings may be performed in lieu of the second profile pit, provided that the soil horizons and substrata observed in the borings are not significantly different from those observed in the first profile pit.

(c) The location of soil profile pits and borings for disposal fields shall be as follows:

1. As shown in Figure 1 of Appendix A, profile pits shall be located at either end of the disposal field, within or no further than 15 feet beyond the boundaries of the disposal field.
2. In cases where a profile pit or part of a profile pit has been excavated within the boundaries of a proposed disposal trench or bed, the pit shall be backfilled after use in a manner that will not result in a major discontinuity with respect to soil horizonation, density or permeability in the soil below the disposal trench or bed.
3. When soil borings are substituted for the second profile pit these shall be located as shown in Figure 1 of Appendix A, at the approximate center of the disposal field and at corners opposite the profile pit. All soil borings shall be within the boundaries of the disposal field, or no further than 15 feet beyond the boundaries of the disposal field.

(d) When a seepage pit(s) is proposed, as allowed in N.J.A.C. 7:9A-7.6, a minimum of one profile pit or two soil borings shall be performed for each seepage pit. Profile pits shall be located within or no further than 15 feet from the proposed seepage pit. Borings shall be located on opposite sides of the seepage pit, no further than 15 feet from the seepage pit.

(e) Profile pits shall be prepared as follows:

1. Profile pits shall be excavated, if possible, to a minimum depth of 10 feet below the existing ground surface or to solid bedrock, where encountered. If the profile pit becomes unstable due to lack of soil cohesion or the presence of groundwater, or both, the pit may be terminated at a depth less than 10 feet and soil evaluation below the depth of the pit may be carried out by means of three or more soil borings, performed as prescribed in (f) below. The depth of the soil evaluation shall never be less than eight feet below the proposed level of infiltration.
2. When a seepage pit is proposed, the profile pit shall extend a minimum of eight feet below the bottom of the seepage pit or to solid bedrock, when encountered. In cases where the minimum required depth is deeper than that practically attainable using ordinary excavating equipment, soil borings should be used rather than a profile pit. Alternatively, borings may be used to extend the depth of profile pits beyond the range of the excavating equipment.
3. It is recommended that the sides of the profile pit be stepped and sloped as shown in Figure 2 of Appendix A, to prevent caving-in and to allow safe access to the upper portion of the pit. An undisturbed face, a minimum of one foot wide and extending from the top of the pit to a depth of five feet, shall be exposed by means of hand tools, for observation of the soil profile characteristics. Evaluation of soil properties below a depth of five feet may be accomplished by examination of samples removed by excavating equipment or by examination of three or more borings, performed as prescribed in (f) below.
4. It is recommended that persons performing soil evaluation not enter into portions of a soil profile pit which have been excavated to depths greater than five feet below the surrounding ground surface. It is the responsibility of persons performing or witnessing soil evaluation to comply with all applicable Federal, State and local laws and regulations governing occupational safety.

(f) Soil borings shall be performed as follows:

1. Soil borings shall be completed to a minimum depth of 10 feet below the existing ground surface or to solid bedrock, where encountered. In no case shall the depth of the borings be less than eight feet below the proposed level of infiltration. Where a seepage pit is proposed, the borings shall extend a minimum of eight feet below the bottom of the seepage pit or to solid bedrock, where encountered.

2. Soil borings shall be made in a manner that will provide a continuous sample of the soil profile without mixing the soil from different depths. Hand augers may be used provided that the hole remains open and does not slump.

(g) In soil profile pits and borings, the following characteristics of each recognizable soil horizon or substratum (not including rock substrata) shall be determined:

1. Depth and thickness of horizon;
2. Soil color, using the Munsell system of classification which includes an alpha-numeric symbol together with a descriptive color name;
3. Estimated soil textural class, using the USDA system of classification;
4. Estimated volume percentage of coarse fragment, if present;
5. Abundance, size and contrast of mottles, if present;
6. Soil structural class (soil profile pits only); and
7. Soil consistence.

(h) Soil profile characteristics shall be reported in log form, using terminology as prescribed in N.J.A.C. 7:9A-5.3.

7:9A-5.3 Terminology required for soil logs

(a) A soil log shall be prepared for each soil profile pit or soil boring. The soil profile characteristics listed in N.J.A.C. 7:9A-5.2(g) shall be described using the terminology specified in (b) through (h) below.

(b) Depth and thickness of each district soil horizon or substratum shall be reported in inches. A distinct soil horizon or substratum is any soil horizon or substratum which differs from horizons or substrata above or below it in color, texture, coarse fragment content, mottling, structure or consistence.

(c) Color shall be described using the Munsell system of classification which includes a descriptive color name such as "strong brown" or "pale red", together with an alpha-numeric designation of hue, value and chroma such as "7.5 YR 5/6" or "2.5 YR 6/2". When mottling is encountered, report the dominant or background color and the mottle colors.

(d) Texture shall be reported as the name of the appropriate textural class which is shown on the USDA textural triangle, Figure 3 of Appendix A, determined based upon the relative proportions of sand, silt and clay in that portion of the soil which excludes the coarse fragment. Texture shall be estimated in the field by feel, or determined by textural analysis as prescribed in N.J.A.C. 7:9A-6.3.

(e) The volume percentage of coarse fragments shall be estimated in the field visually using volume percentage estimation charts provided in Figure 4 of Appendix A. Coarse fragments which are rounded or subrounded in shape shall be classified based upon size, as indicated in (e)1 through 3 below. In the case of shale, slate, or other thin rock fragments, the rock type and the average length and thickness of the rock fragments shall be reported.

1. "Gravel" means a rock fragment from two millimeters (0.1 inches) to 76 millimeters (three inches) in diameter;
2. "Cobble" means a rock fragment from 76 millimeters (three inches) to 254 millimeters (10 inches) in diameter; and
3. "Stone" means a rock fragment greater than 254 millimeters (10 inches) in diameter.

(f) When mottling is observed, the abundance, size, and contrast of the mottles shall be reported using the following terminology:

1. Abundance shall be estimated visually, by using the volume percentage charts provided in Figure 4 of Appendix A, to estimate the percentage of the exposed surface which is occupied by mottles. Abundance of mottles shall be classified as follows:
    i. Mottles are "few" when less than two percent of the exposed surface is occupied by mottles;
    ii. Mottles are "common" when from two percent to 20 percent of the exposed surface is occupied by mottles; and
    iii. Mottles are "many" when more than 20 percent of the exposed surface is occupied by mottles.

2. Size shall be classified based on the estimated average longest dimension of the mottles, as follows:
   i. Mottles are "fine" when they are less than five millimeters in size;
   ii. Mottles are "medium" when they are from five to 15 millimeters in size; and
   iii. Mottles are "course" when they are greater than 15 millimeters in size;
3. Contrast shall be described as follows:
   i. Mottles are "faint" when they may be distinguished only on close examination;
   ii. Mottles are "distinct" when they are readily seen but not prominent; and
   iii. Mottles are "prominent" when they are obvious and one of the outstanding features of the soil horizon.

(g) Soil structure shall be described using the following terms which refer to the shape of the natural soil aggregates:

1. Structure is "spheroidal" when the aggregates are more or less equi-dimensional and lack sharp corners, sharp edges or well-defined faces. This term includes crumb and granular structure as defined by the USDA;
2. Structure is "subangular blocky" when the aggregates are more or less equi-dimensional and possess well-defined flat or somewhat faces, but lack sharp corners or edges;
3. Structure is "angular blocky" when the aggregates are more or less equi-dimensional in shape and possess well-defined flat or somewhat curved faces, sharp corners and sharp edges;
4. Structure is "prismatic" when the aggregates have one axis distinctly longer than the other two and are oriented with the long axis vertical;
5. Structure is "platy" when the aggregates have one axis distinctly shorter than the other two and are oriented with the short axis vertical. Soil horizons with platy structure generally show numerous well-defined horizontal structural faces and lack well defined vertical structural faces;
6. Structure is "massive" when the soil consists of a dense, compact mass showing no recognizable natural aggregates or structural faces; and
7. Structure is "single grain" when the soil consists of loose individual sand grains which lack cohesion and are not bound together into recognizable soil aggregates.

(h) Soil consistence shall be described using the following terminology which refers to the ease with which a soil clod or aggregate may be crushed with the fingers in either the dry or moist condition.

1. In the dry soil condition, soil consistence is characterized as:
   i. "Loose" when the soil is non-coherent;
   ii. "Soft" when the soil mass breaks to a powder of individual grains with slight pressure;
   iii. "Slightly hard" when the soil mass is easily broken between thumb and forefinger;
   iv. "Hard" when the soil mass can be broken in the hands without difficulty, but is barely breakable between thumb and forefinger; and
   v. "Very hard" when the soil mass can be broken in the hands with difficulty, but is not breakable between thumb and forefinger.
2. In the moist soil condition, soil consistence is characterized as:
   i. "Loose" when the soil is non-coherent;
   ii. "Friable" when the soil material crushes easily between thumb and forefinger;
   iii. "Firm" when the soil material crushes under moderate pressure between thumb and forefinger;
   iv. "Very firm" when the soil material is barely crushable under strong pressure between thumb and forefinger; and
   v. "Extremely firm" when the soil material cannot be crushed between thumb and forefinger, but can only be broken apart bit by bit.
3. For any moisture condition, soil consistence is characterized as "cemented" when the soil mass is brittle and hard, and cannot be broken by hand.

7:9A-5.4 Criteria for determination of soil suitability classes

(a) The soil suitability class shall determine what type(s) of standard disposal field installation(s), if any, may be approved on a given site. The soil suitability class is determined based upon the type and depth of limiting zone(s) present. In the case of disturbed ground, additional factors must be considered, as outlined N.J.A.C. 7:9A-5.10.

(b) The depth to the limiting zone shall be measured from the existing ground surface to the top of the limiting zone. In the case of disturbed ground, depth to the limiting zone shall be measured from the pre-existing natural ground surface or the existing ground surface, whichever is lowest. Criteria for recognition of the pre-existing natural ground surface are given in N.J.A.C. 7:9A-5.10(c).

(c) As shown in Table 5.4 below, the soil suitability designation consists of a Roman numeral from I to III which designates the severity of the soil limitation, together with a letter symbol which designates the type(s) of limitation. When more than one limiting zone is present, the following practice shall be followed:

1. The primary classification of the soil is based upon whichever limiting zone presents the most severe limitation (highest number value). Secondary classifications are given based upon limitations which are less severe (lower number values). The primary classification is stated first followed by secondary classifications in parentheses. For example, the classification for a soil with a seasonally high water table (top of the zone of saturation) at a depth of 1.5 feet and a massive rock substratum at seven feet would be III Wr (II Sr).
2. When two or more limiting zones are present with the same degree of limitation, a compound symbol is used, in primary or secondary classifications, consisting of a Roman numeral showing the degree of limitation followed by a letter symbol for each limiting zone. For example, the classification for a soil with a seasonally high water table at 2.5 feet and a fractured rock substratum at three feet would be II Wr, Sc.

Table 5.4 Soil Suitability Classification

Type of Limiting Zone	**Depth[1], Ft.**	**Suitability Class**
Fractured Rock or Excessively Coarse Substratum	>5 0-5	I IISc
Massive Rock or Hydraulically Restrictive	>9 4-9 <4	I IISr IIISr
Hydraulically Restrictive Horizon, Permeable Substratum	>9 4-9 <4	I IIHr IIIHr
Excessively Coarse Horizon	>5 0-5	I IIHc
Zone of Saturation, Regional	>5 2-5 <2	I IIWr IIIWr
Zone of Saturation, Perched	>5 2-5 <2	I IIWp IIIWp

(1) Depth is measured from the existing natural ground surface to the top of the limiting zone. In the case of disturbed ground, the depth to the limiting zone shall be measured from the pre-existing natural ground surface, identified as prescribed in N.J.A.C. 7:9A-5.10, or the existing ground surface, whichever is lowest.

7:9A-5.5 Rock substrata

(a) Criteria for recognition of rock substrata shall include but not be limited to the following:

1. Any solid and continuous body of rock, with or without fractures, or any weathered or broken body of rock fragments overlying a solid body of rock, in which more than 50 percent by volume of the rock fragments are greater than two-millimeters in diameter or large enough to be retained on a two millimeter sieve shall be considered to be a rock substratum. In cases where the content of coarse fragments increases downward in a soil profile underlain by a rock substratum, the upper limit of the limiting zone shall be taken as the depth above which 50 percent or more of the soil material consists of particles less than two millimeters in diameter or small enough to pass through a two millimeter sieve.

2. A rock substratum shall be considered as a fractured rock substratum if, based upon the judgment and experience of the soil evaluator, the rock substratum in question is determined to contain an adequate number of open and inter-connected fractures to allow unimpeded absorption of applied wastewater and transmission of this wastewater away from the disposal area. Any rock substratum which does not contain an adequate number of open and inter-connected fractures shall be considered a massive rock substratum. When doubt exists as to whether the limiting zone should be considered a fractured rock substratum or a massive rock substratum, the administrative authority may require a pit-bailing test or a basin flooding test to be performed as prescribed in N.J.A.C. 7:9A-6.

3. Whenever the presence of a perched zone of saturation, immediately above the rock substratum, is inferred based upon observation of soil morphology, as prescribed in N.J.A.C. 7:9A-5.8, or confined, by direct observation or by testing, as prescribed in N.J.A.C. 7:9A-5.9, the rock substratum shall be considered massive.

7:9A-5.6 Excessively coarse horizons and substrata

(a) Criteria for recognition of excessively coarse horizons or substrata are as follows:

1. Soil horizons or substrata which have a course fragment content greater than 50 percent by volume shall be considered excessively coarse regardless of their measured permeability or percolation rate.

2. Sand textured soil horizons or substrata which contain less than 50 percent by volume coarse fragments shall be considered excessively coarse if they are composed primarily of coarse-very coarse sand (from 0.5 to two millimeters in diameter) and lack detectable amounts (two percent or more) of silt and clay. Soils which lack detectable amounts of silt and clay are soils which are dominantly gritty to the touch, lack cohesion when moist, lack stickiness when wet and do not stain the fingers when rubbed in the hand.

3. When doubt exists as to whether a horizon or substratum should be considered excessively coarse, the administrative authority may require a soil permeability or percolation test to be performed within the horizon or substratum in question. Soil horizons or substrata which are tested shall be considered excessively coarse when the measured permeability is faster than 20 inches per hour or the measured percolation rate is faster than three minutes per inch. Alternatively, soil texture may be verified by textural analysis as prescribed in N.J.A.C. 7:9A-6.3.

7:9A-5.7 Hydraulically restrictive horizons and substrata

(a) Criteria for recognition of hydraulically restrictive horizons and substrata shall include but not be limited to the following:

1. Any soil horizon or substratum which exists immediately below a perched zone of saturation shall be considered hydraulically restrictive. The perched zone of saturation may be observed directly, inferred based on observation of soil profile morphology as prescribed in N.J.A.C. 7:9A-5.8, or confirmed by testing as prescribed in N.J.A.C. 7:9A-5.9.

2. Any soil horizon or substratum possessing a clay, silty clay, or silty clay loam texture, as defined in the U.S.D.A. system of classification, shall be considered to be hydraulically restrictive.

3. Any soil horizon or substratum shall be considered hydraulically restrictive if it possesses a sandy clay, clay loam, silt loam or silt texture together with:

i. A massive or platy structure; or

ii. A hard, very hard, firm, very firm or extremely firm consistence.

4. Any cemented horizon or substratum such as ironstone, which remains hard even when soaked in water, shall be considered hydraulically restrictive.

(b) When doubt exists as to whether a soil horizon or substratum should be considered hydraulically restrictive, the administrative authority may require that the soil horizon or substratum in question be tested by an appropriate method, as prescribed in N.J.A.C. 7:9A-6. The soil horizon or substratum shall be considered to be hydraulically restrictive if the measured permeability is slower than 0.2 inch per hour or the percolation rate is slower than 60 minutes per inch.

7:9A-5.8 Criteria for recognition of zones of saturation

(a) Criteria for recognition of zones of saturation shall include but not be limited to the following:

1. Any layer within or below the soil profile which exhibits mottling shall be considered a zone of saturation.

2. Any layer within or below the soil profile from which ground water seepage is observed shall be considered a zone of saturation.

3. Any layer within or below the soil profile which is below the static water level observed within a soil profile pit or boring shall be considered to be a zone of saturation.

(b) The upper limit of the zone of saturation, which is the seasonally high water table, shall be determined by one of the following means:

1. Where mottling is observed, at any season of the year, the seasonally high water table shall be taken as the highest level at which mottling is observed, except when the water table is observed at a level higher than the level of the mottling.

2. Where mottling is not observed, the seasonally high water table shall be determined based upon either of the following methods:

i. During the months of January through April, inclusive, water levels may be measured directly within soil profile pits or borings. Whenever the Department determines that there has been a significant departure from normal climatic conditions the Department may, with due notice to the administrative authority, lengthen or shorten the period allowed for direct measurement during any given year. In low lying coastal areas where groundwater levels fluctuate with the tides, measurements shall be taken at the time of highest groundwater elevation in response to tidal fluctuation; or

ii. During other times of the year, the depth to the seasonally high water table may be obtained from the Soil Conservation Service County Soil Survey Report provided that the soil series present at the site is identified based upon comparison of soil profile morphology observed within a soil profile pit, and the soil profile description provided for the soil series in question within the County Soil Survey Report. In cases where the seasonal high water table is shown as a range of elevations in the County Soil Survey Report, the highest elevation of the range shall be used as the seasonal high water table.

3. When the determination of seasonally high water table must be made in disturbed ground recognized as prescribed in N.J.A.C. 79:A-5.10, direct observation during the months of January through April inclusive is the only method which shall be permitted.

(c) When a hydraulically restrictive horizon, a hydraulically restrictive substratum, or a massive rock substratum is not present throughout or immediately below the zone of saturation, the zone of saturation shall be considered a regional zone of saturation.

(d) Any zone of saturation which occurs above a hydraulically restrictive horizon, a hydraulically restrictive substratum, or a massive rock substratum shall be considered a regional zone of saturation unless a perched zone of saturation is identified based upon the criteria given in (e) below. When doubt exists as to whether the zone of saturation is regional or perched, and an interceptor drain is proposed to remove the zone of saturation below the disposal field, the administrative authority may require a hydraulic head test to be performed as prescribed in N.J.A.C. 7:9A-5.9.

(e) A zone of saturation shall be considered to be perched whenever any of the following conditions are met:

1. The zone of saturation is present immediately above a hydraulically restrictive horizon underlain by a layer of permeable unsaturated soil which is free of mottling and has a chroma of four or higher;

2. Water is observed ponded above a hydraulically restrictive horizon at the bottom of the soil profile pit but this water drains away naturally when the depth of the pit is extended below the bottom of the hydraulically restrictive horizon; or

3. Water is observed seeping into a profile pit immediately above a hydraulically restrictive horizon, a hydraulically restrictive substratum or a massive rock substratum and this seep is eliminated by means of a trench excavated upslope of the profile pit which intercepts and diverts laterally moving ground water away from the profile pit.
(f) Any zone of saturation which is present below a hydraulically restrictive horizon shall be considered an artesian zone of saturation whenever any of the following conditions are met:
1. Artesian conditions have been observed in contiguous geologic formations or are known to exist in adjacent areas underlain by similar soils and/or geologic substrata;
2. Water-bearing strata which are present below the hydraulically restrictive horizon are known to be inclined and to have outcrop areas upslope or at elevations higher than the elevation of the site; or
3. An unsaturated zone of substantial thickness and continuity is not observed below the hydraulically restrictive horizon. To prove the absence of an artesian condition, the unsaturated zone must be free of mottling and have a chroma of four or higher. When this determination is made during the months of January through April inclusive, the unsaturated zone must be a minimum of one foot in thickness. At times of the year other than January through April inclusive, the unsaturated zone must be a minimum of four feet in thickness. Whenever the Department determines that there has been a specific departure from normal climatic conditions, the Department may, with prior written notice to the administrative authority, adjust or modify the length of seasons for application of the criteria set forth in this paragraph.
(g) When any of the conditions in (f) above are met, the administrative authority shall not approve the removal of the hydraulically restrictive horizon for the purpose of installing a soil replacement disposal field unless it is determined by means of a hydraulic head test, as prescribed in N.J.A.C. 7:9A-5.9, that an artesian zone of saturation is absent below the hydraulically restrictive horizon.
7:9A-5.9 Hydraulic head test
(a) When a hydraulic head test is required by the administrative authority to determine the presence or absence of a perched or artesian zone of saturation, piezometers shall be installed and monitored by the applicant as follows:
1. Piezometer A shall consist of a steel or plastic casing, a minimum of two inches in diameter, perforated or open at the bottom, and extending from above the ground surface to a point immediately above but not penetrating into the hydraulically restrictive horizon.
2. Piezometer B shall consist of a steel or plastic casing, a minimum of two inches in diameter located two to five feet from Piezometer A and extending from above the ground surface to a minimum of one foot below the bottom of the restrictive horizon. Piezometer B must be:
i. Open at the bottom or perforated only below the bottom of the restrictive horizon and within the underlying permeable horizon or stratum; and
ii. Installed or sealed in such a manner that no ground water may move upward or downward through the hydraulically restrictive horizon by flowing around the outside of the casing. When the hydraulically restrictive horizon is a horizon of high clay content and plastic consistence, this may be accomplished by use of a steel well-point which may be driven through the restrictive horizon and into the permeable soil below. In other cases, the piezometer shall be installed within an over-sized borehole with a bentonite pellet seal, a minimum of one foot thick, placed at the appropriate level.
(b) The piezometers shall be developed by pumping or surging. After a period of 24 hours the water levels in both piezometers shall be accurately measured and recorded.
(c) Water level measurements shall be interpreted as follows:
1. An equal water level in both piezometers means that the water level above the hydraulically restrictive horizon is due to the presence of a regional rather than a perched zone of saturation. Interceptor drains shall not be relied on as a means of providing an unsaturated zone below the disposal field.
2. Where water levels are different in piezometers A and B:
i. A water level in piezometer B which is above the bottom of the hydraulically restrictive horizon means an artesian zone of saturation is present below the hydraulically restrictive horizon. Excavation and removal of the

hydraulically restrictive horizon in order to install a soil replacement or mounded soil replacement disposal field shall not be allowed.

ii. A water level in piezometer B which is below the bottom of the hydraulically restrictive horizon means that the water level, if observed, in piezometer A is due to the presence of a perched zone of saturation. No artesian zone of saturation is present below the hydraulically restrictive horizon. Interceptor drains may be proposed as a means of providing an unsaturated zone below the disposal field. Excavation and removal of the restrictive horizon in order to install a soil replacement or mounded soil replacement disposal field may be allowed.

(d) When it is required, the hydraulic head test shall be conducted only during the months of January through April inclusive, and shall be witnessed by the administrative authority or its authorized agent in accordance with N.J.A.C. 7:9A-3.6. Whenever the Department determines that there has been a significant departure from normal climatic conditions, the Department may, with prior written notice to the administrative authority, lengthen or shorten the period allowed for use of this test during any given year.

(e) When piezometers are installed for the purpose of conducting this test, the piezometers shall be removed or filled with cement grout after completion of the test except in those cases where the piezometers will be utilized for monitoring ground water levels or for ground water sampling as required by the administrative authority or by the Department. Piezometers used for monitoring ground water levels over extended periods of time, or for ground water sampling in connection with water quality monitoring, may be considered to be monitoring wells requiring installation by a licensed well driller and a permit issued by the Department pursuant to State law (N.J.S.A. 58:4-1 et seq.). The applicant shall contact the Department for a determination of whether or not a permit is required.

7:9A-5.10 Disturbed ground

(a) When placement of a disposal field is proposed in an area of disturbed ground, the type and depth of soil limiting zones as well as a variety of additional factors must be considered in determination of soil suitability, depending on the nature of the soil disturbance, as outlined in (b) below. Types of soil disturbance which shall be addressed within the soil evaluation and engineering design include but are not limited to filled areas, excavated areas, re-graded areas, artificially drained areas and pre-existing wastewater disposal areas.

(b) A site shall be considered disturbed ground when any of the following conditions are present:

1. Displaced or man-made objects such as tree stumps, branches, plant stems, leaves, building debris or trash of man-made origin, are observed below the ground surface in profile pits or soil borings;

2. Soil profile pits or borings reveal A-horizons or O-horizons which are buried by layers of soil or other material;

3. Soil horizons are absent or mixed in a manner which cannot be explained as a result of natural processes;

4. Mounded areas or depressions in the land surface are observed which do not conform with surrounding topography and which show signs of recent disturbance such as lack of vegetation, weedy vegetation, severe erosion, wheel ruts, etc.;

5. Remnants of building foundations, pavement or other man-made structures are observed at the surface or uncovered in profile pits or soil borings;

6. Subsurface drains or their remnants are observed in profile pits or borings or the outlets of drains are observed at the surface; or

7. Components of an existing wastewater disposal system, or remnants of an abandoned sewage disposal system are present below the site of a proposed new system.

(c) When evidence is found that the surface of the ground may have been modified by a disturbance such as addition of fill material, removal of soil horizons or re-grading, the pre-existing natural ground surface shall be identified based upon the following criteria:

1. When a buried A- or O-horizon is present, the pre-existing natural ground surface shall be taken as the top of the A-horizon or the bottom of the O-horizon.

2. When a buried A- or O-horizon is not present, the level of the pre-existing natural ground surface shall be determined by extrapolation from adjacent areas beyond the limit of soil disturbance. When this method is relief upon, the nature of the pre-existing topography as well as the nature of the ground disturbance shall be

described, using topographic contour maps and profiles where appropriate, to the satisfaction of the administrative authority.
(d) In cases where disturbed soil or other fill material are present at the site, the suitability of this material shall be evaluated based upon its composition and its physical stability as follows:
1. Fill materials containing more than trace amounts of the following types of materials, or any other materials which are subject to disintegration or change in volume, shall be considered unsuitable:
i. Tree stumps, plant stems, leaves, food or animal remains or wastes, wood chips, saw dust, or any organic materials which may be subject to decay;
ii. Trash, discarded furniture, building or demolition debris or any bulky objects containing large voids or subject to collapse or re-orientation; or
iii. Cans, bottles, drums or any containers which are empty or filled with liquids.
2. Layers of fill material which do not contain materials as described in (d)1 above but which do contain course fragments in excess of 50 percent by volume shall be considered excessively coarse horizons or substrata. In the case of disturbed ground, coarse fragments may include man-made or artificial materials as well as rock fragments which are larger than two millimeters in diameter, provided that the man-made materials are limited only to physically and chemically inert materials without large voids, such as brick, concrete or glass fragments.
3. When construction of a wastewater disposal field is proposed within disturbed ground, an acceptable state of compaction of the soil or fill material shall be verified by laboratory tests of samples taken from within the area of the proposed disposal field. Based upon the results of these tests, the design engineer shall certify to the administrative authority that the in-place dry density of the soil or fill material above which the proposed system will be located is a minimum of 90 percent of the Standard Procter Density determined by laboratory analysis.
4. When a disposal field is to be constructed on sloping ground which has regraded, the design engineer shall certify to the administrative authority that the regraded area within and surrounding the individual subsurface sewage disposal system is stable and can structurally support the individual subsurface sewage disposal system.
(e) In cases where the surface of the ground has been raised by the addition of fill material or lowered by the removal of pre-existing soil horizons, soil suitability shall be determined based upon the depth to limiting zones measured from the pre-existing natural ground surface determined as prescribed in (c) above, or the existing ground surface, whichever is lowest.
(f) Ground containing subsurface drainage systems or remnants of abandoned subsurface drainage systems shall be considered unsuitable for the installation of a disposal field unless the drains will be removed or the outlets of the drainage system permanently sealed. Any subsurface drain which has a surface outlet shall be considered as a watercourse and is subject to minimum horizontal setback distances from waste disposal system components as set forth in N.J.A.C. 7:9A-4.3.
(g) Ground containing existing wastewater disposal systems or remnants of abandoned systems shall be considered unsuitable for the installation of a disposal field unless the pre-existing system will be removed prior to installation of the proposed new system.

Subchapter 6. Permeability Testing

7:9A-6.1 General provisions for permeability testing

(a) The design permeability is the basis for determining the minimum required area of the disposal field. Tests shall be required at the site of each disposal field, at the level of infiltration, for determination of the design permeability. Where a conventional disposal field will be installed, tests shall be conducted at a depth of one to three feet below the ground surface, within the soil horizon in which the bottom of the disposal field will be placed. When a soil replacement, mound, or mounded soil replacement installation is proposed, a percolation test shall be conducted within the fill material after it has been emplaced and compacted, or a tube permeameter test shall be conducted using samples of the fill material which have been compacted to a bulk density equivalent to that achieved in the construction of the disposal field. In lieu of this, the permeability class rating method may be used to determine whether the fill material used meets the requirements of N.J.A.C. 7:9A-10.1(f)4.

(b) The administrative authority may require additional tests at depths other than the depth of infiltration when doubt exists regarding the presence or the type of a limiting zone.

(c) The type of tests which may be used shall be determined based upon the purpose of the test and the soil conditions at the depth of the test as shown in Table 6.1 below.

Table 6.1 Type of Test

Test Options:

1-Tube Permeameter Test
2-Soil Permeability Class Rating Test[t]
3-Percolation Test
4-Basin Flooding Test
5-Pit-bailing Test
6-Piezometer Test

Purpose of Test and Soil Conditions at Depth of Test	**Acceptable Test Options**
I. Determination of Design Permeability at Level of Infiltration, Identification of Hydraulically Restrictive or Excessively, Course Horizons or Substrata Above the Water Table	
A. Sands and loamy sands with single grain structure	1, 2 or 3
B. Other soil textures	
1. Undisturbed sample can be taken	1, 2 or 3
2. Undisturbed sample cannot be taken	2 or 3
II. Identification of Massive Rock Substrata Above the Water Table	4
III. Identification of hydraulically Restrictive Horizons or Substrata and Massive Rock Substrata Below the Water Table	5 or 6
IV. Design of Seepage Pits	3

t This test shall not be used in soil horizons or substrata containing coarse fragments in excess of 50 percent by volume or 75 percent by weight.

(d) The number and location of permeability tests required shall be as follows:

1. When the tube permeameter test or the soil permeability class rating test are used to determine the design permeability at the level of infiltration, a minimum of one test shall be conducted within each disposal field and each test shall consist of a minimum of two test replicates. The administrative authority shall require additional tests or more than two replicates per test where the variability of test results exceeds the limits allowed in N.J.A.C. 7:9A-6.2(i)2, or where the results of soil profile pits or borings, made as prescribed in N.J.A.C. 7:9A-5.2, indicate the presence of more than one soil type within the area of the disposal field. When soil tests taken in different parts of the disposal field yield different results, the system shall be designed based upon the most restrictive conditions found within the area of the disposal field.

2. When the basin flooding test, the pit-bailing test or the piezometer test are required for identification of limiting zones, a minimum of one test shall be required within or no further than 15 feet beyond the boundaries of each disposal field. The administrative authority may require more than one test where conditions vary from one part of the disposal field to another.

3. In cases where a pit-bailing or basin flooding test pit or part of a test pit has been excavated within the boundaries of the proposed disposal trench or bed, the pit shall be backfilled after use in a manner that will not result in a major discontinuity with respect to soil horizonation, density, or permeability in the soil below the disposal bed or trench.

(e) When the percolation test is used the following requirements shall be met:

1. When the percolation test is used to determine the design permeability at the level of infiltration, the administrative authority shall require a minimum number of percolation tests based upon the size of the proposed disposal field, as follows:

Size of Disposal Field (Square feet)	Minimum Number of Tests
Less than 1,500	2
1,500 - 3,000	3
3,000 - 4,000	4
4,000 - 6,000	5

2. When the accuracy of a percolation test is questioned, one or more replicate tests may be performed at the same location within the disposal field as a means of better defining the true soil conditions at that particular location. The average of the results obtained from replicate tests at a given location within the disposal field shall be used for design purposes or for determination of soil suitability at that location.
3. The results of percolation tests taken at different locations within the disposal field shall not be averaged.
4. When a percolation test is abandoned due to lack of measurable percolation, this test may be disregarded provided that a minimum of three replicate tests taken at that same location yield acceptable results and provided that all subsequent test replicates taken at that location yield measurable percolation rates.
5. All percolation tests shall be located within the boundaries of the proposed disposal field and only the most restrictive percolation rate obtained within the disposal field shall be utilized for design purposes.
6. Percolation tests shall be uniformly spaced within the area of the disposal field. Acceptable patterns of percolation test placement are shown in Appendix C.
7. When a seepage pit is proposed, as allowed in N.J.A.C. 7:9A-7.6, a minimum of one percolation test shall be performed within each soil horizon or substratum between the invert of the inlet and the bottom of the seepage pit. The administrative authority may require additional tests below the bottom of the seepage pit where the presence of a limiting zone is in question.

(f) The administrative authority or its authorized agent shall witness permeability tests in accordance with the requirements of N.J.A.C. 7:9A-3.6.

(g) When the results of a permeability test or a percolation test are questionable, the administrative authority or its authorized agent may require that the test be repeated. When the tube permeameter test or the soil permeability class rating method is used, the administrative authority may collect and test replicate samples for verification of soil permeability. In cases where the results obtained by the applicant differ from those obtained by the administrative authority, the results obtained by the administrative authority shall be used for design or determination of soil suitability.

(h) Except as provided in N.J.A.C. 7:9A-6.3, only unadulterated water to which no foreign substances or chemical additives have been added shall be used to conduct permeability or percolation tests. The addition of foreign substances or chemical additives to water used for permeability testing shall be considered as a falsification of data subject to penalties as outlined in N.J.A.C. 7:9A-1.7.

(i) The results of all permeability tests or percolation tests, complete or incomplete, including all test replicates, taken within the disposal field or less than 150 feet beyond the boundaries of the proposed disposal field shall be reported to the administrative authority using data submission forms as provided in Appendix B. Results shall be reported regardless of whether or not they are acceptable and regardless of whether or not they are used as a basis for the disposal field design. Failure to report test results shall be considered a falsification of data and may subject the violator to penalties as outlined in N.J.A.C. 7:9A-1.7.

(j) The administrative authority may allow the use of test methods other than the standard test options outlined in N.J.A.C. 7:9A-6.1(c), subject to review and approval of the test method by the Department.

(k) All soil testing procedures relied upon as a basis for the design of an individual subsurface sewage disposal system shall be carried out by or under the direct supervision of a licensed professional engineer.

7:9A-6.2 Tube permeameter test

(a) The following equipment is required for the tube permeameter test:

1. A thin-walled (one millimeter or less in thickness) metal tube, from one and one-half to three inches in diameter, six inches in length, beveled on the lower outside edge;
2. A wooden block with dimensions broader than the diameter of the tube in (a)1 above and a hammer, to drive the tube into the soil;
3. A small trowel;
4. A knife (to trim core);
5. Muslin or similar open-textured cloth and a rubberband;
6. A soaking basin of adequate size and depth to soak cores as prescribed in (c) below;
7. Fine gravel (from two to 10 millimeters in diameter);
8. A test basin of adequate length (generally 10 inches or greater) and width (generally four inches or greater) to accommodate one or more replicate samples at a time. The depth of the basin should be adequate to allow placement of the sample on a layer of gravel while keeping the bottom of the core several inches below the rim of the basin, as prescribed in (d) below (See Figure 5 of Appendix A);
9. A stopper which fits water-tight into the top of the sample tube and which is fitted with a glass standpipe from three to five inches long and from 0.25 to 0.75 inches in diameter (See Figure 5 of Appendix A). The standpipe should have a scale for measuring changes in water level over time as required in (d) below;
10. A small laboratory wash bottle for refilling standpipe;
11. A clock or watch with second hand;
12. A ruler (engineering scale is best);
13. One gallon of water per test. The water should be allowed to stand in an open container until clear of dissolved air. Boiling may be used to remove air provided that the water is allowed to cool down to room temperature before use; and
14. A two millimeter sieve.

(b) When the tube permeameter test is used, undisturbed samples shall be collected as prescribed in (d) below. When the texture of the soil to be tested is a sand or loamy sand and lack of soil cohesion or the presence of large amounts of coarse fragments, roots or worm channels prevent the taking of undisturbed samples, disturbed samples shall be taken as prescribed in (e) below. When the texture of the soil is other than a sand or loamy sand and undisturbed samples cannot be taken, the tube permeameter test shall not be used.

(c) When the tube permeameter test is used, a minimum of two replicate samples shall be taken and the procedures outlined in this section shall be followed for each replicate sample to be tested. It is recommended that more than two replicate samples be taken to avoid the necessity of re-sampling in the event that samples are damaged in transport or the results of one or more replicate tests must be rejected due to extreme variability of results, as required in (i) below. Replicate samples shall be taken from within the same soil horizon at the same location within the area of the proposed disposal field.

(d) The following procedure shall be used to collect each replicate sample:

1. Step One: Expose an undisturbed horizontal surface within and a minimum of three inches above the bottom of the soil horizon or layer to be tested.
2. Step Two: Position the sampling tube on the soil surface at the point chosen for sampling. Care should be taken to avoid large gravel or stones, large roots, worm holes or any discontinuity which might influence results. If the soil is excessively dry it may be moistened, but not saturated, provided that the force of falling water is not allowed to act directly upon the soil surface.
3. Step Three: Hold the wooden block on the top of the sampling tube and drive the tube into the soil a distance of from two to four inches (but not entirely through the horizon) using light even blows with the hammer. Care should be taken to hit the block squarely in the center and to drive the tube straight down

into the soil. Do not attempt to straighten the tube by pushing or by hitting the tube on the side with the hammer.

4. Step Four: When the tube has been driven to the desired depth, carefully remove the soil around the outside of the tube, insert a trowel into the soil below the tube and, exerting pressure from below, lift the sampling tube out of the soil.

5. Step Five: Trim the bottom of the soil core flush with the sampling tube using a knife and taking care not to smear the soil surface. Carefully invert the sampling tube and tap the side lightly with the handle of the knife or similar implement to remove any loose soil which may be resting on the top of the soil core and to verify that an undisturbed sample has been obtained. Omit this step in the case of sandy-textured non-cohesive soils with single grain structure. Check the top and bottom surfaces of the core sample and discard any sample which has worm holes or large cracks caused by handling.

6. Step Six: After the core has been checked for worm holes or signs of disturbance, stretch a piece of muslin cloth over the bottom of the tube and secure with a strong rubberband.

(e) The following procedure shall be used for the collection of disturbed samples for the tube permeameter test:

1. Step One: Collect an adequate volume of the soil or fill material to be tested. Spread the soil on a clean surface and allow to dry in the air until dry to the touch. An oven may be used to accelerate drying provided that the soil is allowed to cool down to room temperature before testing.

2. Step Two: Pass the soil through a two millimeter sieve to remove gravel and stones.

3. Step Three: Stretch a piece of muslin cloth over the bottom of the sampling tubes and place the tubes on a flat surface. Slowly pour the soil into each sampling tube while gently tapping the side of the tube with a hard instrument. Fill the tubes to a depth of three to four inches. Check the bulk density of the sample by dividing the weight of the sample (weight of sample tube containing sample minus the weight of empty sample tube) by the volume of the sample (length of sample multiplied by 3.14 r^2, where r is the internal radius of the sample tube). The minimum acceptable bulk density for disturbed samples is 1.2 grams per cubic centimeter.

(f) The following procedure shall be used for pre-soaking undisturbed or disturbed core samples for the tube permeameter test:

1. Step One: Place the soil core in the pre-soak basin and fill the basin with water to a point just below the top of the soil core. Never fill the basin to a level which is higher than the top of the soil core. Never use water directly from the tap to soak cores. Use only de-aired water as prescribed in (a)13 above. Allow the sample to soak until the top surface of the core is saturated with water. This may require only a few minutes of soaking for sandy textured soils or several days for clay textured soils. Failure to soak the sample for sufficient time may result in greatly reduced permeability measurements due to entrapped air.

2. Step Two: When the sample has soaked for sufficient time, place a one inch layer of fine gravel (from two to 10 millimeters in diameter) on top of the soil core in the sampling tube. Slowly fill the tube with de-aired water taking care not to disturb the surface of the core. A small spatula or similar implement may be used to break the fall of the water as it is poured into the tube.

3. Step Three: Immediately transfer the soil core to the test basin in which a layer of gravel has been placed and gently press the soil core into the gravel so that it stands vertically with its base positioned at the desired depth below the rim of the test basin.

(g) The following procedure shall be used to conduct the tube permeameter test:

1. Step One: When the soil core has been positioned at the desired height within the test basin (see Figure 5 of Appendix A), fill the test basin to overflowing with de-aired water. (Note: The hydraulic head used in the test depends upon the height of the top of the sample tube or standpipe above the rim of the test basin as shown in Figure 5. In general, a higher hydraulic head should be used for heavy textured soils to expedite the test and a lower head should be used for sandy textured soils to prevent an excessively fast flow rate).

2. Step Two: Fill the tube to overflowing with de-aired water and record the time, in minutes, required for the water level in the tube to drop a standard distance such as one-half inch, one inch, or two inches. Repeat this step until the rate of fall becomes constant or the difference between the highest and lowest of three successive readings is less than five percent. When the readings are less than 20 minutes in length the time should be reported to the nearest second.

3. Alternate Step Two: When the rate of fall observed in "Step Two" ((g)2 above) is slow, the flow rate may be increased by use of a standpipe as shown in Figure 5. Carefully insert the standpipe into the top of the sample tube and fill with de-aired water. The apparatus should be checked for leaks where the standpipe fits into the sample tube. Silicon jelly, petroleum jelly or a similar material may be used to prevent leakage. Measure the rate of fall of the water level in the standpipe as in Step Two.

(h) The permeability of each replicate sample tested shall be calculated using the following formula:

1. K (in/hr) = 60 min/hr x L(in)/T(min) x r^2/R^2 x In (H_1/H_2) Where:

K is the permeability of the soil sample;

L is the length of the soil core, in inches;

T is the time, in minutes, required for the water level to drop from H• 1 to H• 2 during the final test interval;

r is the radius of the standpipe, in centimeters or inches;

R is the radius of the soil core, in the same units as "r";

In is the natural logarithm

H_1 is the height of the water level above the rim of the test basin at the beginning of each test interval, in inches; and

H_2 is the height of the water level above the rim of the test basin at the end of each test interval, in inches.

[Note: When the standpipe is not used, the term r^2/R^2 is omitted from the equation.]

(i) Variability of test results shall be evaluated as follows:

1. Soil permeability classes are defined as follows:

Measured Permeability Greater than	**Soil Permeability Class**
20 inches per hour ("in/hr")	K5
6-20 in/hr	K4
2-6 in/hr	K3
0.6-2 in/hr	K2
0.2-0.6 in/hr	K1
Less than 0.2 in/hr	K0

2. The variability of soil permeability test results shall be considered acceptable only where the results of all replicate tests fall within one soil permeability class or two adjacent permeability classes.

3. Where the results of replicate tests differ by more than one soil permeability class, the samples shall be examined for the following defects:

i. Cracks, worm channels, large root channels or poor soil tube contact within the sample yielding the highest permeability value(s);

ii. Large pieces of gravel, roots or unsaturated soil within the interior of the sample yielding the slowest permeability value(s); or

iii. Smearing or compaction of the upper or lower surface of the sample yielding the lowest permeability value(s).

4. If any of the defects described in (i)3 above are found, the defective core(s) shall be discarded and the test repeated using a new replicate sample for each defective replicate sample.

(j) When test results have been obtained with an acceptable range of variability as defined in (i) above, the results shall be interpreted as follows:

1. When the purpose of the test is to determine the design permeability at the level of infiltration, the slowest of the test replicate results shall be used for design purposes.

2. When the purpose of the test is to identify a hydraulically restrictive horizon or substratum above the water table, the horizon or substratum in question shall be considered hydraulically restrictive if the average permeability of the replicate samples tested falls within soil permeability class KO as defined in (i)1 above.

3. When the purpose of the test is to identify an excessively coarse horizon or substratum above the water table, the horizon or substratum in question shall be considered excessively coarse if the average permeability of the replicate samples tested falls within permeability class K5 as defined in (i)1 above.

(k) Where results of replicate tests exceed the limits of variability allowed in (i)2 above, the results shall be interpreted as follows:

1. When the purpose of the test is to determine the design permeability at the depth of infiltration, the slowest of the test replicate results shall be used for design purposes.

2. When the purpose of the test is to identify a hydraulically restrictive horizon or substratum above the water table, the horizon or substratum in question shall be considered hydraulically restrictive if the slowest permeability of the replicate samples tested falls within soil permeability class KO as defined in (i)1 above.

3. When the purpose of the test is to identify an excessively coarse horizon or substratum above the water table, the horizon or substratum in question shall be considered excessively coarse if the fastest permeability of the replicate samples tested falls within permeability class K5 as defined in (i)1 above.

7:9A-6.3 Soil permeability class rating

(a) Determination of permeability by the soil permeability class rating technique is based upon a hydrometer analysis performed as prescribed in (f) below, and a sieve analysis performed as prescribed in (g) below, together with evaluation of soil morphological properties as prescribed in N.J.A.C. 7:9A-5.2 and 5.3. As an alternate to the hydrometer analysis procedure prescribed in (f) below, the hydrometer analysis procedure given in ASTM STANDARD D 422, published by the American Society for Testing and Materials, may be used to determine the percent by weight of sand and the percent by weight of clay in the sample.

(b) The following equipment is required:

1. A two-millimeter sieve, with an eight inch or larger diameter frame;

2. A set of two sieves, with five inch or larger diameter frames, with covers and pans. The sieves shall meet the following specifications:

i. The first sieve shall be 0.25 millimeter, 60-mesh, Bureau of Standards, phosphor bronze wire cloth; and

ii. The second sieve shall be 0.045 millimeter, 325-mesh, Bureau of Standards, phosphor bronze wire cloth (0.0015 wire);

3. A wooden rolling pan or mortar with rubber-tipped pestle;

4. An oven;

5. A scale (0.1 gram accuracy);

6. Distilled water;

7. A sodium hexametaphosphate solution of 50 grams of the salt dissolved in one liter of distilled water;

8. The electric mixer (see section 2.1.1 of ASTM Standard D 422) or mechanical shaker;

9. A 1000 milliliter graduated cylinder with rubber stopper;

10. A soil hydrometer calibrated to read in grams per liter at 68 degrees Fahrenheit (ASTM #152H);

11. A thermometer;

12. A clock with second hand; and

13. A sieve shaker

(c) A loose sample of soil, 200 grams or more, shall be collected from the soil horizon or substratum to be tested.

(d) The soil sample shall be prepared as follows:

1. Pass the soil sample to be tested, which has been allowed to air dry, through a two millimeter sieve to remove coarse fragments. Use moderate pressure with a wooden rolling pin or mortar with rubber-tipped pestle to break soil aggregates (but not soft rock fragments) which are larger than two millimeters.
2. Weigh both the material retained and the material which passes through the sieve. This method shall not be used where the weight of coarse fragments retained on the sieve exceeds 75 percent of the total sample weight.
3. Discard the coarse fragments.

(e) Dispersion of the soil sample shall be accomplished using a motor-mixed or a reciprocating shaker as prescribed below. This procedure shall be followed for each replicate sample tested.

1. Step One: Place 40 grams of air dry soil which has been passed through a two millimeter sieve into a mixing cup or one liter shaker bottle together with 100 milliliters of sodium hexametaphosphate solution and 400 milliliters of distilled water. Weigh out an additional 40 gram sample for determination of oven dry weight. Re-weigh the latter sample after keeping it in an oven at 105 degrees Centigrade for 24 hours. (Only one sample is required for determination of oven-dry weight regardless of the number of replicate samples used for the hydrometer analysis).
2. Step Two: If a motor mixer is used, allow the soil to soak in the cup for 10 minutes, place the cup on the mixer and mix the sample for five minutes. Next, transfer the suspension completely to the cylinder. Rinse the mixing cup with distilled water and pour the rinse water into the cylinder so that none of the suspension is left in the mixing cup. Bring the volume of the suspension in the cylinder up to the 1000 milliliter mark with distilled water. Allow the suspension to reach room temperature.
3. Alternate Step Two: If a reciprocating shaker is used in lieu of the mixer, shake the sample for 12 hours, at a rate of approximately 120 strokes per minute, and transfer to the cylinder rinsing the shaking bottles with distilled water. Bring the volume of the suspension in the cylinder to the 1000 milliliter mark with distilled water. Allow the suspension to reach room temperature.

(f) The following procedure shall be used for the hydrometer analysis:

1. Step One: Calibrate the hydrometer as follows: Add 100 milliliters of sodium hexametaphosphate solution to a 1000 milliliter cylinder and fill to the 1000 milliliter mark with distilled water. Place the stopper in the cylinder and shake vigorously in a back and forth motion. Place the cylinder on the table and lower the hydrometer into the solution. Determine the scale reading at the upper edge of the meniscus surrounding the hydrometer stem. This is the hydrometer calibration, Rc. Record the temperature in degrees Fahrenheit (°F).
2. Step Two: Place a stopper in the cylinder containing the dispersed soil sample, shake the cylinder using a back and forth motion (avoid causing circular currents in the cylinder) and place the cylinder on the table. Record the time immediately. After 20 seconds carefully lower the hydrometer into the cylinder and, after exactly 40 seconds, read the hydrometer. Repeat this step until two successive readings are obtained which agree within 0.5 gram per liter.
3. Step Three: Determine the temperature of the suspension and correct the hydrometer reading as follows:
    i. Subtract the reading obtained in Step One, Rc, from the hydrometer reading.
    ii. For each degree Fahrenheit above 68 add 0.2 gram to the reading or for each degree Fahrenheit below 68 subtract 0.2 gram.
4. Step Four: Remove the hydrometer, stopper the cylinder, and shake the hydrometer as in Step Two. Remove the stopper and immediately place the cylinder on a table where it will not be disturbed. Take a hydrometer reading after exactly two hours and correct the hydrometer reading as in Step Three.
5. Step Five: Using test data reporting forms provided in Appendix B, record, the following data:
    i. Oven dry weight of soil, Wt (from Step One of (e) above);
    ii. Hydrometer calibration, Rc (Step One);
    iii. Hydrometer reading at 40 seconds, R1 (Step Two);
    iv. Temperature of suspension (Step Three);

v. Corrected hydrometer reading, R1' (Step Three);
vi. Hydrometer reading at two hours, R2' (Step Four); and
vii. Corrected hydrometer reading, R2' (Step Four);
6. Step Six: Calculate the percent of sand and percent of clay as follows:
i. Percent of sand = (Wt. - R')/Wt. x 100
ii. Percent of clay = R2'/Wt. x 100
[NOTE: The hydrometer analysis may not be carried out in a room where the temperature varies more than two degrees during the time required to perform the test.]

(g) A sieve analysis shall be performed as prescribed below for each replicate sample used in the hydrometer analysis except when the content of sand determined as prescribed in Step Six of (f) above is less than 25 percent.

1. Step One: After the completion of Step Four in (f) above, pour the suspension from the sedimentation cylinder into a 0.045 millimeter sieve and wash the fine material through the sieve using running water.
2. Step Two: Dry the sieve and its contents in an oven. Cool the sieve and transfer the sand to a pre-weighed evaporating dish (or similar heat resistant vessel) carefully, using a soft brush.
3. Step Three: Place the dish and its contents in an oven at 105 degrees Centigrade, for two hours, to dry. Cool the dish and its contents and weigh to the nearest 0.01 gram. Determine the weight of the sand by subtracting the weight of the dish.
4. Step Four: Assemble a stack of sieves as specified in (a)2 above, consisting of the pan, the 0.045 millimeter sieve and the 0.25 millimeter sieve, from bottom to top, respectively. Inspect sieves carefully before using to make sure that they are clean and undamaged. Transfer the sand from the evaporating dish to the top sieve using a soft brush to complete the transfer.
5. Step Five: Put the cover on the top sieve, firmly fasten the sieves to the sieve shaker and shake for three minutes. Disassemble the stack of sieves, transfer the contents of each sieve to a weighing dish separately. Weigh the contents of each sieve to the nearest 0.01 gram. Record the following data:
i. Total weight of sand fraction, from Step Three;
ii. Weight of sand passing the 0.25 millimeter sieve (retained in the 0.045 millimeter sieve);
iii. Percent fine plus very fine sand: Divide weight of stand passing 0.25 millimeter sieve by total weight of sand fraction and multiply this value by 100.

(h) The following procedure shall be used to determine the soil permeability class:

1. Step One: Using the soil permeability/textural triangle, Figure 6 of Appendix A, determine the soil permeability class of the soil horizon being tested, based upon the average percentage of sand and the average percentage of clay in the replicate samples tested as prescribed in (f) above.
2. Step Two: If the average percentage of fine plus very fine sand in the replicate samples tested, determined as prescribed in Step Five of section (g) above, is 50 percent or greater, adjust the permeability class determined in Step One of this subsection to the next slowest class.
3. Step Three: If the soil horizon being tested is found to have a massive or platy structure or a hard, very hard, firm, very firm or extremely firm consistence, determined as prescribed in N.J.A.C. 7:9A-5.3, adjust the permeability class determined in Step One of this subsection to the next slowest class.

7:9A-6.4 Percolation test

(a) The following equipment is required for the percolation test:

1. A soil auger, post-hole digger or other means of preparing a test hole as prescribed in (b) below;
2. A knife or trowel for removing smeared or compacted surfaces from the walls of the test hole;
3. Fine (from two to 10 millimeter in diameter) gravel (optional);
4. A water supply (50 gallons is generally adequate);
5. A straight board (to serve as fixed reference point for water level measurements);
6. A clock and a ruler (12 inches or longer, engineering scale);
7. An automatic siphon or float valve (optional); and

8. A hole liner consisting of a 14 inch section of slotted pipe or well screen, or a 14 inch length of one-quarter inch hardware cloth or other similar material rolled into a tube (optional). The hole liner shall be no smaller than two inches in diameter less than the test hole.

(b) Percolation tests shall not be conducted in frozen ground or in holes which have been allowed to remain open to the atmosphere for periods greater than three days. The required configuration of the test hole is illustrated in Figure 7 of Appendix A. The following procedure shall be used in preparation of the test hole.

1. Step One: Excavate a test hole having horizontal dimensions of eight to 12 inches at a depth such that the lower six inches of the test hole are contained entirely within the soil horizon or layer of fill material being tested. In order to facilitate access to the lower portion of the hole, the test hole may be excavated from the bottom of a shallow pit provided that the vertical axis of the test hole is a minimum of 14 inches measured from the bottom of the pit to the bottom of the test hole.
2. Step Two: In soil textures other than sands or loamy sands, remove smeared or compacted soil from the sides and bottom of the test hole by inserting the tip of a knife or trowel into the soil surface and gently prying upward and outward. Remove loose soil from the test hole.
3. Step Three: At this point, a one-half inch layer of fine gravel may be placed in the bottom of the hole to protect the soil surface from disturbance or siltation when water is added to the hole. If additional protection is desired, a hole liner as described in (a)8 above may be placed in the hole and the space between the liner and the sides of the hole may be filled with fine gravel.
4. Step Four: Place and secure a straight board horizontally across the top of the test hole, as shown in Figure 7 of Appendix A, to serve as a fixed point for depth of water measurements to be made at appointed time intervals throughout the test.

(c) All soils, except for sandy textured soils which meet the requirements of (d) below, shall be pre-soaked using the following procedure. Any soil which exhibits cracks or fissures between soil aggregates shall be pre-soaked regardless of the texture. Pre-soak as follows:

1. Fill the test hole with water and maintain a minimum depth of 12 inches for a period of four hours by refilling as necessary or by means of an automatic siphon or float valve.
2. At the end of four hours, cease adding water to the hole and allow the hole to drain for a period of from 16 to 24 hours.

(d) In sandy textured soils, including sands, loamy sands and sandy loams, where a rapid percolation rate is anticipated, fill the test hole to a depth of 12 inches and allow to drain completely. Refill the hole to a depth of 12 inches and record the time required for the hole to drain completely. If this time is less than 60 minutes, the test procedure may begin as prescribed in (e) below without further pre-soaking. If water remains in the test hole after 60 minutes, the hole must be pre-soaked as prescribed in (c) above before proceeding with the test.

(e) Immediately following the pre-soak procedure (no more than 28 hours after the start of the pre-soak procedure), the percolation rate shall be determined using the following procedure:

1. Step One: If water remains in the test hole after the completion of the pre-soak period, the test shall be terminated and the percolation rate shall be reported as greater than 60 minutes per inch. If no water remains in the test hole, fill to a depth of seven inches. At a five to 30 minute time interval, depending upon the rate of fall, record the drop in water level to the nearest one-tenth of an inch. Refill the hole at the end of each time interval and repeat this procedure using the same time interval until a constant rate of fall is attained. A constant rate of fall is attained when the difference between the highest and lowest of three consecutive measurements is no greater than two-tenths of an inch.
2. Step Two: Immediately after the completion of Step One, refill the test hole to a depth of seven inches and record the time required for exactly six inches of water to seep away. This time divided by six will be the percolation rate in minutes per inch.

(f) The results of the percolation test shall be interpreted as follows:

1. When the purpose of the test is to determine the design permeability at the level of infiltration, the slowest percolation rate determined within the proposed disposal field shall be used for design purposes.

If any of the measured percolation rates are slower than 60 minutes per inch or faster than three minutes per inch the application shall not be approved. A percolation rate may be the result of a single percolation test or the average of several replicate tests, as allowed in N.J.A.C. 7:9A-6.1(e)2.

2. When the result of the test(s) is an average percolation rate slower than 60 minutes per inch, the horizon or substratum in question shall be considered hydraulically restrictive.

3. When the result of the test(s) is an average percolation rate faster than three minutes per inch, the horizon or substratum in question shall be considered excessively coarse.

4. When a seepage pit is proposed, the design percolation rate shall be calculated by adding the products of the percolation rate and the thickness of each individual horizon tested and dividing the result by the total thickness of all the horizons tested. Any horizon with a percolation rate slower than 40 minutes per inch shall be excluded from this computation.

7:9A-6.5 Pit-bailing test

(a) The following equipment is required for performing a pit-bailing test (see Figure 8 in Appendix A):

1. A back-hoe;
2. Wooden or metal stakes, string and a hanging level;
3. A steel measuring tape;
4. A pump (optional);
5. A stop-watch; and
6. A perforated pipe, with a three inch diameter or greater.

(b) The following procedure shall be used for preparation of the test pit:

1. Step One: Excavate a test pit extending into but not below the soil horizon or layer to be tested. The bottom of the pit should be a minimum of 1.5 feet below the observed water level and a minimum of six feet below the proposed level of infiltration. The bottom of the pit should be relatively flat and level. The shape of the pit within the depth interval tested should be approximately square or round. A rectangular or elliptical pit may be used provided that, within the depth interval tested, the length of the long dimension is no more than twice the length of the short dimension. The excavation made for a soil profile pit as prescribed in N.J.A.C. 7:9A-5.2 may be used provided that all the above requirements are met.

2. Step Two: Allow the water level to rise in the pit for a minimum of two hours and until the sides have stabilized. If large volumes of soil have slumped into the pit, this soil must be removed before proceeding with the test. If the sides of the pit continue to slump and cannot be stabilized, the test shall be abandoned. If water is observed seeping into the pit from soil horizons above the zone of saturation in which the test is being conducted, adequate means shall be taken to intercept and divert this water away from the test pit, otherwise the pit-bailing test shall not be used. If, during the excavation of the pit, the water level in the pit rises suddenly after a hydraulically restrictive horizon is penetrated, and continues to rise above the bottom of the hydraulically restrictive horizon, the pit-bailing test shall not be used.

(c) The following procedure shall be used for performance of the pit-bailing test and the calculation of test results:

1. Step One: Establish a fixed reference point for depth to water level measurements which will not be disturbed during removal of water from the pit or which can be temporarily removed and later re-positioned in exactly the same place. One way to establish a removable reference level mark is as follows:

i. Drive stakes firmly into the ground on opposite sides of the test pit, several feet beyond the edge, where they will not be disturbed.

ii. Next, stretch a string with hanging level from stake to stake, over the pit, and adjust the string to make it level.

iii. Finally, secure the string to the stakes and mark or notch the positions on the stakes where the string is attached so that the string may be removed temporarily and later repositioned exactly in its place.

2. Step Two: Measure the distance from the reference level to the bottom of the pit and to the observed water level.

3. Step Three: Lower the water in the pit by at least one foot, by pumping or bailing. If the back-hoe bucket is used to remove water from the pit, it may be necessary to remove the reference level marker prior to bailing and re-position it in its original position prior to beginning step four.

4. Step Four: Choose a time interval, based upon the observed rate of water level rise. At the end of each time interval, measure and record the information indicated in (c)4 i through iii below and repeat these measurements until the water level in the pit has risen a total of one foot or more.

i. Time, in minutes (the time interval, in minutes, between measurements should be chosen to allow the water level to rise by several inches);

ii. Depth of water level below the reference string at the end of each time interval, to the nearest eighth of an inch or one-hundredth of a foot; and

iii. Area of water surface, in square feet. Measure appropriate dimensions of the water surface, depending on the shape of the pit, to permit calculation of the area of the water surface at the time of each water level depth measurement. Entering a soil pit excavated below the water table can be extremely dangerous and should be avoided unless the pit is relatively shallow and the sides of the pit have been stepped and sloped as prescribed in N.J.A.C. 7:9A-5.2(e)3 to eliminate the likelihood of sudden and severe cave-in of the pit. The distance between two opposite edges of the water surface can be measured accurately, without entering the pit, as follows. Place a board on the ground, perpendicular to the side of the pit and extending out over the edge. Using a plumb-bob, position this board so that its end is directly over the edge of the water surface in the pit, below. Position a second board, in the same manner, on the opposite side of the pit. Measure the distance between the ends of the boards to determine the length of the water surface below.

5. Step Five: Determine whether an adequately consistent set of data has been obtained in accordance with (e)5i and ii below.

i. Calculate the permeability for each time interval using the following equation:

$K_a=(h_{rise}/t) \times [A_{av.}/2.27(H^2-h^2)] \times 60$ min/hr

where:

K_a = permeability, in inches per hour;

h_{rise} = difference in depth to water level at the beginning and end of the time interval, in inches;

t = length of time interval, minutes;

$A_{av.}$ = average of water surface area at the beginning of time interval (end of previous time interval) and at the end of the time interval, in square feet;

H = difference between depth to assumed static water level and actual or assumed depth to impermeable stratum, in feet (depth to impermeable stratum, if unknown, is assumed to be one and one-half times the depth of the pit.); and

h = difference between average depth of water levels at the beginning and end of time interval and actual or assumed depth to impermeable stratum, in feet.

ii. If the calculated values of K_a for successive time intervals show either an increasing or a decreasing trend, repeat Steps Three and Four until consecutive values of K• a are approximately equal.

6. Step Six: Remove as much water as possible from the pit. Continue excavating the pit until an impermeable stratum is encountered or as deep as possible considering the limitations of the excavating equipment used and the nature of the soil conditions encountered. Where no impermeable stratum is encountered, the impermeable stratum shall be assumed to be at the bottom of the excavation.   Due to the potential safety hazards posed by the excavation of a large test pit such as that required for this test,

adequate safety measures shall be taken, including the posting of warning signs and installation of a fence to prohibit access to the pit by the public during periods when the pit is left unattended.

7. Step Seven: Record the depth to the static water level from the same reference level used in (c) Step One, (c)1 above. This step may be conducted either 24 hours after completion of Step Six at (c)6 above or of Step Two at (b)2 above.

8. Step Eight: Re-calculate the permeability, K, using the following formula:

$K=(h_{rise}/t) \times [A_{av.}/2.27(H^2-h^2)] \times 60$ min/hr

where:

K = permeability, inches per hour;

The values of h_{rise}, t, and A_{av}. are the values recorded for these parameters in the last time interval of Step Four of this subsection:

H = difference between depth to actual corrected static water level and actual or assumed depth to impermeable stratum, recorded in Steps Six and Seven, in feet; and

h = difference between the average depth of water levels at the beginning and end of the last time interval recorded in Step Four and the actual or assumed depth to impermeable stratum recorded in Step Six, in feet.

(d) When the permeability calculated in Step Eight of (c) above is slower than 0.2 inch per hour, the horizon(s) being tested shall be considered a hydraulically restrictive horizon and shall not be considered an acceptable zone of wastewater disposal.

7:9A-6.6 Piezometer test

(a) The following equipment is required for the piezometer test:

1. A screw type soil auger, minimum of one inch in diameter, with extensions;

2. A piezometer tube consisting of a metal pipe beveled on the outside lower edge, with an inside diameter about one-sixteenth of an inch larger than the diameter of the soil auger;

3. A maul or hammer, to drive pipe into the ground;

4. A pump with tubing, to evacuate water from piezometer tube;

5. A stop watch;

6. A means for accurately measuring the water level within the piezometer tube as a function of time, which may consist of one of the following:

i. A light-weight rod with measuring scale mounted on a cylindrical float with a diameter one-quarter inch or more smaller than the inside diameter of the piezometer tube;

ii. An electric probe consisting of a thin wire embedded in and protruding from the tapered end of a wooden rod, graduated in inches, and connected in series to a limiting resistor, a millimeter and a 33-volt hearing-aid battery, the opposite terminal of which is connected to the piezometer tube; or

iii. For depths greater than six feet, an electric sounder or the "wetted tape" method should be used.

(b) The following procedure shall be used for the piezometer test:

1. Step One: Remove any sod, vegetation or leaf litter from the ground surface where the test hole will be excavated. The test hole may be excavated from the existing ground surface or from the bottom of a larger excavation or soil profile pit.

2. Install the piezometer in accordance with Step Two A and Two B outlined in (b)2i and ii below or Alternate Step Two outlined in (b)2iii below.

i. Step Two A: Using the soil auger, drill the test hole down to a depth of six inches. Remove the auger and drive the piezometer tube into the hole to a depth of five inches. Re-insert the soil auger through the piezometer tube and into the test hole and drill down six inches further. Remove the soil auger, drive the piezometer tube six inches deeper, re-insert the auger and drill six inches deeper, repeating this procedure until the test hole reaches the top of the soil horizon or zone within a soil horizon to be tested.

ii. Step Two B: Using the soil auger, extend the test hole exactly four inches below the bottom of the piezometer tube (see Figure 9 of Appendix A). In coarse-textured soils lacking cohesion, where the unlined cavity at the bottom of the test hole may be unstable, use a piezometer tube with closely spaced perforations in the lower four inches of its length and drive the tube down to the bottom of the test hole.

iii. Alternate Step Two: Power equipment may be used in lieu of the hand auger to drill the test hole and install the piezometer casing provided that the casing fits tightly into the hole or the installation is sealed with bentonite so that leakage does not occur around the outside of the casing and provided that a suitable unlined cavity is provided at the bottom of the bore hole as required in Step Two B above.

3. Step Three: Allow the lower portion of the test hole to fill with ground water and pump the water out one or more times to minimize the effect of soil puddling and to flush the soil pores in the unlined portion of the test hole.

4. Step Four: Allow the water level to rise within the piezometer until the water level becomes relatively stable. Note the approximate rate of rise and record the static water level using the top of the piezometer tube as a reference point.

5. Step Five: Pump most of the water out of the piezometer tube. Record the time and the depth of the water level below the top of the tube. After an appropriate interval of time, record the new depth of the water level. Choose the length of the time interval based upon the rate of rise observed in Step Four so that the difference in water levels at the beginning and end of the time interval will be large enough to permit an accurate measurement, but do not allow the water level to rise to within eight inches of the static level determined in Step Four.

6. Step Six: Repeat Step Five of this subsection, lowering the water level to approximately the same depth and using the same time interval, until consistent results are obtained.

7. Step Seven: Allow the water level in the piezometer tube to rise and, a minimum of 24 hours later, record the depth of the water table for use in the calculation of permeability.

(c) The permeability of the soil horizon tested shall be determined as follows:

1. Step One: Determine the value of the A-parameter from Figure 10 of Appendix A based upon D, the diameter of the soil auger (or drill bit).

2. Step Two: Calculate the permeability, K, in inches per hour, using following formula:

$K = 60$ min/hr x $(3.14R^2)/At$ x 1n $(d_1 - D_{stat}/d^2 - D_{stat})$ where:

K = the permeability of the soil horizon tested, in inches per hour;

R = the inside radius of the piezometer tube, in inches;

1n = the natural logarithm;

D_{stat} = the depth of the static water level below the top of the piezometer tube determined in Step Seven, in inches;

d_1 = depth of the water level below the top of the piezometer tube at the beginning of the last time interval, in inches;

d_2 = depth of the water level below the top of the piezometer tube at the end of the last time interval, in inches;

t = length of time interval, in minutes; and

A = value determined in Step One above, in inches.

(d) When the permeability calculated in (c)2 above is less than 0.2 inch per hour, the horizon or substratum in question shall be considered hydraulically restrictive and shall not be considered an acceptable zone of wastewater disposal.

(e) When piezometers are used for conducting this test, they shall be installed and removed in accordance with the Department's procedures pursuant to N.J.S.A. 58:4A-4.1 et seq.

7:9A-6.7 Basin flooding test

(a) The following equipment is required for basin flooding test:

1. Excavating equipment capable of producing a test basin as prescribed in (b) below;
2. A water supply (minimum of 375 gallons per basin filling); and
3. A means for accurately measuring the water level within the basin as required in (c) below.

(b) A test basin meeting the following requirements shall be excavated within or immediately adjacent to the proposed disposal field.

1. The bottom of the test basin shall be at a depth between six and eight feet below the bottom of the proposed level of infiltration.
2. The bottom area of the basin shall be a minimum of 50 square feet.
3. A soil profile pit excavated as prescribed in N.J.A.C. 7:9A-5.2 may be utilized for this test provided that the requirements of (b)1 and 2 above are satisfied.
4. The bottom of the basin should be made as level as possible so that high areas of rock do not project above the water level when the basin is flooded as prescribed in (c) below.
5. If ground water is observed within the test basin, the basin flooding test shall not be used.

(c) The following test procedure shall be used for the basin flooding test:

1. Step One: Fill the test basin with exactly 12 inches of water and record the time. Allow the basin to drain completely. If the time required for the basin to drain completely is greater than 24 hours, the test shall be terminated and the limiting zone in question shall be considered to be a massive rock substratum.
2. Step Two: If the basin drains completely within 24 hours after the first flooding, immediately refill the basin to a depth of 12 inches and record the time. If the basin drains completely within 24 hours of the second filling, the limiting zone in question shall be considered to be fractured rock substratum. If water remains in the basin after 24 hours the limiting zone in question shall be considered to be a massive rock substratum.

(d) Due to the potential safety hazards which are posed by the excavation of a large test basin such as that required for this test, adequate safety measures shall be taken including the use of stepped and sloped sidewalls as shown in Figure 2 of Appendix A to permit safe access to the test basin during the test procedure as well as the use of warning signs or a fence to limit access to the basin by the public during periods when the basin is left unattended, or both.

(e) The basin flooding test shall not be conducted in rock strata which have been blasted with explosives.

Subchapter 7. General Design and Construction Requirements

7:9A-7.1 Design requirements

(a) A professional engineer who is licensed in the State of New Jersey shall design all individual subsurface sewage disposal systems.

(b) The engineer shall take into consideration slope, surface drainage, soil characteristics, the presence and depth of limiting zones within the soil, soil permeability, type of wastes and the expected volume of sanitary sewage in the design of all individual subsurface sewage disposal systems.

(c) Individual subsurface sewage disposal systems shall not be designed in a manner that will permit a direct discharge of sanitary sewage or septic tank effluent onto the surface of the ground, into a subsurface drain, or into any water course.

7:9A-7.2 Construction

(a) The system and all its component parts shall be constructed and installed to conform in all details to the requirements set forth in this chapter and to the engineering design which has been approved by the administrative authority. Departures from the approved design which become necessary due to circumstances which arise during construction and installation shall be approved by the design engineer and the administrative authority in accordance with N.J.A.C. 7:9A-3.7 and shall meet or exceed the requirements of this chapter.

(b) Construction and installation shall be performed in such a manner that the capacity of the soil or fill material to adequately absorb or purify the septic tank effluent is not adversely affected.

7:9A-7.3 Type of wastes

(a) The system(s) shall be designed to receive all sanitary sewage from the building served except in the following cases:

1. Separate systems may be designed to receive only greywater, or only blackwater, as allowed in N.J.A.C. 7:9A-7.5.

2. Laundry wastes may be discharged into a seepage pit when approved by the administrative authority as a means of reducing hydraulic loading on an existing disposal field which has been malfunctioning

(b) Drainage from basement floors, footings or roofs shall not enter the individual subsurface sewage disposal system and shall be diverted away from the area of the disposal field.

(c) Discharge of industrial wastes onto the land, into the soil, or into the ground water is prohibited. The administrative authority shall not approve any system serving any establishment engaged in activities such as photo-processing, dry-cleaning, printing, furniture stripping and refinishing, manufacturing, automobile painting, or any other process or activity which may result in discharge of industrial wastes into the system, without prior approval from the Department. Where doubt exists as to whether or not a waste generated by a particular facility may be considered as an industrial waste, the administrative authority shall instruct the applicant to contact the Department for a determination of whether or not a NJPDES permit will be required.

(d) The administrative authority shall report to the Department any discharge of industrial wastes into an individual subsurface sewage disposal system. Use of sewage system cleaners which contain restricted chemical materials shall be considered to be a discharge of industrial wastes and is prohibited.

7:9A-7.4 Volume of sanitary sewage

(a) Each component of the individual subsurface sewage disposal system shall be designed and constructed to adequately treat and dispose of the expected volume of sanitary sewage to be discharged from the premises to be served. The expected volume of sanitary sewage from private residential sources shall be determined based on the criteria set forth in (b) below. The expected volume of sanitary sewage from commercial or institutional establishments shall be determined based on the criteria set forth in (c) below.

(b) The criteria for estimating the volume of sanitary sewage from private residential sources shall be as follows:

1. The daily volume for each bedroom or dwelling unit shall be:

Volume, first bedroom	200 gallons per day ("gal/day")
Volume, each additional bedroom	150 gal/day
Minimum volume per dwelling unit	350 gal/day
Minimum volume per apartment	350 gal/day

2. The minimum volume for a dwelling unit shall be reduced to 200 gallons per day in the case of deed restricted senior citizen communities or mobile home parks with dwelling units less than 500 square feet in size.

(c) The volume of sanitary sewage from commercial or institutional establishments shall be based upon the type and size of the facility and the maximum expected number of persons that may be served during any single day of operation. The volume shall be estimated as follows:

1. Depending upon the method of estimation selected from (d) below, multiply the number of gallons per person (user) by the maximum expected number of persons per day, or multiply the number of gallons per facility (unit) per day by the number of facilities (units) present or proposed.

2. Estimate the maximum number of employees which may be present during a single day of operation and add an additional 15 gallons per employee per each additional eight hour shift, except in the case of (d)24, (d)32, (d)38 and (d)40 below.

(d) The criteria listed below are minimum standards for average facilities of the categories listed. In cases where a facility does not fall within any of the categories, the administrative authority may approve the use of other documented criteria, such as actual water data for the facility or other similar facilities, provided that the value used for design is at least 50 percent greater than the average daily volume of sewage.

Type of Establishment	**Method of Estimation (gallon per user or gallon per unit per day)**
1. Airport	5 gal/passenger
2. Assembly Hall	3 gal/seat/day
3. Auto Service Station	10 gal/car served
4. Bar	5 gal/patron
5. Bathhouse with shower	25 gal/person
without shower	10 gal/person
6. Beach Club	25 gal/person
7. Beauty parlors and salons	120 gal/day/sink
8. Boarding House, Meals	75 gal/guest(2)
	15 gal/non-resident boarder
9. Bowling Alley, no food	125 gal/lane/day
with food, add	5 gal/patron
10. Bus Stop Rest Area	5 gal/passenger
11. Cafeteria	5 gal/customer
12. Camp, Cottage (barracks type)	65 gal/person
13. Camp, Day, no meals	20 gal/person
14. Camp, Resort	100 gal/site/day(2)
15. Camp, Trailer	100 gal/site/day(2)
with toilets, add	10 gal/person/day
16. Church, with or without kitchen	3 gal/seat/day
17. Cocktail Lounge	5 gal/customer
18. Coffee Shop	5 gal/customer
19. Comfort Station/Picnic Grounds	
with toilets	10 gal/person
with toilets and showers	15 gal/person
20. Cottages	100 gal/person[2]
	minimum 350 gal/dwelling unit/day
21. Country Club	60 gal/member/day
	25 gal/non-member
22. Dining Hall	5 gal/customer
23. Dormitory, Bunkhouse	40 gal/bed/day
24. Factory/Industrial Building	15 gal/employee per eight hour shift
with showers, add	15 gal/employee per eight hour shift
25. Hospital, Medical	250 gal/bed/day
26. Hospital, Mental	150 gal/bed/day
27. Hotels	130 gal/room/day
28. Institution, Other than hospital	150 gal/bed/day
29. Laundry, Self-service	50 gal/wash
30. Motel	130 gal/room/day

31. Nursing/Rest Home	150 gal/bed/day
32. Office Buildings	15 gal/employee per eight hour shift or 0.125 gal/ft^2, whichever is greatest
33. Prison	150 gal/inmate/day
34. Restaurant	
sanitary wastes only	5 gal/patron only
kitchen waste, add	5 gal/patron
35. Rooming House, no meals	65 gal/bed/day
36. School, Boarding	100 gal/student/day
37. School, Day	
No cafeteria or showers	10 gal/student/day
Cafeteria only	15 gal/student/day
Cafeteria and showers	20 gal/student/day
Cafeteria, showers and laboratories	25 gal/student/day
38. Shopping Center	0.125 gal/square ft./day(1)
39. Stadium	3 gal/seat/day
40. Store	0.125 gal/square ft./day(1)
41. Swimming Pool	10 gal/person
42. Theater, Indoor	3 gal/seat/day
43. Theater, Outdoor	10 gal/parking space
44. Visitor Center	5 gal/visitor

(1) Volume of sanitary sewage for employees included within method of estimation indicated.

(2) If laundry wastes are anticipated, increase the estimated flow by 50 percent.

7:9A-7.5 Separate disposal of greywater and blackwater

A greywater system may be approved by the administrative authority provided that all of the requirements of these standards are satisfied and provided that an acceptable means for disposal of the blackwater from the building served is indicated in the system design. When the blackwater from the building served by a greywater system is to be disposed of into a waterless toilet, a variance from the Uniform Construction Code, Plumbing sub-code, N.J.A.C. 5:23-3.5, must be obtained by the applicant prior to approval of the greywater system by the administrative authority and the volume of sanitary sewage to be used in the design of the greywater system shall be determined as prescribed in N.J.A.C. 7:9A-7.4. When the black-water from the building served by a greywater system is to be disposed of into a separate subsurface sewage disposal system, the blackwater system shall meet all the requirements of this chapter and the volume of sanitary sewage used in the design of both the greywater system and the blackwater system shall be a minimum of 75 percent of the volume of sanitary sewage determined as prescribed in N.J.A.C. 7:9A-7.4.

7:9A-7.6 Type of system

Each system approved by the administrative authority pursuant to this chapter shall consist of a septic tank which discharges effluent through a gravity flow, gravity dosing or pressure dosing network to a disposal field as hereafter described. Seepage pits shall not be approved for new installations except in the case of a greywater system as provided by in N.J.A.C. 7:9A-7.5. Installation of a seepage pit may be approved as an alteration for an existing system subject to the requirements of N.J.A.C. 7:9A-3.3.

7:9A-7.7 Building sewer

The building sewer shall be designed and constructed in accordance with the provisions of the State Uniform Construction Code, N.J.A.C. 5:23, adopted pursuant to the Uniform Construction Code Act, N.J.S.A. 52:27D-119 et seq.

Subchapter 8. Pretreatment Units

7:9A-8.1 Grease traps

(a) Restaurants, cafeterias, institutional kitchens and other installations discharging large quantities of grease shall use a grease trap. A garbage grinder shall not be used when a grease trap is required.
(b) The grease trap shall be installed in a separate line serving that part of the plumbing system into which the grease will be discharged. The grease trap shall be located close to the source of the wastewater, where the wastewater is still hot, to facilitate separation. Grease traps shall be located, designed and constructed in a manner that will permit easy access and cleaning.
(c) The following equation shall be used to determine the minimum size required for grease traps serving restaurants:
Q = (D) x (HR/2) x (12.5) x (LF), where
Q = size of grease trap in gallons;
D = number of seats in dining area;
HR = number of hours open per day; and
LF = loading factor depending upon restaurant location:
    1.25 for interstate freeways;
    1.0 for other freeways;
    1.0 for recreation areas;
    0.8 for main highways;
    0.5 for other highways.
(d) The following equation shall be used to determine the minimum size required for grease traps serving cafeterias and institutional kitchens:
Q = (M) x (11.25) x (LF), where
Q = size of grease trap in gallons;
M = total number of meals served per day; and
LF = loading factor depending on type of facilities present:
    1.0 with dishwashing;
    0.5 without dishwashing.
(e) In no case shall a grease trap serving a restaurant, cafeteria or institutional kitchen be smaller than 750 gallons in capacity.
(f) The minimum requirements for construction, materials and foundations of grease traps shall be the same as those required for septic tanks, as prescribed in N.J.A.C. 7:9A-8.2.
(g) The inlet and outlet of the grease trap shall be provided with "T" baffles extending to a depth of 12 inches above the tank floor and well above the liquid level.
(h) To facilitate maintenance, manholes extending to finished grade shall be provided. Covers shall be of gas-tight construction and shall be designed to withstand expected loads and prevent access by children.

7:9A-8.2 Septic tanks

(a) The use of a septic tank shall be required for all subsurface wastewater disposal systems. Use of an aerobic treatment unit or any other device in lieu of a septic tank shall not be approved by the administrative authority without prior approval by the Department. An aerobic treatment unit may precede the septic tank if the septic tank and all other components of the subsurface wastewater disposal system are sized in strict conformance with this chapter and:
    1. For batch processing aerobic treatment units the septic tank precedes in series the aerobic treatment unit; or,
    2. For gravity flow aerobic treatment units the septic tank follows in series the aerobic treatment unit.
(b) The minimum capacity of the septic tank shall be determined in accordance with the following criteria:

1. When serving single family dwelling units, septic tanks shall have the minimum capacity of 250 gallons per bedroom. Expansion attics shall be considered additional bedrooms. In no case shall the capacity be less than 1000 gallons.

2. When serving installations other than single family dwelling units, the minimum capacity shall be 1.5 times (150 percent) the volume of sanitary sewage, Q, when Q, determined as prescribed in N.J.A.C. 7:9A-7.4, in less than 1,500 gallons per day. When Q is greater than 1,500 gallons per day, the minimum capacity in gallons shall be 1,125 plus 0.75Q. In no case shall the capacity be less than 1000 gallons.

3. Two or more septic tanks may be connected in series in order to obtain the minimum required liquid capacity providing that each tank is at least as large as the succeeding tank. When a multiple compartment tank is used, the requirements of (d)3 below shall be satisfied.

(c) When domestic garbage grinder units are installed or proposed, a multiple compartment septic tank is required and the liquid capacity of the septic tank(s), exclusive of air space, shall be at least 50 percent greater than the minimum capacity required in (b)1 above

(d) Multiple compartment septic tanks shall be required for institutional and commercial installations where the daily volume of sewage determined as prescribed in N.J.A.C. 7:9A-7.4 is greater than 1000 gallons . When multiple compartment tanks are used the following shall be required:

1. The total capacity of multiple compartment tanks shall not be less than 1000 gallons. The first compartment shall have a liquid capacity of two-thirds the total required liquid capacity determined as prescribed in (b) above.

2. Not more than two compartments shall be provided in tanks having liquid capacities of less than 1250 gallons. Tanks having liquid capacities of over 1250 gallons may be provided with more than two compartments.

3. Multiple compartments may be provided by partitions within a single tank as shown in Figure 11 of Appendix A, or by connecting individual tanks in series. When a single partitioned tank is used, vent holes shall be provided near the top of each partition to allow free exchange of evolved gases between compartments and the two compartments shall be connected by means of a pipe tee, baffle or septic solids retainer, as shown in Figure 11.

(e) Septic tanks shall be designed and constructed according to the following requirements:

1. Septic tanks shall be water-tight and constructed of sound and durable materials which are resistant to corrosion, decay, frost damage or to cracking or buckling due to settlement or backfilling. All joints below the liquid level of the tank or below the seasonally high water table shall be provided with a permanent water-tight seal.

2. Covers shall be designed and constructed so as not to be damaged by any load which is likely to be placed on them. Precast slabs used as covers shall be water-tight, a minimum of three inches in thickness and adequately reinforced.

3. The walls and base of poured-in-place concrete tanks shall not be less than six inches in thickness. The sides and bottom of precast concrete tanks shall be a minimum of three inches in thickness and shall be adequately reinforced.

4. Concrete used in the construction of septic tanks shall conform to the American Concrete Institute (ACI) standards for frost resistance (ACI 318-16-4.5.1) and water-tightness (ACI 318-16-4.5.2). In the case of built-in-place tanks, certification that these standards have been met shall be provided by the design engineer and the certification shall be signed, sealed and attached to the approved engineering design. In the case of precast tanks, certification shall be provided by the manufacturer and the certification displayed on the tank.

5. All inside concrete surfaces shall be sealed with two coatings of an appropriate inert coating to minimize corrosion. Coating of pre-cast tanks shall be applied by the manufacturer prior to delivery to the job site.

6. The base of poured-in-place tanks shall be cast in one piece and shall extend beyond the side and end walls of the tank. Such tanks shall not be emplaced until 48 hours after the base has been poured.

7. Pre-fabricated polyethylene septic tanks shall conform with the standards for materials, wall thickness, fastening of fittings and maximum deformation under load as prescribed by the Canadian Standards Association in CSA Standard CAN3-B66-M79.

8. Pre-fabricated fiberglass septic tanks shall conform to ASTM Standard D4021.

(f) A pre-fabricated septic tank constructed of any material which may be floated or shifted by water or ground cave-in shall be filled with water immediately after it is set in its proper position. When a septic tank is installed below or partially below the level of the seasonally high water table, the design engineer shall show by means of appropriate calculations that the tank is of sufficient weight or will be otherwise secured or anchored so that it will not shift or float if emptied during the time of seasonally high groundwater. Perforating or otherwise damaging the water-tight integrity of a septic tank for the purpose of installation below the water table is prohibited.

(g) Septic tanks shall be placed upon a firm and stable foundation so that the potential for uneven settlement or shifting is minimized. Tanks shall be constructed or installed directly on undisturbed natural soil. If the excavation is dug too deep, it shall be backfilled to the proper elevation with sand. When the tank must be constructed or installed on a layer of fill material greater than one foot in thickness, the fill shall be properly emplaced and compacted as prescribed in N.J.A.C. 7:9A-10.4(f)3.

(h) Metal septic tanks are prohibited. Septic tanks may be constructed of the following materials:

1. Poured-in-place concrete;
2. Precast reinforced concrete;
3. Fiberglass;
4. Polyethylene; or
5. Other materials as approved by the Department.

(i) Septic tanks shall conform to the following specifications:

1. The depth below the liquid level of the tank shall not be less than 36 inches or more than 72 inches.
2. Inlets and outlets shall be arranged so that all flow is directed along the longest horizontal dimension of the tank.
3. Tanks which are rectangular in cross-section shall have an inside length at least twice the inside width. The inside length, measured from the inlet side to the outlet side, shall not be less than 72 inches. The inside width of the tank shall not be less than 36 inches.
4. Upright cylindrical tanks shall have a minimum diameter of 52 inches. Horizontal cylindrical tanks shall have a minimum length of 72 inches and a minimum width at the liquid level of 36 inches.

(j) Inlets and outlets of septic tanks shall conform to the following specifications:

1. Inlet and outlet connections of each tank or compartment shall be arranged so as to obtain effective retention of scum and sludge and shall be fastened with and constructed of, or coated with, materials which are resistant to corrosion by sulfuric acid. Where pipe tees are used, the tees shall be sanitary tees and shall be installed in a manner that will provide a lasting water-tight seal between the tee and the wall of the tank. For this purpose, a manufactured water-proof pipe coupling which is incorporated into the wall of the tank may be used, or an expanding grout which will adhere both to the tee and to the body of the tank where the tee is installed.
2. A baffle or a pipe tee, not less than four inches in diameter, is required at the inlet of the tank. The bottom of the baffle or the bottom of the vertical leg of the tee shall extend below the liquid level a distance equal to 25 to 33 percent of the liquid depth. The invert elevation of the inlet shall not be less than two inches higher than the invert elevation of the tank outlet or the outlet of the first compartment. The inverts of the inlets of subsequent compartments shall be a minimum of one inch higher than their outlets.
3. Outlet connections of the tank or each compartment thereof shall be provided with a tee not less than four inches in diameter or a durable baffle equivalent in size. They shall be permanently fastened in place with the bottom opening extending below the liquid level by a distance equal to 25 to 40 percent of the total liquid depth. Outlet baffles or tees shall be provided with a gas deflection device adequately

designed to prevent gases generated in the septic tank from rising through the outlet baffle or tee. The gas deflection device shall extend a minimum of 2 inches beyond the lateral extent of the outlet baffle or tee, and below the bottom of the outlet baffle or tee. The gas deflection device shall be constructed of, or coated with, materials which are resistant to corrosion by sulfuric acid and shall be securely fastened to the tee or the side of the tank. Figure 12 of Appendix A illustrates several acceptable gas deflection devices. In lieu of a baffle or tee connection, an alternative device such as a septic solids retainer may be used provided that this device bears the seal of the National Sanitation Foundation ("NSF") certifying that the device has been approved by NSF for the specific use proposed and provided that the installation conforms to the manufacturer's recommendations. Where a septic solids retainer is used, a gas deflection baffle is not required.

(k) The space between the liquid surface and the top of the outlet tee or baffle shall not be less than 15 percent of the total liquid depth.

(1) Access openings for septic tanks shall meet the following requirements:

1. Each septic tank or each compartment of a multiple compartment tank shall be provided with at least one access opening which shall be a manhole a minimum of 24 inches square or 24 inches in diameter.
2. All manholes at a minimum shall be extended to within six inches of finished grade by means of a riser fitted with a removable watertight cover. Where manholes are extended flush with finished grade, covers shall be bolted or locked to prevent access by children and shall be of cast iron when a concrete riser is used. When manholes are not extended to finished grade, covers shall be constructed of precast reinforced concrete, fiberglass, polyethylene or other materials as specified by a licensed professional engineer and approved by the administrative authority. The location of the manhole shall be marked on the ground surface by means of a permanent, non-corrosive marker a minimum of three inches in diameter.
3. An inspection port extending to finished grade shall be provided over each tank or compartment inlet and outlet which is not directly below a manhole except for those outlets where a septic solids retainer is used. Inspection ports shall extend to finished grade, shall be constructed of four inch cast iron or Polyvinyl Chloride (PVC), and shall have a locked or bolted cap.
4. Manhole risers and inspection ports on fiberglass or polyethylene tanks shall be constructed of the same material as the tank.

(m) Backfill around septic tanks shall be free of large stones, roots or foreign objects, shall be placed in thin layers, not to exceed eight inches, and shall be thoroughly tamped in a manner that will not produce undue strain on the tank. In the case of pre-fabricated plastic or fiberglass tanks, backfill shall be no thicker than the maximum depth recommended by the manufacturer.

Subchapter 9. Effluent Distribution Networks

7:9A-9.1 General requirements for effluent distribution

(a) Discharge of effluent from the septic tank or grease trap to the disposal field and distribution of effluent within the disposal field shall be accomplished by one of the following methods:

1. The gravity flow method whereby the pretreatment unit discharges directly to a single distribution lateral, an inter-connected network of distribution laterals or to a distribution box discharging to two or more individual distribution laterals;
2. The gravity dosing method whereby the pretreatment unit discharges to a dosing tank with a pump or siphon which in turn discharges to a single distribution lateral, an inter-connected network of distribution laterals or to a distribution box discharging to two or more individual distribution laterals; or
3. The pressure dosing method whereby the pretreatment unit discharges to a dosing tank with a pump or siphon which in turn discharges to an inter-connected network of distribution laterals designed to discharge effluent under pressure.

(b) Each lateral in the distribution network shall receive an equal hydraulic loading. The use of serial distribution is prohibited.
(c) The use of gravity flow is restricted to those cases where less than 600 linear feet of distribution laterals are used and where the relative locations and elevations of the system components will allow gravity flow from the building sewer to the pretreatment unit and on through the distribution network.
(d) Alternating siphons or pumps may be used to alternately dose and rest two or more disposal fields provided that no field or portion of a field receives more than the maximum daily hydraulic loading rate allowed in N.J.A.C. 7:9A-10.2. Soils with a permeability faster than six inches per hour or a percolation rate faster than 15 minutes per inch shall not be rested for periods longer than one day unless pressure distribution is used and shall not receive more than 25 percent of the maximum allowed daily hydraulic loading in a single dose.

7:9A-9.2 Dosing tanks

(a) A dosing tank using a siphon or pump is required for systems using gravity or pressure dosing and shall meet the requirements of (b) through (f) below.
(b) The minimum capacity of dosing tanks using pumps shall be determined as follows:
1. Dosing tanks using pumps shall have sufficient capacity to distribute septic tank effluent equally to all parts of the disposal field during each dosing cycle and to provide adequate reserve storage capacity in the event of a pump malfunction. The total liquid capacity shall be great enough to accommodate the minimum required dose volume (V_d) determined as prescribed in (b)2 below, plus the minimum required reserve storage capacity determined as prescribed in (b)3 below. Additional volume must be provided above the pumping level to accommodate the volume of water displaced by the pump and controls (V_{pd}) as well as any quantity of effluent which will drain back into the dosing tank when the pump shuts off at the end of a dosing cycle (V_{cp}). Additional volume must be provided below the pumping level so that the pump may be placed on a pedestal, above the dosing tank bottom, to prevent the pump from drawing in air or whatever solids may accumulate in the bottom of the dosing tank.
2. The dose volume (V_d) shall be determined based upon the soil permeability or percolation rate, daily volume of sewage (Q) and the total internal volume of the distribution network (V), as shown below. In the case of pressure dosing systems, the volume of the distribution network, V, shall include the volume of the delivery pipe (V_p), the manifold (V_m) and the laterals (V_l).

Soil Permeability (in/hr)	Percolation Rate (min/in)	Required Dose Volume Gravity Dosing	Required Dose Volume Pressure Dosed
6-20	3-15	minimum of 75 percent V,[1] maximum of 25 percent Q	minimum of 10V[2] maximum of 25 percent Q
0.2-6	15-60	minimum of 75 percent V maximum of 100 percent Q	minimum of 10V maximum of 100 percent Q

(1) In cases where 75 percent V is larger than 25 percent Q, the 25 percent Q maximum rather than the percent minimum shall be observed.
(2) In cases where 10V is larger than 25 percent Q, the 25 percent Q maximum rather than the 10V minimum shall be observed.

3. Reserve capacity is the inside volume of the dosing tank which lies between the level at which the high-water alarm switch is set and the invert elevation of the tank inlet, as shown in Figure 13 of Appendix A. A minimum reserve capacity equal to the daily volume of sewage shall be required except where a stand-by pump is provided which is equivalent in performance capacity to the primary pump and which will switch on automatically in the event that the primary pump malfunctions.

(c) The capacity of dosing tanks using siphons shall be adequate to provide the required dose volume determined as prescribed in (b)2 above. No reserve capacity is required when a siphon is used.

(d) All dosing tanks shall meet the following requirements regardless of whether a pump or siphon is used.

1. The requirements for the construction of dosing tanks shall be the same as those prescribed for septic tanks in N.J.A.C. 7:9A-8.2(e). Dosing tanks may be constructed as a separate unit or may share a common wall with the pretreatment unit.
2. Materials used for the construction of dosing tanks shall be the same as those allowed for septic tanks as prescribed in N.J.A.C. 7:9A-8.2(h).
3. Dosing tanks shall be constructed in a manner that will permit venting of the disposal area.
4. Installation requirements for pre-fabricated dosing tanks shall be the same as those for septic tanks, as prescribed in N.J.A.C. 7:9A-8.2(f).
5. Dosing tanks shall be placed on a firm and stable foundation so that the potential for differential settling or shifting is minimized.
6. Inlets shall be above the highest water level attained when the entire reserve capacity is full. Outlets for dosing tanks using siphons shall conform with the manufacturer's recommendations.
7. Dosing tanks shall be readily accessible for service and repair. A removable watertight cover or a manhole with a removable watertight cover shall be provided. Manholes shall be a minimum of 24 inches in diameter or 24 inches square and shall be located directly over the pump or siphon. The top of the tank or manhole riser, at a minimum, shall be extended to within six inches of finished grade and be equipped with a watertight cover. Where manholes are extended flush with finished grade, the cover shall be bolted or locked to prevent access by children and shall be of cast iron when a concrete riser is used. When the top of the tank or manhole is not extended to finished grade, covers shall be constructed of precast reinforced concrete, fiberglass, polyethylene or other materials as specified by a licensed professional engineer and approved by the administrative authority. The location of the manhole shall be marked on the ground surface by means of a permanent, non-corrosive marker a minimum of three inches in diameter.
8. Requirements for backfilling around dosing tanks shall be the same as for septic tanks, as prescribed in N.J.A.C. 7:9A-8.2(m).

(e) Dosing may be accomplished by means of an automatic siphon when the low water level in the dosing tank is at a higher elevation than the invert of the highest distribution lateral. When a siphon is used the following requirements shall be met:

1. Siphons shall be constructed of durable materials not subject to corrosion by acid or alkali.
2. Extreme care shall be utilized in the installation of siphons. The installation shall conform exactly and in all details to the manufacturer's recommendations and specifications.
3. The horizontal dimensions of the dosing tank shall be adjusted so that the volume obtained by multiplying the manufacturer's rated siphon drawing depth by the internal horizontal area of the tank will be equal to the required dose volume determined as prescribed in (b)2 above.
4. When installation is complete, the siphon shall be primed by filling it with water at which time the siphon shall be checked for leaks as evidenced by air bubbles rising from the bell casing or piping. Any leaks shall be repaired before final approval is given.
5. In gravity dosing systems, when the delivery pipe between the dosing tank and the distribution box or distribution network is long, the siphon invert shall be set at an elevation sufficiently higher than the invert of the highest distribution lateral to compensate for any head losses due to friction in the connecting pipe. Friction head shall be determined using Figure 16 of Appendix A.
6. In pressure dosing systems, the invert of the siphon shall be set higher than the invert of the distribution laterals by a distance equal to the total operating head determined as prescribed in N.J.A.C. 7:9A-9.7(a)ii.

7. For facilities from which large quantities of septic tank effluent may be discharged at one time, the design engineer shall make certain that the siphon discharge rate will not be exceeded by the maximum expected rate of inflow at time of peak flow.

8. Each dosing tank shall be equipped with a cycle counter activated by a weighted float or mercury switch to facilitate monitoring of siphon performance.

9. Dosing tanks using siphons shall be equipped with an overflow to the distribution box or distribution network and a high-water alarm meeting the requirements of (f)7iii below. The invert of the overflow shall be just above the level of the high-water alarm switch which shall be several inches above the normal high-water level of the dosing tank.

(f) Dosing may be accomplished by means of a pump when either gravity dosing or pressure dosing is used. Duplicate pumps may be required by the administrative authority. The following requirements shall be met:

1. The pump must be rated by the manufacturer to handle septic tank effluent and all equipment must be listed and identified for the intended use as determined by the design.

2. Pumps used for gravity dosing systems must be rated by the manufacturer, as indicated by the manufacturer's pump performance curve, to be capable of delivering the total required dose volume within a period of 15 minutes or less when working against a total dynamic head equal to the total design operating head. For the purpose of making this determination, the total design operating head shall be considered as the sum of the elevation head and the friction head calculated as prescribed in N.J.A.C. 7:9A-9.7(a)7.

3. Selection of an adequate pump for pressure dosing is part of the design procedure for pressure dosing systems and shall be performed in conformance with N.J.A.C. 7:9A-9.7(a).

4. Pumps shall be set on a pedestal so that the intake is elevated several inches above the bottom of the dosing tank.

5. Easy or "quick-disconnect" couplings shall be used to facilitate removal of the pump for servicing.

6. For facilities from which large quantities of septic tank effluent may be discharged at one time, the design engineer shall make certain that the pump discharge rate will not be exceeded by the maximum expected rate of inflow at times of peak flow.

7. The operation of the pump shall be controlled by means of automatic switches which are activated by the rising and falling level of effluent in the dosing tank. Such switches shall meet the following requirements:

i. Switches shall be able to withstand the humid and corrosive atmosphere in the dosing tank. Mercury or weighted float type switches are suitable for this purpose. Pressure-diaphragm type switches are prohibited.

ii. The pump-on and pump-off switches shall be set at appropriate levels to provide a dose volume as required in N.J.A.C. 7:9A-9.2(b)2. The pump-off switch shall be set six inches above the pump intake. The pump-on switch shall be set at a distance, d, above the pump-off switch, which is calculated by means of the following formula:

d, in = $(V_d + V_{cp} + V_{pd}) \times (1\ ft^3/7.48\ gal) \times (12\ in/1\ ft)/(A)$, where:

V_d is the required dose volume, in gallons, determined as prescribed in N.J.A.C. 7:9A-9.2(a)2;

V_{cp} is the internal volume of all pipes which will drain back into the dosing tank at the end of a dosing cycle, in gallons;

V_{pd} is the displacement, in gallons, of pump and controls; and

A is the internal horizontal area of the dosing tank, in square feet.

iii. A high-water alarm switch shall be set four inches above the pump-on switch and shall activate visible and audible alarms which can be readily seen and heard by occupants within the building served. The high-water alarm switch shall meet the same requirements prescribed for pump-control switches in (f)7i above. The alarm and its switch shall not be on the same electrical circuit as the pump and its switches.

iv. All electrical contacts and relays shall be located outside of the dosing tank and a gas-tight seal shall be provided where electrical conduits enter the tank.
v. All electrical service lines from the home or facility to the pump control panel shall be protected by electrical conduit.

7:9A-9.3 Connecting and delivery pipes

(a) Connecting pipes between pretreatment units and dosing tanks, distribution boxes or distribution networks, and delivery pipes discharging effluent from dosing tanks shall be of such size as to serve the connected fixtures but in no case less than one and one half inches in diameter. Delivery pipes from dosing tanks using siphons shall be one nominal size larger than the siphon to facilitate venting.
(b) Delivery pipes for pressure dosing networks shall be constructed of Polyvinyl Chloride (PVC) plastic (ASTM D 2665), schedule 40, SDR-21 or SDR-26; or Acrylonitrile-Butadiene-Styrene (ABS) plastic (ASTM 2661). Connecting pipes may be constructed of any of the following materials:
1. Plastic meeting the following criteria:
i. PVC (ASTM D 2665)--schedule 40, SDR-21 or SDR-26; or
ii. ABS (ASTM 2661).
2. Cast-iron; or
3. Other material acceptable to the administrative authority.
(c) All pipe joints in connecting pipes and delivery pipes shall be made water-tight and protected against damage by roots.
(d) Connecting pipes and delivery pipes shall be laid on a firm foundation satisfactory to the administrative authority.
(e) The alignment and grade of connecting pipes shall meet the following requirements:
i. Connecting pipes shall have a minimum grade of one-quarter inch per foot unless otherwise authorized by the administrative authority.
ii. Connecting pipes shall be laid in a continuous grade and, as nearly as possible, in a straight line. Drop manholes may be installed if found necessary. Horizontal bends, where required, shall not be sharper than 45 degrees. The inside angle between adjacent sections of pipe shall be no less than 135 degrees.
(f) In cases where the delivery pipe from the dosing tank will be installed higher than the maximum expected depth of frost penetration, measures shall be taken, as outlined in this subsection, to insure that the delivery pipe will drain at the end of each dosing cycle.
1. In the case of dosing tanks using pumps, when the low-water level in the tank is lower than the invert of the distribution box or distribution network, the delivery pipe shall be sloped back towards the dosing tank and there shall be no check-valve at the pump so that the delivery pipe will drain back into the dosing tank at the end of each dosing cycle. Also, a one-eighth inch weep hole shall be provided, at the invert of the pump discharge pipe, at a point which is above the high water level in the dosing tank.
2. In the case of dosing tanks using siphons, or when a pump is used and the elevation of the low-water level in the dosing tank is higher than the invert of the distribution box or distribution network, the distribution network must be designed so that the delivery pipe (as well as the manifold pipe, in pressure distribution systems) will drain out through the distribution laterals at the end of each dosing cycle. In the latter case, where a pump is used, a one-eighth inch weep hole shall be drilled in the delivery pipe, at its highest point within the dosing tank, to prevent effluent from siphoning out of the tank between dosing cycles.

7:9A-9.4 Distribution boxes

(a) A distribution box shall be required for all gravity flow systems and all gravity dosing systems where the effluent shall be distributed between two or more distribution laterals which are not inter-connected. The following requirements shall be met:

1. Distribution boxes shall be water-tight and constructed of sound and durable materials which will resist decay or corrosion by sulfuric acid, frost damage, cracking or buckling due to backfilling or other anticipated stresses.
2. The distribution box shall be set perfectly level and shall be installed as follows:
   i. In the case of disposal beds, the distribution box shall be installed directly on the filter material within the disposal bed.
   ii. In the case of disposal trenches, the distribution box shall be set on a layer of gravel or a concrete footing extending downward below the maximum expected depth of frost penetration. Where gravel is used, the gravel shall extend laterally a minimum of six inches beyond the sides of the distribution box.
3. A separate outlet shall be provided for each distribution lateral. The inverts of all outlets shall be securely set at the same level which shall be a minimum of two inches above the bottom of the box. When installation is complete the distribution box shall be filled with water at which time the installation shall be checked to make sure that it is level. Adjustments shall be made as necessary so that all outlets are permanently and securely fixed at exactly the same elevation prior to backfilling.
4. The invert of the inlet shall be at least one inch above the invert of the outlets. Where dosing is employed, or where the connecting pipe from the pre-treatment unit has a steep slope, measures shall be taken to prevent direct flow of effluent across the distribution box resulting in unequal distribution of effluent among the distribution box outlets. This may be accomplished by installation of a baffle or elbow within the distribution box or by use of two distribution boxes connected in series. In the latter case, all outlets of the first distribution box shall be sealed off except for the outlet which discharges to the second distribution box.
5. Distribution boxes shall be provided with a means of access which may be a removable lid in the case of smaller boxes. Access to larger boxes may be provided by means of manholes and inspection ports with removable water-tight covers. In any case, the following requirements shall be met:
   i. Access openings must be adequate in size and located to facilitate removal of accumulated solids and inspection of the inlet and all outlets.
   ii. All access openings shall be extended to within 12 to 18 inches of the finished grade surface.
   iii. Access openings shall be constructed in such a manner as to prevent the entrance of surface water.

7:9A-9.5 Laterals; gravity distribution

(a) Gravity flow networks and gravity dosing networks may consist of a single distribution lateral, two or more laterals connected by means of elbows or tees, or two or more separate distribution laterals connected independently to a distribution box. Distribution laterals shall meet all the following requirements:
1. Distribution laterals shall be a minimum of three inches in diameter.
2. Distribution laterals shall consist of lengths of rigid perforated pipe connected with tight joints.
3. Spacing and arrangement of distribution laterals shall conform with N.J.A.C. 7:9A-10.3(d).
4. Perforations shall be evenly spaced along two rows running the length of the pipe, on each side, midway between the invert and the centerline which separates the upper and lower halves of the pipe. Perforations shall be no smaller than three-eighth inch and no longer than three-quarter inch in diameter.
5. Each individual distribution line shall be approximately level and shall be capped at the end, except where the laterals are connected together by loops. In no case shall the slope of the distribution lines be greater than two inches per 100 feet.
6. An inspection port shall be provided in each corner of the disposal bed or at each end of a disposal trench. Inspection ports shall consist of a perforated pipe with a removable cap, extending from the level of infiltration to finished grade.

(b) The following materials are acceptable for distribution laterals:
1. Clay pipe, standard and extra strength perforated (ASTM C-211); or

2. Plastic:
   i. Acrylonitrile-Butadiene-Styrene (ABS) (ASTM D-2751);
   ii. Polyvinyl Chloride (PVC) (ASTM D-2729, D-3033, D-3034);
   iii. Styrene-Rubber (ASTM D-2852, D-3298); or
   iv. Polyethylene, straight wall (ASTM F-810).

7:9A-9.6 Pressure dosing networks

(a) Pipe networks for pressure dosing systems shall consist of two or more distribution laterals connected to a central or end manifold. The following requirements shall be met:

1. The size of laterals shall be no less than one but no greater than three inches in diameter and shall be chosen in conformance with N.J.A.C. 7:9A-9.7(a)3. The size of the manifold pipe shall be chosen in conformance with N.J.A.C. 7:9A-9.7(a)5.
2. Spacing and arrangement of laterals shall conform with the requirements of N.J.A.C. 7:9A-10.3(d).
3. All joints and connections shall be water-tight. Solvent-weld joints shall be used.
4. Holes shall be spaced evenly, in a straight line along the invert of each lateral. Hole diameter and spacing may vary from one-quarter to one-half inch and from 30 to 60 inches, respectively, and shall be chosen in conformance with N.J.A.C. 7:9A-9.7(a)2. In bed systems, holes in adjacent laterals shall be off-set by one-half the hole spacing so that the distance between holes in adjacent laterals is maximized. All holes shall be deburred.
5. The ends of the laterals shall be capped. A small hole shall be drilled horizontally in the end-cap of each lateral, near the crown, to facilitate venting at the beginning of each dosing cycle.
6. Each individual distribution line shall be approximately level. In no case shall the slope of the distribution lines be greater than two inches per 100 feet.
7. An inspection port shall be provided in each corner of a disposal bed or at each end of a disposal trench. Inspection ports shall consist of a perforated pipe with a removable cap, extending from the level of infiltration to finished grade.
8. Pressure dosing networks shall be constructed of PVC plastic (ASTM D-2662), schedule 40, SDR-21 or SDR-26, or ABS plastic (ASTM 2661) pipe.

7:9A-9.7 Design procedure for pressure dosing systems

(a) The following procedure shall be used for disposal fields consisting of a disposal bed or disposal trenches which are at equal elevations.

1. Step One: Determine the length, number and spacing of distribution laterals based upon the required size of the disposal field, determined as prescribed in N.J.A.C. 7:9A-10.2, and the requirements for spacing of disposal trenches or the requirements for spacing of distribution laterals within disposal beds as prescribed in N.J.A.C. 7:9A-10.3(d). The number of distribution laterals will also depend upon whether a central or end manifold arrangement is used.
2. Step Two: Select the hole diameter and spacing. The hole diameter shall be a minimum of one-quarter inch but no larger than one-half inch. The minimum allowed hole spacing shall be 30 inches. The maximum allowed hole spacing shall be 60 inches, except in the case of systems installed in soils or fill material with a permeability faster than six inches per hour or a percolation rate faster than 15 minutes per inch, in which case the maximum allowed hole spacing shall be 36 inches.
3. Step Three: Based upon the hole diameter and the hole spacing selected and the length of the laterals, determine the required diameter of laterals using Figure 14 of Appendix A. If the disposal field configuration is such that it is beyond the applicable limits of Figure 14, other methods of hydraulically evaluating adequate lateral diameter may be used subject to prior approval by the administrative authority.
4. Step Four: Pressure distribution systems shall be designed so that a minimum pressure head of 2.5 feet shall be maintained at the distal end of the laterals. Based upon the hole diameter and the design pressure

head at the distal end of the laterals, determine the hole discharge rate from the table below. Determine the lateral discharge rate by multiplying the hole discharge rate by the number of holes per lateral.
Discharge Rate (gallons per minute) based on Hole Diameter (inches)

Pressure Head (ft.)	**1/4**	**5/16**	**3/8**	**7/16**	**1/2**
2.5	1.18	1.85	2.66	3.63	4.73
3.0	1.28	1.99	2.87	3.91	5.10
3.5	1.40	2.19	3.15	4.29	5.60
4.0	1.47	2.30	3.31	4.51	5.89
4.5	1.59	2.48	3.57	4.86	6.35
5.0	1.65	2.57	3.71	5.04	6.59

5. Step Five: Based upon the number of laterals and the lateral spacing, determine the manifold length. Based upon the manifold length, the lateral discharge rate and the number of laterals, using Figure 15 of Appendix A, determine the required manifold diameter. If the disposal field configuration is such that it is beyond the applicable limits of Figure 15, other methods of hydraulically evaluating proper manifold diameter may be used subject to approval by the administrative authority.
6. Step Six: Determine the necessary system discharge rate by multiplying the lateral discharge rate by the number of laterals; and
7. Step Seven: For pump systems, select the proper pump as follows:
    i. Using Figure 16 of Appendix A, determine the friction head based upon the system discharge rate and the diameter and length of the delivery pipe. If the system discharge rate is such that it is beyond the applicable limits of Figure 16, then other methods of determining friction head in the delivery pipe may be used subject to approval by the administrative authority.
    ii. Calculate the total operating head, H_t, using the following formula:
    H_t, = $H_f + H_e + H_p$
    H_f is the friction head, in feet, determined in (a)7i above;
    H_e is the elevation head, in feet, calculated by subtracting the dosing tank low water elevation from the elevation of the invert of the distribution laterals; and
    H_p is the design pressure head to be maintained at the supply end of the laterals, in feet.
    iii. Choose a pump which is rated by the manufacturer to deliver a flow rate equal to or greater than the system discharge rate calculated in Step Six when working against a total dynamic head equal to the total operating head calculated in (a)7ii above.
8. Alternate Step Seven: For systems using siphons, determine the siphon elevation as follows:
    i. Determine the friction head in the delivery pipe as in (a)7i above.
    ii. Calculate the total operating head, Ht, using the following formula:
    Ht, = Hf + He + Hp
    Hf is the friction head, in feet, determined in (a)7i above;
    He is the elevation head, in feet, calculated by subtracting the dosing tank low water elevation from the elevation of the invert of the distribution laterals; and
    Hp is the design pressure head to be maintained at the distal end of the laterals, in feet.
    iii. Calculate the total operating head, H_t, by the following equation:
    H_t, ft = $H_f + H_v + H_p$
    where:
    H_f, is the friction head, in feet, determined from Figure 16 of Appendix A.
    H_v, is the velocity head, in feet, determined in (a)8ii above.
    H_p, is the design pressure head to be maintained at the supply end of the laterals, in feet.

iv. Choose a siphon rated to discharge at a flow rate equal to or greater than the system discharge rate. Install the siphon at an elevation such that the siphon invert is higher than the invert of the distribution laterals by a distance equal to the total operating head calculated in (a)7iii above.

(b) If a trench system is proposed where the elevation of the infiltrative surface will not be the same in all trenches, the design engineer must demonstrate by means of appropriate calculations to the satisfaction of the administrative authority, that all portions of all trenches will receive equal hydraulic loading in conformance with the requirements of N.J.A.C. 7:9A-10.2. One way of accomplishing this would be to divide the disposal field into sections consisting of individual trenches or groups of trenches which are at the same elevation and which are dosed individually in conformance with the requirements of this section.

Subchapter 10. Disposal Fields

7:9A-10.1 General design requirements for disposal fields

(a) A disposal field shall be required for all new systems except as allowed in N.J.A.C. 7:9A-7.6, in which case a seepage pit may be approved in lieu of a disposal field. The disposal field shall consist of one or more disposal trenches or a disposal bed designed, constructed and installed as hereafter prescribed.

(b) The disposal field installation shall be such that the disposal field is underlain by a suitable zone of treatment as prescribed in (d) below and a suitable zone of disposal as prescribed in (e) below. Acceptable options for disposal field installation are as follows:

1. Conventional installation: The disposal field shall be installed directly within the native soil and the level of infiltration shall be from one to three feet below the existing ground surface, as shown in Figure 17 of Appendix A.
2. Soil replacement, bottom-lined installation: The excavation for the disposal bed or each individual trench shall be extended below the level of infiltration and back-filled up to the level of infiltration with suitable fill. The disposal bed or trenches shall be installed on top of the fill with the level of infiltration one to three feet below the existing ground surface, as shown in Figure 18 of Appendix A.
3. Soil replacement, fill-enclosed installation: An excavation shall be made below the level of infiltration and extending laterally a minimum of two feet beyond the perimeter of the disposal field on all sides. This excavation shall be back-filled with suitable fill, the disposal bed or trenches installed within the fill, and the level of infiltration shall be at existing ground surface to three feet below the existing ground surface, as shown in Figure 19 of Appendix A.
4. Mounded installation: Fill material shall be placed above the ground surface; the disposal field shall be installed within the fill; and the level of infiltration shall be one to four feet above the existing ground surface (measured on the upslope side of the disposal bed or each individual disposal trench), as shown in Figure 20 of Appendix A.
5. Mounded soil replacement installation: An excavation shall be made below the ground surface; fill material shall be placed within this excavation and mounded up above the existing ground surface; the disposal field shall be installed within the fill; and the level of infiltration shall be at existing ground surface to four feet above the existing ground surface (measured on the upslope side of the disposal bed or each individual disposal trench), as shown in Figure 21 of Appendix A.

(c) The type of disposal field installation permitted shall be determined based upon the soil suitability class as outlined in Table 10.1, below.

TABLE 10.1 TYPE OF DISPOSAL FIELD INSTALLATION
C = Conventional Installation
SRB = Soil Replacement, Bottom-lined Installation
SRE = Soil Replacement, Fill-enclosed Installation
M = Mound Installation
MSR = Mounded Soil Replacement Installation[1]

Type of Limiting Zone	Depth[2], Ft.	Suitability Class	Type of Installation Permitted[3]
Fractured Rock or	>5	I	C, (SRB, SRE, M, MSR)
Excessively Coarse Substratum	0-5	IISc	SRE, M, (MSR)
Massive Rock	>9	I	C, (SRB, SRE, M, MSR)
Hydraulically Restrictive	4-9	IISr	M, (MSR)
Substratum	<4	IIISr	UNSUITABLE
Hydraulically Restrictive	>9	I	C, (SRB, SRE, M, MSR)
Horizon, Permeable	4-9	IIHr	SRB, SRE, M, (MSR)
Substratum	<4	IIIHr	SRB, SRE, (MSR)
Excessively Coarse	>5	I	C, (SRB, SRE, M, MSR)
Horizon	0-5	IIHc	SRE, M, (MSR)
Zone of Saturation,	>5	I	C, (SRB, SRE, M, MSR)
Regional	2-5	IIWr	M, (MSR)
	<2	IIIWr	UNSUITABLE
Zone of Saturation,	>5	I	C, (SRB, SRE, M, MSR)
Perched	2-5	IIWp	C[4], (SRB[4], SRE, M, MSR)
	<2	IIIWp	C[4], (SRB[4], SRE, M, MSR)

(1) Mounded soil replacement systems are generally required only in cases where several limiting zones are present as, for example, in compound soil suitability classes such as IIScWr, IIIHr (IISr) or IIIHr (IIWr).
(2) Depth is measured from the existing ground surface to the top of the limiting zone. In the case of disturbed ground, the depth to the limiting zone shall be measured from the pre-existing natural ground surface, identified as prescribed in N.J.A.C. 7:9A-5.10(c), or the existing ground surface, whichever is lowest.
(3) Installations shown in parentheses are allowed but are generally not the most cost-effective type of installation for the soil suitability class unless other soil limitations are present.
(4) An interceptor drain or other means of removing the perched zone of saturation is required.

Note: In soils with a compound soil suitability class, where more than one limiting zone is present in the soil, a disposal field installation shall not be approved unless the type of installation proposed is listed in Table 10.1 as an acceptable option for each of the soil suitability classes which apply.

(d) A zone of treatment (see Figures 22, 23 and 24 in Appendix A), a minimum of four feet in thickness, shall be present below the disposal field and shall meet all of the following requirements:

1. The zone of treatment shall be composed of suitable soil which meets all of the criteria listed in (d)2 below, suitable fill material which satisfies the requirements of (f) below, or a combination of suitable soil and suitable fill.
2. Suitable soil within the zone of treatment shall meet the following criteria:
   i. Coarse fragment content less than 50 percent by volume;
   ii. Permeability less than 20 inches per hour and greater than 0.2 inches per hour, or a percolation rate slower than three minutes per inch and faster than 60 minutes per inch.

3. The zone of treatment shall not contain or be interrupted by fractured or massive rock substrata, hydraulically restrictive horizons or substrata, perched zones of saturation or regional zones of saturation. When excessively coarse horizons or substrata are present above, within or below the zone of treatment, these horizons shall not be considered part of the zone of treatment.

4. For design purposes, the top of the zone of treatment shall be considered to be the bottom of the disposal field or the bottom of an excessively coarse horizon when such a horizon is present immediately below the bottom of the disposal field. The bottom of the zone of treatment shall be considered to be whichever of the features listed below occurs at a shallower depth below the disposal field, except that in no case shall the bottom of the zone of treatment extend to a depth greater than eight feet below finished grade.

i. An imaginary horizontal surface at a depth of four feet below the top of the zone of treatment, excluding the thickness of any intervening excessively coarse horizons;

ii. The top of the shallowest limiting zone which is present in the soil below the disposal field; or

iii. The bottom of the shallowest soil profile pit or boring made within the area of the disposal field.

(e) A zone of disposal (see Figures 22, 23 and 24 in Appendix A), a minimum of four feet in thickness, shall be present below the zone of treatment and shall meet all of the following requirements:

1. The zone of disposal shall be composed of native soil or rock material which has a permeability more rapid than 0.2 inch per hour or a percolation rate more rapid than 60 minutes per inch;

2. When the permeability in the zone of disposal has been determined, as prescribed in N.J.A.C. 7:9A-6, to be two inches per hour or faster, the minimum required thickness of the zone of disposal may be reduced to two feet. This determination shall not be made using the percolation test or basin flooding test;

3. The zone of disposal shall not contain or be interrupted by any hydraulically restrictive horizon unless the entire thickness of this horizon has been removed throughout the entire area of the disposal field and has been replaced with fill material meeting the requirements of (f)5 below. The thickness of any restrictive horizon which has been removed shall not be counted as part of the zone of disposal; and

4. For design purposes, the top of the zone of disposal shall be taken as the bottom of the zone of treatment. The bottom of the zone of disposal shall be considered to be whichever of the following features is present at a shallower depth below the disposal field:

i. The top of any massive rock or hydraulically restrictive substratum;

ii. The top of the shallowest hydraulically restrictive horizon which occurs below the bottom of the disposal field, except when the hydraulically restrictive horizon is to be removed and replaced with suitable fill materials; or

iii. The bottom of the shallowest soil profile pit or boring made below the disposal field.

(f) When fill material is used in disposal field construction, the following requirements shall be met:

1. When a soil replacement installation is proposed, the zone of treatment may consist partly or entirely of fill material provided that the requirements of N.J.A.C. 7:9A-10.4 are satisfied and the fill material used meets the requirements of (f)4 below. The zone of disposal may contain a layer of fill provided that the fill material used within the zone of disposal meets the requirements of (f)5 below.

2. When a mound installation is proposed, the zone of treatment may consist partly or entirely of fill material provided that the requirements of N.J.A.C. 7:9A-10.5 are satisfied and the fill material used meets the requirements of (f)4 below.

3. When a mounded soil replacement installation is proposed, the zone of treatment may consist partly or entirely of fill material provided that the requirements of N.J.A.C. 7:9A-10.6 are satisfied and the fill material used meets the requirements of (f)4 below. The zone of disposal may contain a layer of fill provided that the fill material used within the zone of disposal meets the requirements of (f)5 below.

4. When fill material is utilized within the zone of treatment, the fill shall meet the following requirements:

i. Coarse fragment content less than 15 percent by volume or less than 25 percent by weight;

ii. Textural analysis (composition, by weight, of size fraction passing the two millimeter sieve): from 85 to 95 percent sand, from five to 15 percent silt plus clay, minimum two percent clay; and

iii. Permeability from two to 20 inches per hour; or percolation rate from three to 30 minutes per inch.

5. When fill material is placed within the zone of disposal, the fill material shall meet the following requirements:

i. Textural analysis (composition, by weight, of size fraction passing the two millimeter sieve): 85 percent or more sand; and

ii. Permeability greater than two inches per hour; or percolation rate faster than 30 minutes per inch.

(g) The following requirements shall be met when installing a disposal field in sloping ground:

1. The interface between filter material and the underlying soil or fill material at the bottom of each individual trench or bed shall be level;

2. On strongly sloping sites the shape of the disposal field shall be elongated with the long axis parallel to the topographic contour;

3. When the slope is greater than 10 percent, trenches shall be used rather than beds;

4. Mound or mounded soil replacement installations shall be restricted to slopes less than 10 percent; and

5. When disposal trenches are installed at different elevations and gravity flow or gravity dosing are used, the distribution of effluent between trenches shall be accomplished by means of a distribution box.

(h) When a conventional or soil replacement installation is proposed, the bottom of the disposal field shall be at a depth of from one to three feet below the existing ground surface. When a mound or mounded soil replacement installation is proposed, the level of infiltration shall be at an elevation no higher than four feet above the existing ground surface, measured on the upslope side of the disposal bed or each individual disposal trench. In no case shall the level of infiltration be greater than three feet below the finished grade.

7:9A-10.2 Disposal field sizing requirements

(a) The minimum required disposal field size or the maximum allowable hydraulic loading rate shall be determined, using sizing criteria as prescribed below, based upon the volume of sanitary sewage, determined as prescribed in N.J.A.C. 7:9A-7.4, and the results of permeability tests or percolation tests performed as prescribed in N.J.A.C. 7:9A-6.

1. The disposal field sizing criteria to be used shall be determined based upon the type of disposal field, disposal field installation and the method of effluent distribution used, as follows:

TABLE 10.2(a) APPLICABLE DISPOSAL FIELD SIZING CRITERIA

Type of Disposal Field Installation	Type of Disposal Field	Method of Distribution	Applicable Sizing Criteria
Conventional	Trench	Gravity	N.J.A.C. 7:9A-10.2(b)
		Pressure	N.J.A.C. 7:9A-10.2(b)
	Bed	Gravity	N.J.A.C. 7:9A-10.2(c)
		Pressure	N.J.A.C. 7:9A-10.2(c)
Soil Replacement, Bottom-lined	Trench	Gravity	N.J.A.C. 7:9A-10.2(c)
		Pressure	N.J.A.C. 7:9A-10.2(d)
	Bed	Gravity	N.J.A.C. 7:9A-10.2(c)
		Pressure	N.J.A.C. 7:9A-10.2(d)
Soil Replacement, Fill-enclosed	Trench	Gravity	N.J.A.C. 7:9A-10.2(b)
		Pressure	N.J.A.C. 7:9A-10.2(b)
	Bed	Gravity	N.J.A.C. 7:9A-10.2(c)
		Pressure	N.J.A.C. 7:9A-10.2(d)
Mounded, Mounded Soil Replacement	Trench	Gravity	N.J.A.C. 7:9A-10.2(b)
		Pressure	N.J.A.C. 7:9A-10.2(b)
	Bed	Gravity	N.J.A.C. 7:9A-10.2(c)
		Pressure	N.J.A.C. 7:9A-10.2(d)

(b) All disposal fields using trenches, except for bottom-lined soil replacement installations, shall meet the following size requirements:

1. The minimum required length of trenches per gallon of daily sewage volume, L/Q, shall be determined from Table 10.2(b) below, based upon the trench width selected and the results of permeability tests or percolation tests, performed as prescribed in N.J.A.C. 7:9A-6.
2. The minimum required length of trenches, L, shall then be determined by multiplying the value of L/Q obtained from the table by the daily volume of sewage, Q, determined as prescribed in N.J.A.C. 7:9A-7.4.

(c) All disposal beds using gravity flow or gravity dosing, all conventionally installed disposal beds using pressure dosing and all bottom-lined soil replacement trench installations using gravity flow or gravity dosing shall meet the following size requirements.

1. The minimum required bottom area of disposal field per gallon of daily sewage volume, A/Q, shall be determined from Table 10.2(c) below, based upon the results of permeability tests or percolation tests performed as prescribed in N.J.A.C. 7:9A-6.
2. The minimum required bottom area shall then be determined by multiplying the value of A/Q obtained from the table by the daily volume of sewage, Q, in gallons, determined as prescribed in N.J.A.C. 7:9A-7.4.

(d) All disposal beds using pressure dosing except for conventional installations and all bottom-lined soil replacement trench installations using pressure dosing shall have a minimum size of 1.33 square feet of bottom area per gallon of daily sewage volume.

TABLE 10.2(b) MINIMUM REQUIRED DISPOSAL TRENCH LENGTH PER GALLON OF DAILY SEWAGE VOLUME, L/Q (ft/gal per day)

Permeability (in/hr)	Percolation Rate (min/in)	Trench Width (ft):	L/Q (ft/gal per day)(1) 1.5	2.0	2.5	3.0
6-20	3-15		0.65	0.54	0.46	0.40
2-6	16-30		0.83	0.69	0.59	0.52
0.6-2	31-45		1.03	0.85	0.73	0.64
0.2-0.6	46-60		1.18	0.98	0.84	0.74

TABLE 10.2(c) MINIMUM REQUIRED DISPOSAL FIELD BOTTOM AREA PER GALLON OF DAILY SEWAGE VOLUME, A/Q (ft^2/gal per day)

Permeability (in/hr)	Percolation Rate (min/in)	A/Q(1) (ft^2/gal per day)
6-20	3-15	1.61
2-6	16-30	2.08
0.6-2	31-45	2.56
0.2-0.6	46-60	2.94

(1) Additional Requirements:

a. Where garbage disposal units are installed or proposed, the value obtained from this table shall be increased by a factor of 25 percent for use in disposal field sizing.

7:9A-10.3 Specific requirements for conventional disposal field installations

(a) A conventional installation shall be made by placing the disposal bed or each individual disposal trench in an excavation made directly within the natural soil.

(b) All rough-grading shall be in accordance with the following requirements:

1. Sites which have been re-graded prior to site evaluation, soil evaluation or permeability testing shall be considered to be disturbed ground and all requirements relating to disturbed ground shall be met.
2. When a site is re-graded after site evaluation, soil evaluation or permeability testing, this re-grading shall be carried out in conformance with an engineering design which has been approved by the administrative authority.

(c) Excavation for the disposal field shall be in accordance with the following procedures:

1. Adequate measures shall be used to insure that the bottom of the disposal bed or each individual disposal trench is level.
2. In soil textures other than sands or loamy sands, excavation which exposes the infiltrative surface of the disposal field shall not be carried out when the soil moisture content is above the lower plastic limit. This means that when a small lump of soil, taken from the depth of the proposed excavation, can be rolled out with the fingers to form a wire or rod, one-eighth of an inch in thickness, and does not crumble when handled, the soil is too wet to proceed with the excavation.
3. Excavation shall be carried out in a manner that will avoid unnecessary compaction of the disposal field bottom and sidewalls. Heavy equipment such as bulldozers or front-end loaders shall not be driven over the exposed infiltrative surface of the disposal field. Excavation should be carried out with a backhoe operating from between disposal trenches or from outside the perimeter of previously excavated portions of the disposal bed. If it becomes necessary to walk on the disposal field bottom, a suitable board shall be laid over the soil to avoid trampling.
4. Any smeared or compacted soil surfaces which have been produced on the bottom or sidewalls of the excavation shall be removed to expose a fresh soil surface which is rough and uneven.

5. Work should be scheduled so that the bottom and sidewalls of the excavation will not be exposed to rainfall or wind-blown silt between the time of excavation and the time of final inspection and backfilling. Any loose soil or debris which is washed into or otherwise deposited within the excavation as a result of the excavation remaining open to the elements shall be carefully removed prior to backfilling.

(d) The construction of the distribution network shall be in accordance with N.J.A.C. 7:9A-9.5, when gravity flow or gravity dosing is used, or N.J.A.C. 7:9A-9.6, when pressure dosing is used. Additional requirements for disposal trenches or beds are given in (d)1, and 2 below, respectively.

1. Disposal trenches shall be constructed in accordance with the following requirements:

i. The minimum spacing between trenches (sidewall to sidewall) shall be six feet.

ii. The minimum width of trenches shall be 1.5 feet.

iii. The maximum width of trenches shall be three feet.

iv. There shall be one distribution line per trench.

2. Disposal beds shall be constructed in conformance with the following requirements:

i. There shall be a minimum of two distribution lines per bed.

ii. The maximum distance from edge of bed to nearest distribution line shall be three feet.

iii. The minimum distance from edge of bed to nearest distribution line shall be one foot.

iv. The maximum spacing between distribution lines for gravity distribution shall be three feet.

v. The required spacing between distribution lines for pressure distribution shall be from 3/4 to 5/4 of the hole spacing;

vi. The spacing between all distribution lines shall be equal and uniform; and

vii. Holes in pressure distribution lines shall be aligned so that holes in adjacent laterals shall be off-set by one-half the hole spacing.

(e) Filter material shall meet the following requirements:

1. Filter material shall cover the distribution lines and extend the full width of the trench or bed, shall extend between 12 and 18 inches deep beneath the bottom of the distribution lines and shall extend at least two inches above the top of the lines.

2. The filter material shall be washed gravel or crushed stone, free of fines, dust, ashes or clay. Refer to the New Jersey Department of Transportation standard sizes for coarse aggregates as shown in Figure 26 of Appendix A. The filter material shall conform in size and gradation to size number 24, size number three or size number four.

3. The filter material shall be covered with drainage fabric, untreated building paper or a four to eight inch thickness of salt-hay or straw, as the laying of the distribution lines progresses. When drainage fabric or untreated building paper is used, the following requirements shall be met:

i. Edges of adjacent sheets shall be overlapped by a minimum of six inches.

ii. Drainage fabric shall be specified in the engineering design and shall have adequate tensile strength to prevent ripping during installation and backfilling, adequate air permeability to allow free passage of gases, and adequate particle retention to prevent downward migration of soil particles into the filter material.

iii. Use of water-proof paper is prohibited.

4. The filter material may be laid into the excavation using a backhoe, front-end loader or dump truck provided that this operation is carried out from sides of the system rather than by driving out onto the exposed disposal field infiltrative surface. In the case of large beds, tracked equipment may be operated within the disposal bed provided that the equipment does not exert a ground pressure in excess of eight pounds per square inch and provided that the filter material is pushed out in front of the vehicle while maintaining a minimum thickness of one foot of filter material below the vehicle tracks at all times.

(f) Backfill and final grading shall be carried out in accordance with the following requirements:

1. A minimum of nine inches and no more than 18 inches of backfill shall be placed over the top of the disposal field filter material.

2. Backfill material shall be of earth similar to that found at the site and free of large stones, tree stumps, broken masonry or other waste construction material.
3. In no case shall the backfill material be more permeable than the surrounding soil.
4. Backfill shall completely cover the entire disposal bed or each of the disposal trenches and shall be graded smoothly into the surrounding topography on all sides.
5. The following practices shall be followed:
i. Heavy machinery, rubber-tired vehicles or other vehicles exerting a ground pressure in excess of eight pounds per square inch shall not be permitted to pass over the disposal field after the filter material and distribution network have been installed.
ii. Tracked equipment may be used for the purpose of backfilling and final grading provided that this equipment does not exert a pressure on the underlying soil in excess of eight pounds per square inch.
iii. Final grading shall be completed in accordance with the approved engineering design and in such a manner that surface water will not collect over the disposal field.
iv. After completion of backfilling and final grading, the backfilled area over the disposal field shall be seeded or sodded to establish a vegetative cover or otherwise stabilized against erosion in a manner acceptable to the administrative authority.

7:9A-10.4 Specific requirements for soil replacement disposal field installations

(a) A soil replacement disposal field installation shall be made by installing the disposal bed or each individual disposal trench on top of or within suitable fill material which has been placed in an excavation made below the existing ground surface. In a bottom-lined installation, the fill material shall be placed below the disposal field only, as prescribed in (b) below. In a fill-enclosed installation, the fill shall be placed around the sides as well as below the disposal field, as prescribed in (c) below. The type of soil replacement disposal field installation required depends upon the soil limitations present and the slope across the disposal area as follows:
1. A fill-enclosed installation shall be required when:
i. The limiting zone is a perched zone of saturation underlain by a hydraulically restrictive horizon and the slope across the disposal field is less than five percent;
ii. The limiting zone is a excessively coarse horizon or substratum; or
iii. The limiting zone is a fractured rock substratum.
2. A bottom-lined installation may be permitted where:
i. The limiting zone is a hydraulically restrictive horizon and no perched zone of saturation is present; or
ii. The limiting zone is an perched zone of saturation underlain by a hydraulically restrictive horizon and the slope across the disposal field is five percent or greater.
(b) Bottom-lined soil replacement disposal field installations shall be constructed as follows:
1. An excavation shall be made within the area occupied by the disposal bed or by each individual disposal trench and, where the limiting zone is a hydraulically restrictive horizon, the excavation(s) shall extend a minimum of two feet below the bottom of the hydraulically restrictive horizon.
2. The excavation shall be backfilled to the level of infiltration with suitable fill material.
3. The disposal field shall be constructed on top of the fill material within the excavation(s).
4. An interceptor drain designed and constructed as prescribed in N.J.A.C. 7:9A-10.7 shall be provided to divert away from the disposal field laterally moving ground water which may be perched above any hydraulically restrictive horizon penetrated by the excavation.
(c) Fill-enclosed soil replacement disposal field installations shall be constructed as follows:
1. An excavation shall be made to the required depth extending throughout the entire area to be occupied by the disposal field and beyond the perimeter of the disposal field a minimum of two feet in all directions. In cases where the limiting zone is a fractured rock substratum and a pit-bailing or basin

flooding test has been used to establish adequate permeability, the depth of the disposal field excavation shall be no less than the depth of the test pit.

2. The excavation shall be backfilled with suitable fill material.

3. The disposal field shall be constructed within the fill material so that the entire disposal bed or each individual trench is surrounded by a minimum of two feet of fill material on all sides.

(d) Requirements and restrictions relating to site regrading shall be the same as those prescribed for conventional installations in N.J.A.C. 7:9A-10.3(b).

(e) Excavation prior to the placement of fill material shall be carried out in accordance with the requirements of N.J.A.C. 7:9A-10.3(c)2 through 5.

(f) Fill material used in soil replacement disposal field installations shall meet the following requirements:

1. The fill material used below the disposal field shall meet the requirements for texture and permeability which are prescribed in N.J.A.C. 7:9A-10.1(f).

2. The minimum depth of fill below the disposal field shall be one foot.

3. Compaction of fill material shall be required whenever fill material is used below the disposal field and shall be carried out in accordance with the following requirements:

i. Compaction of fill shall be carried out as directed by a professional engineer and as indicated on the approved engineering design.

ii. Based upon a final inspection, a professional engineer shall certify by signature and seal that compaction of the fill has been performed adequately to prevent failure of any component of the system due to excessive settlement or differential settlement.

iii. Fill material shall be spread and compacted in layers one foot or less in thickness.

iv. Compaction may be accomplished manually or mechanically, by tamping or rolling, or by driving over the filled area in a controlled pattern using tracked or rubber-tired vehicles. Compaction may also be accomplished by puddling.

v. When heavy excavating equipment is operated within the excavation for the purpose of placement of compaction of the fill material, this equipment shall not be driven directly on the exposed bottom of the excavation. A minimum of one foot of fill material shall be maintained below the vehicle tracks or wheels at all times.

(g) Construction of the disposal field and distribution network shall be as prescribed for conventional installations in N.J.A.C. 7:9A-10.3(d).

(h) Filter material shall be as prescribed for conventional installations, in N.J.A.C. 7:9A-10.3(e).

(i) Backfill and final grading shall be as required in N.J.A.C. 7:9A-10.3(f) and shall extend a minimum of five feet, in all directions, beyond the perimeter of the filled area.

7:9A-10.5 Specific requirements for mounded disposal field installations

(a) A mounded disposal field installation shall be made by installing the disposal field as prescribed below, within suitable fill which has been placed above the existing ground surface.

(b) Requirements and restrictions relating to site regrading shall be the same as those prescribed for conventional installations in N.J.A.C. 7:9A-10.3(b).

(c) On sloping sites, the disposal field shall be elongated in shape with the long axis parallel to the topographic contour.

(d) Prior to placement of fill material, the ground surface shall be prepared as follows:

1. Excessive vegetation shall be cut and removed. Large trees including the stumps shall be removed. If large holes are left as a result of stump removal these shall be filled with fill material meeting the requirements of N.J.A.C. 7:9A-10.1(f)4.

2. The delivery pipe from the dosing tank shall be installed and the excavation backfilled and compacted prior to preparation of the ground surface for fill placement.

3. The area within the perimeter of the mound shall be plowed or disked to produce a thoroughly roughened surface. Plowing shall be done using a two bottom or larger moldboard plow or chisel plow

and shall be parallel to the topographic contour in such a direction that each plow furrow will be thrown upslope. The soil should be broken-up to a depth of six to eight inches. Alternatively, a roto-tiller may be used provided that the surface soil is of sand or loamy sand texture.

(e) A mound shall be constructed by placing a layer of fill material over the ground within and adjacent to the area of the disposal field. The method of emplacement and lateral extent of the fill material shall be as follows:

1. The area of the fill layer shall include the area of the disposal field plus a lateral extension of fill material surrounding the disposal field on all sides.
2. The minimum required width of the lateral fill extension shall be 20 feet where gravity distribution is to be used and five feet where pressure distribution is to be used.
3. Within the area of the lateral fill extension, the top surface of the fill material shall be kept level with or higher than the invert of the distribution laterals.
4. On sloping sites, the width of the lateral fill extension may be reduced on the upslope side of the disposal field provided that the top surface of the fill material is kept level with or higher than the invert of the distribution laterals up until the point where the top surface of the fill material intersects with the existing slope.
5. At the outside edge of the lateral fill extension, the mound shall be terminated by sloping the top surface of the fill layer downward at a slope of three to one or less. Alternatively, lateral support for the fill layer may be provided by a retaining wall or a berm of soil material meeting the requirements of N.J.A.C. 7:9A-10.3(f)2 and sloped at a grade of three to one or less.
6. Fill material below the disposal field and within the area of the lateral fill extensions shall be suitable fill material meeting the requirements of N.J.A.C. 7:9A-10.1(f)4.
7. Compaction of fill shall be carried out as prescribed in N.J.A.C. 7:9A-10.4(f).

(f) Construction and installation of the disposal field and distribution network shall be as prescribed for conventional installations in N.J.A.C. 7:9A-10.3(d).

(g) Filter material shall be as prescribed for conventional installations in N.J.A.C. 7:9A-10.3(e).

(h) Backfill and final grading over the mound shall be completed as follows:

1. Immediately above the disposal field filter material which has been covered with a suitable barrier material, as prescribed in N.J.A.C. 7:9A-10.3(e)3, a layer of topsoil, suitable for establishment of a good vegetative cover, 12 to 18 inches in thickness at the center of the mound and six to 12 inches in thickness at the edges, shall be placed over the entire mound, covering the top and side slopes. The topsoil shall be build up thicker along the long axis of the mound so that a convex profile is produced parallel to the direction of the slope. The topsoil shall be lightly compacted by tamping or rolling to prevent settlement.
2. Immediately after completion of final grading, the mound surface shall be mulched and seeded, or sodded, to establish a good vegetative cover and to prevent erosion.

7:9A-10.6 Specific requirements for mounded soil replacement disposal field installations

(a) Mounded soil replacement disposal fields shall be constructed as follows:

1. An excavation shall be made to the required depth throughout the entire area of the disposal field and extended laterally in all directions a minimum of two feet beyond the perimeter of the disposal field.
2. This excavation shall be backfilled with suitable fill material and the fill material mounded up over the excavation to produce a mound of the desired height in which to install the disposal field.
3. The sides of the mound shall be constructed with slopes of three to one or less.

(b) Requirements and restrictions relating to site regrading shall be the same as those prescribed for conventional installations in N.J.A.C. 7:9A-10.3(b).

(c) Excavation prior to placement of fill material shall be carried out as specified in N.J.A.C. 7:9A-10.3(c)2 through 5.

(d) Fill material shall meet the requirements of N.J.A.C. 7:9A-10.4(d).

(e) Construction of the disposal field and distribution network shall be as prescribed for conventional installations in N.J.A.C. 7:9A-10.3(d).
(f) Filter material shall be as prescribed for conventional installations, in N.J.A.C. 7:9A-10.3(e).
(g) Backfill and final grading shall be as prescribed for mounded installations, in N.J.A.C. 7:9A-10.5(h).

7:9A-10.7 Interceptor drains

(a) Interceptor drains may be used on sloping sites to improve site suitability by intercepting laterally moving ground water which is perched above a hydraulically restrictive horizon provided that the requirements of (b) through (k) below are met.
(b) Interceptor drains shall be oriented parallel to the length and width of the disposal field and shall be installed on all sides except for the downslope side, as shown in Figure 25 of Appendix A.
(c) Interceptor drains designed to intercept ground water which is perched above a hydraulically restrictive horizon shall extend to the top but not through the entire thickness of the hydraulically restrictive horizon.
(d) The minimum distance between the disposal field and an interceptor drain shall be as prescribed in (d)1 and 2 below. The only exceptions to these requirements shall be where the bottom of the drain is at an elevation which is higher than the bottom of the disposal field or where the drain is set at the top of a restrictive horizon which is penetrated by the excavation for a soil replacement or mounded soil replacement installation, in which cases the minimum setback distance between the disposal field and the drain shall be 20 feet.

1. The minimum distance between a disposal field and any portion of an interceptor drain which is downslope of the disposal field shall be 50 feet.
2. The minimum distance between a disposal field and those portions of the interceptor drain which are upslope of the disposal field's downslope side shall be 50 feet unless a shorter distance is calculated using the formula given in (d)3 below. In no case shall this distance be less than 10 feet.
3. Calculate the minimum required horizontal separation distance, D, using the equation, $D = Q/(LKI^2)$, where:

Q is the volume of sanitary sewage, determined as prescribed in N.J.A.C. 7:9A-7.4, in gallons per day, multiplied by a unit conversion factor of 1 ft^3/7.48 gallons.
L is the total length of the disposal field, in feet, measured parallel to the topographic contour.
K is the horizontal saturated permeability above the restrictive horizon, in inches per hour, determined as prescribed in N.J.A.C. 7:9A-6.5 or 6.6, multiplied by unit conversion factors of (1 foot/12 inches) and (24 hours/1 day).
I is the slope, in feet/foot, measured perpendicular to the topographic contour and described based on appropriately located subsurface explorations.

(e) Excavation shall be carried out as follows:

1. The excavation for the interceptor drain shall be made to the exact depth required in (c) above, a minimum two feet wide, and shall extend for the entire length of the drain, around the upslope side of the disposal field and down both ends of the field to the downslope side, as shown in Figure 25 of Appendix A.
2. To accommodate the drain discharge pipes, the excavation shall extend, on each end of the disposal field, beyond the extent of the drain, from the downslope side of the disposal field to free-flowing outlet meeting the requirements of (f) below.
3. The part of the excavation in which the drain discharge pipe will be laid shall have a slope which is steep enough to carry away the intercepted ground water.

(f) That portion of the excavation which will accommodate the drain shall be filled with filter material to a depth which is a minimum of one foot higher than the top of the perched zone of saturation which is to be drained. Filter material used for this purpose shall be washed gravel or crushed stone, free of fines, dust, ashes or clay, and shall conform in size and gradation with one of the following New Jersey Department of

Transportation standard sizes for coarse aggregate as shown in Figure 26 of Appendix A: size number four, size number five, size number 56 or size number six.

(g) Barrier material shall consist of continuous layers of drainage fabric and shall be placed throughout the entire length of the drain, above, below and along the sides of the filter material. The following requirements shall be met:

1. The edges of adjacent sheets shall be overlapped by a minimum of six inches.
2. The type of drainage fabric used shall be specified in the engineering design and shall have adequate tensile strength to prevent ripping during installation and backfilling, adequate permeability to allow unimpeded passage of water, and adequate particle retention to prevent migration of soil particles into the filter material.

(h) Drainage pipe shall be laid throughout the entire length of the excavation and shall be placed immediately above the barrier material at the bottom of the excavation and midway between the sides. The type of drainage pipe used shall be as follows:

1. Upslope of the downslope side of the disposal field, where the excavation is filled with filter material, the pipe shall be perforated or laid with open joints.
2. Downslope of the downslope edge of the disposal field, and beyond the extent of the filter material, the pipe shall be non-perforated and laid with tight joints.
3. The size of the pipe shall be large enough to handle the expected amount of flow and in no case shall the pipe diameter be less than four inches.
4. Materials used for drainage pipe shall be as allowed in N.J.A.C. 7:9A-9.5(b).

(i) Free-flowing outlets shall be provided downslope of the drain, on each end of the disposal field. outlets shall meet the following requirements:

1. Outlets may empty into a surface water body, a drainage swale discharging to a surface water body, a storm sewer, a groundwater recharge basin, a gravel bed, dedicated seepage pit, or dry well.
2. Outlets shall be designed, constructed, located and maintained in a manner which does not cause soil erosion, surface flooding or damage to adjacent properties, does not create a public nuisance, and does not violate any applicable Federal, State or local laws or regulations.
3. Adequate measures shall be taken to protect each outlet from entry of rodents or other small animals.

(j) Backfill over the drain and the drain discharge pipes shall be of earth similar to that found at the site and free of large stones, broken masonry, stumps or other waste construction material.

(k) Where an interceptor drain is proposed to divert laterally moving perched ground water away from the area of the disposal field, the drain shall be installed and its satisfactory performance confirmed prior to granting of final approval, as follows.

1. After installation of the drain has been completed, borings or pits shall be excavated to the top of (but not penetrating) the hydraulically restrictive horizon, hydraulically restrictive substratum or massive rock substratum above which the perched zone of saturation is located. This shall be done on the upslope and downslope sides of the drain and during a time of year when the presence of the perched zone of saturation is anticipated. Piezometers may also be used for this purpose provided that they do not penetrate through the hydraulically restrictive horizon and provided that the requirements of N.J.A.C. 7:9A-5.9(e) are met.
2. The drain shall be considered to be performing adequately if no perched zone of saturation is observed on the downslope side of the drain at the same time that a perched zone of saturation is observed on the upslope side of the drain. This test shall be witnessed by the administrative authority or its authorized agent.

Subchapter 11. Seepage Pits

7:9A-11.1 Site/soil requirements

(a) Seepage pits shall not be approved except as specified in N.J.A.C. 7:9A-7.6. When a seepage pit is approved, the following site/soil requirements shall be met:

1. The bottom of any seepage pit shall be a minimum of eight feet above any hydraulically restrictive horizon or substratum not fully penetrated or any massive rock substratum.
2. The bottom of any seepage pit shall be a minimum of four feet above any fractured rock substratum.
3. The bottom of any seepage pit shall be a minimum of four feet above the level of the seasonally high water table.

7:9A-11.2 Design requirements

(a) The percolating area shall be considered to be the total outside surface of the seepage pit lining below the inlet and exclusive of any soil horizons with a percolation rate slower than 40 minutes per inch. The bottom of the seepage pit shall not be counted as part of the percolating area.

(b) The minimum required percolating area for dwelling units shall be determined from the following table, based upon a weighted average, of the percolation rates of all the soil layers exposed in the sidewalls, determined as prescribed in N.J.A.C. 7:9A-6.4(f)4. In no case, however, shall the percolating area be less than 110 square feet per dwelling unit.

Average Percolation Rate (Min/inch)	Minimum Area Per Bedroom Per Day (Square feet)
10 or less	72
11-20	108
21-30	144
31-40	180
over 40	not acceptable

(c) The minimum percolating area for facilities other than individual dwellings shall be determined from the following table based upon the volume of sanitary sewage, determined as prescribed in N.J.A.C. 7:9A-7.4, and a weighted average of the percolation rates of all soil layers exposed in the sidewalls, determined as prescribed in N.J.A.C. 7:9A-6.4(f)4. In no case, however, shall the percolating area be less than 110 square feet.

Average Percolation Rate (Min/inch)	Minimum Area Per Gallon Per Day (Square feet)
10 or less	0.48
11-20	0.72
21-30	0.96
31-40	1.20
over 40	not acceptable

7:9A-11.3 Construction requirements

(a) Seepage pits shall be constructed within an excavation affording adequate working space and shall be constructed of stone, brick, cinder, precast concrete or concrete block, or similar material laid dry with open joints where permeable strata has been penetrated, except that if the seepage pit is not of circular construction or if the surrounding ground is subject to cave-in, all horizontal joints shall be mortared in such a manner as to prevent structural failure. The following requirements shall be met:

1. All joints above the inlet, in all cases, shall be made water-tight.
2. Before placement of backfill, all sidewall areas shall be scarified.
3. The bottom of the seepage pit shall be filled with coarse gravel to a depth of one foot unless the bottom is in a sand or gravel formation.

(b) Seepage pits shall be backfilled according to the following procedure:

1. The space between the excavation and the seepage pit wall shall be backfilled with at least three inches of coarse gravel or filter material meeting the requirements of N.J.A.C. 7:9A-10.3(e)2.
2. Where cinder or concrete blocks are laid with core openings exposed, the space between the excavation and seepage pit wall shall be backfilled with at least six inches of two and one-half inch crushed stone or gravel.
3. Backfill above the inlet shall be as required for disposal fields in N.J.A.C. 7:9A-10.3(f)2 and shall be thoroughly compacted by hand or mechanical tamping methods. The use of heavy machinery for this purpose is prohibited.

(c) Covers shall be constructed of reinforced concrete, shall be a minimum of three inches in thickness, water-tight, and shall be designed and constructed so as not to be damaged by any load which is likely to be placed upon them.

(d) At least one access opening with a removable water-tight cover and a minimum dimension of 24 inches shall be provided. Access openings shall meet the following requirements:

1. Access shall be adequate to permit pumping out of the pit as well as inspection and maintenance of the inlet.
2. When the cover of the seepage pit is deeper than 12 inches below finished grade, the access opening shall be extended to within 12 inches of finished grade by means of a concrete riser with a cast-iron manhole cover.
3. When the access opening is below finished grade, a permanent marker at finished grade shall be provided to indicate its location.
4. When the access opening is at or above finished grade, the cover shall be bolted, locked or otherwise secured to prevent access by children.

Subchapter 12. Operation and Maintenance

7:9A-12.1 System use

(a) The individual subsurface sewage disposal system shall be used only for the disposal of wastes of the type and origin provided for in the approved engineering design. No permanent or temporary connection shall be made to any source of wastes, wastewater or clean water. This prohibition does not apply to those plumbing fixtures which are normally present within the type of facility indicated in the approved engineering design such as air conditioning condensate, heating system condensate and water softener backwash.

(b) Drainage from basement floors, footings or roofs shall not enter the individual subsurface sewage disposal system and shall be diverted away from the area of the disposal field.

(c) As set forth in N.J.S.A. 58:10A-17, no person shall use or introduce or cause any other person to use or introduce into any individual subsurface sewage disposal system any sewage system cleaner containing any restricted chemical material.

(d) Disposal of materials containing toxic substances into an individual subsurface sewage disposal system is prohibited. Material containing toxic substances include, but are not limited to, waste oil (other than cooking oil), oil-based or acrylic paints, varnishes, photographic solutions, pesticides, insecticides, paint thinners, organic solvents or degreasers and drain-openers.

(e) Inert or non-biodegradable substances shall not be disposed of in the individual subsurface sewage disposal system. Such substances include, but are not limited to, disposable diapers containing plastic, cat box litter, coffee grounds, cigarette filters, sanitary napkins, facial tissues and wet-strength paper towels.

(f) Large quantities of cooking greases or fats shall not be discharged into systems not equipped with a grease trap designed and constructed as prescribed in N.J.A.C. 7:9A-8.1.
(g) Major plumbing leaks shall be repaired promptly to prevent hydraulic overloading of the system.

7:9A-12.2 [Reserved]

7:9A-12.3 [Reserved]

7:9A-12.4 [Reserved]

7:9A-12.5 [Reserved]

7:9A-12.6 [Reserved]

7:9A-12.7 System testing

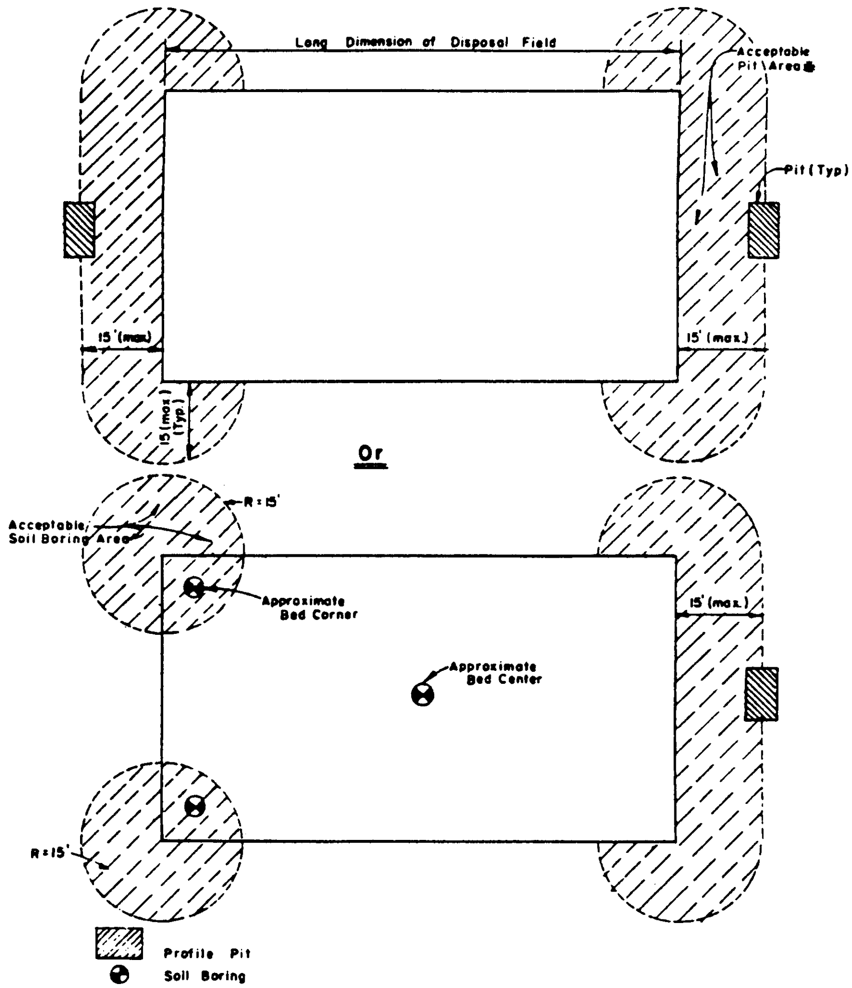
No person shall test an individual subsurface sewage disposal system in a manner that will adversely affect the functioning of the system. Hydraulic loading shall not be applied in excess of the design flow capacity of the septic tank and/or grease trap unless all solids have been removed from the septic tank and/or grease trap prior to testing or unless the hydraulic loading is applied at a point that will bypass the septic tank and/or grease trap. All testing of operating systems which requires a hydraulic loading which is in excess of the design flow shall be performed under the supervision of a licensed professional engineer.

7:9A-12.8 Abandoned systems

(a) When it is necessary to abandon a system or components of a system in place for any reason other than connection to a sanitary sewer line, all septic tanks, dosing tanks, seepage pits, dry wells and cesspools which are to be abandoned shall be emptied of wastes and removed or filled completely with gravel, stones or soil material in a manner which is acceptable to the administrative authority. In cases where the individual subsurface sewage disposal system, or components thereof, is being abandoned due to the connection of the facility to a sanitary sewer line, the local plumbing inspector shall ensure the system is abandoned in accordance with the requirements of this section.
(b) Gravel filter material, fill material, soil or other similar material from an abandoned individual subsurface sewage disposal system that is removed from the ground shall be managed as follows:
1. If the abandoned system served single family or multi-family dwelling unit(s), the material shall be either:
i. Placed into trenches or pits excavated on the property and covered using the soil removed during the excavation of the trenches or pits; or
ii. Disposed of, or reused beneficially, in accordance with the New Jersey Solid Waste Management Act, N.J.S.A. 13:1E-1 et seq., and implementing rules at N.J.A.C. 7:26; or
2. If the abandoned system served a commercial, industrial or any facility other than single family or multi-family dwelling unit(s), the material shall be disposed of, or reused beneficially, in accordance with the New Jersey Solid Waste Management Act, N.J.S.A. 13:1E-1 et seq., and implementing rules at N.J.A.C. 7:26.
(c) Any system components, other than the material described at (b) above, from an abandoned individual subsurface sewage disposal system that are removed from the ground shall be disposed of, or reused beneficially, in accordance with the New Jersey Solid Waste Management Act, N.J.S.A. 13:1D-1 et seq., and implementing rules at N.J.A.C. 7:26.

APPENDIX A. FIGURES

APPENDIX A—FIGURES



*Profile pits may be located within the boundaries of the disposal field also, provided that they are backfilled after use as prescribed in N.J.A.C. 7:9A-5.2(c).

Figure 1. Location of Soil Profile Pits and Borings

Figure 1 Location of Soil Profile Pits and Borings

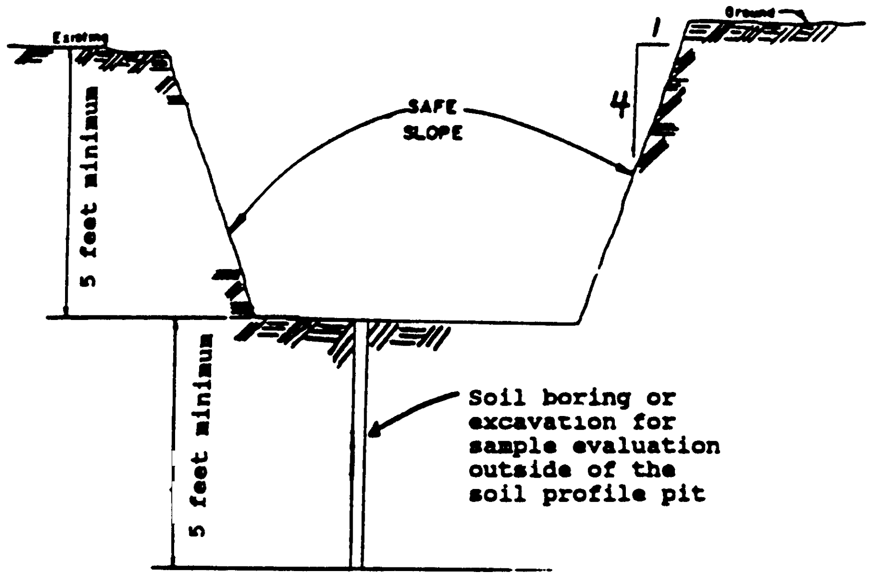
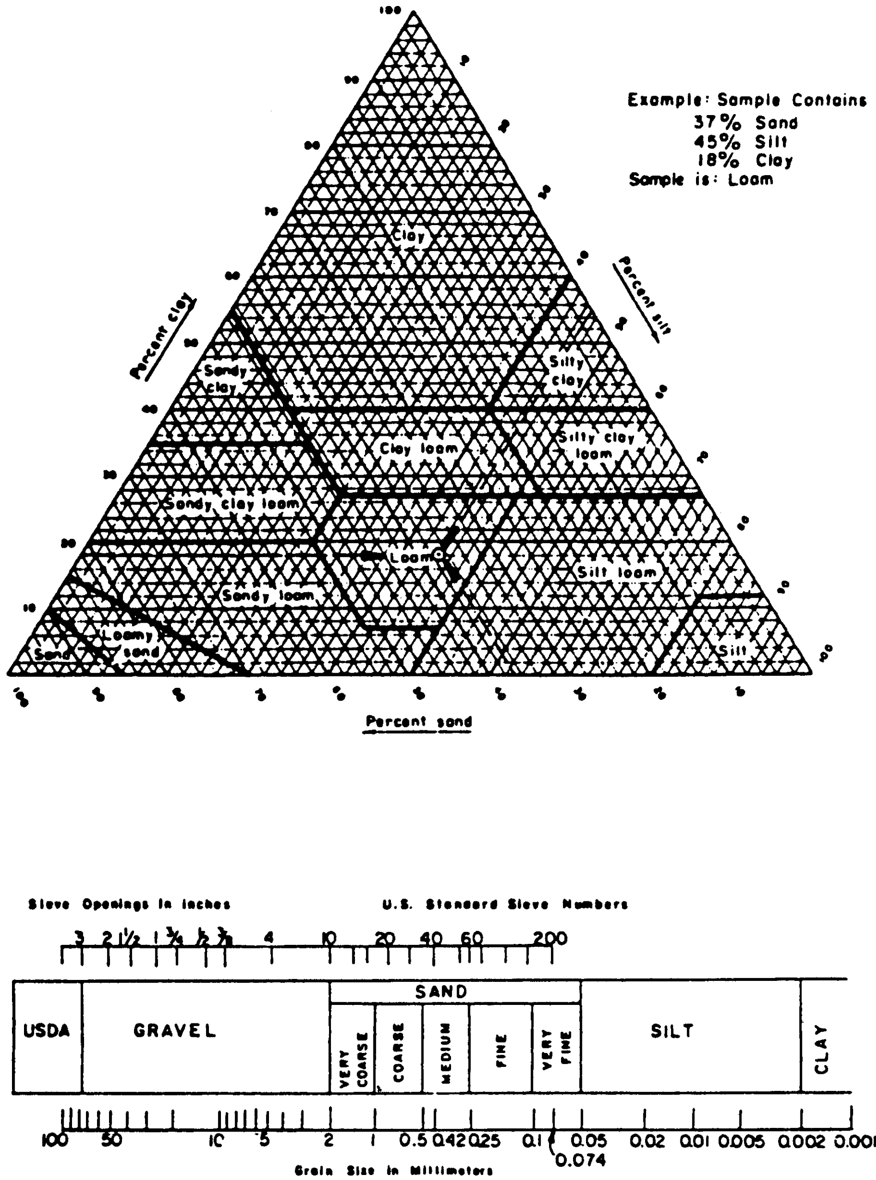


Figure 2. Recommended Cross-section of Soil Profile Pit.

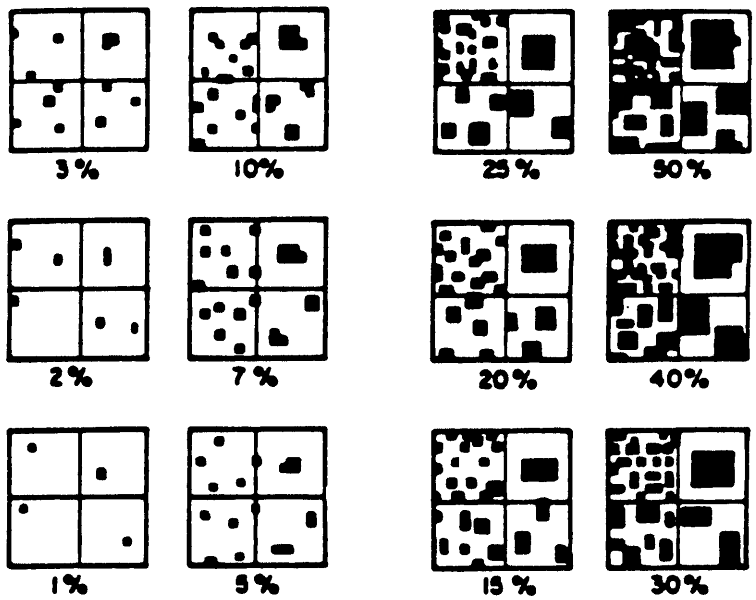
Figure 2 Recommended Cross Section of Soil Profile Pit



Adapted from U.S. Dept. of the Interior, Water & Power Research Service (1974) *Earth Manual*, 2nd Edition, pg. 82

Figure 3. U.S.D.A. System of Soil Textural Classification

Figure 3 USDA Textural Triangle

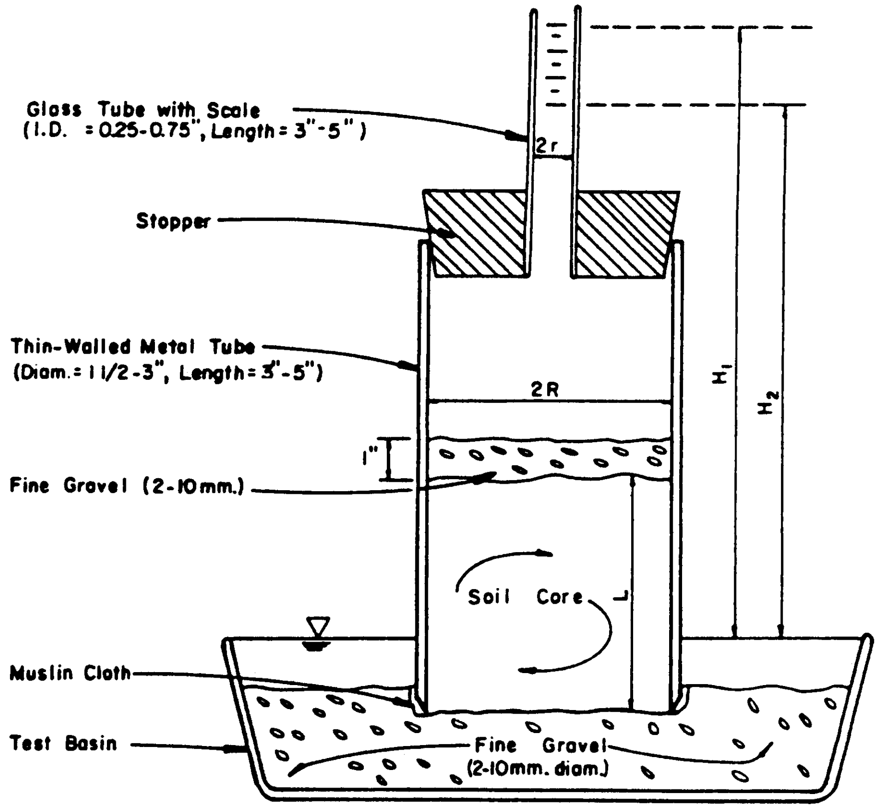


Charts for estimating proportions of Mottles and Coarse Fragments.
Each fourth of any one square has the same amount of black.

Adapted from *Technical Manual for Sewage Enforcement Officers* Commonwealth of Pennsylvania, Dept. of Environmental Resources. Div of Local Environmental Services, Bureau of Water Quality Management

Figure 4. Charts for Visual Estimation of Volume Percentage

Figure 4 Charts for Visual Estimation of Volume Percentage



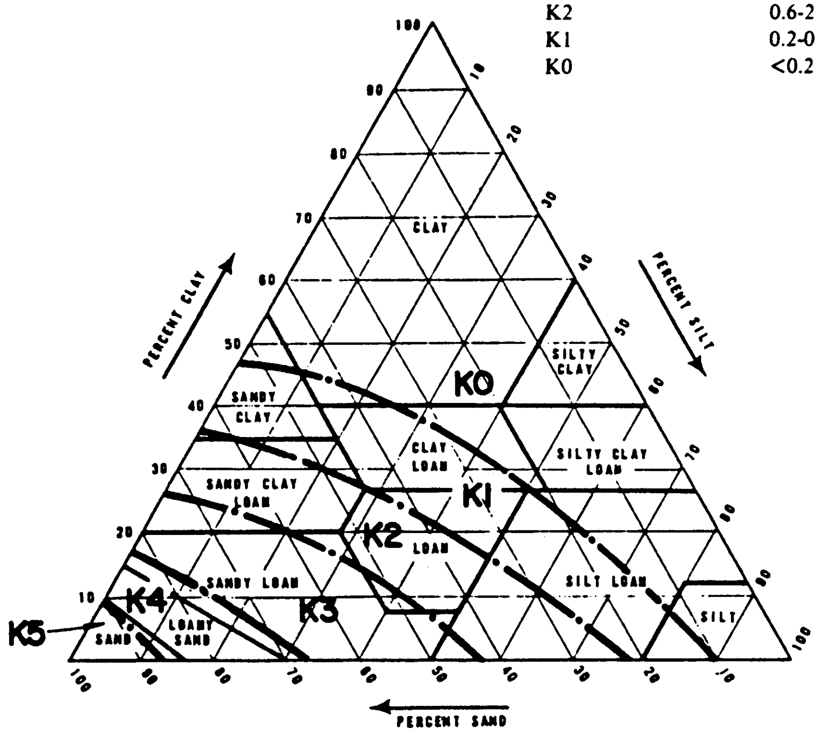
$$K(\text{in./hr.}) = 60(\text{min/hr.}) \times r^2/R^2 \times L(\text{in.})/T(\text{min.}) \times \mathit{ln}\ (H_1/H_2)$$

Figure 5. Tube Permeameter (with standpipe)

Figure 5   Tube Permeameter

Legend:

Permea-bility Class	Permea-bility (in/hr)
K5	>20
K4	6-20
K3	2-6
K2	0.6-2
K1	0.2-0
K0	<0.2



Adapted from N.N. Hantzsche et al. (1982) Soil Textural Analysis for Onsite Sewage Disposal Evaluation, Proc. 3rd Nat. Symposium on Individual and Small Community Sewage Treatment, Am. Soc. Agric. Eng., St. Joseph, Michigan

Figure 6. Soil Permeability/Textural Triangle

Figure 6 Soil permeability/Textural Triangle

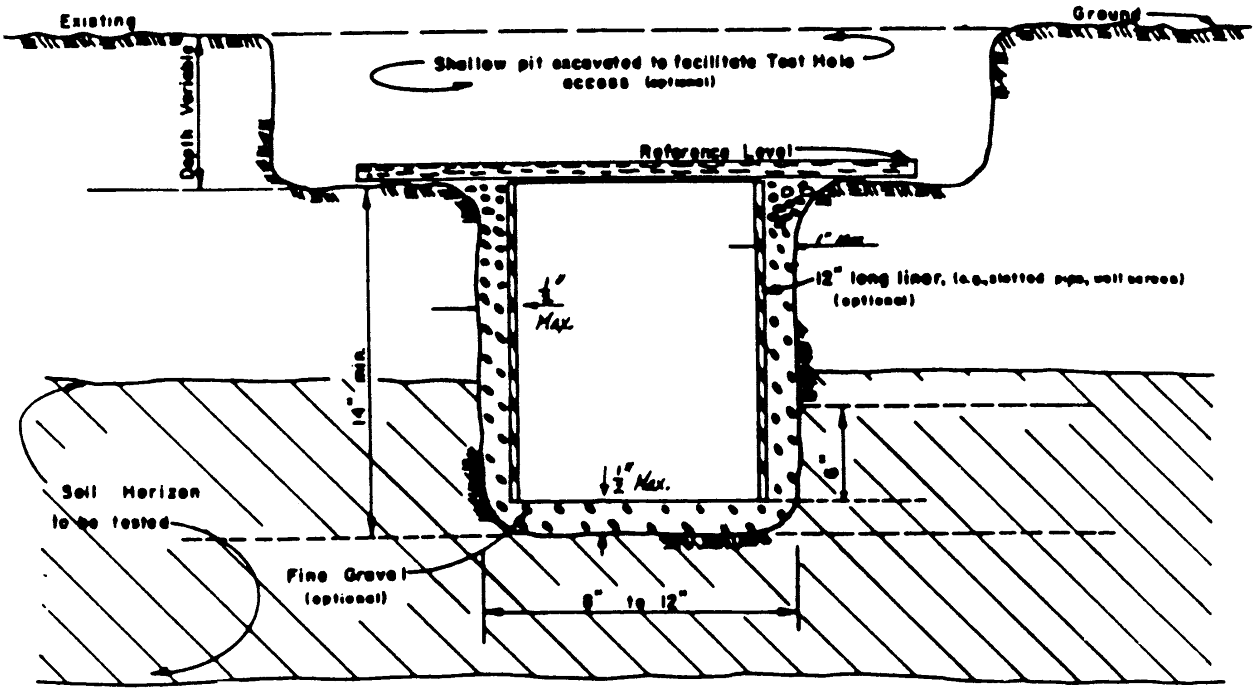
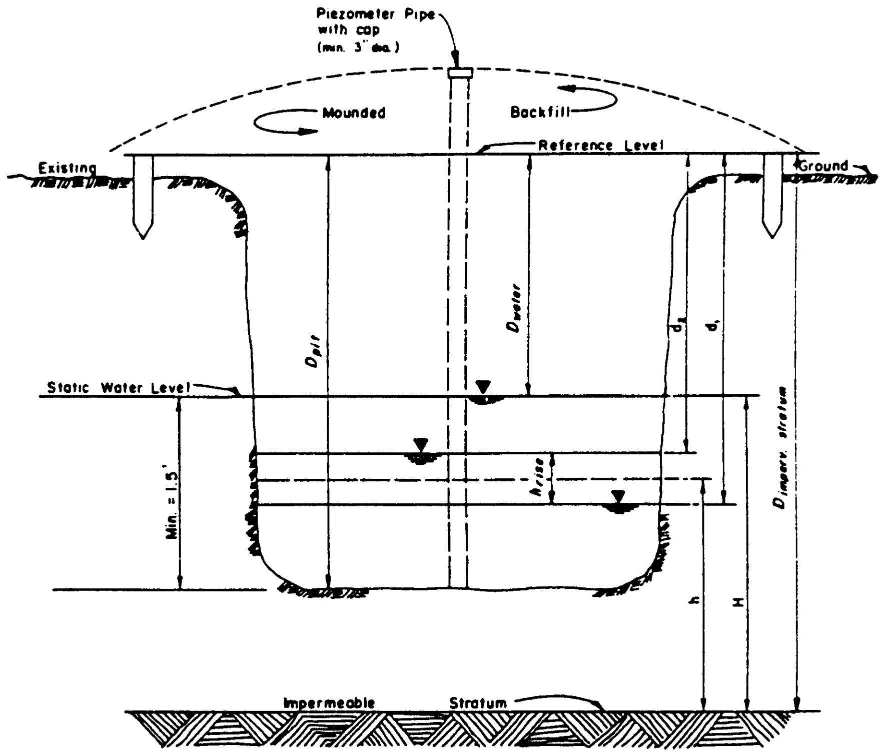


Figure 7. Percolation Test

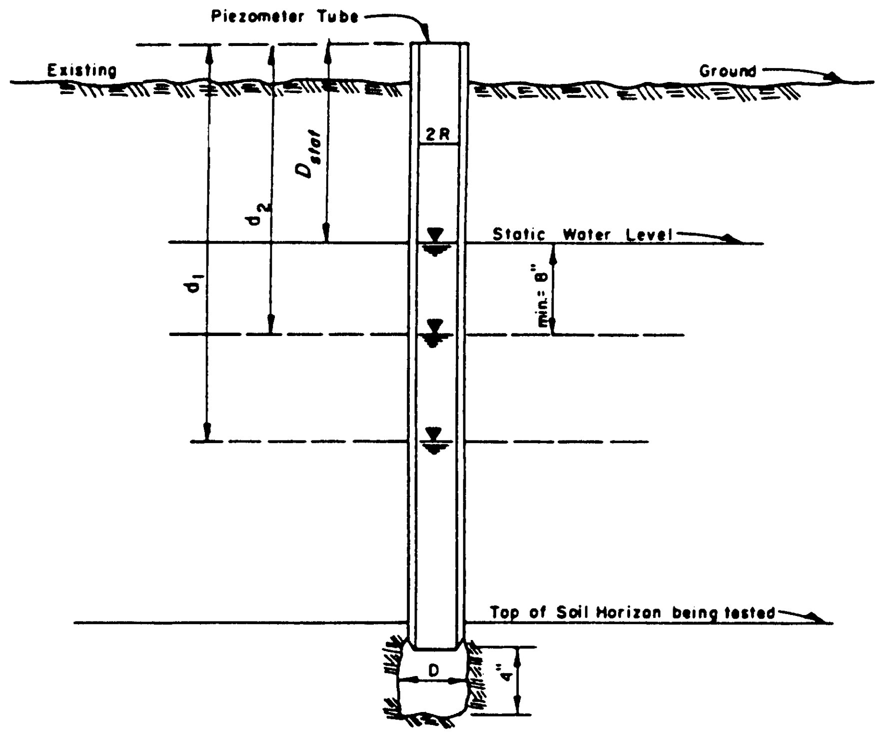
Figure 7 Percolation Test



$$K\,(\text{in./hr.}) = [(h_{rise})/t] \times [A_{ex}/2.27\,(H^2 - h^2)] \times 60\ \text{min/hr.}$$

Figure 8. Pit-bailing Test.

Figure 8 Pit-Bailing Test



$$K = 60\ \text{min/hr.} \times (3.14\ R^2/At) \times \mathit{ln}\left[(d_1 - D_{stat}) / (d_2 - D_{stat})\right]$$

Figure 9. Piezometer Test.

Figure 9 Piezometer Test

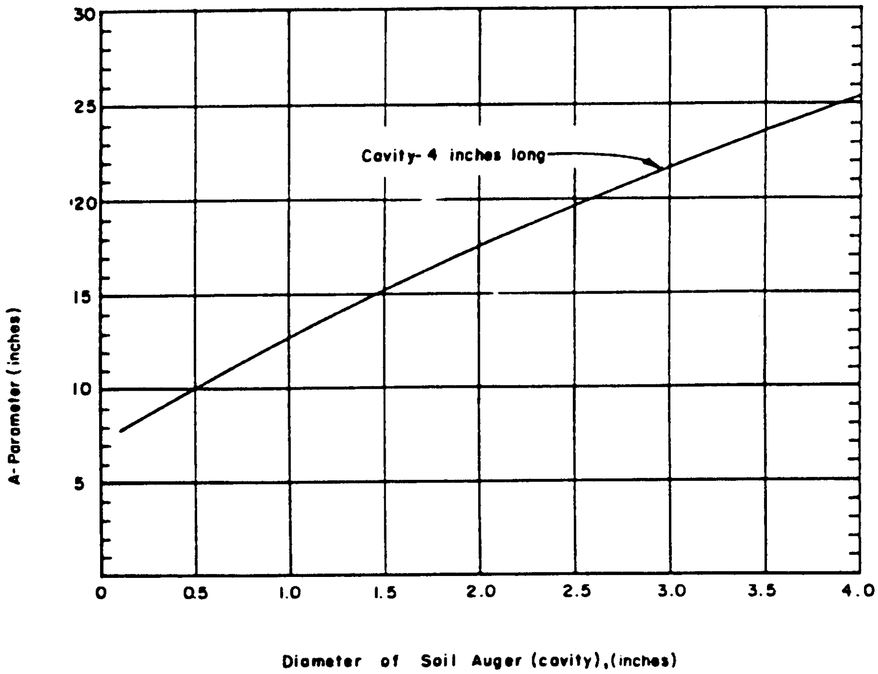


Figure 10. "A" Parameter for Piezometer Test.

Figure 10 "A" Parameter of Piezometer Test

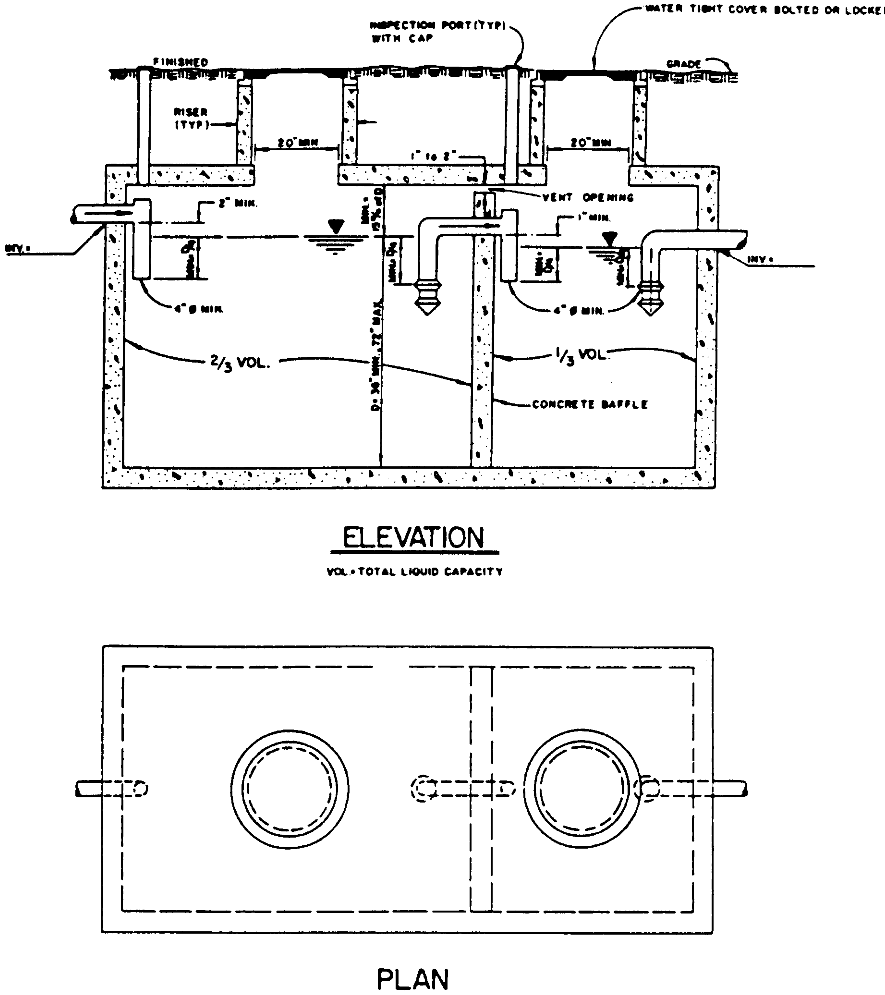


Figure 11. Multiple Compartment Septic Tank with Septic Solids Retainer

Figure 11 Multiple Compartment Septic Tank with Septic Solids Retainer

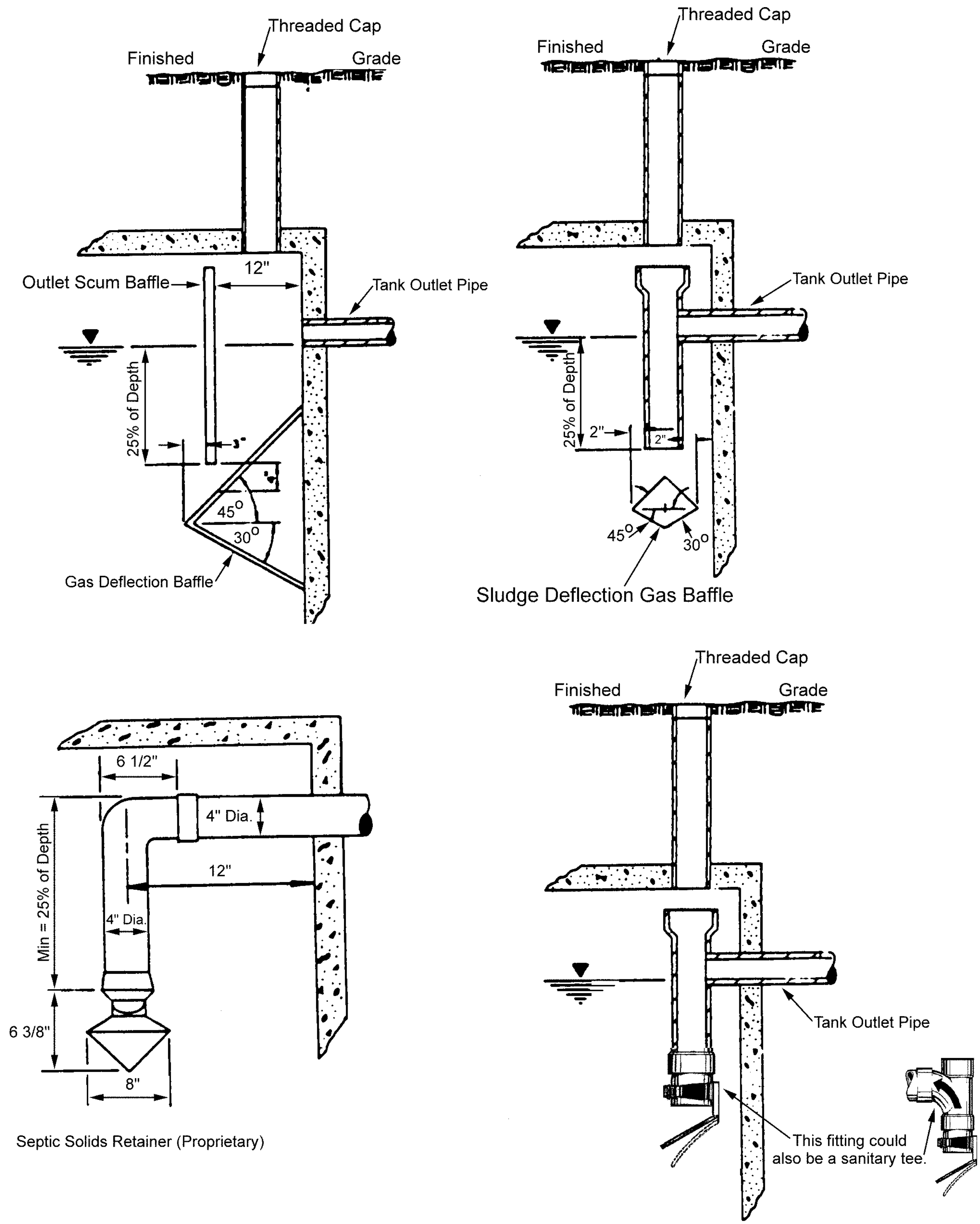
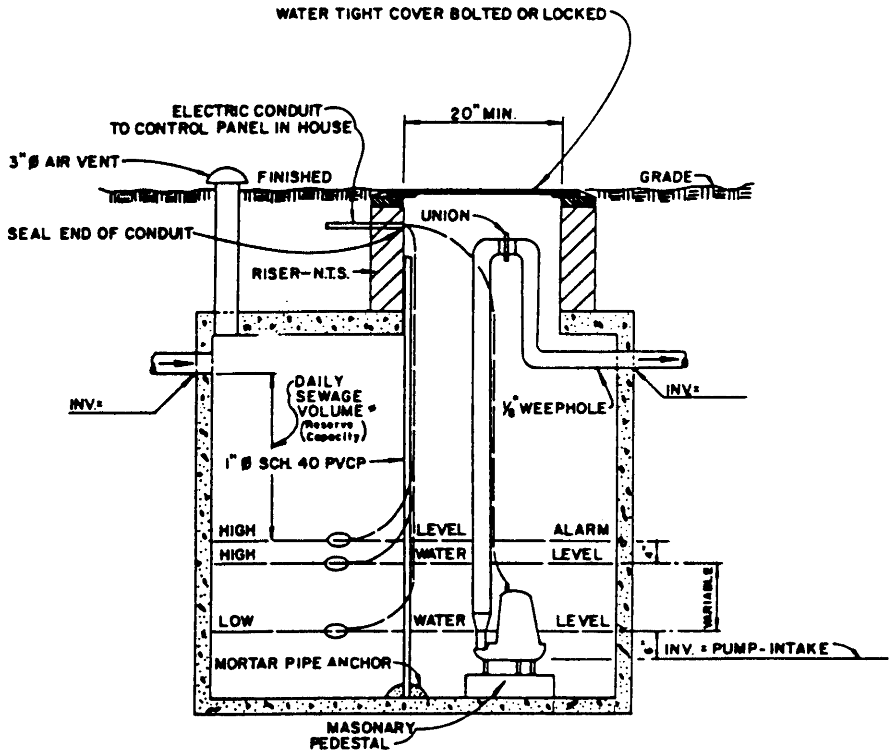


Figure 12. Gas Deflection Baffles

Gas Baffle

Figure 12 Gas Deflection Baffles



* Except where dual pumps used.

Figure 13. Dosing Tank with Pump.

Figure 13 Dosing Tank with Pump

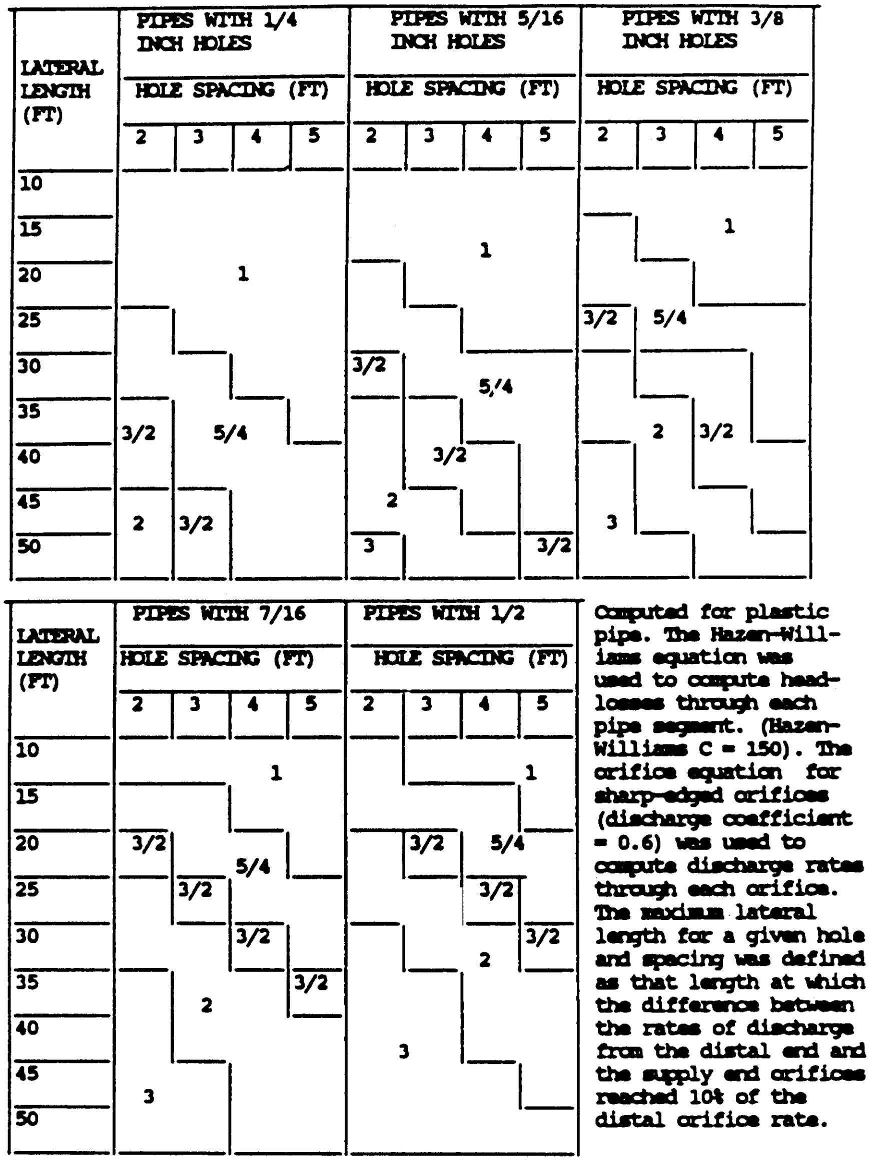


Figure 14. Required Lateral Diameters, in Inches, For Various Hole Diameters, Hole Spacings and Lateral Lengths

Figure 14 Required Lateral Diameters

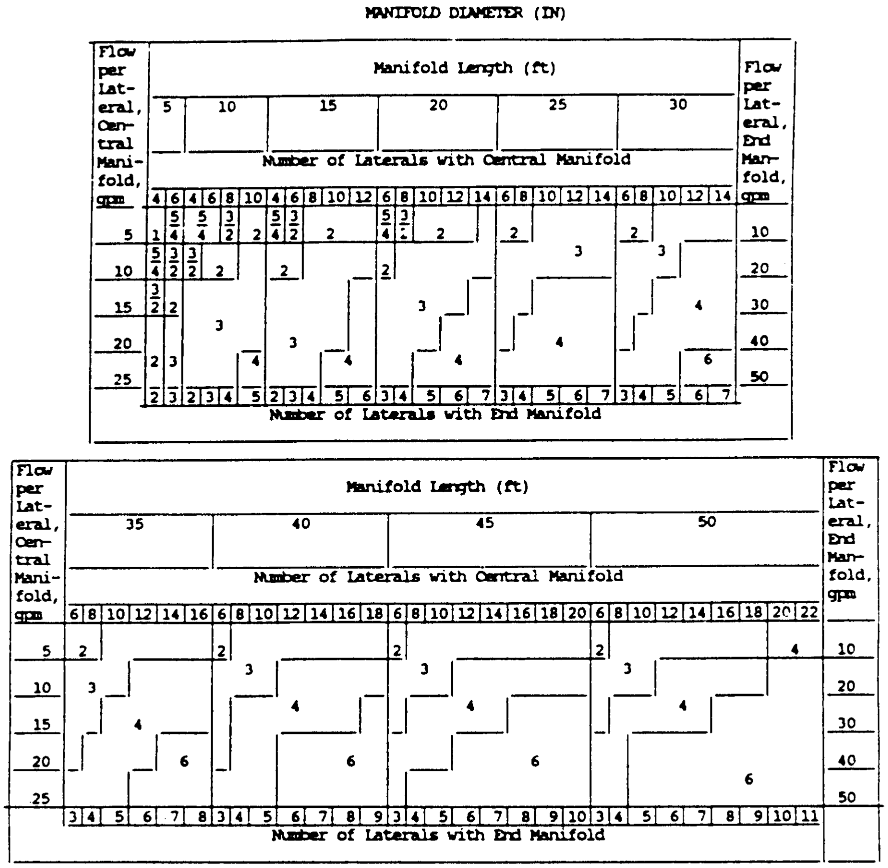


Figure 15. Required Manifold Diameters For Various Manifold Lengths, Number of Laterals and Lateral Discharge Rates

Computed for plastic pipe only. The Hazen-Williams equation was used to compute headlosses through each segment (Hazen-Williams C = 150). The maximum manifold length for given lateral discharge rate and spacing was defined as that length at which the difference between the heads at the distal and supply ends of the manifold reached 10 percent of the head at the distal end.

Figure 16 (Agency Note: Current Figure 16 in the New Jersey Administrative Code is proposed for deletion and replacement with proposed Figure 16 as shown below)

Figure 15 Required Manifold Diameters

FRICTION LOSS IN SCHEDULE 40 PLASTIC PIPE, C=150
(ft/100 ft)

Pipe Diameter (in)

Flow (gpm)	1	1 1/4	1 1/2	2	2 1/2	3	4	6	8	10
2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4	1.01	.....	.....	.....	.....	.....	.....	.....	.....	.....
6	2.14	0.55	.....	.....	.....	.....	.....	.....	.....	.....
8	3.63	0.97	0.46	.....	.....	.....	.....	.....	.....	.....
10	5.50	1.46	0.70	0.21	.....	.....	.....	.....	.....	.....
12	5.64	2.09	1.01	0.30	0.12	.....	.....	.....	.....	.....
15	11.75	3.06	1.45	0.44	0.18	0.07	.....	.....	.....	.....
18		4.37	2.07	0.62	0.25	0.10	.....	.....	.....	.....
20		5.23	2.46	0.73	0.31	0.12	.....	.....	.....	.....
25		7.89	3.72	1.10	0.46	0.16	.....	.....	.....	.....
30		11.10	5.22	1.55	0.65	0.23	.....	.....	.....	.....
35			6.95	2.06	0.87	0.30	0.07	.....	.....	.....
40			8.90	2.62	1.11	0.39	0.09	.....	.....	.....
45			11.06	3.29	1.38	0.48	0.12	.....	.....	.....
50			13.45	3.98	1.68	0.58	0.16	.....	.....	.....
55			16.04	4.75	2.00	0.70	0.18	.....	.....	.....
60			18.85	5.58	2.35	0.81	0.21	.....	.....	.....
65			21.86	6.47	2.72	0.95	0.25	.....	.....	.....
70				7.43	3.13	1.08	0.28	.....	.....	.....
75				8.44	3.55	1.12	0.33	.....	.....	.....
80				9.51	4.00	1.38	0.37	.....	.....	.....
85				10.64	4.49	1.55	0.41	.....	.....	.....
90				11.83	4.98	1.73	0.46	.....	.....	.....
95					5.50	1.91	0.49	.....	.....	.....
100					6.05	2.09	0.55	0.07	.....	.....
110					7.22	2.51	0.67	0.09	.....	.....
120					8.48	2.94	0.78	0.11	.....	.....
130						3.42	0.91	0.12	.....	.....
140						3.92	1.04	0.14	.....	.....
150						4.45	1.17	0.16	.....	.....
200							2.02	0.28	0.07	.....
250							3.05	0.41	0.11	.....
300								0.58	0.16	.....
350								0.78	0.20	0.07
400								0.99	0.26	0.09
450								1.22	0.32	0.11
500									0.38	0.14
600									0.54	0.18
700									0.72	0.24
800										0.32
900										0.38
1000										0.46

Amended by R.1993 d.294, effective June 21, 1993. See: 24 NJ.R. 1987(a), 25 NJ.R. 2704(b).

Figure 16 Friction Loss in Schedule 40 Pipe

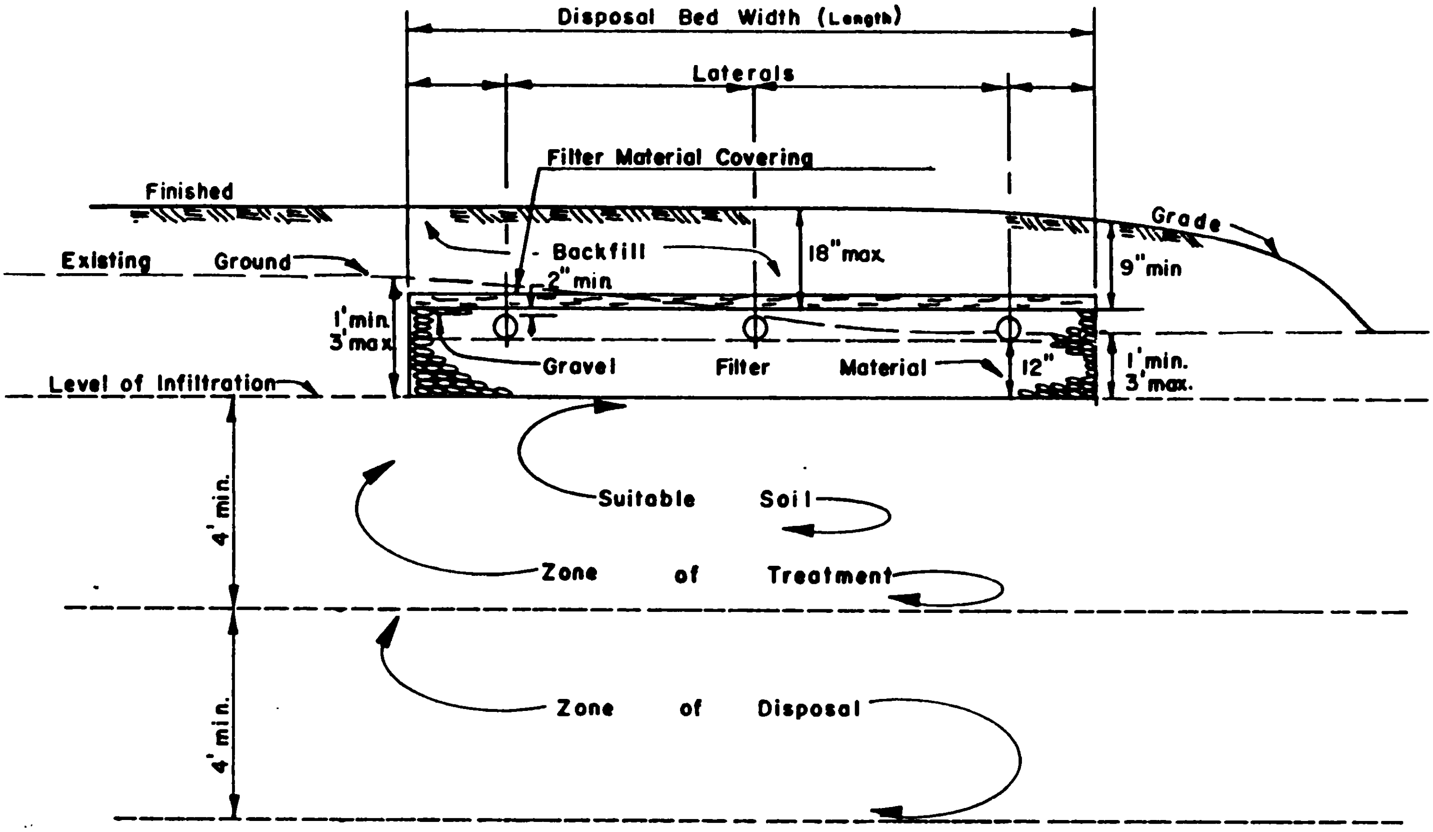


Figure 17. Conventional Disposal Field Installation.

Figure 17 Conventional Disposal Field Installations

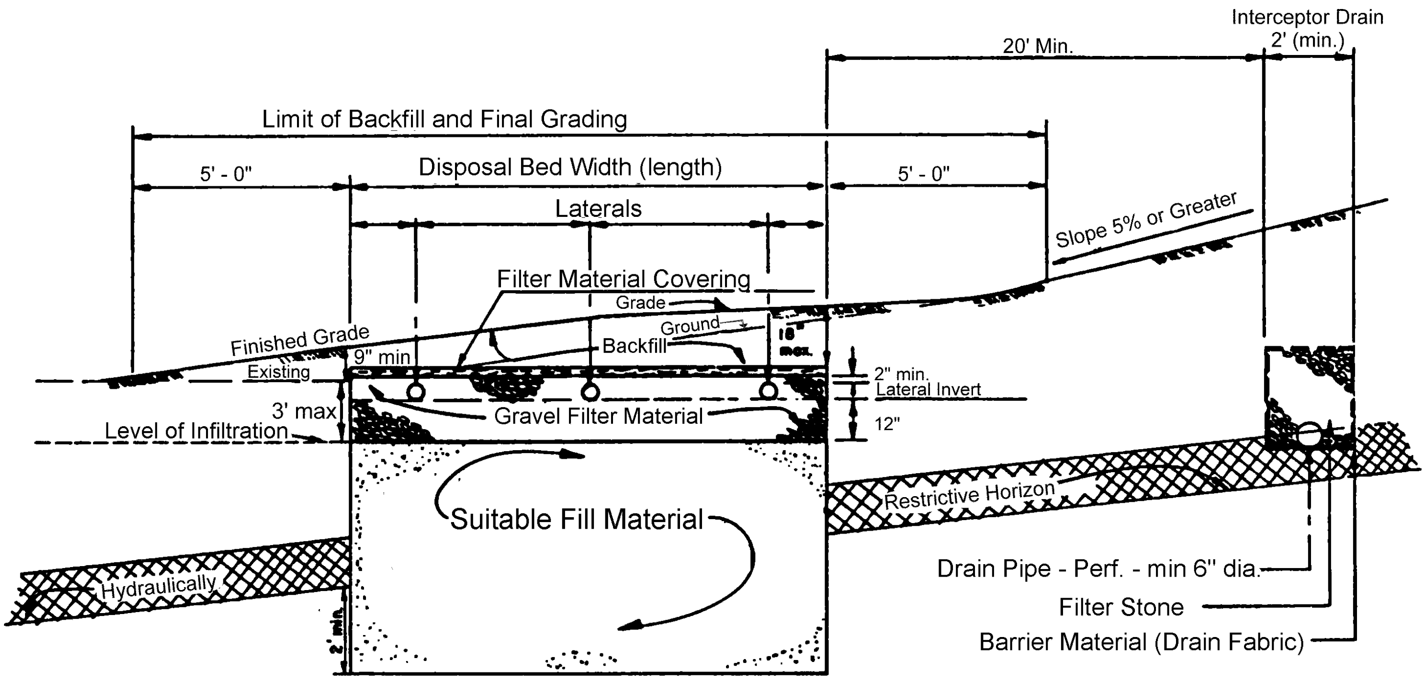


Figure 18. Soil Replacement, Bottom-Lined Disposal Field Installation

Figure 18 Soil Replacement, Bottom Lined Disposal Field Installation

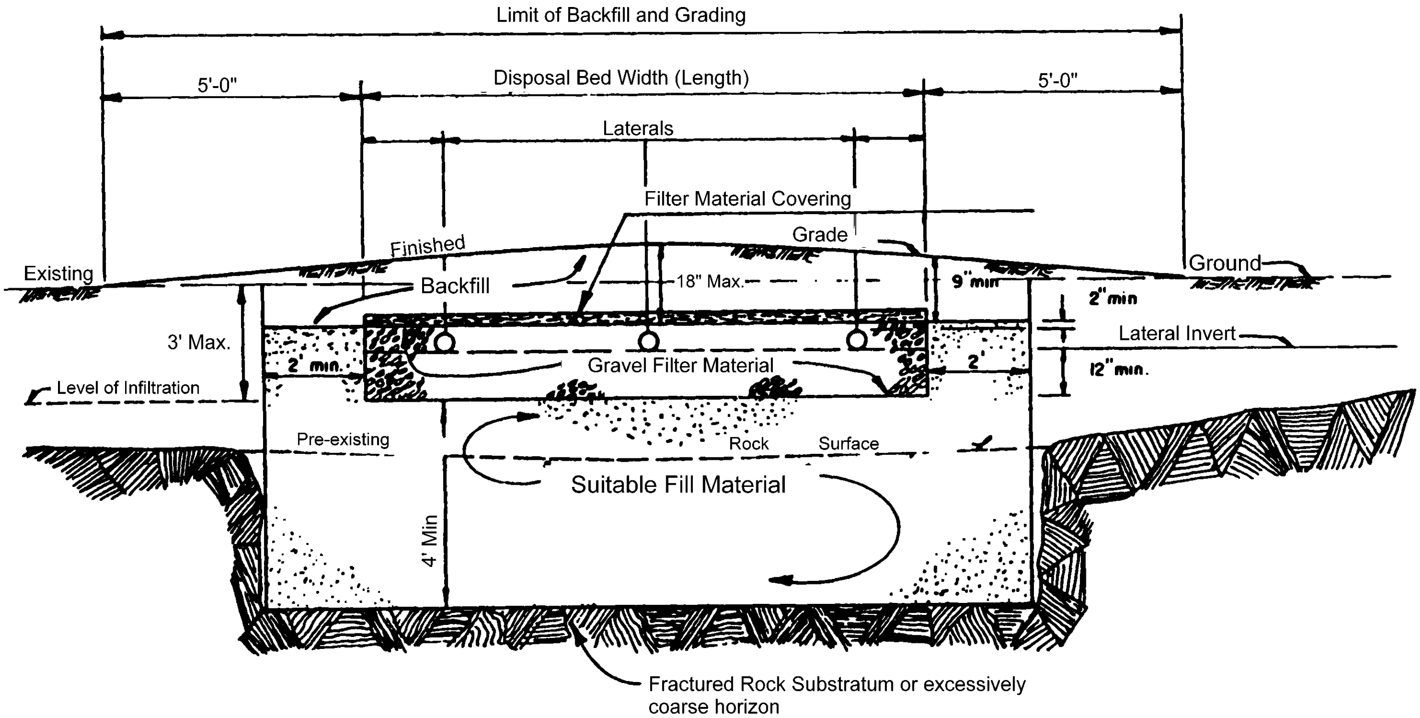


Figure 19. Soil Replacement, Fill-enclosed Disposal Field Installation

Figure 19 Soil Replacement, Fill Enclosed Disposal Field Installation

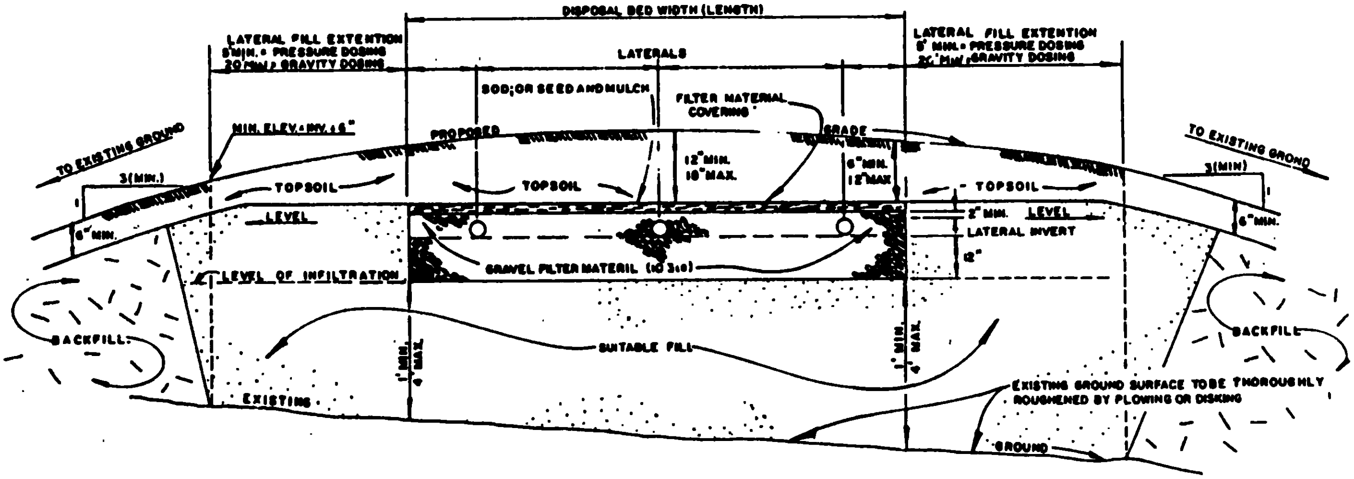


Figure 20. Mounded Disposal Field Installation.

Figure 20 Mounded Disposal Field Installation

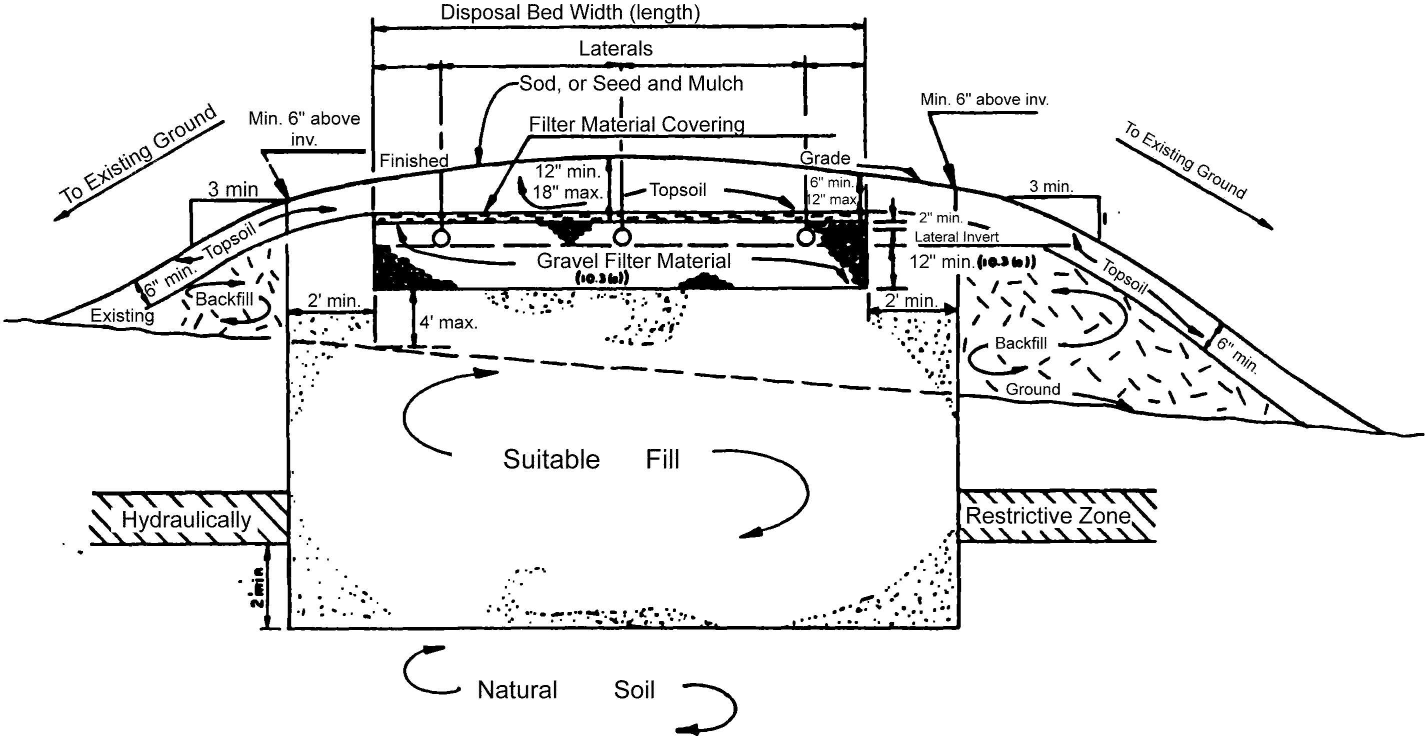


Figure 21. Mounded Soil Replacement Disposal Field Installation

Figure 21 Mounded Soil Replacement Disposal Field Installation

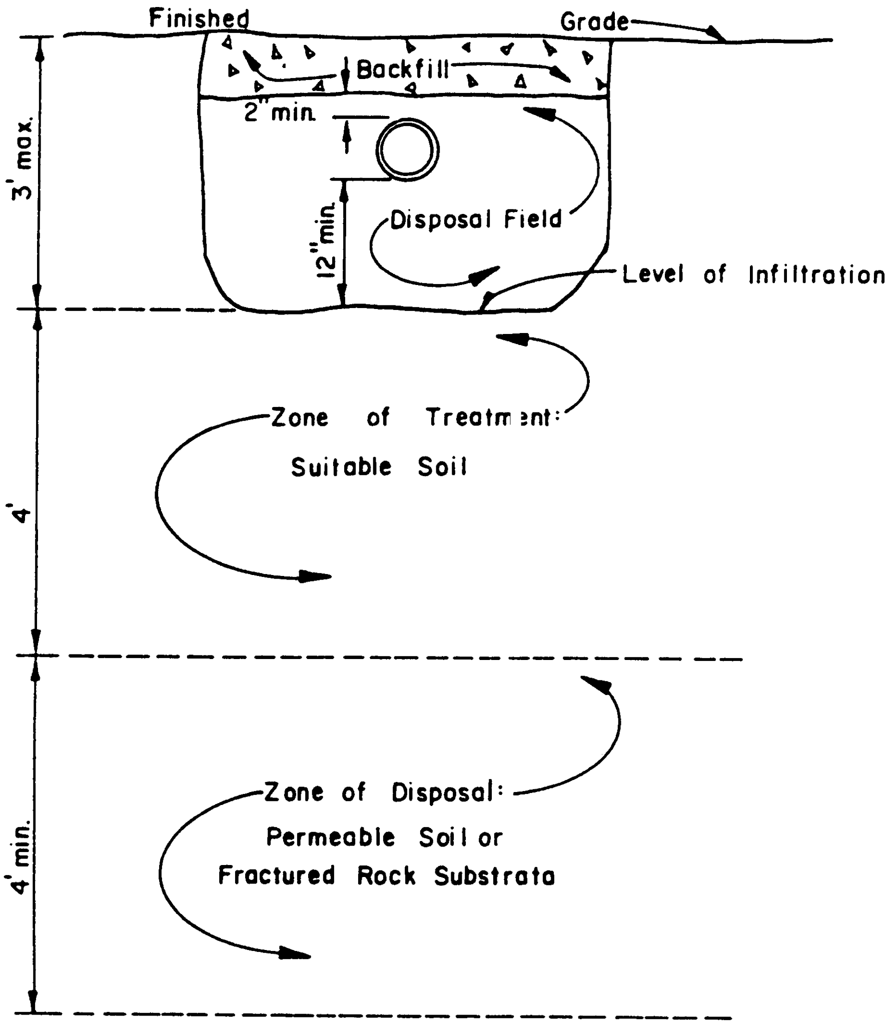


Figure 22. Zone of Treatment and zone of Disposal, Conventional Installations.

Figure 22 Zone of Treatment and Zone of Disposal : Conventional Installations

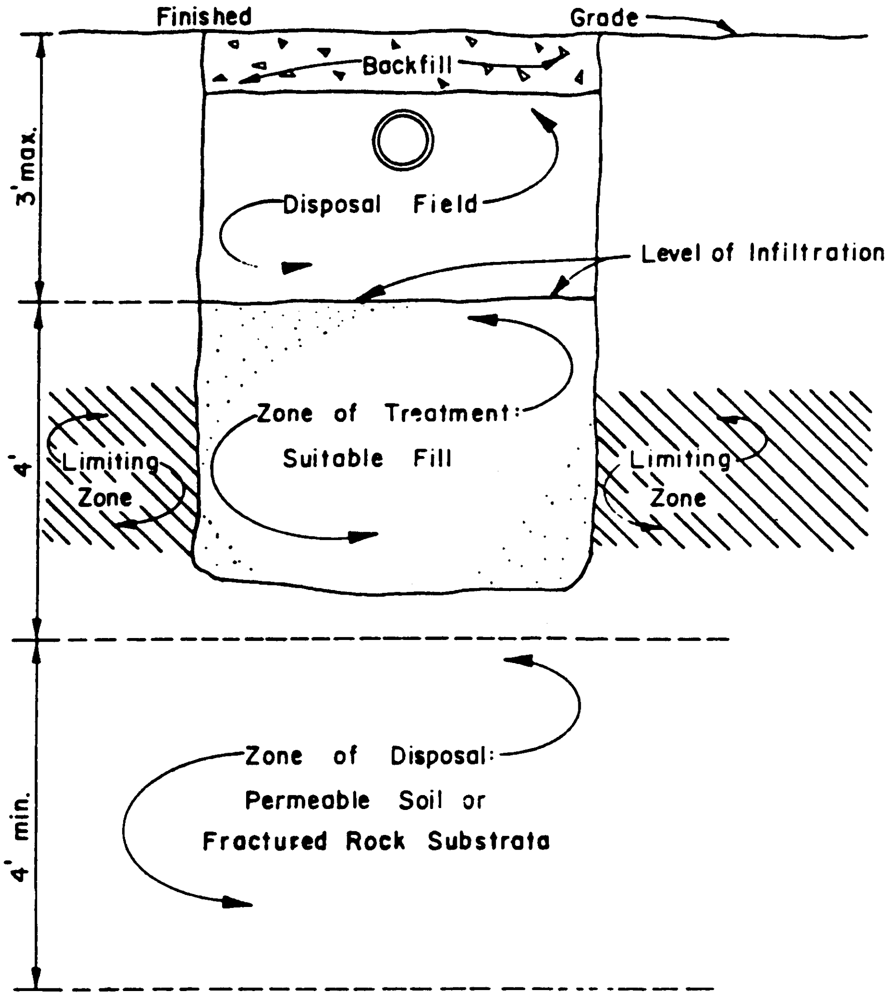


Figure 23. Placement of Fill Material Within Zone of Treatment.

Figure 23 Placement of Fill Material Within Zone of Treatment

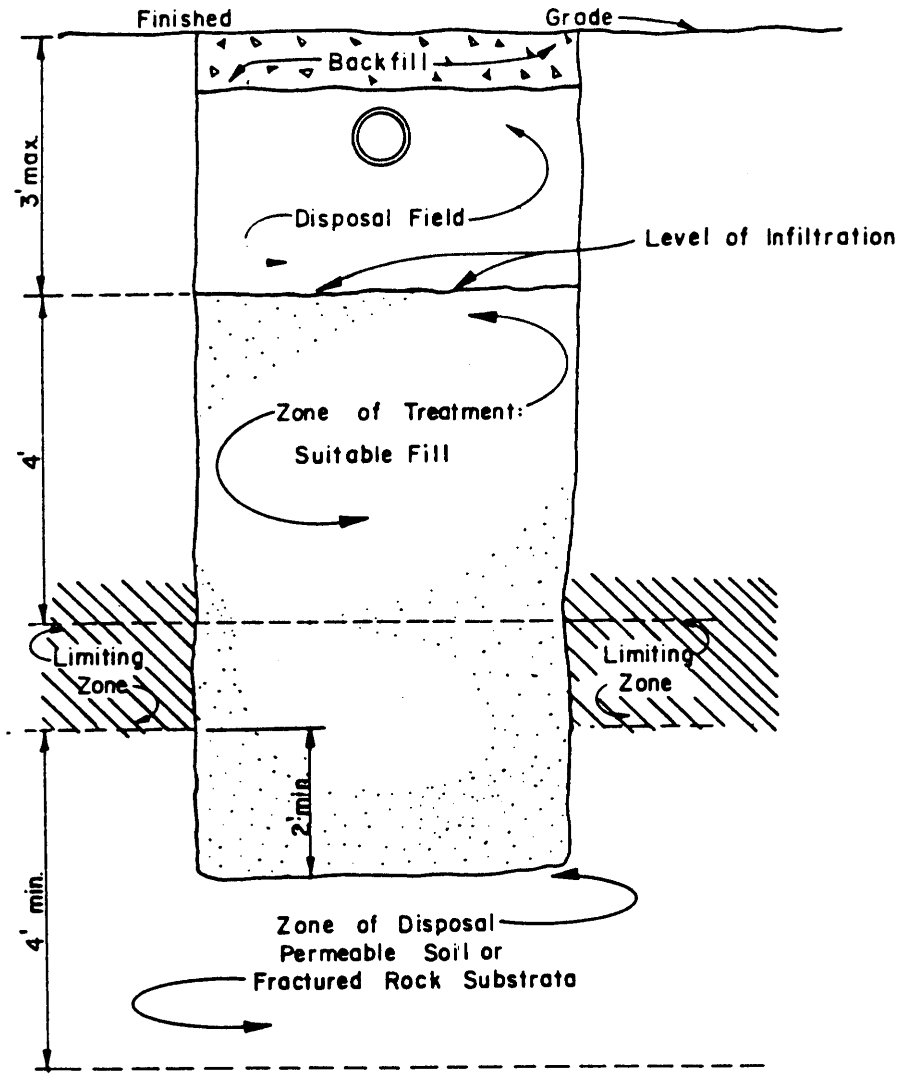


Figure 24. Placement of Fill Material Within Zone of Disposal.

Figure 24 Placement of Fill Material Within Zone of Disposal

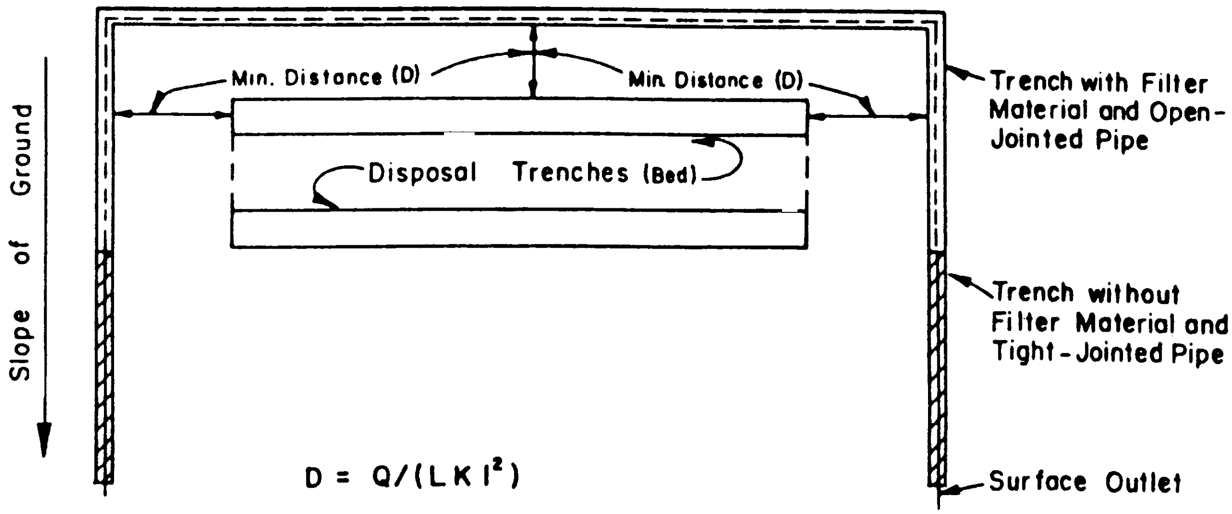


Figure 25. Disposal Field with Interceptor Drain.

Figure 25 Disposal Field with Interceptor Drain

Size Number	Nominal Size Square Openings (1)	Amounts finer than each laboratory sieve (square openings), percentage by weight														
		4	3½	3	2½	2	1½	1	¾	½	⅜	No. 4	No. 8	No. 16	No. 50	No. 100
1	3½ to 1½	100	90–100		25–60		0–15		0–5							
2	2½ to 1½			100	90–100	35–70	0–15		0–5							
24	2½ to ¾			100	90–100		25–60		0–10	0–5						
3	2 to 1				100	90–100	35–70	0–15		0–5						
357	2 to No. 4				100	95–100		35–70		10–30		0–5				
4	1½ to ¾					100	90–100	20–55	0–15		0–5					
467	1½ to No. 4					100	95–100		35–70		10–30	0–5				
5	1 to ½						100	90–100	20–55	0–10	0–5					
56	1 to ⅜						100	90–100	40–75	15–35	0–15	0–5				
57	1 to No. 4						100	95–100		25–60		0–10	0–5			
6	¾ to ⅜							100	90–100	20–55	0–15	0–5				
67	¾ to No. 4							100	90–100		20–55	0–10	0–5			
68	¾ to No. 8							100	90–100		30–65	5–25	0–10	0–5		
7	½ to No. 4								100	90–100	40–70	0–15	0–5			
78	½ to No. 8								100	90–100	40–75	5–25	0–10	0–5		
8	⅜ to No. 8									100	85–100	10–30	0–10	0–5		
89	⅜ to No. 16									100	90–100	20–55	5–30	0–10	0–5	
9	No. 4 to No. 16										100	85–100	10–40	0–10	0–5	
10	No. 4 to 0[2]										100	85–100				10–30

[1] In inches, except where otherwise indicated. Numbered sieves are those of the United States Sieve Series.
[2] Screenings.

Figure 26 New Jersey Department of Transportation Standard Sizes for Coarse Aggregates

APPENDIX B
STANDARD FORMS FOR SUBMISSION OF SOILS/ENGINEERING DATA

COUNTY/MUNICIPALITY
Form 1
General Information
1. Type of Permit Needed (Check applicable categories):
___ New Construction ___ Alteration/No Expansion or Change of Use
___ Alteration/Expansion or Change in Use
___ Alteration/Malfunctioning System
___ Deviation from Standards ___ Repairs to Existing System
2. Location of Project:
Municipality ___ Block No. __ Lot No. __
Street Address Zip __
3. Name of Applicant (print): _____
4. Applicant's Present Address:
5. Applicant's Phone Number:
6. Type Of Facility:
___ Residential
___ Commercial/Institutional
Specify Type of Establishment:
7. Type of Wastes to be Discharged:
___ Sanitary Sewage
___ Industrial Wastes
___ Other—Specify Type
8. Other Approvals/Certification/Waivers/Exemptions (Attach to Application):
___ Pinelands Commission
___ U.S. Army Corps of Engineers
___ NJDEP—Bureau of Flood Plain Management
___ Other—Specify:
9. I hereby certify that the information furnished on Form 1 of this application is true. I am aware that false swearing is a crime in this State and subject to prosecution.
Signature of Applicant ______ Date______
FOR AGENCY USE ONLY
___ Application Denied—Reason for Denial/Citation of Rules Violated: _____
___ Application Approved
___ Application Approved Subject to Approval by NJDEP
Date of Action __ Signature of Authorized Agent __
Name and Title
COUNTY/MUNICIPALITY

Form 2a
General Site Evaluation Data
Lot ___ Block ___
1. Name of Site Evaluator (print):
2. Business Address of Site Evaluator:
3. Business Phone Number of Site Evaluator:
4. Special Site Limitations Identified (Check appropriate Categories):
___ Flood Plains ___ Bedrock Outcrops ___ Wetlands
___ Excessively Stony ___ Disturbed Ground ___ Sink Holes
___ Sand Dunes ___ Steep Slopes
___ Other—Specify
5. Soil Logs—Enter on Form 2b—Use one sheet for each soil log.
6. Considerations Relating to Disturbed Ground:
a) Type of Disturbance (Check appropriate categories):
___ Filled Area ___ Excavated Area ___ Re-graded Area
___ Subsurface Drains ___ Other—Specify
b) Pre-existing Natural Ground Surface
Elevation Relative to Existing Ground Surface
Method of Identification
c) Suitability of Disturbed Ground
___ Unsuitable: Objects Subject to Disintegration or Change in Volume
___ Excessively Coarse
___ Proctor Test performed _____% Standard Proctor Density = _____
7. Hydraulic Head Test:
a) Hydraulically Restrictive Horizon: Depth Top to Bottom ___
b) Piezometer A: Depth to Bottom ___ Depth of Water Level (24 hrs)
c) Piezometer B: Depth to Bottom ___ Depth of Water Level (24 hrs)
d) Witnessed by _____ Signature _____ Date
8. Attachments (Check items included):
___ Site Plan
___ Key Map Showing Location of Site On U.S.G.S. Quadrangle or Other Accurate Map
___ Key Map Showing Location of Site on U.S.D.A. Soil Survey Map
___ Other—Specify
9. I hereby certify that the information furnished on Form 2a of this application (and the attachments thereto) is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.
Signature of Soil Evaluator Date
Signature of Professional Engineer License #
COUNTY/MUNICIPALITY

Form 2b
Soil Log and Interpretation
Lot ____ Block ____
1. Log Number ____ Method (Check One): ___ Profile Pit ___ Boring
2. Soil Log
Depth (inches)
Top-Bottom
Munsel Color Name and Symbol; Estimated Textural Class: Estimated Volume % Coarse Fragment, If Present; Structure; Moist or Dry Consistence; Mottling—Abundance, Size and Contrast, If Present
3. Ground Water Observations:
___ Seepage—Indicate Depth _____
___ Pit/Boring Flooded—Depth after ___ Hours ____
4. Soil Limiting Zones (Check Appropriate Categories):
___ Fractured Rock Substratum—Depth to Top ____
___ Massive Rock Substratum—Depth to Top ____
___ Excessively Coarse Horizon—Depth Top to Bottom __
___ Excessively Coarse Substratum—Depth to Top ____
___ Hydraulically Restrictive Horizon—Depth Top to Bottom __
___ Hydraulically Restrictive Substratum—Depth to Top ___
___ Perched Zone of Saturation—Depth Top to Bottom ___
___ Regional Zone of Saturation—Depth to Top ____
5. Soil Suitability Classification:
6. I hereby certify that the information furnished on Form 2b of this application is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.
Signature of Site Evaluator Date
Signature of Professional Engineer License # ________
COUNTY/MUNICIPALITY

Form 3a
Soil Permeability Data
Lot Block
Assign a number for each test and a letter for each test replicate. Show test data and calculations on Form 3b, 3c, 3d, 3e, 3f or 3g. Use one sheet for each separate test or test replicate.
1. Summary of Data—Enter data for each test replicate on a separate line.

Type of Test	Test (number)	Replicate (letter)	Depth (inches)	Result*

* For tube permeameter, pit-bailing and piezometer tests report results in inches per hour. For Soil permeability class rating give soil permeability class number. For percolation test report result in minutes per inch. For basin flooding test report result as positive if basin drains completely within 24 hours after second filing, negative otherwise.
2. Design Permeability/Percolation Rate: Specify Test Number _____
___ Average of Test Replicates
___ Single Replicate
___ Slowest of Replicates
3.

Type of Limiting Zone Identified	Test Number

4. Attachments (Check items included):
___ Form 3b—Tube Permeameter Test Data—Number of Sheets ____
___ Form 3c—Soil Permeability Class Rating Test Data—Number of Sheets ________
___ Form 3d—Percolation Test Data—Number of Sheets___
___ Form 3e—Pit-Bailing Test Data—Number of Sheets___
___ Form 3f—Piezometer Test Data—Number of Sheets___
___ Form 3g—Basin Flooding Test Data—Number of Sheets___
5. I hereby certify that the information furnished on Form 3a of this application (and the attachments thereto) is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.
Signature of Soil Evaluator Date
Signature of Professional Engineer License # ____

Form 3b
Tube Permeameter Test Data
1. Test Number ____ Replicate (Letter) ____ Date Collected __________
2. Material Tested: ___ Fill ___ Test in Native Soil—Indicate Depth _____
3. Type of Sample: ___ Undisturbed ___ Disturbed
4. Sample Dimensions: Inside Radius of Sample Tube, R, in cm _____ Length of Sample, L, in inches____
5. Bulk Density Determination (Disturbed Samples Only):
Sample Weight (Wt. Tube Containing Sample—Wt. of Empty Tube), grams _____________
Sample Volume (L x 2.54cm./inch x $3.14R^2$), cc_____
Bulk Density (Sample Wt./Sample Volume), grams/cc____
6. Standpipe Used: ___ No ___ Yes —Indicate Internal Radius, cm ________
7. Height of Water Level Above Rim of Test Basin, in inches:
At the Beginning of Each Test Interval, H_1______
At the End of Each Test Interval, H_2_______
8. Rate of Water Level Drop (Add additional lines if needed):

Time, Start of Test Interval, t_1	Time, End of Test, Interval t_2	**Length of Test Interval, t, minutes**

9. Calculation of Permeability:
K, (in/hr) = 60 min/hr x r^2/R^2 x L(in)/t(min) x ln (H_1/H_2) = 60 min/hr x ___ / ___ x ___ / _
x in (___ / _) = _
10. Defects in the Sample (Check appropriate items):
___ None ___ Cracks ___ Worm Channels
___ Root Channels ___ Soil/Tube Contact
___ Large Gravel ___ Large Roots
___ Dry Soil ___ Smearing ___ Compaction
___ Other—Specify
11. I hereby certify that the information furnished on Form 3b of this application is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.
Signature of Site Evaluator _______ Date __
Signature of Professional Engineer License # ____

Form 3c
Soil Permeability Class Rating Data
1. Test Number ______ Replicate (Letter) ____
2. Sample Depth_Soil Pit/Boring Number_Date Collected__
3. Coarse Fragment Content:
Total Weight of Sample, W.T., grams ________
Weight of Material Retained on 2mm sieve, W.C.F., grams____
Wt. % Coarse Fragment (W.C.F./W.T. x 100):_____
4. Oven Dry Weight (24 hrs., 105°C) of 40 Gram Air Dry Sample, grams, Wt ___________ _
5. Hydrometer Calibration, Rc________
6. Hydrometer Reading—40 seconds, grams, R1_____
Temperature of Suspension, °F________
7. Corrected Hydrometer Reading, grams, R1' ______
8. Hydrometer Reading—2 hours, grams, R2______
Temperature of Suspension, °F________
9. Corrected Hydrometer Reading, grams, R2'______
10. % sand = (Wt. - R1')/Wt. x 100 = (___ - ___)/ ___ x 100 = __
11. % clay = R2'/Wt. x 100 = ____/___ x 100 = _____
12. Sieve Analysis:
a. Oven Dry Wt. (2 hrs., 105°C) Total Sand Fraction (Soil Retained in 0.045 mm Sieve), grams_____
b. Wt. of Fine Plus Very Fine Sand Fraction (Sand Passing 0.25 mm Sieve), grams_____
c. % Fine Plus Very Fine Sand (b/a)_____
13. Soil Morphology (Natural Soil Samples Only):
Structure of Soil Horizon Tested_____
Consistence of Soil Horizon Tested: Dry_____ Moist___
14. Soil Permeability Class Rating (Based upon average textural analysis of this replicate and other replicate samples)_____
15. I hereby certify that the information furnished on Form 3c of this application is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.
Signature of Site Evaluator Date
Signature of Professional Engineer License #

Form 3d
Percolation Test Data
1. Test Number _____ Replicate (Letter)____ Date Tested ___
2. Depth_____
3. Pre-soak:_____
____ Sandy Textured Soil Only, Shortened Pre-soak—Indicate Time Required for 12 Inches of Water to Drain After Second Filling, Minutes

____ Four Hour Pre-soak Completed—Indicate Result:
____ Test Hole Drained Within 16 to 24 Hours After Pre-soak
____ Test Hole Did Not Drain Within 24 Hours After Pre-soak
4. Rate of Fall Data:
a. Time Interval Selected, Minutes_____
b. Record the Drop in Water Level During Each Time Interval to the Nearest 1/10th-Inch On the Lines Below:

Depth of Water, Start of Interval (inches)	Depth of Water, End of Interval (inches)	Drop in Water Level(Inches)

5. Percolation Rate:
a. Time, minutes, Required for a Six-inch Drop in Water Level__
b. Percolation Rate = a/6 = __/6 = ____ min/in
6. I hereby certify that the information furnished on Form 3d of this application is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.
Signature of Site Evaluator ______ Date ___
Signature of Professional Engineer ______ License # _____

Form 3e
Piezometer Test Data
1. Test Number _____ Reference Soil Log _____ Date Tested ___
2. Diameter of Soil Auger, in. _____ Depth of Test Hole, in. ___
Inside Radius of Pipe, R, in. _____
3. Depth to Apparent Static Water Level, in. _____
4. Measure and Record:

Water Depth, Start of Interval inches, d_1	Time at Start of Interval	Water Depth, End of Interval inches, d_1	Time at End of Interval	Length of Interval, min, t

5. Depth to Water Level After 24 Hour Stabilization Period, D_{static} in. _
6. Value of A-parameter _____
7. Calculation of Permeability:
K, in/hr = [$(3.14R^2)/(A \times t)$] x [ln(d_1-D_{stat}/d_2-D_{stat})] x 60 min/hr = [(3.14 __)/(____ x __)] x [ln(__-__/_-_)] x 60 min/hr = __
8. I hereby certify that the information furnished on Form 3e of this application is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.
Signature of Site Evaluator ______ Date ___
Signature of Professional Engineer _______ License # _____

Form 3f
Pit-Bailing Test Data

1. Test Number _____ Reference Soil Log _____ Date Tested ___
2. Using the reference level established, measure and record the following:

—Depth to Bottom of Pit, ft, D_{pit} _____
—Depth to Water Level after 2 hr. Stabilization Period, ft, D_{water} ___
—Depth to Impermeable Stratum, ft, $D_{stratum}$ _______ (If depth is unknown assume it to be 1.5 times the depth of the pit.)
—Height of Water Level Above Impermeable Stratum, ft, H _____ ($H = D_{stratum} - D_{water}$)
—Length of Time Interval, T, in minutes _____

3. At the interval chosen, record the following data in the table below:

—Time of Measurement, t_n, minutes
—Depth of Water Level Below Reference Level, d_n, inches
—Water Surface Dimensions, ft: l,w

4. Calculate the following values and enter in the table below:

—Water Surface Area, ft2, An
—Water level Risem h_{rise} (Subtract current value of d_n from previous value)
—Ave. Water Surface Area, ft2, A_{av} (Take average of An and previous An)
—Ave. Height of Water Level Above Impermeable Stratum, ft, h (Take ave. of d_n and previous value of d_n, convert to ft., and subtract from $D_{stratum}$)
—Permeability, in/hr, K_a (Calculate using formula): $K_a = [h_{rise}/T] \times [A_{av}. /2.27 (H^2 - h^2)] \times 60$ min/hr

t_n	d_n (in.)	l, w (ft^2)	A_n, (ft^2)	h_{rise} (in)	A_{ay} (ft^2)	H (ft)	K_a
t_0				XXXX	XXXX	XXXX	XXXX
T_1							
T_2							
T_3							
T_4							
T_0				XXXX	XXXX	XXXX	XXXX
T_1							
T_2							
T_3							
T_4							
T_0				XXXX	XXXX	XXXX	XXXX
T_1							
T_2							
T_3							
T_4							

5. Record the Following Data:

—Final Depth of Pit, D_{pit}, ft _____
—Depth to Impermeable Stratum, ft, $D_{stratum}$ _______ (If no impermeable stratum is encountered assume $D_{stratum} = D_{pit}$)
—Height of Standpipe Above Reference Level, ft, h_{pipe} ____
—Depth to Water Level after 24 hr. Stabilization Period, ft, D_{water} ____ (Take measurement from top of standpipe. Subtract h_{pipe})
—Height of Static Water Level Above Impermeable Stratum, ft, H ____ ($H = D_{stratum} - D_{water}$)
—Average Height of Water Level Above Impermeable Stratum, ft, h ___ (Take average of d_n from beginning and end of last time interval recorded in section 4, convert this to ft., subtract from $D_{stratum}$)

6. Re-calculation of K using data from section 5 above and from final time interval of section 4:

$K = [h_{rise}/t] \times [Aav/2.27(H_2 - h_2)] \times 60$ min/hr = [__/__] x [__/2.27 (____ - __)] x 60 min/hr = _____

7. I hereby certify that the information furnished on Form 3f of this application is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.

Signature of Site Evaluator Date

Signature of Professional Engineer License #

Form 3g
Basin Flooding Test Data
1. Test Number _____ Reference Soil Log _____ Date Tested
2. Depth of Pit, ft _____
3. Area of Pit, ft^2 _____
4. Description of Rock Substratum Within Test Zone:
Type of Rock
Name of Formation
Average Fracture Spacing
Type of Fractures (Check Appropriate Category):
____ Open (Wide), Clean—Width of Openings, mm ____
____ Open (Wide), Infilled with Fines—Width of Openings, mm ___
____ Tight (Closed)
Orientation of Fractures:
____ Horizontal (Parallel to Pit Bottom) Or Nearly So
____ Inclined
____ Vertical (Parallel to Sides of Pit) Or Nearly So
Hardness of Rock:
____ Rippable with Hand Tools
____ Not Rippable with Hand Tools, Rippable by Machine
____ Not Rippable by Machine, Explosives Used
5. Time of First Basin Flooding _____
Volume of Water Added, Gal. _____
6. Result of First Basin Flooding:
____ Basin Drained within 24 Hrs.—Indicate Time ____
____ Basin Not Drained within 24 Hrs.
7. Time of Second Basin Flooding ____
Volume of Water Added, Gal. ____
8. Result of Second Basin Flooding:
___ Basin Drained within 24 Hrs.—Indicate Time __
___ Basin Not Drained within 24 Hrs.
9. I hereby certify that the information furnished on Form 3g of this application is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.
Signature of Site Evaluator Date
Signature of Professional Engineer License #

Form 4
General Design Data
1. Volume of Sanitary Sewage, gal. ____
___ Residential: No. of Dwelling Units ___ Total No. of Bedrooms
___ Commercial/Institutional — Indicate type of establishment and show method of calculation. If estimate is based on water meter data, indicate source of data, frequency of readings, average daily flow, and maximum recorded daily reading
2. Alterations or Repairs
a) Reason for Alteration or Repair (Check appropriate categories):
___ Expansion or Change in Use ___ Upgrade Existing Facilities
___ Correct Malfunctioning System ___ OtherSpecify _____
b) Describe Nature of Alteration or Repairs:
3. System Components:
a) Grease Trap Capacity, gals ____
Show Calculation Used: _____
b) Septic Tank Capacities, gals: ___ First (Single) Compartment Second Compartment
Third Compartment
c) Effluent Distribution
Method: ___ Gravity Flow ___ Gravity Dosing ___ Pressure Dosing
Dosing Device: ___ Pump ___ Siphon
d) Dosing Tank Capacities, gals: Total Capacity ___ Dose Volume (V_d) ___ Reserve Capacity _____
e) Laterals: Number ___ Total Length ___ Pipe Diameter___ Spacing _
f) Connecting Pipe: Diameter____ Length __
g) Manifold: Diameter____ Length __
h) Disposal Field: Type of Installation ___
Design Permeability (Percolation Rate) ___
Trenches: Width ____ Total Length ____ Bed: Area _
i) Seepage Pits: Design Percolation Rate ___
Number of Pits ____ Total Percolating Area Provided _
4. Attachments (Check items included):
___ General Plan of System Showing Location of All System Components
___ X-Sections of Each System Component Including Grease Trap, Septic Tank, Dosing Tank, Disposal Field, Seepage Pits and Interceptor Drains
___ Pump Performance Curve
___ Other—Specify
5. I hereby certify that the information furnished on Form 4 of this application (and attachments thereto) is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.
Signature of Professional Engineer Date

Form 5
Design of Pressure Dosing System
1. Configuration of Distribution Network:
Type of Manifold: ___ End ___ Central
Distribution Laterals: Number ___ Length, ft ___ , Diameter, ins _____, Total Lateral Volume (V_l), gals
Hole Diameter, ins ___ Hole Spacing, ins _______
Number of laterals, n
2. Lateral Discharge Rate:
Design Pressure Head at Distal End of Laterals (H_p), ft ______
Hole Discharge Rate, gpm ______
Number of Holes per Lateral, n ________
Lateral Discharge Rate, gpm ______
3. Manifold Length, ft ___ Manifold Diameter, ins _____, Total Manifold Volume (V_m) ______
4. System Discharge Rate, gpm ______
5. Dose Volume:
Daily Volume of Sewage (Q), gpd_____
Design Permeability, in/hr ____or Percolation Rate, min/in _____
Total Volume of Delivery Pipe (V_p) _____
Internal Volume of Distribution Network (V), ($V_p + V_m + V_l$)_____
Dose Volume (V_d) _____
6a. Pump Selection:
Length of Delivery Pipe _____, Diameter of Delivery Pipe ___
Friction Loss in Delivery Pipe (H_f), ft _____
Elevation of Dosing Tank Low Water Level _____
Elevation of Lateral Invert _____
Elevation Head (H_e), ft _____
Total Operating Head (H_t), ($H_p + H_f + H_e$), ft _
Pump Model ___ Rated Horsepower _
Pump Discharge Rate at Total Operating Head, gpm _____
6b. Siphon Elevation:
Diameter of Delivery Pipe _____ Length of Delivery Pipe _____
Friction Loss in Delivery Pipe (H_f), ft _____
Velocity Head (H_v), ft ______
Total Operating Head (H_t), ($H_p + H_f + H_v$), ft _____
Elevation of Lateral Invert _____
Elevation of Siphon Invert ______
7. I hereby certify that the information furnished on Form 4 of this application (and attachments thereto) is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.
Signature of Professional Engineer Date

Standard Forms For Certificate Of Compliance
County/Municipality of
INSTRUCTIONS: Part A is to be completely filled in for all Certifications. Only Part B or Part C will be completed. Part B will be completed if the administrative authority relies upon the certification signed and sealed by a New Jersey licensed professional engineer that the system has been located, constructed, installed or altered in compliance with the requirements of N.J.A.C. 7:9A-1 and the Application to Construct/Alter/Repair an Individual Subsurface Sewage Disposal System which was approved by the administrative authority. Part C will be completed if the administrative authority performs the certification.

Part A — General Information
1. Permitted Activities (Check applicable categories):
Permit Number __
___ New Construction
___ Alteration/No Expansion or Change of Use
___ Alteration/Expansion or Change in Use
___ Alteration/Malfunctioning System
___ Deviation from Standards
___ Repairs to Existing System
2. Location of Project:
Municipality _____ Lot ____ Block
Street Address
3. Name and Present Adress of Applicant:
Applicant's Phone Number ____

Part B—Professional Engineers Certification
I certify under penalty of law that the subsurface sewage disposal system identified in Part A has been located, constructed, installed or altered in compliance with the requirements of N.J.A.C. 7:9A-1 and the Application to Construct/Alter/Repair an Individual Subsurface Sewage Disposal System which was approved by the administrative authority. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

(Signature)
SEAL

Name (Type or Print), License #
Date:

Part C—Certification by Administrative Authority
I certify under penalty of law that the subsurface sewage disposal system identified in Part A has been located, constructed, installed or altered in compliance with the requirements of N.J.A.C. 7:9A-1 and the Application to Construct/Alter/Repair an Individual Subsurface Sewage Disposal System which was approved by the administrative authority. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Authorized Signature Type of License Held

Name (Typed or Printed) License Number

Date

For Agency Use Only
Date Received:
Form Determined To Be: ___ Complete ___ Incomplete
Date Returned
Date Received
Date Certification Approved:
Authorized Signature:

APPENDIX C UNIFORM PLACEMENT OF PERCOLATION TESTS

Uniform Placement of Percolation Tests

N.J.A.C. 7:9A-6.1(e)7 of these standards requires that percolation tests be spaced uniformly within the area of the disposal field. Acceptable patterns or arrangements for percolation test placement depend upon the size and shape of the disposal field as outlined below. Patterns other than those provided below may be approved provided that it is determined by the Administrative Authority that the test results submitted are representative of the soil conditions throughout the entire area of the disposal field.

Definitions

The following words and terms shall have the following meanings when used within Appendix B of this chapter:

"Center" means the intersection of the two disposal field diagonals.

"Diagonal" means a line connecting opposite corners of the disposal field.

"Elongated disposal field" means a disposal field with a length/width ratio of 3.0-5.0.

"End" means one of the two shorter sides in a disposal field which has a length/width ratio not equal to 1.0.

"Length" means the longest dimension of the disposal field, or the distance between the ends of the disposal field.

"Long axis" means a line connecting the midpoints of the disposal field ends.

"Rectangular disposal field" means a disposal field with a length/width ratio of 1.5-3.0.

"Side" means one of the two longer sides of a disposal field which has a length/width ratio not equal to 1.0.

"Square disposal field" means a disposal field with a length/width ratio of 1.0-1.5.

"Very elongated disposal field" means a disposal field with a length/width ratio greater than 5.0.

"Width" means the shortest dimension of the disposal field, or the distance between the sides of the disposal field.

A. When the disposal field is less than 1500 square feet, a minimum of two percolation tests are required and the following arrangements are acceptable:

All Disposal Field Shapes

1. Both tests spaced along the long axis of the field, the minimum distance between tests one third of the length of the field.

2. Both tests spaced along the diagonal of the field, the minimum distance between tests one third the length of the diagonal.

B. When the disposal field size is 1500 to 3000 square feet, a minimum of three percolation tests are required and the following arrangements are acceptable:

All Disposal Field Shapes

1. All tests spaced evenly along the diagonal of the field, the minimum distance between tests one quarter the length of the diagonal.

2. One test near the midpoint of a side, one test near each of the two opposite corners.

Field Shape Rectangular to Very Elongated (L/W > 1.5)

3. All three tests spaced evenly along the long axis; minimum distance between tests one quarter the length of the disposal field.

C. When the disposal field size is 3000 to 4500 square feet, a minimum of four percolation tests are required and the following arrangements are acceptable:

Field Shape Square to Rectangular (L/W = 1.0 - 3.0)

1. One test near the midpoint of each of the sides and ends.

2. One test near each of the four corners.

All Field Shapes

3. A zig-zag pattern with tests placed at points along one side which are approximately zero thirds and two thirds the distance from end to end, and along the opposite side at points which are approximately one third and three thirds the distance from end to end.

Field Shape Elongated to Very Elongated (L/W > 3.0)

4. All tests spaced evenly along the long axis of the field, the minimum distance between tests one fifth the length of the field.

5. All tests spaced evenly along the diagonal of the field, the minimum distance between tests one fifth the length of the diagonals.

D. When the disposal field size exceeds 4500 square feet, a minimum of five percolation tests are required and the following arrangements are acceptable:

Square Fields

1. One test near the midpoints of each of the sides and ends, one test near the center of the field.

Field Shape Square to Rectangular (L/W = 1.0 - 3.0)

2. One test near each corner of the field, one test near the center of the field.

All Field Shapes

3. A zig-zag pattern with tests placed at points along one side which are approximately zero fourths, two fourths and four fourths the distance from end to end, and along the opposite side at points which are approximately one fourth and three fourths the distance from end to end.

Field Shape Elongated to Very Elongated (L/W > 3.0)

4. All tests spaced evenly along the long axis of the field, the minimum distance between tests one sixth the length of the field.

5. All tests spaced evenly along the diagonal of the field, the minimum distance between tests one sixth the length of the diagonal.

Uniform Placement of Percolation Tests—Figures

(a) Square Disposal Fields, L/W = 1.0 - 1.5

(b) Rectangular Disposal Fields, L/W = 1.5 - 3.0

(c) Elongated Disposal Fields, L/W = 3.0 - 5.0

(d) Very Elongated Disposal Fields, L/W > 5

A. Disposal Field Size Up To 1500 Square Ft.— Minimum of 2 Percolation Tests Required

B. Disposal Field Size 1500-3000 Square Ft.— Minimum of 3 Percolation Tests Required

The figures are not included in this document, but if they are required, please refer to the official version of the regulation. It is typically sufficient to distribute the sample points in a uniform manner.

APPENDIX D SOIL SUITABILITY CLASSIFICATION OF NEW JERSEY SOILS

Explanation of the Soil Suitability Classification System

The suitability of soil for onsite disposal of sanitary wastewater by means of individual subsurface sewage disposal systems is classified based upon the type and depth of soil limiting zones as outlined below. Definitions and criteria for recognition of soil limiting zones are provided in Subchapters 2 and 5 of this chapter.

Type of Limiting Zone	Depth, ft.	Suitability Class
Fractured Rock or Excessively Coarse Substrata	>5 0-5	I, IISc
Massive Rock or Hydraulically Restrictive Substrata	>9 4-9 0-4	I IISr IIISr
Hydraulically Restrictive Horizon, Permeable Substratum	>9 4-9 0-4	I IIHr IIIHr
Excessively Coarse Horizon	>5 0-5	I IIHc
Zone of Saturation, Regional	>5 2-5 0-2	I IIWr IIIWr
Zone of Saturation, Perched	>5 2-5 0-2	I IIWp IIIWp

The soil suitability classification consists of a Roman numeral from I to III which is indicative of the severity of the limitation and a letter symbol which indicates the type of limiting zone. (In general the limitation is considered more severe when the limiting zone occurs at a shallower depth in or below the soil profile). Where more than one type of limiting zone is present, the primary classification of the soil is based upon whichever limiting zone(s) presents the most severe limitation (highest numerical symbol). Secondary limitations are given based upon limitations which are less severe (lower numerical symbols). The primary classification is stated first, followed by secondary classifications in parentheses. For example, the classification for a soil with a seasonally high water table (top of a regional zone of saturation) at a depth of 1.5 feet and a massive rock substratum at a depth of 7 feet would be IIIWr(IISr).

Where two or more limiting zones are present with the same degree of limitation, a compound symbol is used in primary or secondary classifications, consisting of a Roman numeral showing the degree of limitation together with a letter symbol for each type of limited zone. For example, the classification for a soil with a seasonally high water table at a depth 2.5 feet and a fractured rock substratum at a depth of 3 feet would be IIWrSc.

Soil Suitability Classes of New Jersey Soil Series

The type of standard septic system installation, if any, which can be approved on a specific site depends upon the soil suitability class which must be determined based upon detailed onsite soil evaluation. Such evaluation is costly and would normally not be performed prior to the purchase of land or the granting of preliminary or conceptual approvals for large tracts of land which are to be subdivided for residential or commercial development. In these or other situations where more general information regarding soil suitability is required, preliminary determinations may be made based upon information contained in the county soil surveys which are published by the U.S.D.A.—Soil Conservation Service in cooperation with the N.J. Agricultural Experiment Station and Cook College of Rutgers, The State University. These soil surveys contain descriptions of the various soil series which occur in New Jersey together with maps showing the geographic distribution of the soils. At present, published soil surveys or preliminary field maps are available for every county in the state with the exception of Essex and Hudson.

A soil series is a group of similar soil types having major horizons which are similar in thickness, arrangement and other important characteristics. The soil suitability classes provided for each New Jersey soil series listed below are based primarily upon the soil profile descriptions given in the soil survey reports.

Soil series may be divided into one or more soil phases which differ in the texture of the surface horizon, stoniness or some other property. Although soil phase differences may affect design and construction requirements, they are generally not a factor in determination of the soil suitability class given for a particular soil series. In some cases a soil series may have one or more variants which may differ significantly with respect to the types or depths of soil limiting zones. In such cases each variant is treated as a separate soil type with respect to the classification.

Each soil series is characterized by a range of soil profile characteristics so that two or more soil suitability classes may be possible for a given soil series. The soil suitability classes given below are those which are considered most typical for a given soil series. Other soil suitability classes are possible depending upon conditions which may vary from location to location.

Soil survey maps delineate the boundaries of soil mapping units in which a specific soil series, soil phase, soil complex, association or other grouping is predominant. Within every soil mapping unit however, there may be areas of dissimilar soils which are too small and scattered or otherwise impractical to show at the scale of mapping used. For this reason, use of the soil survey is not a substitute for onsite soil evaluation when detailed information for a specific site is required.

Many soil series in the coastal plain region of southern New Jersey are underlain by stratified sedimentary formations which consist of layers of contrasting grain size. In some cases layers of highly permeable sand and gravel may alternate with hydraulically restrictive layers of silt and clay. Where hydraulically restrictive layers occur at depths less than nine feet they will be a determining factor for the soil suitability classification. The presence of such layers below a depth of five feet however, is generally not indicated in the soil survey reports and therefore may not be reflected in the soil suitability classes given here. As a result, coastal plain soils series which are classified as having no limitation (Roman numeral I) with respect to hydraulically restrictive horizons and substrata may in some locations have IIHr or IISr limitations. In other cases, soil series which are assigned classifications of IISr or IIISr may in some locations have permeable substrata at depths below the extent of soil survey data such that a classification of IIHr or IIIHr may be appropriate.

In the northern portion of the state many soil series are described as having bedrock substrata at shallow depths below the soil profile. Soil survey reports generally do not provide information relative to the permeability of these rock substrata. Rock substrata underlying soil profiles of the same soil series may often range from excessively permeable to relatively impermeable. Soil suitability classes are given to represent those conditions which are considered most typical for a soil series. In many cases, however, soil series which are given classes of I or IISc may in some locations have the more severe limitations associated with classes IISr or IIISr. Classifications of rock substrata given here must be regarded as preliminary in nature and may be subject to modification based upon detailed onsite evaluation and testing.

Soil Series (Variant) Name	Typical Classification(s)
Abbottstown	IIIHR, Wp(IIISc); IISr, Wp(IIISc)
Adelphia	IIWr
Adelphia Clayey Substratum	IIISr(IIWr)
Adelphia Glauconitic Varian	IIISr(IIWr)
Adelphia Truncate	IIIWr
Adrian	IIIWr
Albia	IIIHr,Wp; IIISr,Wp
Amwell	IIIHr,Wp; IIIHr,Wp(IISr)
Amwell Rock Substratum	IIIHr,Wp; IIIHr,Wp(IIsr)

Annandale	IIIHr
Arendtsvillee	I; IISc
Atherton	IIIWr
Athol	I
Atsion	IIIWr
Atsion Tide Flooded	IIIWr
Aura	I; IIHr
Aura Moderately Fir	I; IIHr
Aura Ironstone Varian	I; IIHr
Barclay	IIWr; IIIWr
Bartle	IIIHr(IIWp)
Bat	IIIHr(IIWpSc)
Bath Ston	IIIHr(IIWpSc)
Baybor	IIISrWr
Bayboro Ponde	IIISrWr
Bedingto	IISc
Berk	IISc
Berrylan	IIIWr
Berryland Floode	IIIWr
Berryland Freq. Floode	IIIWr
Berryland Heavy Subsoil Var.	IIIWr
Bertie	IIIWr
Bib	IIIWr
Biddeford	IIISrWr
Birdsbor	I; IIWr; IISc; IIWrSc
Birdsboro Gravelly Solum Var.	I
Birdsboro Sandy Subsoil Var.	IISc
Boonton	IIIHrWp; IIISrWp
Bowmansville	IIIWr
Braceville	IIIHrWp
Bucks	IISc; IISr
Califon	IIIHrWp
Califon Friable Subsoil Var.	IIIWr
Carisle Muc	IIIWr
Chalfon	IIISrWp
Chenango	IISc
Chillum	I; ISc; IIISr
Chippewa	IIISrWr
Cokesbury	IIIHrWp
Colemantown	IIIHrWp
Collington	I
Colonie	I
Colts Neck	I, IIHr
Croton	IIISrWp; IIISrWr
Donlonton	IIIHrWr
Downer	I
Downer Clayey Substratum	I
Downer Gravelly Substratum	I; IISc

Downer Loamy Substratum	I
Downer Truncated	I
Doylestown	IIISrWr
Dragstown	IIIWr; IIWr
Duffield	I; IISr
Duffield Very Rock	IISr
Dunellen	I
Dunellen Mod. Well Drained Var.	IIIWr
Edneyville	I;IISc
Elkton	IIISrWr
Ellington Loamy Subsoil Var.;	IISrWpWr, IIISrWpWr
Evesboro	I
Evesboro Clayey Substratum	IIISr; IIIHr
Evesboro Sandy Loam Subsoil Var.	I
Fallsington	IIIWr
Fallsington Clayey Substratum	IIIHr
Fallsington Var.	IIIHrWrWp
Fort Mott	I
Fredon	IIIWr
Freehold	I
Freehold Clayey Substratum	IIISr
Fripp	I
Galestown	I
Galestown Clayey Substratum	IISr
Haledon	IIIHrWp
Haledon Wet Var.	IIIHrWpWr
Halsey	IIIWr; IIIWr(IISc)
Hammonton	IIWr;
Hammonton Clayey Substratum	IIISr(IIWrWp); IIIHr(IIWrWp)
Hazen	I; IISc
Hazleton	IISc
Hero	IIScWr; IIWr
Hibernia	IIIHrWp
Holmdel	IIIWr; IIWr
Holmdel Clayey Substratum	IIISrWr
Holyoke Rock	IISc; IIISr
Hoosic	I; IISc
Howell	IIWr; IIIWr
Keansburg	IIIWr
Keyport	IIISr(IIWp)
Klej	IIWr; IIIWr
Klej Clayey Substratum	IIISrWr; IIISr(IIWr)
Klej Loamy Substratum	IIISrWr; IIISr(IIWr)
Klinesvillee Shal	IISc; IISr
Kresson	IIIHrWp(IIWr)
Lakehurst	IIWr; IIIWr
Lakehurst Clayey Substratum	IIISrWrWp; IIISr(IIWrWp)
Lakehurst Loamy Substratum	IIWr; IIIWr

Lakehurst Thick Surface	IIWr; IIIWr
Lakeland	I
Lakeland Firm Substratum	I
Lakeland Water Tabl	IIWr
Lakewood	I
Lakewood Loamy Substratum	I
Lakewood Thick Surface	I
Lamington	IIIHrWpWr
Lansdale	IISc
Lansdown	IIIHrWp(IISc): IIIHrWp(IISr)
Lansdowne Var.	IIIHrWp(IISc); IIISrWp
Lawrenceville	IIISrWp; IIIHrWp
Legore	I; IISr
Lehigh	IIISrWp; IIIHrWp(IISc)
Lenoir	IIISrWr
Leon	IIIWr
Livingston	IIISrWr
Lyons	IIIWr; IIISrWr; IIISrWr(IISc)
Manahawkin	IIIWr;
Marlton	IIIHr(IIWp); IIIHr
Matapeake	IIISr(IIWp); IISrWp: I
Matapeake Thin Solum	I
Matawan	IIWr; IIIHrWp(IIWr)
Mattapex	IIISr(IIWr); IIWr
Mattapex Clayey Substratum	IIISrWr
Mattapex Glauconitic Substratum	IIWr
Meckesville	IIIHr(IIWp)
Middlebury	IIIWr
Minoa	IIIWr
Mount Lucas	IIIWp(IISr)
Mullica	IIIWr
Mullica Loamy Substratum	IIIWr
Nassau	IIISr; IISc
Neshaminy	IISr
Neshaminy Fragipan Var.	IIISrWp; IIIHrWP
Netcong	I
Nixon	I
Nexin Va	IIWr; IIIWr
Nixonton	IIIWr
Norto	IIIHr
Norwich	IIIHrWr
Oquaga	IISc; IIISr(IISc)
Othello	IIIWr
Otisville	IISc
Palmyra	IISc
Parkeer	IISc
Parker Rock	IISc
Parsippany	IIHrWr; IIISrWr

Parsippany Sandy Loam Substratum	IIIHrWr
Parsippany Var.	IIISrWr
Pasquotank	IIIWr
Pattenburg	IISc
Pattenburg Moderately Wet	IIScWr; IIIWr(IISc)
Pemberton	IIWr; IIIWr
Pemberton Thick Surface	IIWr;IIIWr
Penn	IISc; IIISr
Penn Shal	IISc; IIISr
Phalanx	IISc
Plummer	IIIWr
Plummer Very We	IIIWr
Pocomoke	IIIWr
Pompton	IIIWr; IIIWr(IISc)
Pope	I; IISc
Portsmouth	IIIWr
Preakness	IIIWr
Preakness Dark Surface Var.	IIIWr
Quakertown	IISc; I
Quakertown Channery	IISc
Raritan	IIIHrWp; IIIHrWp(IISc); IIIHrWp(IISr)
Raynham	IIIWr
Readington	IIIHrWp(IISc); IIWpSrSc; IIWrSc
Reaville	IIISrWp(IIHc)
Reavillee Deep Var.	IIISrWp(IIHc)
Reavillee Wet Var.	IIISrWp(IIHc)
Ridgebury	IIIHrWp
Riverheaf	I; IISc
Riverhead Neutral Var.	I; IISc
Rockaway	IIIHrWp
Rowland	IIIWr
Royce	IISc
Sassafra s	I
Sassafras Clayey Substratum	IIISr; IISr; IIIHr; IIHr
Sassafras Water Tabl	IIWr
Shrewsbury	IIIWr
Shrewsbury Clayey Substratum	IIIWrSr
Shrewsbury Ironstone Var.	IIIWrHr
Shrewsbury Truncate	IIIWr
Sloan	IIIWr
Steinsburg	IISc
St. Johns	IIIWr
St. Johns Clayey Substratum	IIIWrSr
Swartswood	IIIHrWp
Tinton	I
Tinton Thick Surfac	I;
Tioga	I; IIWr; IIWrSc; IISc
Turbotville	IIIHrWp

Unadilla	I
Valois	I
Venango	IIIHrWp; IIISrWp
Wallkill	IIIWr
Washington	I; IISc
Wassaic	IISc; IIISr
Wassaic Rock	IISc; IIISr
Watchung	IIIHrWpWr
Wayland	IIIWr; IIIWrSr
Weeksville	IIIWr
Westphalia	I
Whippany	IIISrWp;
Whippany Sandy Loan Substratum	IIIHrWp
Whitman	IIIHrWp
Woodmansie	I
Woodmansie Firm Substratum	I
Woodmansie Loamy Substratum	I
Woodstown	IIIWr; IIWr
Woodstown Clayey Substratum	IIIWrSr; IIIWr(IISr); IIWrSr;
Woodstown Loamy Substratum	IIIWr; IIWr
Wooster	IISc; I
Wurtsboro	IIIHrWp; IIIHrWp(IISc)

Following is a listing of miscellaneous mapping unit designations which do not consist of any one specific soil series or soil series variant. In general these mapping units cannot be assigned a soil suitability class due to extreme variability or a lack of data. The type of limitations which are generally associated with these mapping units are indicated below:

Mapping Unit Designation	Type(s) of Limitations
Alluvial Land (Various Modifying Terms)	Flooding, Wetland
Clayey Land-Keyport Material	Hydraulically Restrictive Substrata
Clayey Land-Marlton Material	Hydraulically Restrictive Substrata
Clay Pit	Disturbed Ground, Hydraulically Restrictive Substrata
Coastal Beach	Dunes, Excessively Coarse Substrata
Cut and Fill Land	Disturbed Ground
Dune Land	Dunes, Excessively Course Substrata
Fill Land (Various Modifying Terms)	Disturbed Ground
Fluvaquent	Flooding
Fresh Water Mars	Wetland
Gravel Pit	Disturbed Ground, Excessively Coarse Substrata
Humaquept	Wetland
Made Land (Various Modifying Terms)	Disturbed Ground
Marsh (Various Modifying Terms)	Wetland
Mine Dump	Disturbed Ground
Muck (Various Modifying Terms)	Wetland
Peat (Various Modifying Terms)	Wetland

Pits (Various Modifying Terms)	Disturbed Ground
Psamment	Dunes, Excessively Coarse Substrata
Quarrie	Disturbed Ground
Rock Land-Edneyville Material	Rock Outcrops, Excessively Coarse Substrata
Rock Outcrop	Rock Outcrops
Rough Broken Land	Excessively Stony
Sand Pits	Disturbed Ground, Excessively Coarse Substrata
Sandy Land	Excessively Coarse Substrata
Steep Stony Land Parker Materia	Slope, Excessively Stony
Sulphaquent	Wetland
Sulphihemist	Wetland
Swamp	Wetland
Tidal Marsh	Wetland
Urban Land	Disturbed Ground