

Section III ~

Natural Resource Vulnerability



East Main Hill Farm

*"In the end, our society will be defined not only by what we create,
but by what we refuse to destroy."*

~ John Sawhill, Nature Conservancy President, 1990-2000 ~

Natural Resource Vulnerability

Environmental Indicators~

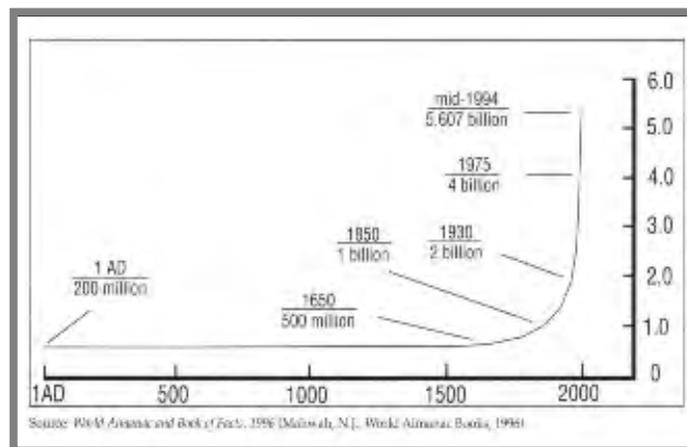
Environmental indicators are direct or indirect measures of environmental quality that are used to assess the status and trends of environmental conditions. These trends may refer to causes, pressures, or stressors resulting from human or natural processes that are affecting the environment; the state or condition of resources; and societal responses or efforts to mitigate environmental stresses (NJDEP, 1998).

The following section provides an overview of the trends (e.g., demographic, land use, impervious cover) that may be negatively impacting the significant natural resources identified in Part II of the Clinton Township Natural Resources Inventory. This section also involves use of the Geographic Information System (GIS) to further identify natural resource vulnerability. This process (“overlay analysis”) involves placing specific resource maps (or “GIS coverages”) over other resource maps to identify the areas in Clinton Township that are most vulnerable to environmental impact.

Population Trends~

There are many factors that present a risk to worldwide resources. Consider the following population information graph illustrating the most important trend that directly and indirectly affects the extent and the quality of our natural resources.

The illustration below shows an unprecedented, exponential growth in worldwide population between 1900 and 1960. Similar trends have taken place throughout the northeastern United States. In the past several decades we have witnessed severe, negative impacts on our natural resources due to exponential population growth, socioeconomic, and development trends.



Source: *Population Trends, Living In the Environment*, Miller, 1987.

County Population Trends~

Hunterdon County has experienced substantial population growth since the 1960s, which has led to changes in land use patterns. Demographic information obtained from the United States Census and the Hunterdon County Planning Board shows that between 1960 and 1990 the county almost doubled in population. In fact, the county experienced the second highest population growth statewide. Between 1980 and 1990, the County experienced a 24% population growth and population densities increased from 203 to 251 persons per square mile (Hunterdon County Planning Board, 1993). More recent countywide population (Hunterdon County Planning Board, 2001) trends are presented below, and indicate 14, 213 additional people in Hunterdon County between 1990 and 2000 (13% growth), or 33 additional people per square mile:

Table 14, Hunterdon County Population Trends

| | 1980 | 1990 | 2000 |
|-------------------|-------------|-------------|-------------|
| Population | 87, 361 | 107, 776 | 121, 989 |
| Density | 203 | 251 | 284 |

Source: Hunterdon County Planning Board, 1993 & Kyle, 2001.

Countywide land use trends are also important environmental indicators. The 1992 Hunterdon County Tax Assessment Office records indicated that of the total area, fifty-nine percent (59%) of the land use in the county was still agricultural, followed by residential (22%), vacant (open space) (9%), exempt (7%), commercial (2%), and industrial (1%).

The New Jersey Land Use Study (Rutgers & NJDEP, 1972, 1984, 1995) indicates that Hunterdon County experienced a 5% increase in land area development (excluding water) between 1984 and 1995. By 1995, Hunterdon County was 22% developed. The same study indicates the following land cover losses experienced in three general categories between 1984 and 1995.

- **Cultivated Grass-** Loss of 9,315 acres
- **Upland Forests-** Loss 2,400 acres
- **Wetland-** Loss of 870 acres

The study concludes that human-induced landscape change, primarily in the residential, commercial, and transportation categories, is the single most important factor influencing the state of land. Furthermore, the study states that the most significant impacts of both suburban and urban growth are loss of fertile agricultural lands, loss and fragmentation of wildlife habitat, loss of wetlands, and an increase in impervious surface (e.g., parking lots, rooftops, and

roadways). The increase in impervious surface results in water quality degradation, flooding, and loss of open space for recreation, increased traffic, and loss of aesthetic quality to the landscape ((Rutgers & NJDEP, 1972, 1984, and 1995).

Clinton Township Population & Socio-Economic Trends~

Township-wide demographic information is an important component of natural resource planning. The table below shows a significant increase in population growth between 1960 and 2000. In fact population growth and population densities have more than tripled in the Township since 1960.

Table 15
Clinton Township, Historic Population Trends

| Year | Population | Population Density (persons per sq mile) |
|-------------|-------------------|---|
| 1960 | 3,770 | 125 |
| 1970 | 5,119 | 170 |
| 1980 | 7,345 | 244 |
| 1990 | 10,816 | 360 |
| 2000 | 12,957 | 430 |

Sources: The United States Census, Hunterdon County Planning Board, and Clinton Township Planning Board, 2000.

Other worthwhile socio-economic demographic data, as they relate to natural resource protections, are noteworthy. For instance, in 1990 the median household income in Clinton Township was \$67,918, while the median family income was \$75,605 (2000 median household income is not yet available). When compared with Hunterdon County figures, the median income levels are the highest in the entire county.

In addition, housing values, educational attainment, employment, and annual wage data are also higher than the county average (United States Census & Hunterdon County). This type of demographic information is helpful. It often correlates with the ability, understanding, and willingness of a population to contribute funding to open space and natural resource protection efforts.

Clinton Township Land Development Data~

In relation to natural resources, other land use-related indicators may also be used to determine development pressures placed upon the Township's significant natural resources. For example, the numbers of building permits issued are relevant indicators of growth and development.

Table 16, indicates that Clinton Township experienced an overall increase in building permits issued from 1991 to 2001. However the number of permits issued declined several times within the ten year period

The table also indicates that the highest number of permits was issued in 2001 (146 permits). On average, the number of permits issued during this time period ranks Clinton Township as third highest in permits issued compared with the surrounding municipalities. In terms of subdivisions approved between 1991 and 2000, Clinton Township approved 499 lots. According to the Hunterdon County Planning Board, one permit is given for each individual dwelling. The following table indicates the total number of building permits issued in Clinton Township in the last 10 years.

Table 16, Residential Building Permits Issued, Clinton Township 1991-2000

| Year | Number of Building Permits |
|-------------|-----------------------------------|
| 1991 | 46 |
| 1992 | 69 |
| 1993 | 120 |
| 1994 | 110 |
| 1995 | 125 |
| 1996 | 65 |
| 1997 | 108 |
| 1998 | 70 |
| 1999 | 119 |
| 2000 | 91 |
| 2001* | 146 |

Source: Clinton Township Construction Department Records, 2001.

** As of December 12, 2001*

Community Design Trends, Land Use & Non-point Source Pollution~

An obvious consequence of population growth and the creation of more densely developed land is extreme pressure is placed on the region's limited natural resources. In addition, zoning and land development policies in the region, as well as consumer preferences regarding new housing, have favored large lot, single-family residential development. The region has also witnessed the separation of residential areas from commercial and industrial areas (e.g., zoning district), and an increased reliance upon automobiles and extensive transportation networks linking our neighborhoods to shopping, manufacturing, and office centers.

This development vision has transformed distinctive, compact, village-centered communities that are surrounded by open space to typically disconnected subdivisions, shopping centers, and office parks with limited amounts of open space. This development pattern is what some planners have called "planned sprawl" (Arendt, 1994). It is also a development pattern that often results in loss of habitat, intensive use of finite resources (e.g., water, energy), the need for additional and expensive infrastructure (See Map 17), and often results in increased point and nonpoint source pollution.

Point source pollution (an example is a pipe, channel, or ditch connected to a wastewater treatment plant) may be traced directly to a single point of discharge. However, nonpoint source pollution is now identified as the primary source of surface water and groundwater contamination in the nation. Nonpoint source pollution can be attributed to both agricultural and developed land. Agricultural land may contain residual and accumulated fertilizers, pesticides, sediment, herbicides, and animal wastes. When stormwater flows over the land, it transports these pollutants to our surface water resources. There are associated pollutants common to every type of land use including residential neighborhoods (e.g., lawn chemicals, septic effluent), office parks, shopping centers, manufacturing facilities (e.g., petroleum based hydrocarbons), and areas experiencing new development (e.g., sediment).



Round Valley Swimming Area, Clinton Township

The GIS land use/land cover information available from NJDEP (1995/97 LU/LC) for Clinton Township (Map 18) is based upon the United States Geological Services' Anderson Classification System (USGS, 1976). The land use classification system is a hierarchical system based on four digits representing one to four levels of classification. The Level I classification is general, Level II is descriptive, Level III is a more detailed description, and Level IV is the most detailed level of classification. Within the Level I series, include urban, agriculture, forest, water, wetlands, and barren lands. Within each Level I series are more detailed levels of classification. An example for a forestland code is as follows:

- ❖ 4--- Forestland
- ❖ 43-- Forestland, Mixed Deciduous / Coniferous
- ❖ 431- Forestland, Mixed Deciduous / Coniferous, Coniferous Prevalent (> 50% coniferous)
- ❖ 4311 Forestland, Mixed Deciduous / Coniferous, Coniferous Prevalent (> 50% coniferous) 10-50% Crown Closure

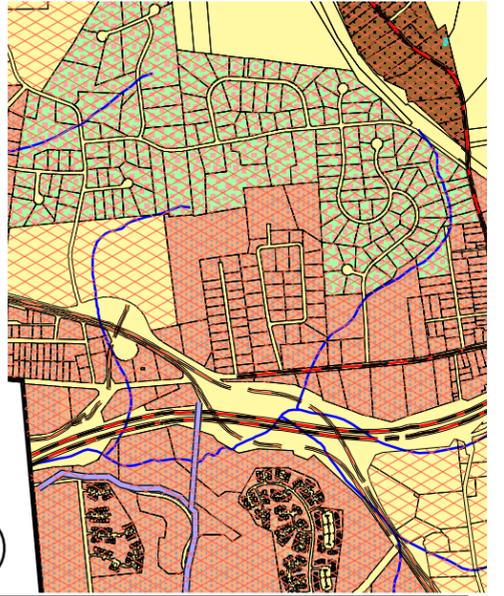
Using a Level I classification, the land use/land cover in Clinton Township is comprised of 38% agricultural land, 36% open space and recreational land, 18% residential land, 7% commercial land, and 1% industrial land. One way to determine pollution vulnerability is to assess the predominate land uses within the Township (e.g., urban & agricultural). One must then relate the predominant land use with the non-point source pollutants commonly associated with a particular type of development. The following two tables illustrate the non-point source pollutants associated with predominant land uses in Clinton Township, as well as the potential environmental impacts associated with particular pollutants:

Table 17, Predominant Land Uses & Non-Point Source Pollutants

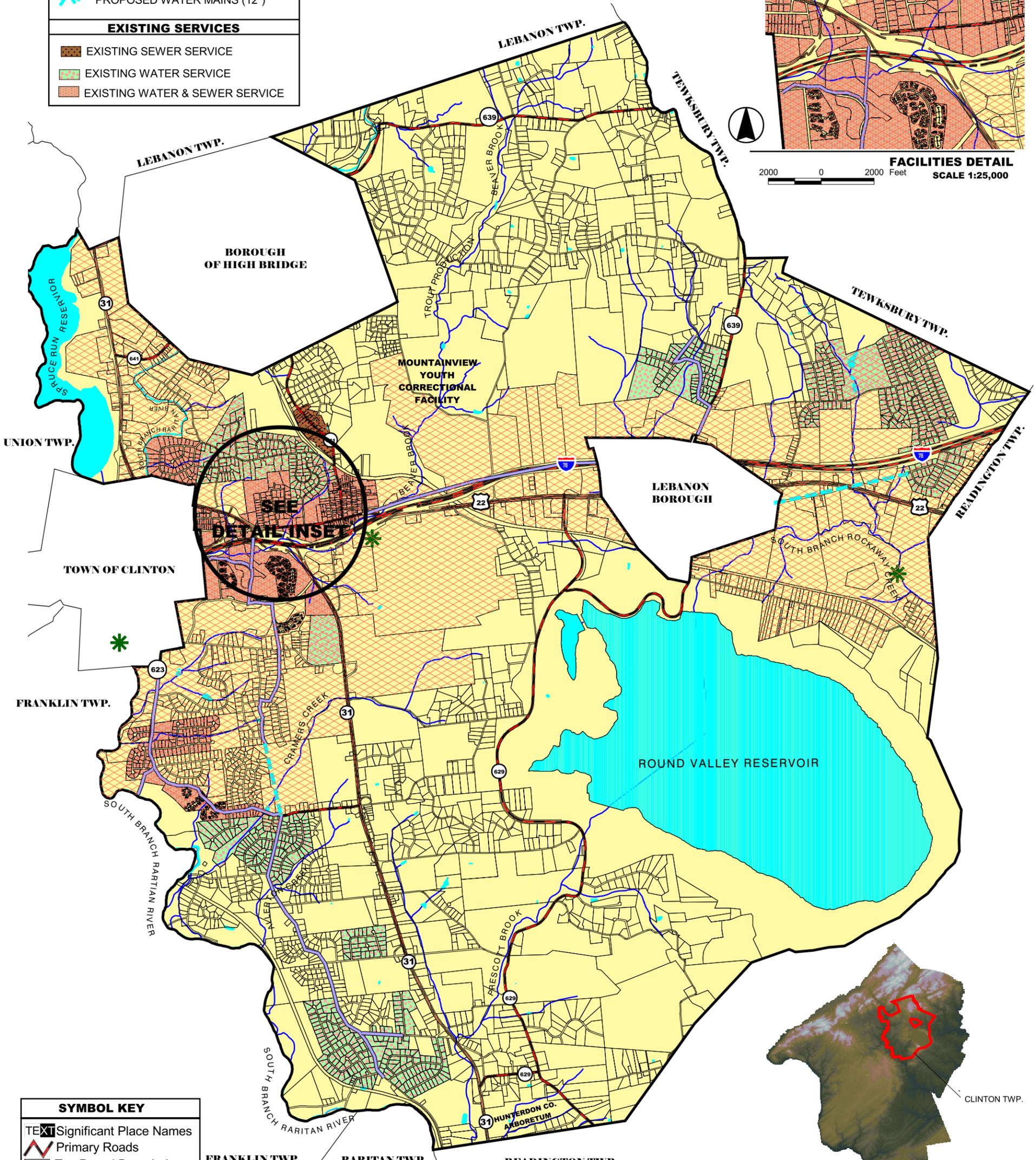
| Land Use/Land Cover | Percentage of Total Township Acreage | Associated Non-point Source Pollutants |
|---|--------------------------------------|--|
| Agricultural | 38 | Agricultural runoff comprised of soil particles, suspended solids, phosphorus & nitrogen from agricultural fertilizers, pathogens from animal waste, heavy metals and chemicals associated with pesticides and herbicides. |
| Open Space/Recreational | 36 | Runoff comprised of soil particles, suspended solids, phosphorus, and nitrogen associated with natural processes. Recreational runoff comprised of sediments, phosphorus & nitrogen associated with lawn care fertilizers, & heavy metals and chemicals associated with pesticides and herbicides. |
| Urban Land (Residential, commercial, industrial, transportation utilities) | 26 | Urban runoff comprised of soil particles, suspended solids, from new construction, phosphorus & nitrogen from lawn care fertilizers, pesticides from landscaping, heavy metals & salts from de-icing of roadways & leaking storage tanks, pathogens from failing septic tanks & sludge, thermal energy from hydrologic & habitat modification. |

Sources: NJDEP/USGS, 1997 & APA Report # 476, 1997.

| UTILITY LOCATIONS KEY | |
|-----------------------|--------------------------------|
| | PROPOSED TREATMENT PLANT |
| | PROPOSED SEWER SERVICE AREA |
| WATER MAINS | |
| | EXISTING WATER MAINS (12") |
| | PROPOSED WATER MAINS (12") |
| EXISTING SERVICES | |
| | EXISTING SEWER SERVICE |
| | EXISTING WATER SERVICE |
| | EXISTING WATER & SEWER SERVICE |



FACILITIES DETAIL
SCALE 1:25,000
2000 0 2000 Feet



**SEE
DETAIL INSET**

| SYMBOL KEY | |
|------------|-------------------------|
| | Significant Place Names |
| | Primary Roads |
| | Tax Parcel Boundaries |
| | Lakes |
| | Networked Streams |

HUNTERDON COUNTY
SCALE 1:800,000
30000 0 30000 Feet
Study Area

CLINTON TOWNSHIP, NRI, 2001

1000 0 1000 2000 3000 4000 Feet
SCALE 1:45,000
Map Projection: State Plane of New Jersey, NAD 83, Feet

Utility/ Services generated from map labeled, "Water and Sewer Utility Plan", 1992, prepared by Banisch Assoc., from Clinton Township Master Plan, Hunterdon County, New Jersey
Scale: 1:24,000
New Jersey, Department of Environmental Protection, GIS data
Web Site Downloads State Municipalities of New Jersey
Scale 1:100,000

NOTES:
1. DATA ACCURACY IS LIMITED TO THE ACCURACY AND SCALE OF THE ORIGINAL DATA SOURCES.
2. THESE MAPS ARE PART OF A RESOURCE INVENTORY CONDUCTED FOR CLINTON TOWNSHIP AND SHOULD BE USED IN CONJUNCTION WITH THE COMPILED TEXT.

MAP 17: WATER & SEWER UTILITIES MAP

DRAWN BY: KJM
CHECKED BY: CK, SF
Project No.: 215.01

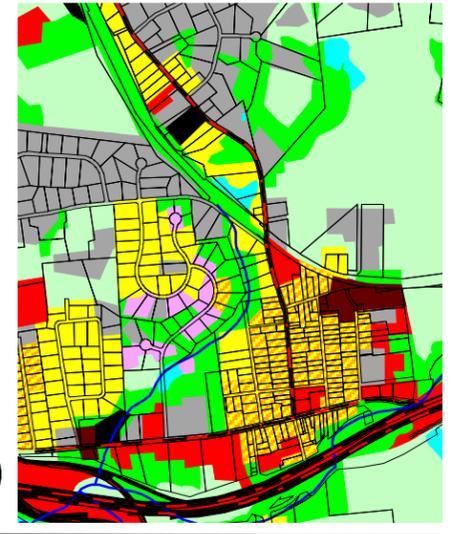


Table 18
Potential Impacts of Associated Pollutants

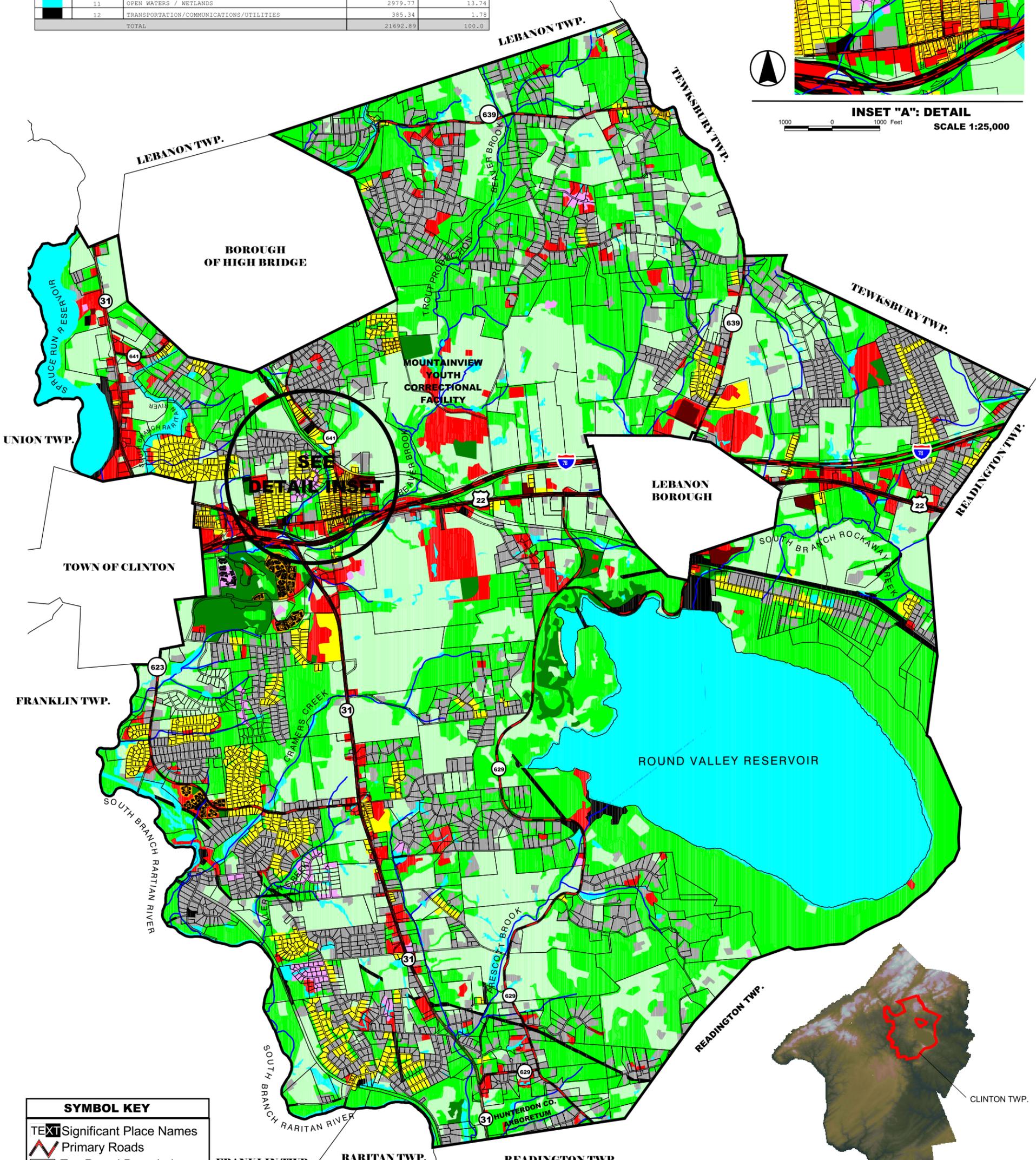
| Pollutants / Land Use | Impacts On Fisheries | Impacts On Water Supply | Impacts On Wetlands | Impacts On Recreation |
|--|---|--|--|---|
| Sedimentation <i>(Construction, Urban Runoff, Gravel Operations, Agriculture, Logging, Hydro modification)</i> | Decreases light transmissivity, food, cover, dissolved oxygen, spawning habitat, transports absorbed or adsorbed contaminants. | Damages water treatment pumps & equipment, increases treatment costs, reduces reservoir volume, toxic substances adhere to sediments, reduces well yields, and decreases river bottom infiltration. | Reduces flood capacity, increases peak discharges, and alters habitat. | Decreases water clarity (public health & safety), reduces aesthetic and recreational value, and reduces sport fishing populations. |
| Phosphorus & Nitrogen <i>(Urban Development, Gravel operations, Agriculture, Land disposal, Illegal waste disposal, animal waste)</i> | Promotes algae blooms, inhibits aquatic plant growth, favors survival of less desirable plant species and reduces dissolved oxygen levels. | Promotes algae blooms, increases treatment costs, increases nitrate concentrations (permitted levels). | Alters wetland plant community composition & habitat. | Promotes eutrophication of lakes & rivers, increases algae growth (public health & safety), decreases aesthetic value, degrades fishing and boating activities, reduces tourism and adjacent property values. |
| Thermal <i>(Construction, Mining & Gravel Operations, Logging, Agriculture, Urban Runoff, Hydrologic Modification, Habitat Modification)</i> | Reduces vigor, growth, resistance to disease, and dissolved oxygen. Changes cold-water fisheries to warm water fisheries. | Increase temperature thereby accelerating pump/equipment corrosion, promotes biological activity thus producing odors and poor taste, creates a more favorable environment for pathogens, and increases treatment costs. | May alter wetland vegetation & species composition. | May stimulate growth of algae and aquatic plants thereby reducing water clarity, aesthetic value, sports fishing population & tourism. |
| Salts <i>(Mining, Urban runoff, Construction, Road de-icing)</i> | Increases salt-tolerant species, creates stressful environment, destroys habitat and food source plants for some species, and alters species composition of affected areas. | Reduces drinking water quality and increases treatment costs. | Alters wetland plant community composition. Destroys habitat and food sources for wetland animals. | May cause skin and eye irritations. |

Sources: Adapted from Massachusetts DEP, 1990 & APA Report #476, 1997.

| KEY | LULC CODE | LULC LABEL DESCRIPTION | ACERAGE | PERCENTAGE |
|-----|-----------|--|----------|------------|
| | 0 | TRANSITIONAL AREAS | 102.93 | 0.47 |
| | 1 | PARKS, RECREATIONAL LANDS | 376.63 | 1.74 |
| | 2 | BEACHES | 3.40 | 0.02 |
| | 3 | COMMERCIAL/SERVICES | 1076.62 | 4.96 |
| | 4 | FORESTED LAND | 7405.46 | 34.14 |
| | 5 | INDUSTRIAL | 51.84 | 0.24 |
| | 6 | AGRICULTURAL / OPEN SPACE | 5332.75 | 24.58 |
| | 7 | RESIDENTIAL, HIGH DENSITY, MULTIPLE DWELLING | 61.47 | 0.28 |
| | 8 | RESIDENTIAL, RURAL, SINGLE UNIT | 3054.65 | 14.08 |
| | 9 | RESIDENTIAL, SINGLE UNIT, LOW DENSITY | 773.57 | 3.57 |
| | 10 | RESIDENTIAL, SINGLE UNIT, MEDIUM DENSITY | 88.46 | 0.41 |
| | 11 | OPEN WATERS / WETLANDS | 2979.77 | 13.74 |
| | 12 | TRANSPORTATION/COMMUNICATIONS/UTILITIES | 385.34 | 1.78 |
| | | TOTAL | 21692.89 | 100.0 |



INSET "A": DETAIL
 1000 0 1000 Feet
SCALE 1:25,000



UNION TWP.

LEBANON TWP.

LEBANON TWP.

TEWKSBURY TWP.

TEWKSBURY TWP.

READINGTON TWP.

LEBANON BOROUGH

TOWN OF CLINTON

FRANKLIN TWP.

ROUND VALLEY RESERVOIR

SOUTH BRANCH RARITAN RIVER

SOUTH BRANCH RARITAN RIVER

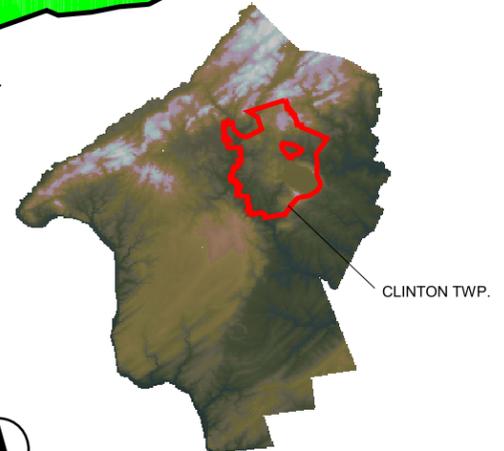
FRANKLIN TWP.

RARITAN TWP.

READINGTON TWP.

READINGTON TWP.

| SYMBOL KEY | |
|---------------|-------------------------|
| TEXT | Significant Place Names |
| Red line | Primary Roads |
| Black outline | Tax Parcel Boundaries |
| Blue area | Lakes |
| Blue line | Networked Streams |



30000 0 30000 Feet
HUNTERDON COUNTY
SCALE 1:800,000
 Study Area

CLINTON TOWNSHIP, NRI, 2001

2000 0 2000 4000 6000 Feet
 SCALE 1:45,000
 Map Projection: State Plane of New Jersey, NAD 83, Feet



New Jersey, Department of Environmental Protection, GIS data
 Web Site Downloads State LULC for WMA 8, 1995-1997
 Scale 1:24,000
 New Jersey, Department of Environmental Protection, GIS data
 Web Site Downloads State Municipalities of New Jersey
 Scale 1:100,000

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MAP18: LANDUSE / LANDCOVER

DRAWN BY: KJM
 CHECKED BY: CK, SF
 Project No.: 215.01

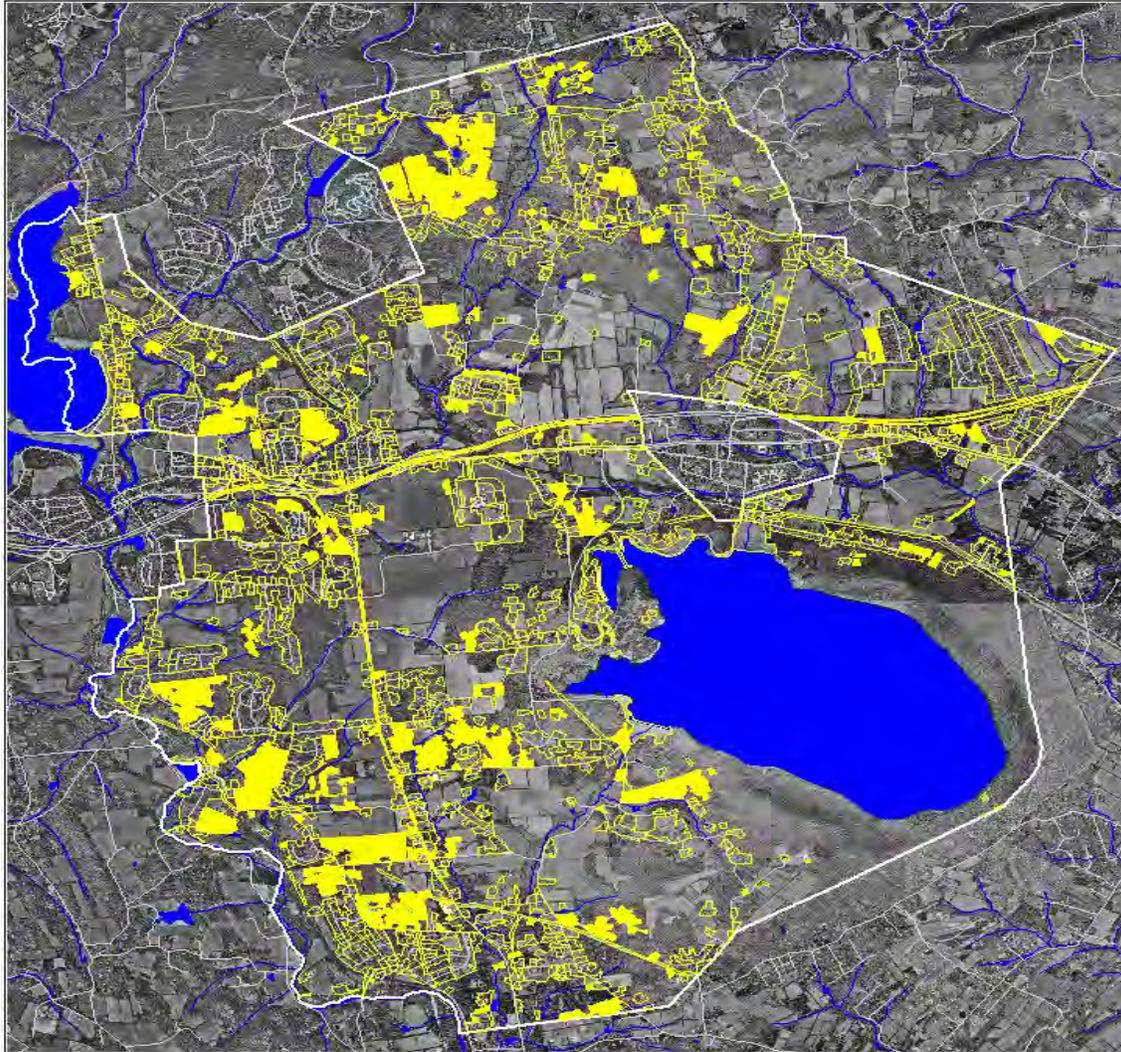


Clinton Township Land Use Trends~

Another source for resource vulnerability information is the New Jersey land use trend analysis study. The study resulted in land use/land cover and impervious surface maps (“Maps for Mayors”) for all municipalities in New Jersey. The maps were developed to provide trend analysis data for Townships throughout the state. The maps allow conclusions to be made about the development patterns between two distinct time periods. This particular methodology is often referred to as “change detection analysis”. The trend analysis map for Clinton Township (III-12) illustrates the following:

- The light yellow lines on the map indicate land developed by 1986. In 1986 most development appeared to take place along primary travel corridors (Routes 31, 22, 629, 623, and 513).
- By 1986, most development was residential and existed in the western portions of the Township (west of Routes 31 and 641), however pockets of sprawling residential development occurred throughout the Township.
- Using GIS to overlay developed areas with natural resource areas, it is evident that the sprawling development pattern in 1986 resulted in the loss of a significant amount of forested, headwater, groundwater recharge, steeply sloping, agricultural, and significant habitat areas.
- The solid yellow areas indicate land developed between 1986 and 1995/97. The sprawling pattern continues with developments taking place throughout the Township.
- The largest developments taking place between 1986 and 1995/97 included land within the Beaver Brook subwatershed (e.g., Herman Thau Road), Prescott Brook subwatershed (e.g., Stanton Mountain Road, Route 618), Allerton Creek (e.g., Route 623, Lilac Drive), and along the South Branch Raritan River subwatershed (e.g., Hamden Road, Wellington Drive, and Route 623).
- GIS was again used to determine the natural resources lost between 1986 and 1995/97. Because the sprawling development pattern continues, it is again evident that significant and vulnerable resources were lost. Most notable was the development in the headwaters of Prescott Creek as well as land adjacent to Route 31.

**Clinton Twp, New Jersey
 Showing Growth in Developed Use Areas
 from 1986 to 1995/97**



Legend

- Municipal Boundary
- Roads
- Streams
- Lakes
- Developed Area as in 1986
- Developed Area Growth from 1986 to 1995/1997

Note: Developed areas include buildings, parking lots, etc.



The yellow outlined areas delineate areas that were developed as of 1986. The solid yellow areas have been developed between 1986 and 1995/97. The total area of impervious surface (buildings, sidewalks, driveways, parking lots, etc.) is about 231 acres. About 29 acres of this total were added since 1986. The total area of impervious surface constitutes 1% of the total (21,875) acres in the municipality.

Source: NJDEP, Department of GIS, "Maps for Mayors", 2001.

Impervious Surface & Environmental Impacts~

As areas in Clinton Township are developed, more and more pervious land is being covered with impervious roadways, parking lots, compacted soil, and structures. The negative impacts related to increased impervious surfaces were previously discussed (e.g., increased stormwater runoff, decreased groundwater aquifer recharge). Again, increased stormwater results in an increase in nonpoint source pollution. It is estimated that sixty percent (60%) of the pollutants entering our waterways are from stormwater/nonpoint sources (PADEP, 1998). Stormwater runoff from impervious surfaces can also modify watershed hydrology and stream hydraulics and result in streambank erosion. Suspended soil particles, derived from bank erosion, may also cause siltation of the downstream water bodies.

The New Jersey Growth map (“Maps for Mayors”) also contains an estimate for the current amount of impervious surface cover (sidewalks, driveways, parking lots, etc). Experts in stormwater management state that exceeding 10% impervious surface in a given watershed area results in an exponential increase in stream channel enlargement as well as a reduction in the diversity of fish and aquatic insects (Schueler, 1992). With regard to impervious surface Township-wide, the map on the previous page shows that NJDEP estimates that the total area of impermeable surface constitutes 1% of the total acreage in the municipality. Based on a NJWSA study completed in May 2002, the percent total impervious area for Clinton ranges significantly throughout the Township. South of Route 78, the impervious surface cover is predominantly less than 5%. North of Route 78, the percent impervious cover ranges between 5% and 10%, except along the Route 31 corridor, where it is between 10% and 25%.



Streambank Erosion Along Beaver Brook, Clinton, New Jersey

Additional vulnerability indicators~

Another method of determining natural resource vulnerability and potential pollution is to determine the location of Superfund sites, state hazardous waste sites, regulated storage tanks, sewage and sludge disposal sites, solid waste disposal sites, solid waste transfer stations, underground injection wells, and other regulated facilities. The following information was obtained from the NJDEP and is provided to present a sense of additional facilities located throughout the Township:

- ❖ **Superfund (CERCLA & SARA) Sites** – In 1980, Congress enacted the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), commonly known as the Superfund, in response to the dangers of uncontrolled or abandoned contaminated sites. The Superfund Amendments and Re-authorization Act (SARA) amended CERCLA in 1986. CERCLA and SARA require that a National Priorities List (NPL) of sites throughout the United States be maintained and revised at least annually. There are no federal Superfund Sites located in Clinton Township.
- ❖ **Hazardous Waste Generators** – The Resource Conservation and Recovery Act (RCRA) was enacted in 1976 as a response to growing public awareness of serious problems related to disposal of hazardous waste. The hazardous waste provision of RCRA requires that those entities generating, transporting, or disposing of hazardous waste obtain a permit. The NJDEP database notes that there are no registered hazardous waste generators, transporters, and/or disposers of hazardous waste in Clinton Township.
- ❖ **Regulated Storage Tanks** – Amendments to RCRA (1984) now require that underground storage (over 2000 gallons) tanks be registered with the NJDEP's Underground Storage Tank Program. The NJDEP database lists sixty-one (61) permitted storage tanks in Clinton Township. Of those, twenty-two tanks are located in Annandale.
- ❖ **Solid Waste Disposal** – In 1984, the amendments to RCRA required that landfills and surface impoundments have double liners, a leachate collection system, and groundwater monitoring facilities. Subsequent amendments required that landfills and transfer facilities obtain permits and follow strict environmental regulations. The NJDEP, Division of Solid and Hazardous Waste database notes that there are no solid waste disposal sites in Clinton Township. However there is 1 municipal solid waste transfer station located on Petticoat Lane in Clinton Township.
- ❖ **State Hazardous Waste Contamination Sites** – The Known Contaminated Sites in New Jersey (KCS-NJ) is a listing of sites in the state where contamination of soil or ground water is confirmed. Sites listed are those where remediation is either underway or pending. As of May 2001, four (4) sites in Clinton Township that are on the NJDEP State Hazardous Waste Contamination Site list. Additional information

may be obtained from the NJDEP/NJ Water Supply Authority Technical report entitled "Groundwater of the Raritan Basin" (Draft, May 2001)

- ❖ **Chemical Storage** – The Community Right to Know Act of 1986 is also known as Title III of the Superfund Amendments and Re-authorization Act of 1986 (SARA). The NJDEP's Bureau of Chemical Information and Prevention collects, processes, and disseminates information used by the public, emergency planners, and first responders to determine the extent of chemical hazards in the community. There are forty-one (41) facilities storing 500 pounds or more of hazardous chemicals in Clinton Township.

Natural Resource Vulnerability, Overlay Analysis ~

Geographic Information Systems (GIS) are tools used to 1) organize and display spatial information and 2) analyze the spatial impact of alternatives (Moraine, 1999). For this Natural Resources Inventory (NRI), extensive organization and display of spatial information was completed (see Maps 1-19) and some analysis in order to determine trends, is presented throughout the inventory. The analysis of spatial patterns in natural systems has progressed dramatically in recent decades due to the rapid development of GIS and remote sensing capabilities (Moraine, 1999). Therefore, many more analyses may be completed in the future. The investigation of the cause and effects of certain development scenarios on ecological processes is one example (e.g., build out scenarios in the business district and potential impacts on high priority forest areas along Route 22).

The Clinton Township NRI incorporates and applies three types of maps:

- Source maps that contain basic information such as the location of wetlands and soil types.
- Interpretive or attribute maps which include features such as septic suitability. Such maps are based on judgments of the capabilities or limitations of natural resource features with respect to development and land use.
- Synthesis maps integrating information contained in other map types to provide guidance for land use and development planning purposes (e.g., Map 19 & Map 20).

Overlay analysis is used to create synthesis maps. The overlay analysis for the vulnerability maps contained in this section first involved selecting those resources determined most vulnerable in Maps 3-16 and illustrating them on the GIS map entitled “Natural Resource Vulnerability” (Map 19). Information illustrated on Map 19 includes: environmentally sensitive geologic formations (Allentown Dolomite & Jacksonburg Limestone), steep slopes (15% and greater), environmentally sensitive soils (severe & moderately severe land development constraints), environmentally sensitive water features (streams floodplains & riparian wetlands), and priority habitat areas (forest, wetland, & grassland).

Although the Natural Resource Vulnerability Map (Map 19) appears complicated by the quantity of information provided, the map clearly illustrates the presence of vulnerable resources throughout Clinton Township. This map was used as a precursor for a more scientific overlay analysis map entitled “Pollution Vulnerability” (Map 20).

Critical Resource Areas in Clinton Township ~

In order to protect the natural resources identified in Section II of this Natural Resources Inventory, sensitive land use planning is required. Usually land use planning recommendations are intended to protect inventoried resources from detrimental environmental impacts resulting from poor land development practices. In order to implement environmentally protective planning, it is important to agree upon a system that adequately defines “environmentally sensitive” areas. Environmental sensitivity is therefore based upon those features in the Township that are environmentally unique or sensitive to disturbance including: hydric soils, wetlands, floodplains, steep slopes, severely erosive soils, significant grassland, forest and wetland habitat, groundwater recharge areas, and land that is shallow to bedrock and shallow to groundwater.

It is also important to equate development in environmentally sensitive areas with environmental impact or “pollution vulnerability”. For example, allowing a high density residential development on a parcel exhibiting several features sensitive to disturbance (e.g., steep slopes-Map 6, highly erosive soils- Map 8, and trout production streams-Map 13) would also result in surface water pollution vulnerability. Environmental impacts resulting from allowing land development in this sensitive area can include soil erosion, and sedimentation of local trout production waterways. Environmentally sensitive planning would require the developer to integrate appropriate resource protection measures into the design.

In addition, it stands to reason that regions of the Township, or individual parcels containing nine sensitive features (e.g., Class A Critical Areas), are more susceptible to environmental impact (or pollution vulnerability) than those areas including three sensitive features (e.g., Class C Critical Areas). It is also essential that the selected basis for protecting critical areas be tied to existing environmental regulations. For example, protecting floodplains is promulgated through the Floodplain Management Act, septic suitability through NJ State Septic Regulations 7:9A, wetlands through the NJ Freshwater Wetlands Protection Act 7:7A, etc.

The following environmental vulnerability classifications are based upon the sensitivity of environmental features in Clinton Township, the acceptance that development in environmentally sensitive areas may be equated with pollution vulnerability, and the importance of tying existing environmental regulations to the selected environmental planning and municipal natural resource protection framework:

- **Class A, Critical Areas-** Contains land exhibiting hydric soils, wetlands, floodplains, shallow to bedrock, slopes exceeding 25%, groundwater recharge areas, shallow depth to groundwater, severely erosive soils, and NJDEP high priority habitat (*Pollution Vulnerability is High*).
- **Class B, Critical Areas-** Contains land exhibiting shallow depth to groundwater, shallow depth to bedrock, slopes exceeding 15%, moderately erosive soils, and NJDEP moderate priority habitat (*Pollution Vulnerability is Intermediate*).
- **Class C, Critical Areas-** Contains land exhibiting slightly erodible soils, shallow to bedrock, shallow depth to groundwater (*Pollution Vulnerability is Moderate*).

Geographic Information System (GIS) Mapping Methodology ~

In order to create the pollution vulnerability map (Map 20), the following coverages were used to compare data: soils, septic suitability, surface water resources, critical habitat mapping, groundwater recharge areas and slopes. The coverages were compiled together and converted from a vector file to a raster (grid) file. The grids were set to the same size (100 square feet).

During the vector to raster conversion, each feature was outlined and assigned a numerical value. If an information type was a simple affirmative or negative, they were assigned a numerical value of 1 (e.g., affirmative) or 0 (e.g., negative). Data exhibiting more discrete information were assigned a range of values. For example, the lowest pollution vulnerability was given a 0 and each intermitted value was given a number that was one more the previous (e.g., slopes in the 0-3% range were assigned an intermitted value of “0”, and slopes in the 3-8% range were assigned a “1” etc.). Next, the data were overlaid using the arithmetic method in Model Builder, Spatial Analyst (Version 2.0, ESRI Software.) The arithmetic overlay consisted of assigning non-weighted summation values to the overlapping raster areas. The arithmetic values were later mapped in a discrete grid system, and the values were split into a range of values pertinent to the mapping process.

The numerical distribution of the non-weighted values indicated that the values increased regularly and with intensity. Therefore, it was decided that less vulnerable areas should be assigned to those in the 0-5 range, intermediate value to those in the 5-10 range, and the highest to those areas in the 10-20 range. The highest value has a larger range than the intermediate and

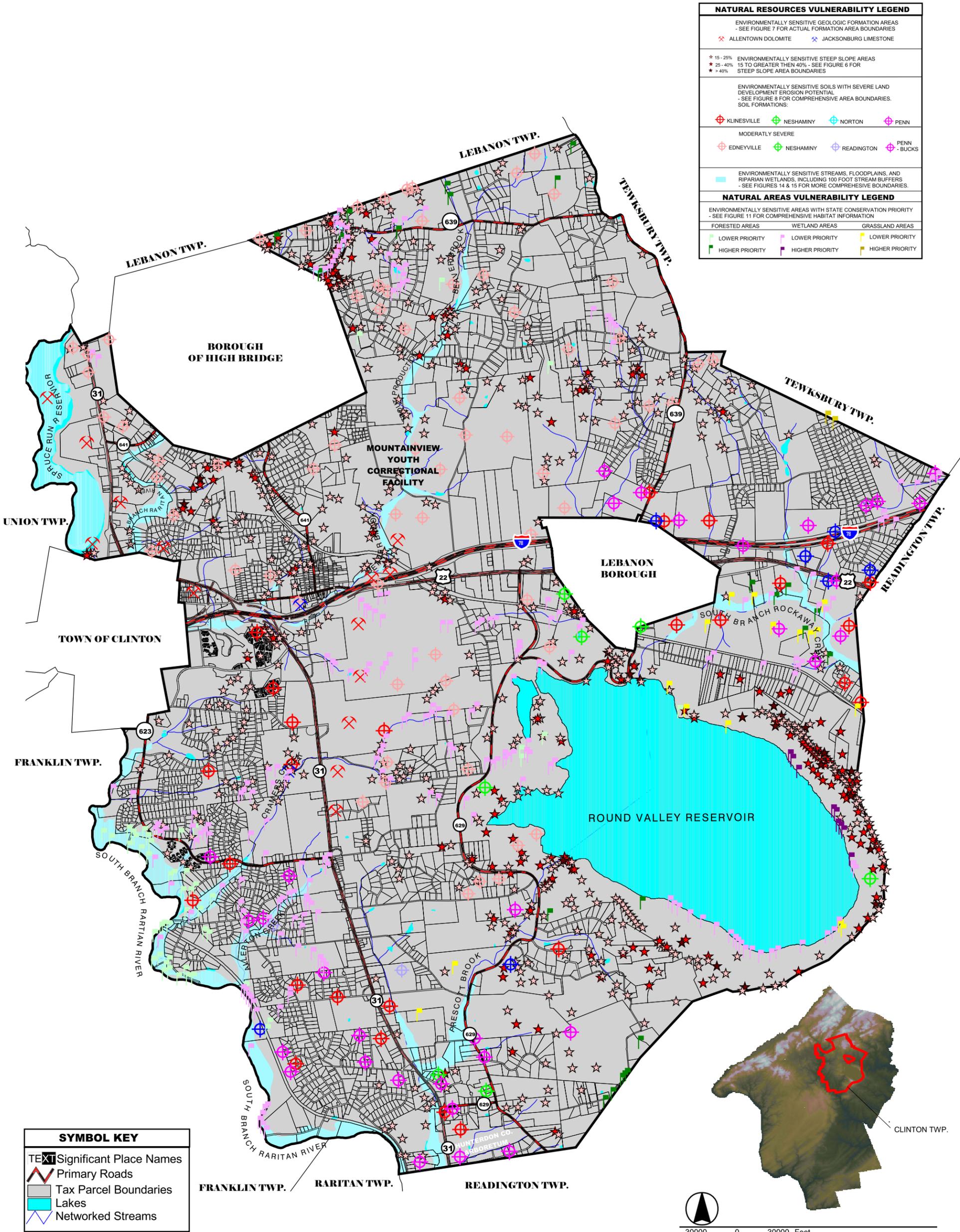
moderate ranges, because the values added to the highest vulnerability range exhibited the largest variations. Statistically, the large single values require the highest range of available values.

Finally, a color key was generated in order to create the following Critical Area range classes:

- **Class A, Critical Areas-** Pollution Vulnerability is High (Red)
- **Class B, Critical Areas-** Pollution Vulnerability is Intermediate (Yellow)
- **Class C, Critical Areas-** Pollution Vulnerability is Moderate (Green)

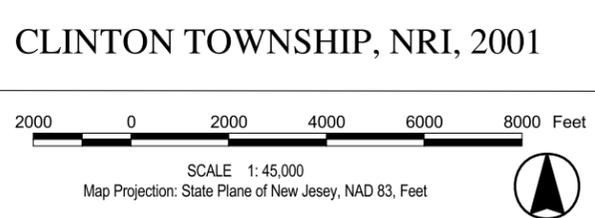
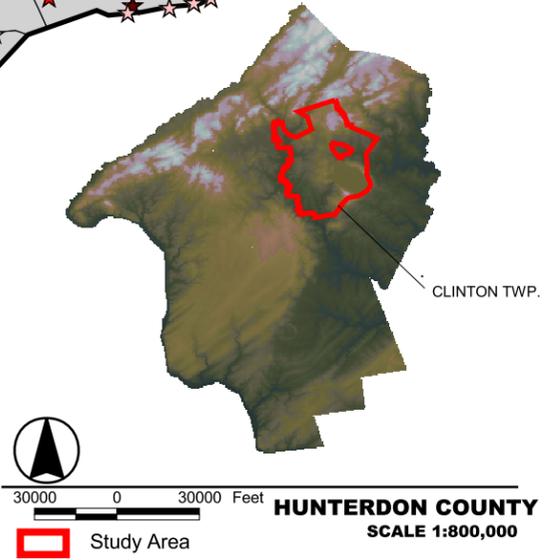


The Mews Construction Site, Off of East Street, Annandale



| NATURAL RESOURCES VULNERABILITY LEGEND | | | |
|--|-------------------------|-------------------|---------------|
| ENVIRONMENTALLY SENSITIVE GEOLOGIC FORMATION AREAS - SEE FIGURE 7 FOR ACTUAL FORMATION AREA BOUNDARIES | | | |
| ✕ ALLENTOWN DOLOMITE | ✕ JACKSONBURG LIMESTONE | | |
| ENVIRONMENTALLY SENSITIVE STEEP SLOPE AREAS 15 TO GREATER THEN 40% - SEE FIGURE 6 FOR STEEP SLOPE AREA BOUNDARIES | | | |
| ★ 15 - 25% | ★ 25 - 40% | ★ 40% + | |
| ENVIRONMENTALLY SENSITIVE SOILS WITH SEVERE LAND DEVELOPMENT EROSION POTENTIAL - SEE FIGURE 8 FOR COMPREHENSIVE AREA BOUNDARIES. SOIL FORMATIONS: | | | |
| ⊕ KLVESVILLE | ⊕ NESHAMINY | ⊕ NORTON | ⊕ PENN |
| MODERATLY SEVERE | | | |
| ⊕ EDNEYVILLE | ⊕ NESHAMINY | ⊕ READINGTON | ⊕ PENN -BUCKS |
| ENVIRONMENTALLY SENSITIVE STREAMS, FLOODPLAINS, AND RIPARIAN WETLANDS, INCLUDING 100 FOOT STREAM BUFFERS - SEE FIGURES 14 & 15 FOR MORE COMPREHENSIVE BOUNDARIES. | | | |
| NATURAL AREAS VULNERABILITY LEGEND | | | |
| ENVIRONMENTALLY SENSITIVE AREAS WITH STATE CONSERVATION PRIORITY - SEE FIGURE 11 FOR COMPREHENSIVE HABITAT INFORMATION | | | |
| FORESTED AREAS | WETLAND AREAS | GRASSLAND AREAS | |
| □ LOWER PRIORITY | □ LOWER PRIORITY | □ LOWER PRIORITY | |
| □ HIGHER PRIORITY | □ HIGHER PRIORITY | □ HIGHER PRIORITY | |

| SYMBOL KEY | |
|------------|-------------------------|
| TEXT | Significant Place Names |
| ▬ | Primary Roads |
| ▭ | Tax Parcel Boundaries |
| ▭ | Lakes |
| ▬ | Networked Streams |



Natural Resources Map Prepared by Princeton Hydro, from Compiled Data
Scale 1:45,000
New Jersey, Department of Interior, Geologic Survey, GIS data Downloads, Monochromatic Bitmap Geographic Images of Hunterdon County, New Jersey.
Scale 1:24,000
New Jersey, Department of Environmental Protection, GIS data Web Site Downloads State Municipalities of New Jersey
Scale 1:100,000

NOTES:
1. DATA ACCURACY IS LIMITED TO THE ACCURACY AND SCALE OF THE ORIGINAL DATA SOURCES.
2. THESE MAPS ARE PART OF A RESOURCE INVENTORY CONDUCTED FOR CLINTON TOWNSHIP AND SHOULD BE USED IN CONJUNCTION WITH THE COMPILED TEXT.

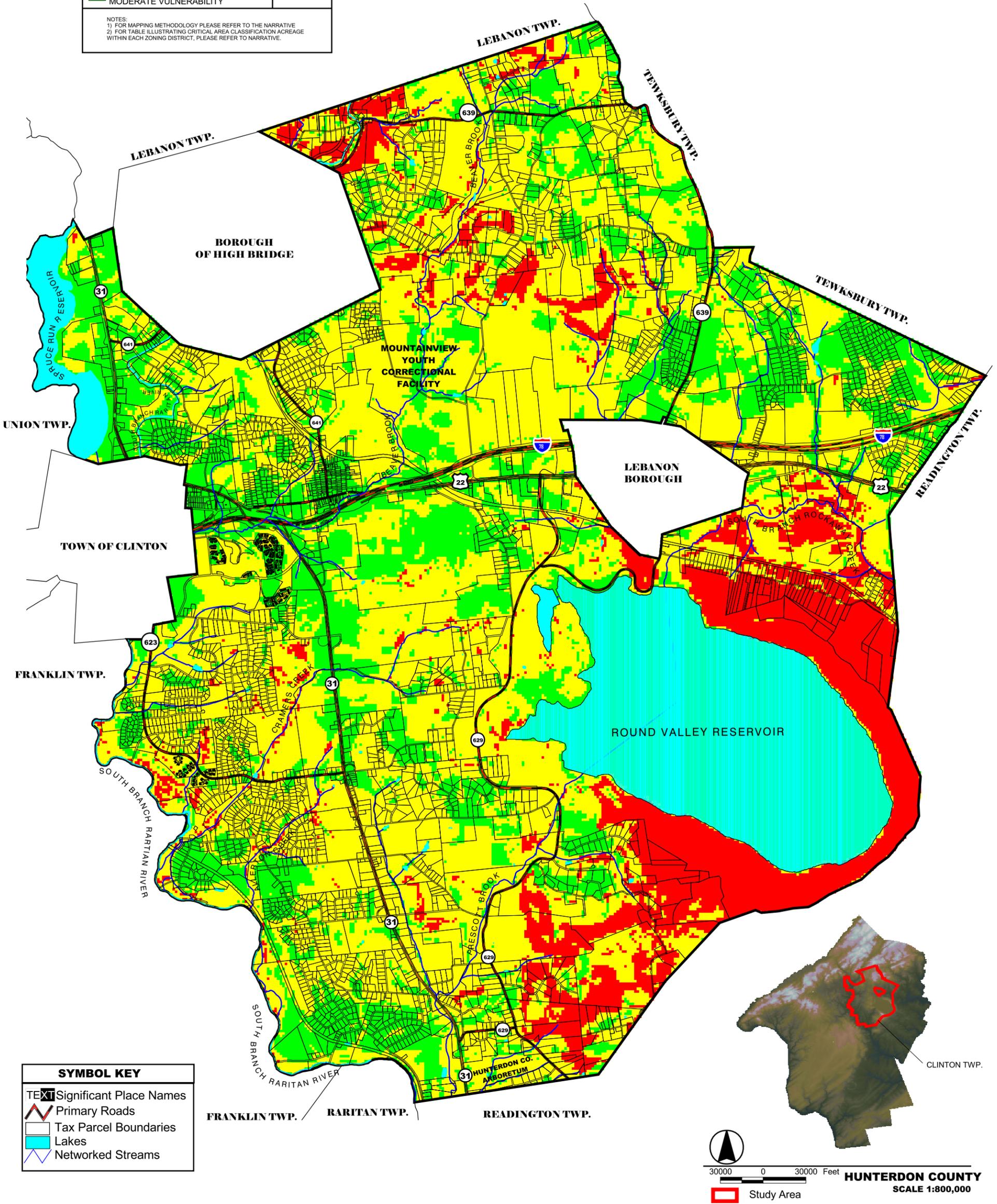
MAP 19: NATURAL RESOURCE VULNERABILITY

| | |
|-------------|--------|
| DRAWN BY: | KJM |
| CHECKED BY: | CK, SF |

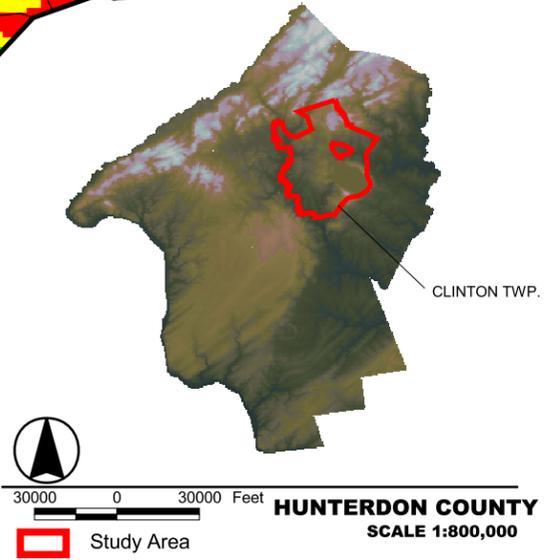
Project No.: 215.01

| POLLUTION VULNERABILITY CLASSIFICATION | LAND AREA (ACREAGES) |
|---|----------------------|
| ■ CLASS A: CRITICAL AREAS, HIGH POLLUTION VULNERABILITY | 2654.51 |
| ■ CLASS B: CRITICAL AREAS, INTERMEDIATE VULNERABILITY | 11425.18 |
| ■ CLASS C: CRITICAL AREAS, MODERATE VULNERABILITY | 7611.31 |

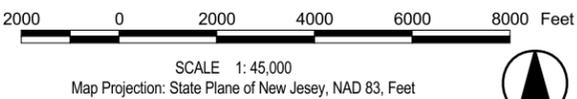
NOTES:
1) FOR MAPPING METHODOLOGY PLEASE REFER TO THE NARRATIVE
2) FOR TABLE ILLUSTRATING CRITICAL AREA CLASSIFICATION ACREAGE WITHIN EACH ZONING DISTRICT, PLEASE REFER TO NARRATIVE.



| SYMBOL KEY | |
|---|-------------------------|
| TEXT | Significant Place Names |
| | Primary Roads |
| | Tax Parcel Boundaries |
| | Lakes |
| | Networked Streams |



CLINTON TOWNSHIP, NRI, 2001



Pollution Vulnerability Map Prepared by Princeton Hydro, from Compiled Data
Scale 1:45,000
New Jersey, Department of Interior, Geologic Survey, GIS data Downloads, Monochromatic Bitmap Geographic Images of Hunterdon County, New Jersey.
Scale 1:24,000
New Jersey, Department of Environmental Protection, GIS data Web Site Downloads State Municipalities of New Jersey
Scale 1:100,000

NOTES:
1. DATA ACCURACY IS LIMITED TO THE ACCURACY AND SCALE OF THE ORIGINAL DATA SOURCES.
2. THESE MAPS ARE PART OF A RESOURCE INVENTORY CONDUCTED FOR CLINTON TOWNSHIP AND SHOULD BE USED IN CONJUNCTION WITH THE COMPILED TEXT.

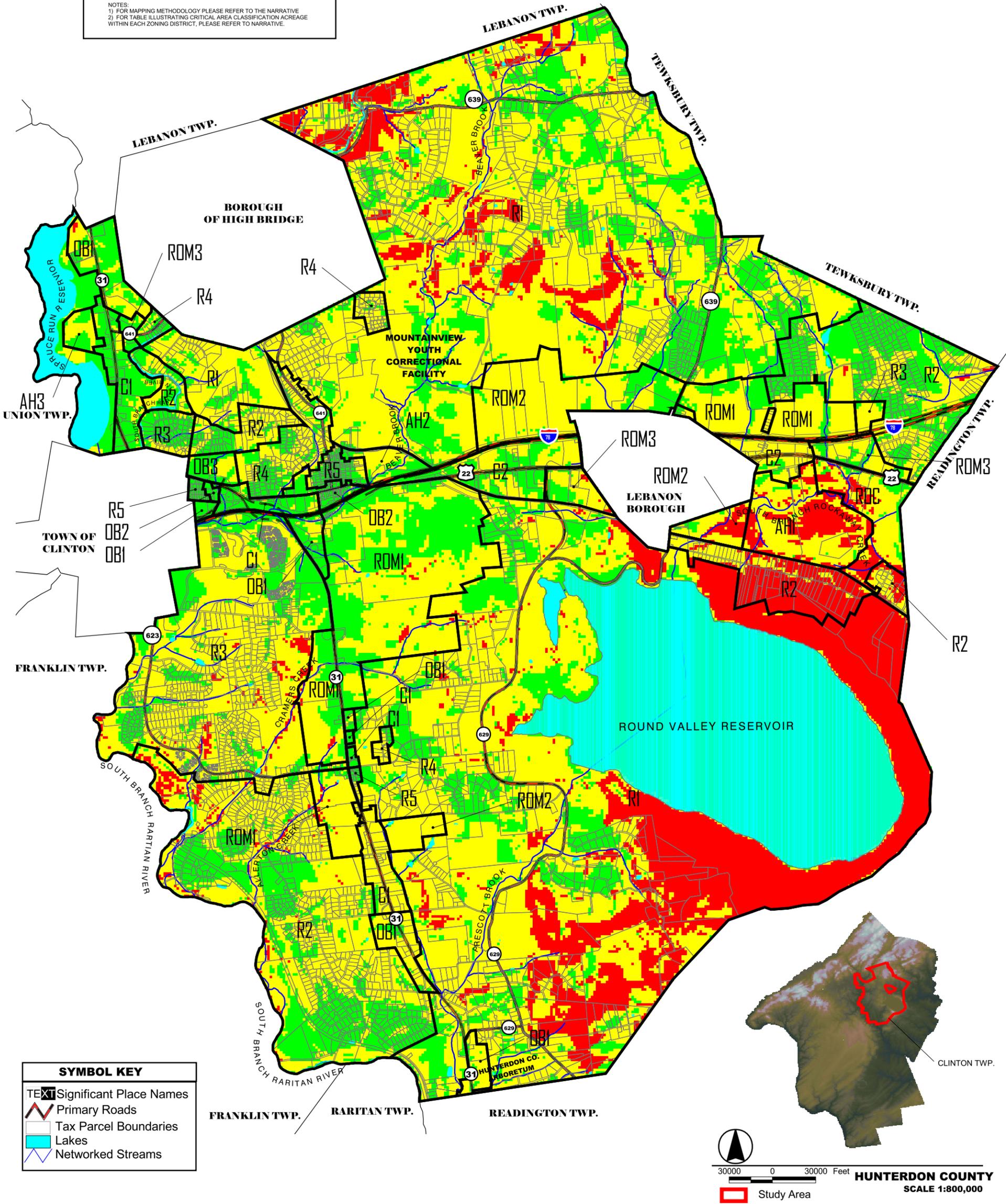
MAP 20: POLLUTION VULNERABILITY

| | |
|---------------------|--------|
| DRAWN BY: | KJM |
| CHECKED BY: | CK, SF |
| Project No.: 215.01 | |



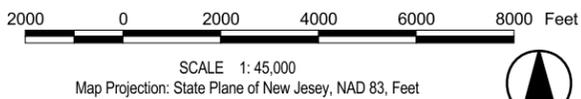
| POLLUTION VULNERABILITY CLASSIFICATION | LAND AREA (ACREAGES) |
|---|----------------------|
| ■ CLASS A: CRITICAL AREAS, HIGH POLLUTION VULNERABILITY | 2654.51 |
| ■ CLASS B: CRITICAL AREAS, INTERMEDIATE VULNERABILITY | 11425.18 |
| ■ CLASS C: CRITICAL AREAS, MODERATE VULNERABILITY | 7611.31 |

NOTES:
 1) FOR MAPPING METHODOLOGY PLEASE REFER TO THE NARRATIVE
 2) FOR TABLE ILLUSTRATING CRITICAL AREA CLASSIFICATION ACREAGE WITHIN EACH ZONING DISTRICT, PLEASE REFER TO NARRATIVE.



| SYMBOL KEY | |
|------------|-------------------------|
| TEXT | Significant Place Names |
| | Primary Roads |
| | Tax Parcel Boundaries |
| | Lakes |
| | Networked Streams |

CLINTON TOWNSHIP, NRI, 2001



Pollution Vulnerability Map Prepared by Princeton Hydro, from Compiled Data
 Scale 1:45,000
 New Jersey, Department of Interior, Geologic Survey, GIS data Downloads, Monochromatic Bitmap Geographic Images of Hunterdon County, New Jersey.
 Scale 1:24,000
 New Jersey, Department of Environmental Protection, GIS data Web Site Downloads State Municipalities of New Jersey
 Scale 1:100,000

NOTES:
 1. DATA ACCURACY IS LIMITED TO THE ACCURACY AND SCALE OF THE ORIGINAL DATA SOURCES.
 2. THESE MAPS ARE PART OF A RESOURCE INVENTORY CONDUCTED FOR CLINTON TOWNSHIP AND SHOULD BE USED IN CONJUNCTION WITH THE COMPILED TEXT.

MAP 21: POLLUTION VULNERABILITY & ZONING OVERLAY

| | |
|---------------------|--------|
| DRAWN BY: | KJM |
| CHECKED BY: | CK, SF |
| Project No.: 215.01 | |



Pollution Vulnerability Findings ~

The pollution vulnerability GIS overlay analysis and the resulting Pollution Vulnerability Map (Map 20) indicate the following:

High Pollution Vulnerability

- Approximately 36% of Clinton Township (7,611 acres) is categorized as Class A Critical Area with High Pollution Vulnerability.
- The majority of Class A, High Pollution Vulnerability land is located in the vicinity of Round Valley Reservoir, on land south west of Round Valley Reservoir and East of Route 629, and in the northern portion of the municipality.
- The majority of Class A land is zoned (R-1) Residential (4,596 acres), followed by (R-2) Residential (1,392 acres), and (ROM-1) Research/Office/Manufacturing (539 acres).

Intermediate Pollution Vulnerability

- Approximately 52% of Clinton Township (11,425 acres) is categorized as Class B Critical Area with Intermediate Pollution Vulnerability.
- The Class B, Intermediate Pollution Vulnerability land is located throughout the municipality. Please refer to Map 20 for more information.
- The majority of Class B land is zoned (R-1) Residential (6,416 acres), followed by (R-2) Residential (1,392 acres), and (R-3) Residential (1,118 acres).

Moderate Pollution Vulnerability

- Approximately 12% of Clinton Township (2,655 acres) is categorized as Class C Critical Area with Moderate Pollution Vulnerability.
- Class C, Moderate Pollution Vulnerability land is located throughout the municipality. Please refer to Map 20 for more information.
- The majority of Class C land is zoned (R-1) Residential (2,105 acres), followed by (R-2) Residential (283 acres), and (AH-1) Affordable Housing (126 acres).

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Section IV ~ Environmental Resource Recommendations



Valley Crest Road

- Maintain large, intact patches of native vegetation and prevent fragmentation by development.
- Establish and implement scientifically based criteria for species and habitat protection.
- Protect rare elements and guide development away from rare features.
- Maintain connections among riparian corridors.
- Maintain significant ecological processes in protected areas.
- Contribute to the regional persistence of rare species.
- Balance the opportunity for economic development with the habitat needs of wildlife, and the recreational needs of the public.

~ The American Planning Association, 1997 ~
Seven Environmental Protection Principles For Natural Resource Protection

Environmental Resource Recommendations

Introduction ~

Valuable natural resources may be protected through numerous regulatory and non-regulatory methods. The chosen methods depend upon constitutionally protected land ownership rights, existing environmental protection regulations, regional and local planning codes, local philosophy, professional knowledge, and funding opportunities. Elected and appointed officials, land owners, local developers, the business community, environmental organizations, and individual citizens often have different opinions about the way we should protect our natural resources.

Not too long ago, the idea of setting aside ecologically significant land and protecting habitat was considered an irrational idea. However, preserving significant land in the United States is now an accepted philosophy. Preservationists are those members of the community supporting the idea that land should be set-aside in perpetuity. Preservationists support the idea that natural systems should be left untouched in order to naturally evolve. Some preservationists feel that life on earth is imperiled, that humans are a naturally destructive species, and that all development should cease (Andrew Blowers, 1999).

Conservationists support the idea that our most valuable natural resources should be protected, but they should be managed for a variety of low-impact uses. An example of conserving and managing land for a specific use would include protecting the vegetated floodplain adjacent to a river, thinning out mature or diseased trees, and developing a pedestrian path through the area. Therefore, high density/high impact development (e.g., residential homes, stores, or industry on small parcels) is prohibited, but the land is *not* left untouched. Conserved land is often purchased by government agencies, private landowners, or environmental conservation groups and managed for farming, hunting, and recreational uses.

Finally, there are many Americans that feel landowners are free to develop their property according to their wishes, and that the Constitution enables that right. The argument is that any reduction of economic return due to development restrictions is unconstitutional and should be considered a “taking”. The takings clause has provided fruitful ground for litigation for many years. Most elected and appointed officials strive to balance the need for development with the need to protect the health and welfare of citizens.

The following section of this resource inventory provides an overview of NRI findings as well as a variety of regulatory and non-regulatory preservation, conservation, and resource management goals intended to help balance landowner rights with the protection of the significant natural resources located in Clinton Township. For more

information refer to all sections of the study as well as the reference section at the end of this document.

The Framework for Management Recommendations ~

The preservation, conservation, and resource management recommendations included in this section are based upon the following framework:

- Management recommendations are based upon the goals and objectives adopted and incorporated in the Clinton Township Master Plan (NRI, Section I),
- Resource recommendations are based upon existing regulations included in the Clinton Township Zoning and Land Development Ordinance (NRI, Section I),
- Recommendations are based upon the findings included in this inventory (NRI, Sections I-IV & General Overview Below),
- Management recommendations consider the seven environmental protection principles adopted by the American Planning Association in 1997 (Listed on page IV-7)
- Resource management recommendations are based upon the goals and objectives recently adopted in the New Jersey State Development and Redevelopment Plan (NJ Planning Commission, 2001).

Environmental Protection, Guiding Principles ~

The following guiding principles were accepted by the Clinton Township Environmental Commission and provided a framework for the goals, objectives and recommendations included in this section.

- Maintain large, intact patches of native vegetation and prevent fragmentation by development.
- Establish and implement scientifically based criteria for species and habitat protection.
- Protect rare elements and guide development away from rare features.
- Maintain connections among habitat by protecting corridors for movement.
- Maintain significant ecological processes in protected areas.
- Contribute to the regional persistence of rare species by protecting associated habitat.
- Balance the opportunity for economic development with the habitat needs of wildlife, and the recreational needs of the public.

*Overview of Findings ~***Inventory Findings**

- **Climate** ~ The climate in Clinton Township is categorized as continental, and has an average annual precipitation of 45-46 inches. Winter temperatures average 28-32⁰F with mid summer averages of 69-73⁰F.
- **Air Quality** ~ Increases in commuter and truck traffic are related to air quality degradation. The closest air quality monitoring station (Flemington, NJ) indicates that carbon monoxide standards were not exceeded, but ozone health standards were exceeded 21 times during the summer season (1988-2000).
- **Terrain** ~ Sloping terrain (100-750 MSL) and fluctuating elevations characterize the Township. Seventy-three percent (73%) contains slopes in the 3-15 % range. The majority of steeply sloping land (15 - > 40%) is located around the Round Valley Reservoir and along Route 639 bordering Lebanon Township and the Borough of High Bridge.
- **Geology** ~ Major geologic formations in the Township include the Losee, Hardyston, Kittatinny, Jacksonburg, Stockton, Locatong, Brunswick and Byram formations. Surficial geologic materials include stream, wetland, glacial, windblown and hill slope sediments, as well as weathered bedrock material.
- **Geologic Features** ~ Significant geological features such as eskers, drumlins, cavernous limestone formations, historic limestone kilns, and caves are located throughout the Township. The Leigh Cave, located in Clinton Township, is one of the largest caves in New Jersey.
- **Soil Limitations** ~ Approximately 31% of the soils present severe or moderately severe (33%) limitations to the placement of individual, on-lot septic systems and have severe (2%) or moderately severe (37%) erosion potential.
- **Significant Soils** ~ Clinton Township contains 20 of the 23 prime farmland soils listed by the Hunterdon County Soil Conservation District as well as 40 soils of statewide importance.
- **High Priority Habitats** ~ The NJDEP has identified approximately 4, 000 acres of grassland, 500 acres of forested, and 800 acres of wetland habitats throughout Clinton Township. These habitats are classified as “high priority”, because they support rare plant and animal communities.

-
- **Threatened & Endangered Species** ~ A total of 1 endangered and 3 threatened bird species; 1 endangered and 3 threatened amphibian species; 2 significant invertebrate species; and over 30 endangered plant species are located within Clinton Township. They are listed in the New Jersey State Natural Heritage Database. Sensitive ecosystems listed in the state database include a cave terrestrial community and a bat hibernacula.
 - **Game & Non-Game Species** ~ Local agencies report numerous non-threatened birds and mammals that may soon be threatened due to loss of habitat.
 - **Historic & Cultural Features** ~ Archeologists have unearthed arrow points, spear points, knives, scrapers and other articles in Clinton Township which were fashioned and used by Lenapi Indians. Early European explorers arrived in the early 17th Century and were followed by English, Quaker, Dutch and German settlers in the late 17th and early 18th Centuries.
 - **Historic Districts & Historic Sites** ~ The following registered Historic Districts are located in Clinton Township: Allerton, Annandale, Cokesbury, Hamden, Potterstown, and Turnpike. There are 72 registered and over 200 locally significant Historic Sites in Clinton Township.
 - **Watershed Area** ~ Clinton Township is located in the NJDEP-designated North and South Branch Raritan Watershed Management Area (WMA 8). Within WMA 8 are the following subwatersheds: Allerton Creek, Beaver Brook, Cramers Creek, South Branch Rockaway Creek, Prescott Brook, and the South Branch Raritan sub watersheds.
 - **Rivers & Streams**~ There are over 60 miles of streams and tributaries within the Township. They are all classified as Category 2 freshwater waterways (FW-2) and therefore require that water quality be maintained in order to continue meeting the state water quality standards. Stream flow data indicate “flashy” streamflow with a marginal capacity to ameliorate increases in peak flows.
 - **Surface Water Quality** ~ The biological and chemical water quality reports prepared by the NJDEP (WMA 8) & NJWSA note that the waterways of the Raritan River Basin were monitored in 1994 and 1999. NJDEP data for WMA 8 indicate the majority (73%) were non-impaired although there is some localized degradation from agricultural or residential sources. NJWSA data for the *entire* Raritan Basin indicate that approximately 38% of the monitoring stations were non-impaired, 57% moderately impaired, and 5% severely impaired.

-
- **Groundwater** ~ The aquifers beneath Clinton Township are federally designated Sole Source Aquifers requiring the review of all federally funded projects in the Township. Of the groundwater wells monitored by NJDEP, all were well within the NJDEPs specific groundwater quality criteria (Class IIA & Practical Quantitation Levels).

Findings, Environmental Vulnerability Indicators

- **County Population** ~ Between 1960 and 1990, the population of Hunterdon County doubled. More recently (1990-2000) the population of the County has increased by 13%.
- **County Land Use** ~ Land use records indicate that 22% of Hunterdon County is developed and that over 9, 000 acres of cultivated grassland, 2, 400 acres of upland forests, and close to 1, 000 acres of wetland areas were lost between 1984 and 1995.
- **Township Population** ~ Between 1960 and 2000, Clinton Township's population has more than tripled. Although the rate of growth has declined, population projections for the Township indicate an additional 28% increase between 1990 and 2010.
- **State Planning** ~ The environmentally sensitive state planning areas (PA4/5 & PA5) designation is assigned to approximately 46% of the land area in Clinton Township.
- **Local Zoning** ~ The majority of the Township (over 13, 000 acres or 61%) is assigned the Single Family Residential (R-1) Zoning District.
- **Township Land Use** ~ Land use in Clinton Township is comprised of 38% agricultural land, 36% vacant open space and recreational land, 7% commercial land, and 1% industrial land. Common nonpoint source pollutants associated with previously listed land uses include: eroded soil, phosphorus, nitrogen, heavy metals and chemicals associated with fertilizers and pesticides, salts, animal and human waste pathogens, and thermal energy.
- **Impervious Surface & Stormwater** ~ Approximately 6% of Clinton Township's land area contain surfaces prohibiting the movement of water from the land surface into the underlying soil (e.g., impervious surface/impervious cover).
- **Township Development** ~ Land developed by 1986 is located adjacent to or in proximity to Clinton Township's primary travel corridors. Single-family dwelling units and attached housing in the western half of Clinton Township comprise the bulk of development and population growth since 1986, however pockets of sprawling development have occurred throughout the Township.

- **Township Regulations** ~ The Clinton Township Land Development Ordinance contains over thirty environmental resource and land development protection tools.
- **Township Open Space Preservation Efforts** ~ The Township has successfully preserved 705 acres of open space and farmland, and close to 1,200 additional acres are under contract or negotiation. Proposed open space acquisitions (48 properties) contain over 3,500 acres of land.
- **Municipal & Hazardous Waste** ~ There are no Superfund sites, solid waste disposal facilities, registered hazardous waste generators, transporters or disposers of hazardous waste in Clinton Township. However, there is one municipal solid waste transfer station. There are 61 regulated storage tanks, 4 confirmed state hazardous waste contamination sites, and 41 chemical storage facilities in the Township.
- **Vulnerability Analysis** ~ The Geographical Information System (GIS) overlay analysis performed for this study resulted in the following Critical Area/Vulnerability land area classifications: Class A Critical Areas (High Vulnerability)- 36% of Clinton Township Land Area (7, 611 acres); Class B Critical Areas (Intermediate Vulnerability)- 52% of Land Area (11, 425 acres); Class C Critical Areas (Moderate Pollution Vulnerability)- 12% Land Area (2,655 acres)

Recommendations~

Environmental Planning Recommendations

In the face of substantial development pressures, the Township will most likely continue to implement policies designed to retain the rural and agricultural character of Clinton Township (Clinton Township Master Plan, Banisch Associates, 2000). Therefore, Clinton Township elected and appointed officials should continue working with government and private entities to maintain previously preserved resources, preserve additional parcels, and to prevent environmental impacts to all significant environmental resources. Future resource protection planning strategies should be based upon the resource information gathered for this study and the vulnerability parameters included in Section III of the Clinton Township Natural Resources Inventory.

In addition, the New Jersey State Development and Redevelopment Plan was recently re-adopted. The planning goals and strategies contained in the plan are considered the basis for future planning, investment, and regulatory policies. The resource protection policies in the state plan are designed to prevent pollution, excess land consumption, and excessive traffic congestion. Through the coordination of public and private actions, the State hopes to guide future growth into compact, ecologically designed forms of

development and redevelopment (NJ State Planning Commission, 2001). The state plan continues to rely upon the Environmentally Sensitive Planning Area (PA 4/5) to protect critical environmental and cultural resources throughout the state (Part I, Map 3, Clinton Township NRI).

The following management recommendations are based upon the goals, objectives and recommended activities listed in the Clinton Township Master Plan (Banisch Associates, 2000) and the New Jersey Development and Redevelopment Plan (NJ State Planning Commission, 2001).

- The Conservation Plan, Land Use and Management and Natural Resource elements of the updated Master Plan should include new objectives relating to resource protection and agricultural and open space preservation. All related objectives should note the development of an updated Natural Resources Inventory, updated Geographic Information System (GIS) maps, and the critical area classification system included in the Natural Resources Inventory.
- The Conservation Plan, Land Use and Management and Natural Resource elements of the updated Master Plan should recommend that relevant recommendations and findings in the Clinton Township Natural Resources Inventory be incorporated into an ordinance(s).
- The Land Use and Management and Natural Resource elements of the updated Master Plan should include objectives relating to the desirability of controlled development throughout the Township. The plan should recommend a variety of controls and should be based upon the vulnerability classifications included in this inventory.
- The Land Use and Management and Natural Resource elements of the updated Master Plan should include an objective emphasizing the importance of the environmental standards in the ordinance, the value of wellhead protection programs, the need for environmental impact assessments, and the implementation of required best management practices.
- The *Recreation* and Open Space element of the updated Master Plan should include an objective relating to the value of, and the need for, public and private recreational opportunities. Pertinent objectives included in the State Open Space and Recreation Plan update should be incorporated. Additional parks and recreational opportunities should be provided to residents. However, the level of recreational development should be based upon the land vulnerability classification of the parcel.

- The Land Use and Management, Natural Resource, and Water and Sanitary Sewer Utility elements of the updated Master Plan should be revised to include site suitability objectives for lots served by on-lot septic systems (e.g., specific minimum lot size, soil suitability, depth to water table), the need for adequate treatment capacity in all zoning districts, and the importance of stormwater management.
- The Land Use Management element of the updated Master Plan should include objectives for Cluster Developments and Planned Development Overlays based upon the physical characteristics and environmental vulnerability of the parcel.
- The Circulation Plan element should be revised to incorporate findings in the Route 78/Route 31 Corridor Study (Hunterdon County Planning Board) and the Scenic Road Study. The importance of reducing auto emissions should be highlighted as well as the importance of providing landscape buffering and site improvement standards to protect scenic vistas.
- The Master Plan should incorporate open space, recreation, noise control, wellhead protection, and architectural review standards recommended by the Clinton Township Planning Board and included in the Master Plan Reexamination Report, Land Use & Circulation Plan Elements (Banisch Associates, 1999).

Environmental Regulation Recommendations

The following recommendations are designed to support local zoning and regulatory recommendations included in the Clinton Township Master Plan (Banisch Associates, 2000), and to build upon existing zoning and land development regulations by incorporating findings contained in this study.

- The elected and appointed officials in Clinton Township should continue enforcing resource protective regulations currently included in the Township's development regulations.
- Development regulations should be revised to provide a specific minimum lot size for a lot served by a septic system in the R-4 and R-5 Districts or larger lots for those intended for on-lot septic systems. Zoning and land development regulatory revisions should be based upon septic suitability.
- The Residential (R-3) Zoning District in the Blossom Hill Road & Deer Hill Road Areas should be changed from R-3 to R-2. Adequate community sewage treatment is not available in this area and the lots should be larger to allow for adequate on-lot disposal sewage treatment facilities.

-
- The following Planning Board recommendations should be incorporated into the Clinton Township Land Development Ordinance: revised noise control standards, revised wellhead protection standards, and architectural (and historical) review standards.
 - The Township should consider implementing the riparian buffer ordinance currently under development by the Clinton Township Environmental Commission.
 - Environmental Impact Assessments should be completed for all development proposals; especially those located in Class A and Class B Critical Areas (vulnerable areas noted in Part III of the Natural Resources Inventory).
 - Consideration should be given to implementing additional wetland buffer protection provisions.
 - Best management practices should be required for all development proposals including stormwater quality treatment, increased stormwater recharge, and the elimination of in-stream stormwater discharge.
 - Proposed golf courses should include impact information, particularly their effect upon water quality and groundwater supply.
 - The Township should implement recent revisions to water quality management rules in order to protect surface and groundwater resources.
 - More restrictions to the amount and location of impervious surfaces should be considered in light of the Townships existing increasing impervious surface coverage.
 - Natural Habitat preservation and restoration should be strongly encouraged by the applicable zoning laws and building permit approval process. Manicured campuses and groomed lawns should be discouraged. Natural habitats should be encouraged as a viable landscaping alternative.
 - Additional open space set asides should be considered, particularly in Class A and Class B Critical Areas noted in Part II of the NRI.
 - Increased capital should be set aside and grants obtained to complete additional analysis and to revise current regulations to be more protective of valuable natural resources.

LIST OF REFERENCES

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