

1.0 INTRODUCTION

This report, *The Initial Surface Water Quality Watershed Characterization and Assessment Report for the Wallkill River Watershed Management Area (WMA 02)*, represents an initial step in the watershed management planning process that summarizes existing information related to surface water quality in WMA 02 that was readily available to the Department. This report serves two main purposes: 1) it is a preliminary step towards developing a comprehensive watershed characterization and assessment report for WMA 02; and 2) it compiles preliminary information to help define a set of surface water quality issues including the development of Total Maximum Daily Loads (TMDLs) for the impaired waters within WMA 02. It's intended audience within the Watershed Management area includes: the Technical Advisory Committee (TAC), the TMDL Work Group, and technical staff within NJDEP. A non-technical summary for general readership will subsequently be developed by NJDEP's Division of Watershed Management (DWM) and provided to the Watershed Management Area's Public Advisory Committee (PAC).

This Surface Water Quality Characterization Report relies on information readily available to the Department and was gathered from published reports, ambient and site-specific monitoring data, and our geographic information system (GIS). Regulatory and other program reports and databases were used to generate maps and summarize information regarding point and non-point pollution sources (i.e., contributing factors). Subsequent to this report, emphasis will be placed on identifying and integrating other data sets (including stakeholder data) through the ongoing watershed management planning process. It is expected that additional information will be required to complete the analysis, including monitoring, modeling, and a more refined assessment of potential contaminant loads. The report makes extensive use of GIS maps in conveying surface water quality characterization data (e.g. point and nonpoint sources of pollution, known contaminated sites, roads, population, and pesticide applications) as deemed appropriate.

This Surface Water Quality Characterization and Assessment Report is the surface water quality component of a much broader assessment to be provided in a subsequent Watershed Characterization and Assessment Report (WCA) for WMA 02. The WCA Report will include new and additional data, findings and other contributions from the Department and the WMA 02 stakeholders, and will comprehensively address watershed issues such as ground water and drinking water quality, water quantity, land and living resources, contributing factors, existing and planned management measures, watershed assessment, and data management/data assessment needs. The expanded report will be viewed as a "living document" and will be expected to change over time based on continued input from WMA 02 stakeholders. Such changes will serve as the technical basis for the iterative planning cycle. In the future, an INTERNET version of this and other related documents will be made available to the general public as a Watershed Webpage.

1.1 BACKGROUND

New Jersey's watershed management approach relies on sound science and a collaborative stakeholder process to protect, maintain and improve the water resources of the state. In order to achieve this goal, the New Jersey Department of Environmental

Protection (Department) intends to employ a collaborative planning process by which government agencies and the watershed community can work together to identify and address water resource issues and concerns on a geographic basis. The development of a WCA Report is one of the first steps in this collaborative planning process. Watershed characterization and assessment will enable the Department and its partners to target and prioritize watershed issues to be addressed through the watershed management process. Data gaps identified during this phase may require new monitoring and modeling efforts to both verify current water resource trends; to project future trends; and to identify water resource issues, problems and pollution sources.

The resulting detailed watershed characterization and assessment will identify a set of priority issues of concern for each watershed management area (WMA), to be addressed by the watershed management area plan (WMA Plan). To facilitate efficient compilation of characterization and assessment information and to manage resources in the planning process DEP has partitioned the State into twenty WMAs (See Figure 1.1-1). Specific water resource goals and measurable environmental objectives (e.g. specific percent reduction in pollutant loading, or elimination of projected water supply deficits, over a specified time period) will be developed for each issue. In certain WMAs watershed goals will be formalized through the development of Total Maximum Daily Loads (TMDLs). TMDLs represent the assimilative or carrying capacity of the receiving water, taking into consideration point and nonpoint sources of pollution, as well as surface water withdrawals and ground water and atmospheric deposition impacts on receiving waters. TMDLs are an important planning tool, since they can be used to explore different load allocation strategies and to reserve future capacity of receiving water in order to meet certain watershed protection goals.

Where TMDLs are required to address documented surface water quality impairment; a TMDL is developed as a mechanism for identifying all the contributors to surface water quality impacts and for setting goals for load reductions for specific pollutants as necessary to meet surface water quality standards. Allocations are made to the varying sources contributing to the water quality problem in order to reduce the total pollutant load received by the waterbody. Load reduction goals established through TMDLs are achieved through the issuance of wasteload allocations (WLAs) for point source discharges, load allocations (LAs) for nonpoint source discharges, and water allocations for surface water withdrawals.

In some WMAs the TMDLs may still be required even though the receiving waters are predominantly impacted by nonpoint source pollution. In such cases, the TMDL would consist mainly of the load allocation for the major categories of nonpoint source pollution contributors along with an implementation plan for best management practices (BMPs) for stormwater management and nonpoint source pollution control, headwaters protection practices, or other mechanisms for addressing the priority issues of concern.

The WCA Report for WMA 02 will ultimately provide the scientific basis for establishing a planning baseline that will be used by the Department and the WMA 02 PAC to identify and prioritize issues of concern and to establish environmental goals and objectives for the watershed management area. It will serve as a technical support document for the watershed management area plan, which will identify regulatory and non-regulatory management measures, responsibilities and funding needed to attain the environmental goals and objectives. The WMA Plan will include: a summary of the baseline

information; water resources trends and priority concerns; watershed goals and objectives; selected management strategies, including pollution trading agreements as appropriate; and implementation responsibilities and schedules.

Active involvement of watershed stakeholders is essential to the successful development of a WMAP. A partnership is being formed in WMA 02 that includes representatives of federal, state, regional, and local agencies, academics, citizens, business and industry, water purveyors, dischargers, agriculturists, environmental and public interest groups. The PAC including one or more technical subcommittees will provide a formal avenue for this partnership to work with the Department on expanding and refining this initial Surface Water Quality Characterization Report into a comprehensive Watershed Characterization and Assessment Report through the watershed management planning process.

In presenting this report, the Department recognizes that the preliminary data and findings presented here are incomplete and need to be expanded and refined through a collaborative stakeholder process. However, by compiling and evaluating the Department's own database for information and trends pertinent to the surface water quality issues in WMA 02, the report provides information to the TAC, TMDL workgroup and DEP technical staff who will inform/advise the PAC which will then have the information necessary to begin implementing the watershed management approach presented in the *Draft Statewide Watershed Management Framework Document for the State of New Jersey* (January 1997).

1.2 NJ Environmental Performance Partnership (NEPPS) System

The State of New Jersey is enhancing its implementation of results-based environmental management through its continued participation in the National Environmental Performance Partnership Agreement (PPA) with EPA (NJDEP 1999). NEPPS emphasizes management for environmental results through its use of long-term goals and indicators as measures of environmental progress. The NEPPS process also places greater emphasis on scientific assessments of trends in environmental quality, and through its identification of key issues, provides many elements for use in long-term environmental strategic planning. The PPA covers nine goal areas: global climate change, air quality/radiation, water quality, land & natural resources, site remediation, solid/hazardous waste, pesticides, environmental mercury and open & effective government.

The NEPPS goals for water quality are summarized below.

Table 1.2 Water Quality PPA Goal & Subgoal Listing
SW01: Aquatic life designated use – protect & enhance aquatic life designated use
SW02: Recreational designated uses - protect recreational designated uses in tidal/non-tidal waters
SW03: Fish & shellfish consumption – protect fish & shellfish consumption designated use
SW04: Surface water supply designated use – protect surface water supply designated use
GW01: Ground water quality designated uses – ground water quality will meet all standards for designated uses & ground water discharging to surface water will not adversely impact surface water
GW02: Ground water quantity designated uses – protect & insure adequate ground water quantity for designated uses & for base flow to surface waters
DW00: Safe drinking water – every person in NJ will have safe drinking water
DW01: Source water protection – source water used for drinking water will be protected from Pollution
DW02: Waterborne infectious disease – the consumption of drinking water shall not cause detectable waterborne infectious disease
DW03 Lead – every person should drink water with lead contamination less than 15ppb
DW04: Nitrate – every person should drink water with nitrate contamination less than 10ppm
DW05: Mercury – every person should drink water with mercury contamination less than 2ppb
DW06: VOCs – every person in NJ should drink water with VOC concentrations less than the MCLs
DW07: Disinfection by-products – every person in NJ should drink water that contains the minimum concentration of disinfection by-products without compromising microbiological safety
DW08: Radionuclides – every person should drink water with radiological concentrations less than the MCLs
DW09: Adequate ground & surface water quantity – protect & insure adequate ground & surface water quantity for drinking water use

2.0 SETTING: NATURAL AND BUILT LANDSCAPE

2.1 Location

Figure 2.1-1 depicts the 15 municipalities that lie entirely or partially within the Wallkill, Pochuck & Papakating Watershed Management Area (WMA 02) boundary. Sussex County overlies almost the entire Management Area with the exception of a small portion of the eastward wing which extends into Passaic County (and West Milford Township). The area and population density for each municipality is provided in Table 2.1-1 in Appendix 1. WMA 02 includes parts of five watersheds (Figure 2.1-2) that drain portions of northwestern New Jersey. WMA 02 encompasses 208 square miles and at the widest points is approximately 23 miles long and 20 miles wide. WMA 02 straddles the boundary between the Valley and Ridge Physiographic Province (western portion of the WMA) and the Highlands (eastern portion). Land elevations (Figure 2.1-3) begin at slightly over 400 feet above sea level within the Pochuck river valley and extend beyond 1600 feet along the upper north west edge of the WMA. The overall topography consists of a network of broad river valleys spread out amongst rolling hills. Dramatic increases in relief are restricted to relatively narrow bands forming the northwest rim and along portions the eastern border of the WMA. The Wallkill flows north into New York, eventually passing New Paltz in Ulster County and converging with the Hudson River approximately 15 miles north of New Paltz.

There are over 80 dams and impoundments on the rivers and streams in WMA 02 (Figure 2.1-4) creating localized lake-like conditions, which can affect flow, water quality and sedimentation. Dam is defined as “any artificial dike, levee or other barrier, together with appurtenant works, which is constructed for the purpose of impounding water on a permanent or temporary basis, that raises the water level five feet or more above the usual, mean, low water height when measured from the downstream toe-of-dam to the emergency spillway crest or, in the absence of an emergency spillway, the top-of dam” (N.J.A.C. 7:20-1.8). These dams are classified based on safety considerations (i.e., potential failure impacts on people, property or the impoundment’s integrity itself).

Class I - High Hazard Potential: probable loss of life/extensive property damage.

Class II - Significant Hazard Potential: significant damage to property

Class III - Low Hazard Potential: loss of the dam itself

Class IV - Small Dams: impounds less than 15 acre-feet of water to top of dam.

2.2 Surface Water Hydrology

The New Jersey portion of WMA 02 includes the following watersheds:

Watershed	Drainage (sq. mi.)	Watershed	Drainage (sq. mi.)
Wallkill River (Upper and Lower)	90.2	Papakating Creek	60.6
Pochuck Creek	54.3	Rutgers Creek Tributaries	3.2

These New Jersey drainages consist of headwaters which then flow into lower New York State to then drain into the Hudson River Watershed (Figure 2.2-1). The complete watersheds are therefore co-managed by both NJDEP, the New York Department of Environmental Conservation (NYDEC) and the Interstate Sanitation Commission (ISC) a bi-state autonomous agency which encompasses regional waterway planning, monitoring, environmental management activities as well as federal reporting requirements under Section 305 (b) of the Clean Water Act. More detailed information on these watersheds is supplied below.

2.2.1 Wallkill River

The Wallkill River is divided into both upper (61 square miles) and lower (30 square miles) sub-watersheds, divided just south of the confluence with the Papakating Creek or just east of Sussex Borough. The Wallkill River in New Jersey is 27 miles long. The river's headwater begins as the outflow of Lake Mohawk in Sparta Township in the southern-most portion of the WMA and then runs north by north east, flowing through Ogdensburg, Franklin and Hamburg Boroughs, eventually forming the border between Wantage and Vernon Townships. The river runs the length of the WMA roughly bisecting it into east and west halves before exiting into New York. There are numerous lakes and ponds in the watershed including Lake Mohawk, Newton Reservoir, Beaver Lake, Lake Grinnell and Walkill Lake. There are 10 permitted discharges to surface water in the watershed. These discharges will be discussed in more detail in Section 4: Contributing Factors.

2.2.2 Papakating Creek

Papakating Creek drains an area of 61 square miles which represents much of WMA 02. This 15 mile long creek runs through north-central Sussex County to join the Wallkill River just east of Sussex Borough. Major tributaries to the Papakating include the West Branch Papakating Creek and Clove River. The watershed contains two permitted discharges to surface water.

2.2.3 Pochuck Creek

The Pochuck Creek drainage basin is 49 square miles. The New Jersey portion of the River is 8 miles long and flows northward into New York State eventually joining the Wallkill River above Eden, New York in Orange County. The major tributaries to the Pochuck include Black Creek, Wawayanda Brook and Lake Lookout Brook. Significant Lakes in the region include Upper Greenwood Lake, Lake Wawayanda and Highland Lake. There are 4 permitted discharges to surface water in the watershed.

2.2.4 Rutgers Creek Tributaries

Only about 7.5 miles of stream comprise the New Jersey portion of this largely New York based watershed which extends into New Jersey at the northwestern corner of WMA 02. Streams in this sub-watershed either begin in New Jersey or have their origins

in New York just above the border and then flow into New Jersey before returning back into New York. These tributaries are part of a larger system which drains portions of the western Wallkill River watershed in New York State and join the mainstem Wallkill River north of Eden in Orange County.

2.3 Land Use

Level I land use and land coverages (LU/LC) for WMA 02 are shown on Figure 2.3-1. Level I depictions are provided in the Figure since they allow the best level of resolution across relatively large areas. Level II LU/LC can be selected and analyzed in each major classification area as described below which will be utilized in a subsequent more detailed assessment of WMA 02 probably on a watershed basis. These digital land use data were generated from 1986 aerial photogrammetry. NJDEP is updating this land use/land cover data statewide using 1995/97 overflights. While this work is expected to be completed in 2000, new urban lands developed between 1987 and 1995 are currently available and are depicted in Figure 2.3-2. Additional land use characterizations for WMA 02 will be updated as these new data becomes available.

The primary land use classifications in WMA 02 (as represented in Figure 2.3-1 for 1986) include: 13 % urban or built land, 57 % forested, 21 % agricultural, 5 % wetlands, 1 % barren lands and 3 % water. Figure 2.3-2 shows an increase of 4.3 square miles of urban lands occurring between 1987 and 1995, principally converted from forested and agricultural land. Agricultural lands appear to concentrate in the lower central and western third of WMA 02 with an additional cluster along the Pochuck. Agricultural lands appear least in the eastern uplands. Although forested lands are located throughout the WMA, contiguous forests are most abundant in the central and eastern portions of the WMA. Built lands appear widely scattered with clusters tightly surrounding Lake Mohawk, as well as Highland, Barry and Lower Greenwood Lakes. In addition, many built areas are closely nested adjacent to streams. The overall result of this pattern of clustering around waterways is to increase the potential for direct and significant nonpoint source impacts to the adjacent lakes and streams within WMA 2.

2.3.1 Urban or Built (up) Lands

The Level I Urban or Built-up Land category is characterized by intensive land use where the landscape has been altered by human activities. Although structures are usually present, this category is not restricted to traditional urban areas. Urban or Built-up Land Level II categories include Residential; Commercial and Service; Industrial; Transportation, Communication and Utilities; Industrial and Commercial Complexes; Mixed Urban or Built-up; Other Urban or Built-up and Recreational. Included with each of the above land uses are associated lands, buildings, parking lots, access roads, and other appurtenances, unless these are specifically excluded.

2.3.2 Forest

This Level I category contains any lands covered by woody vegetation other than wetlands. These areas are capable of producing timber and other wood products, and of

supporting many kinds of outdoor recreation. Forestland is an important category environmentally, because it affects air quality, water quality, wildlife habitat, climate, and many other aspects of the ecology of an area. The Level II categories under Forestland are Deciduous; Coniferous; Mixed Deciduous-Coniferous; and Brushland.

2.3.3 Agricultural

This Level I category includes all lands used primarily for the production of food and fiber and some of the structures associated with this production. These areas are easily distinguished from the other categories and represent a significant land use in New Jersey. The Level II categories of Agricultural Land are; Cropland and Pastureland; Orchards; Vineyards; Nurseries/Horticultural Areas; and Confined Feeding Operations. Agricultural facilities can be of environmental concern because of the potential for non-point source pollution associated with fertilizer and pesticide applications as well as livestock management activities.

2.3.4 Wetlands

The wetlands are those areas that are inundated or saturated by surface or ground waters at a frequency and duration sufficient to support vegetation adapted for life in saturated soil conditions. Included in this category are naturally vegetated swamps, marshes, bogs and savannas which are normally associated with topographically low elevations but may be located at any elevation where water perches over an impervious subsurface layer (e.g., clay lens). Wetlands that have been modified for recreation, agriculture, or industry are not included but described under that specific use category. The wetlands of New Jersey are located around the numerous interior stream systems, and along our coastal rivers and bays. New Jersey, by its numerous different physiographic regions, supports various wetland habitats dependent upon physiographic and geological variables. The Level II classification separates wetlands into a variety of categories based on vegetation type (e.g., grassy, shrub, forested) and flow conditions (e.g., tidal vs. non-tidal). Wetlands appear to be widely scattered throughout the WMA, however, notable concentrations are observed adjacent to the central Wallkill River channel and the channels of the Pochuck and Black Creeks.

2.3.5 Barren Lands

Barren lands are characterized by thin soil, sand or rocks and a lack of vegetative cover in a non-urban setting. Vegetation, if present, is widely spaced. Barren land such as beaches and rock faces are found in nature but also result from man's activities. Extraction mining operations, landfills and other disposal sites compose the majority of man-altered barren lands. Of concern under this land use category are mines or quarries which often require NJPDES permits for pump out activities. Upon abandonment some of them may also become landfills which in turn can become nonpoint pollution sources. A review of locations delineated as "extraction mining" show numerous sites in the central portion of the Wallkill watershed especially in the vicinity of Hardyston Township, Hamburg Borough and Ogdensburg Borough. Many large sites appear to be

directly adjacent to the Wallkill. In addition, what appears to be a large site lies close to the Black Creek in the center of Vernon Township.

2.3.6 Water

All areas within the landmass of New Jersey, periodically covered by water, are included in this category. All waterbodies are delineated as they existed at the time of data acquisition, except areas in an obvious state of flood. Level I includes four (4) Level II categories; Streams and Canals; Natural Lakes; Artificial Lakes; and Bays and Estuaries. Not included in this category are water treatment and sewage treatment facilities. Stream or flowing waters in WMA 02 represent portions of the headwaters of a very large watershed which lies predominantly in New York State. Lakes within this WMA are most likely a mixture of natural (largely formed via glaciating processes), artificial (manmade impounded streams) and augmented natural lakes (natural lakes which are enhanced in size through the addition of an impoundment). A review of dams associated with lakes in WMA 02 (Figure 2.1-4) indicate that most lakes over five acres in size appear to be associated with one or more dams.

2.4 Population

Population density is usually a good indicator of potential human stress on the lands and waters of an environment. Municipal total population and population density (census) data in WMA 02, as of 1990, are provided in Table 2.1-1. Population densities for 1990 are illustrated in Figure 2.4-1. Historical population change for municipalities (1930 - 1990) is illustrated in Figure 2.4-2 and presented on Table 2.4-2a. Population change expressed as percentages from 1970 to 1980 and from 1980 to 1990 are presented on Table 2.4-2b. Population projections to the year 2020 are illustrated in Figure 2.4-3 and provided on Table 2.4-3 (along with percent change 1990 to 2020). Municipality population change (1930 - 1990) combined with projections to the year 2020 are graphically represented in Figure 2.4-4 (1960 - 1990) and contained in Table 2.4-4.

Populations in WMA 02 are clustered around Lake Mohawk in Sparta Township, and around Highland and Upper Greenwood Lakes in West Milford and Vernon Townships respectively. Other clusters are in and just west of Sussex Borough, and in the Boroughs of Ogdensburg, Franklin and Hamburg. Of concern for water quality is that these population clusters closely adjoin many of the major lakes and rivers of the WMA. Water quality may be impacted by these population clusters closely adjoining many of the major lakes and rivers due to the associated non-point sources of pollution (i.e., impervious surfaces storm water runoff, septic individual wastewater system failures, lawn care products, etc.)

The population of WMA 02 has shown substantial growth within the past twenty years. Based upon census data between 1970 and 1990, Wantage, Vernon and Frankford Townships, for example, have shown robust growth at 119%, 250%, 84%, respectively. Some municipalities, in contrast have shown limited growth such as Franklin Borough at 17% and Sussex Borough at 8%. Although West Milford, Byram and Montague townships have shown growth (47%, 75% and 150% growth, respectively), most of their impacts are most likely felt in the neighboring WMAs.

3.0 Surface Water Quality Concerns

In the sections that follow, New Jersey's Surface Water Quality Standards are described, including applicable stream classifications for WMA 02. Statewide monitoring programs for water and sediment chemistry, sanitary quality, biological health, lake trophic status and fish tissue contamination are described. In addition, a study of water quality trends between 1985 and 1995 conducted by USGS under contract to NJDEP was used to summarize trends. In addition, the Impaired Waterbodies List (303d Program) is described.

Only readily available data were used to prepare this assessment. Additional datasets collected by the NJDEP, other agencies and watershed partners are needed to improve this initial assessment. Further, additional data collection efforts are underway or being planned by the Department to develop TMDLs and address data gaps. Integration of these datasets will provide the scientific and technical basis for the Watershed Management Plan for WMA 02.

3.1 Surface Water Quality Standards

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. A draft map of the SWQS is provided on Figure 3.1-1. SWQS are explained below.

Water Quality Goals: National water quality goals were established in the Federal Clean Water Act. These goals state that surface waters should be fishable, swimmable and potable (after reasonable treatment). The national goals are reflected in the designated uses of waters established in New Jersey's Surface Water Quality Standards (SWQS) and the water goal statement developed under the National Environmental Performance Partnership Agreement (NEPPS).

Designated uses: The designated water uses in WMA 02 are primary and secondary contact recreation (i.e., swimmable); maintenance, migration and propagation of the natural and established biota (i.e., fishable) and public potable water supply, after such treatment as required by law or regulation (i.e., potable). These uses were established based on physical, chemical, biological, and hydrological characteristics of the waters and the economic considerations related to attaining various uses. Designated uses that apply to streams and rivers within WMA 02 are listed in the SWQS and are evaluated periodically.

Water Classifications: Waters in WMA 02 are grouped into classifications as follows:

FW1: 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: General fresh surface water classification applied to fresh waters that are not FW1 or Pinelands Waters.

TP: Trout Production waters are designated for trout spawning/nursery during their first year.

TM: Trout Maintenance waters are designated for the support of trout throughout the year.

NT: 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.

ND: Nondegradation waters are waters set aside for posterity because of their clarity, color, scenic setting, other characteristic of aesthetic value, unique ecological significance, or exceptional water supply significance. These include all waters designated as FW1 in this report.

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 of C1 antidegradation policies

C2: Category 2 waters are waters that are not designated as Outstanding Natural Resource Water (i.e., FW1 or PL) or C1 for implementation of antidegradation policies.

Water Quality Policies: Anti-degradation policies apply to all surface waters of the State. Existing uses must be either maintained or protected, and no irreversible changes to water quality are allowed that would impair or preclude attainment of designated uses. Waters classified as nondegradation waters (i.e., FW1) must be maintained in their natural state, and are not to be subject to any manmade wastewater discharges. Narrative criteria that prohibit changes in natural water quality apply to high quality waters. Water quality characteristics that do not meet criteria must be improved to meet criteria.

Water Quality Criteria: States are required to adopt water quality criteria that will protect both the existing and designated uses of a waterbody with an adequate degree of safety. Numerical criteria are often established for chemical pollutants, sanitary quality, and physical characteristics of the water such as temperature and dissolved oxygen. Narrative criteria that prohibit toxicity in surface waters are established to protect against the effects of multiple pollutants. A summary of SWQS criteria that apply to FW2-NT waters is provided in Table A3.1-1 in the Appendix.

Table 3.1-1: SWQS Stream Classification and Stream Miles

SWQ Classification	Trout Classification	Antidegradation Policy	Length (mi.)
FW1	NA	ND	13.34
FW1	TP	ND	6.05
FW1	TM	ND	1.77
FW2	TP	C1	22.56
FW2	TM	C1	2.37
FW2	TM	C2	90.25
FW2	NT	C1	21.42
FW2	NT	C2	36.39
FW2	NT	NS	198.74
		Total	392.89

3.2 Surface Water Quality Monitoring Programs

Monitoring data are used to evaluate current conditions and trends with respect to Surface Water Quality Standards, identify emerging issues and evaluate effectiveness of management measures. The NJDEP's primary surface water quality monitoring unit is the Water Monitoring Management (WMM), although other units also perform some monitoring functions and some monitoring is conducted cooperatively with other entities, especially the United States Geological Survey (USGS). Monitoring stations in WMA 02 that are routinely sampled by NJDEP and / or USGS are shown on Figure 3.2-1 and Table A3.2-1 in the Appendix. The monitoring networks are explained below.

Ambient Stream Monitoring Network (ASMN): The NJDEP and the United States Geological Survey (USGS) have cooperatively operated the Ambient Stream Monitoring Network (ASMN) in New Jersey since the 1970s. The data from this network were used to assess the physical, chemical, and sanitary quality of freshwater streams and sediments. Long term water chemistry and sanitary quality data are available for the following stations in WMA 02:

Table 3.2-1 Water Quality Monitoring Stations in WMA 02

Station #	Location	SWQS Classification	Drainage Area (sq. mi.)	Years Sampled
01367770	Wallkill near Sussex (above the Papakating confluence)	FW2-NT	60.8	1976-current
01368000	Wallkill near Unionville NY	FW2-NT	140	1963-78; 1991-97
01367910	Papakating Creek at Sussex	FW2-NT	59.4	1976-97
01368950	Black Creek near Vernon	FW2-NT	17.3	1976-97

Routine water column parameters and observations collected at each monitoring station on a quarterly schedule are shown on Table 3.2-2.

Table 3.2-2: Routine Water Quality Parameters

Date/ Time	Calcium	Nitrite
Instantaneous discharge	Magnesium	Nitrate + Nitrite
Specific conductivity	Sodium	Ammonia - total
PH	Potassium	Ammonia - dissolved
Water temperature	ANC Unfiltered?	Ammonia + organic N -total
Barometric pressure	Sulfate	Ammonia + organic N - dis
Dissolved oxygen	Chloride	Total Nitrogen
DO % saturation (calculated)	Fluoride	Dissolved Nitrogen
BOD (5 day)	Silica	Total Phosphorus
Fecal Coliform	Solids (residue)	Dissolved Phosphorus
Enterococcus	Solids (calculated)	Dissolved Organic Carbon
Hardness	Residue at 105 C	Suspended Organic Carbon

Supplemental water column parameters are collected 2 times per year at 1/3 of the stations on a rotating schedule. Thus, all stations are sampled over 3 years. Parameters include:

Table 3.2-3: Supplemental Water Quality Parameters

Chemical oxygen demand	Arsenic	Beryllium
Boron	Cadmium	Chromium
Copper	Iron	Lead
Manganese	Mercury	Nickel
Selenium	Zinc	

Supplemental sediment parameters include metals, organic pesticides, herbicides and PCBs.

Under contract to NJDEP, USGS conducted a project to characterize water quality status and trends in NJ between 1986 and 1995. (USGS, 1999). The results were used in the characterizations that follow to summarize trends.

Redesigned Ambient Stream Monitoring Network: Although the Ambient Stream Monitoring Network was sufficient to assess general status and trends, changes were needed to provide data for water quality indicators and watershed management. Therefore, a NJDEP/USGS interagency committee redesigned the network. The Redesigned Ambient Stream Monitoring Network has been operating since the fall of 1997. Thus, data from 1990-1997 collected in the previous network are used to provide an overview of long-term water quality conditions for this assessment. In the future, water quality assessments can be updated using data from the redesigned network. An overview of the redesigned network is provided in Appendix 3.

NJDEP Ambient Biomonitoring Network (AMNET): Ambient chemical monitoring is now extensively supplemented by biological assessments of in-stream benthic macroinvertebrate communities (See Figure 3.2-1). These bottom- dwelling communities of larval insects and crustacea (See Appendix A3.2-3) were examined using USEPA's Rapid Bioassessment Protocols - Level II. (USEPA, 1989). Using this protocol, communities are examined for pollution tolerant

and intolerant forms and the results are used to compute the New Jersey Impairment Score (NJIS).

Monitoring at over 800 locations statewide is conducted on a 5-year rotating schedule. Round 1 sampling was completed in the mid-1990's and Round 2 sampling is ongoing now. In Round 2, the assessments were improved by sampling various types of stream habitat at each monitoring location and by conducting a visual habitat assessment. Various components of the habitat are examined and results are used to compute a Habitat Assessment Score.

Benthic macroinvertebrate communities integrate the effects of multiple stressors including habitat quality (e.g., temperature, flow, erosion, sedimentation); chemical quality (e.g., contaminants in water and / or sediment) and natural shifts in population. Further, benthic macroinvertebrate communities may reveal the impacts of chronic stressors which may be overlooked by the short-term "snapshot" view provided by ambient chemical sampling. Thus, benthic data provide a useful indicator to screen the overall health of aquatic communities. Other components of EPA's Rapid Bioassessment Protocol are being added to provide a more comprehensive picture of the health of aquatic ecosystems. Indicators that are being explored include fish and algal communities and presence of rare and threatened species.

Clean Lakes Program: In WMA02, two lakes were included in the Clean Lakes Program: Clove Lake and Lake Waywayanda. The Clean Lakes Program evaluates public lakes possessing water quality problems, which in turn impair the lake's recreational value. These assessments began in the late 1970's and continued into the mid-1990's. Natural and constructed lakes are assessed. Typically under the Clean Lakes Program, lakes that require management due to use impairments are identified by citizens or other groups. Phase I Diagnostic Studies are conducted to evaluate water quality and document use impairments. The diagnostic study results are used to develop appropriate management proposals (typically dredging) for funding. If funding is secured, the management project is conducted in Phase II. Lakes are monitored again after the management project is completed.

Many lakes in WMA 02 are private and as such are not monitored by state and federal lake management programs (See Figures 2.1-2 and 2.1-4). Examples of such lakes in WMA 02 are Lakes Mohawk and Grinnell, Highland, Barry, Wallkill, Beaver and Upper Greenwood Lakes. Many of these lakes may experience use impairments; however, the Department is not always made aware of this by the communities overseeing these lakes.

Toxics in Biota Program: To evaluate contaminants in fish in terms of risks for human consumption, levels of PCBs, dioxins, chlordane and mercury have been carried out in various water of the state (i.e., edible tissue of fish and shellfish). PCBs, dioxin and chlordane are contaminants typically associated with point sources (e.g., hazardous waste sites) in the coastal and estuarine areas of the state. In contrast, most freshwater fish contamination in New Jersey is typically associated with mercury (i.e., ostensibly due to non-point source atmospheric deposition pollution). A DEP guide to health advisories for eating fish and shellfish caught in New Jersey waters is updated and published annually in the Department's Fish & Wildlife Digest (DEP 2000). Affecting WMA 02 is a Statewide consumption advisory for largemouth bass and chain pickerel (i.e., for all freshwater bodies in New Jersey). The advisory directs the general population not eat more than one meal a week and that high-risk individuals (i.e., pregnant and breast feeding women) not eat more than one meal a month. Certain other lakes and reservoirs in New Jersey are posted for the more restrictive advisory but none of them are in WMA 02. It

should be noted that although data may show elevated levels of mercury in fish, it does not affect the quality of the waters used for drinking and bathing.

3.3 Surface Water Quality in the Wallkill River Watershed

3.3.1 Chemical and Sanitary Water Quality in the Wallkill River Watershed

Through 1997, the Wallkill River was monitored near Sussex (01367770), just below the confluence with Papakating Creek and near Unionville, NY (01368000). Both of these stations are located in FW2-NT waters. See Figure 3.3-1 for a summary of water quality trends.

Dissolved Oxygen: Levels are significantly above the SWQS criteria for FW2-NT waters and no exceedences were identified between 1990 and 1997. Between 1986 and 1995, a slightly decreasing downward trend in DO (-0.13 mg/l per year) was found in the Wallkill at Unionville. This trend may have been affected by changes in flow. No trends were found at Sussex. (USGS, 1999). These data indicate very good water quality with respect to DO.

Temperature: No exceedences of the upper criterion for FW2-NT waters or trends were identified. These data indicate very good water quality with respect to temperature.

Nutrients: Phosphorus levels met SWQS criterion of 0.1 mg/l between 1995 and 1997. Although no trends were identified between 1986 and 1995 (USGS, 1999), levels were historically slightly elevated. These data indicate very good water quality with respect to total phosphorus. As shown on Figure 3.3-3, total phosphorus in bottom sediments was 430 mg/kg in the Wallkill River at Sussex and dropped to 42 mg/kg in the Wallkill River near Unionville between 1990 and 1994. This drop may be due to the large wetland area acting as a phosphorus sink.

Levels of nitrate are very low at both monitoring locations (about 1 ppm), but were rising slightly between 1986 and 1995 in the Wallkill near Unionville (+0.039 mg/l per year). (USGS, 1999). These data indicate very good water quality with respect to nitrate.

Bacteria: Fecal coliform levels were elevated at both monitoring locations, and no statistically significant trends were found. These data indicate poor water quality with respect to fecal coliform bacteria.

Heavy Metals: Levels of metals were very low between 1990 and 1997. Insufficient data were available to analyze trends. Additional metals data are being collected through the 303d Evaluation Monitoring Program described elsewhere.

Summary: Water quality in the Wallkill River is overall very good. Similar to many areas in the state, elevated fecal coliform impairs swimmable use. See Figure 3.3-1 and Table A3.3-1 in the Appendix for additional information on Water Quality Status and Trends in WMA02.

3.3.2 Biological Evaluation of the Wallkill River Watershed

The Wallkill River Watershed is monitored at 5 mainstem locations and 1 tributary (Beaver Run). Data were collected primarily in 1990 and 1998. Based on these two sample events, benthic communities that were not impaired in 1990 declined to moderate impairment by 1998 or remained moderately impaired over this time period. (NJDEP, 1999). See Figure 3.3-2 and Table A3.3-2: Benthic Macroinvertebrate Status and Trends in WMA02 in the Appendix for additional information.

As noted from the water quality discussion above, chemical water quality as measured by the Wallkill at Sussex location is very good. Habitat quality was evaluated in the 1998 sample event. All locations exhibited optimal or sub-optimal habitat scores; none were marginal or poor. Thus additional investigations are needed to evaluate potential cause(s) of this apparent decline in biological health. Potential causes include changes in flow (e.g., storms, drought, etc.), natural conditions (e.g., recent hatch). Also, it is possible that one or more contributing factors were not identified in the habitat assessment or water quality monitoring.

3.3.3 Lake Trophic Status in the Wallkill River Watershed

As shown on Figure 3.3-3, none of the Wallkill River Watershed lakes were monitored in the Clean Lakes Program.

3.4 Water Quality in the Papakating Creek Watershed

3.4.1 Chemical and Sanitary Water Quality in the Papakating Creek Watershed

The Papakating Creek is a major tributary to the Wallkill River and the Papakating Creek at Sussex water quality monitoring station (01367910) is located in FW2-Non Trout waters. See Figure 3.3-1 for a summary of water quality trends.

Dissolved Oxygen: Levels are significantly above the SWQS criteria for FW2-NT waters and no exceedences were identified between 1990 and 1997. An increasing (improving) trend was identified between 1985 and 1996 (USGS, 1999). These data indicate very good water quality with respect to dissolved oxygen.

Temperature: No violations of the upper criterion for non-trout waters. These data indicate very good water quality with respect to temperature.

Nutrients: Between 1990 and 1994, the Papakating Creek at Sussex showed elevated phosphorus, with 31% of samples exceeding the criterion for total phosphorus. However, a statistically significant downward trend (-0.006 mg/l per year) was identified between 1986 and 1995 (USGS, 1999). Between 1995 and 1997, 21% of the samples exceeded the SWQS criterion for total phosphorus. These data indicate marginal water quality with respect to total phosphorus. As shown on Figure 3.3-3, total phosphorus in bottom sediments was 520 mg/kg in the Papakating Creek at Sussex between 1990 and 1994.

Nitrate levels are well below the SWQS criterion and no statistically significant trends were identified (USGS, 1999). These data indicate very good water quality with respect to nitrate.

Bacteria: The Papakating Creek exhibited elevated bacterial levels and no statistically significant trends were identified (USGS, 1999). These data indicate poor water quality with respect to fecal coliform bacteria.

Heavy Metals: Between 1995 and 1997, metals levels were very low. Only one sample exhibited elevated lead in 1990. This sample was collected prior to implementation of improved sample collection and analysis techniques, and may be the result of sample contamination. Additional metals data are being collected through the 303d Evaluation Monitoring Program, described elsewhere in this report.

Summary: Water quality in the Wallkill River is very good for most parameters. However, elevated bacterial and phosphorus levels require additional attention. See Figure 3.3-1 and Table A3.3-1 in the Appendix for additional information on Water Quality Status and Trends in WMA02.

3.4.2 Biological Evaluation of Stream Water Quality in Papakating Creek Watershed

The Papakating Creek Watershed is monitored at 3 locations on the mainstem, 2 locations on the West Branch, and 3 locations on Clove Run. Data were collected primarily in 1990 and 1998. See Figure 3.3-2 and Table A3.3-2: Benthic Macroinvertebrate Status and Trends in WMA02 in the Appendix for additional information.

Based on these two sample events, benthic communities on the Papakating Creek mainstem remained not impaired in the headwaters, moderately impaired at Pelletstown and declined from not impaired to moderately impaired at the basin outlet. Benthic communities on the West Branch of the Papakating Creek also remained not impaired in the headwaters and declined from not impaired to moderately impaired at the downstream end. One Clove Run station declined from not impaired to moderately impaired, while the other, sampled only in 1998, was not impaired. The downstream end of Clove Run remained moderately impaired. (NJDEP, 1999).

As noted from the water quality discussion above, chemical water quality as measured by the Papakating Creek at Sussex location is good, although the effect of elevated total phosphorus on benthic health is unclear. Habitat quality was evaluated in the 1998 sample event. All locations that were not impaired exhibited optimal habitat scores; moderately impaired locations exhibited optimal, sub-optimal and marginal habitat scores. Additional investigations are needed to evaluate potential cause(s) of moderate impairment and apparent decline in biological health. Potential causes include habitat alterations (e.g., siltation, erosion, etc.) changes in flow (e.g., storms, drought, etc.), natural conditions (e.g., recent hatch) and water quality (e.g., elevated total phosphorus or other factors).

3.4.3 Evaluation of Water Quality in Lakes: Trophic Status

As shown on Figure 3.3-3, Clove Lake was monitored in the Clean Lakes Program in 1983 and was classified as eutrophic due to elevated total phosphorus and chlorophyll a. This lake has a surface area of 35 acres and is used for recreation and swimming.

3.5 Surface Water Quality in the Black Creek (Pochuck) Watershed

3.5.1 Chemical and Sanitary Water Quality in the Black Creek Watershed

The Black Creek is monitored near Vernon, NJ (01368950), just below the NY border. This station is located in FW2-NT waters. See Figure 3.3-1 for a summary of water quality trends.

Dissolved Oxygen: Although median concentrations were 7.9 mg/l between 1995 and 1997, one sample exceeded the SWQS for DO (i.e., fell below 4 mg/l DO). No statistically significant trends were identified between 1986 and 1995 (USGS, 1999). Additional evaluation of diurnal DO is needed at this location. These data indicate marginal water quality with respect to dissolved oxygen.

Temperature: No violations of the upper criterion for non-trout waters and no statistically significant trends were identified between 1986 and 1995 (USGS, 1999). These data indicate very good water quality with respect to temperature.

Nutrients: Average levels of total phosphorus were low (0.04 mg/l TP) between 1995 and 1997. Additionally, decreasing trends (-0.003 mg/l per year) were identified between 1986 and 1995 (USGS, 1999). However, one sample collected between 1995 and 1997 exceeded SWQS criterion. These data indicate marginal water quality with respect to total phosphorus. As shown on Figure 3.3-3, total phosphorus in bottom sediments was 720 mg/kg in the Black Creek at Vernon between 1990 and 1994.

Levels of nitrate were significantly below the SWQS criterion and no statistically significant trends were identified between 1986 and 1995 (USGS, 1999). These data indicate very good water quality with respect to nitrate.

Bacteria: Exhibited elevated bacterial levels and no statistically significant trends were identified between 1986 and 1995 (USGS, 1999). These data indicate poor water quality with respect to fecal coliform bacteria.

Heavy Metals: Levels are at acceptable levels when compared to human health SWQS criteria. Additional metals data are being collected through the 303d Evaluation Monitoring Program, described elsewhere in this report.

Summary: The Black Creek near Vernon showed elevated bacteria and total phosphorus levels. In addition, levels of DO dropped below the minimum standard for protection of aquatic life in one sample event. These data indicate marginal water quality in the Black Creek near Vernon.

See Figure 3.3-1 and Table A3.3-1 in the Appendix for additional information on Water Quality Status and Trends in WMA02.

3.5.2 Biological Evaluation of the Black Creek Watershed

The Black Creek Watershed is monitored at 3 locations: on the mainstem, on Lake Lookout Brook and Waywayanda Brook. Data were collected at Waywayanda Brook primarily in 1990 and 1998; the other locations were sampled only in 1998. See Figure 3.3-2 and Table A3.3-2: Benthic Macroinvertebrate Status and Trends in WMA02 in the Appendix for additional information.

Black Creek and Waywayanda Brook both exhibited moderate impairment and sub-optimal habitat scores. Lake Lookout Brook exhibited a decline from not impaired in 1990 to moderate impairment in 1998, despite optimal habitat.

Water quality and habitat degradation may contribute to impairment in the Black Creek. Other potential contributing factors include flow alterations and natural factors. Additional investigations are needed to identify potential contributing factors to biological impairment at these locations in the Black Creek Watershed.

3.5.3 Lakes Trophic Status in the Black Creek Watershed

As shown on Figure 3.3-3, Lake Waywayanda was monitored in the Clean Lakes Program in 1991 and found to be eutrophic due to macrophyte growth. This 240 acre lake is located in Waywayanda State Park, and is used for recreation and swimming.

3.6 Impaired Waterbodies List

Section 303(d) of the Federal Clean Water Act requires states to identify waters that are not attaining surface water quality standards, despite the implementation of technology based effluent limits. Impaired waterbodies are ranked by considering the type, severity and spatial extent of the impairment, among other factors. Based on the ranking, high priority waterbodies are identified for TMDL development in the next two years. The 303d List is proposed and adopted in a public process (See Table A3.6-1 in the Appendix).

Impaired waterbodies have been identified using data sources identified above (i.e., chemical and sanitary water quality, benthic macroinvertebrate monitoring, Clean Lakes Program data and fish tissue studies). In addition, county data have also been used. The latest NJ Impaired Waterbodies List (303d List) was published in 1998. This list was based on 303d Lists published in 1992, 1994 and 1996 as well as a list of waterbodies suspected to be impaired by toxics developed in 1989 (i.e., the 304(l) List) and data collected through 1996.

Impaired waterbodies remain on the 303d List until new data show that the SWQS are currently being met or the basis for the listing is no longer applicable (e.g., change in SWQS criterion). Strategies to attain SWQS include development of TMDLs for chemical/ sanitary exceedences of SWQS, implementation of nonpoint source and stormwater management measures, land preservation, etc.

Federal implementing regulations for Section 303d are found at 40 CFR 130.7; NJ implementing regulations are found at N.J.A.C. 7:15-6. USEPA published proposed revisions to 40 CFR 130.7 in 1999, and these are expected to be adopted in 2000. USEPA proposed and

adopted an amendment to 40 CFR 130.7 that eliminates the requirement for states to submit a 2000 Impaired Waterbodies List. The intent was to encourage states to collect new data to evaluate listed waters and allow time for TMDL development. NJ is planning to propose revisions to state regulations in the Watershed Management Planning Rules in 2000. In addition, NJDEP and USEPA are establishing an Interagency 303d Technical Workgroup to jointly develop detailed 303d Listing and De-Listing procedures. Procedures will be available for public review and comment. These procedures will be used to evaluate data collected through 2001 to develop the 2002 Impaired Waterbodies List.

3.6.1 New Jersey's 1998 Impaired Waterbodies List

The 1998 303(d) List has been divided into three distinct parts: 1.) Waterways with Known Impairments; and 2.) Candidate Waters (Sub-Lists A and B). Waterways with Known Impairments (Sub-List 1) includes waterbodies with known current or historical exceedences of SWQS numerical criteria or use impairments. TMDLs are likely to be needed in these waterbodies.

There is some evidence of impairment but additional data are needed to evaluate Candidate Waters (Sub-List II). The results of additional evaluation will be used to identify appropriate management measures, including TMDL development as needed or to remove waters that are shown to be not impaired. This sub-list is further divided into two parts (A and B) based on the strength of evidence for water quality impairment.

Sub-List I: Waterways with Known Water Quality Impairment includes:

- Conventional pollutants and fecal coliform
- Lakes with confirmed water quality problems and Clean Lakes Program Phase 1 studies
- Waters with fish consumption advisories
- Other data collected using current QA/QC procedures

Sub-List IIA: Candidate TMDL Waters- Known Water Quality Impairment

- Severely impaired benthic macroinvertebrate locations

Sub-List IIB: Candidate TMDL Waters - Suspected Water Quality Impairment

- Metals and ammonia data (data age and data quality issues)
- Lakes with suspected water quality problems based on limited data
- Moderately impaired benthic macroinvertebrate locations

3.6.2 Impaired Waterbodies in WMA 02

Impaired waterbodies included on the 1998 Impaired Waterbodies List for WMA 02 is provided in Table A3.6-1 in the Appendix. Chemical impairments are summarized on Table 3.6-1 below.

Table 3.6-1: 1998 Impaired Waterbodies List for WMA02 (chemical/ sanitary only)

Reach	Pollutants
Papakating Creek at Sussex	fecal coliform, total phosphorus
Black Creek near Vernon	fecal coliform, total phosphorus

Wallkill River at Franklin	temperature, fecal coliform, total phosphorus, arsenic, beryllium, cadmium, chromium, lead, mercury *
Wallkill River near Sussex	fecal coliform, total phosphorus, lead *
Wallkill River near Unionville	fecal coliform, total phosphorus, lead *
Note: metals are from 304(l) list and the stream reach, not specific monitoring location, is listed on 303d	

NJDEP is evaluating these impaired waterbodies to ensure that the TMDL project for WMA 02 addresses current water quality impairments. A review of the most recent 5 years of data was conducted to develop preliminary recommendations for TMDL planning. Results are provided in Appendix A3.6-2: Preliminary TMDL Parameter Recommendations for WMA02. These recommendations will be re-evaluated and finalized based on the results of 303d Evaluation Monitoring, which is described below.

3.6.3 303d Evaluation Monitoring

In order to focus TMDL development on waterbodies with current impairments, 303d Evaluation Monitoring is being conducted by NJDEP. This monitoring effort is currently focused on metals and conventional constituents in freshwater streams. In New Jersey and nationally, concerns regarding the quality of historical metals data have been raised. In addition, total recoverable metals data were compared to dissolved criteria for protection of aquatic life, potentially overestimating of exceedences of metals criteria. Therefore, clean sampling and analysis techniques are being implemented and total recoverable and dissolved metals data are being collected from waterbodies on the 1998 303d List. Results will be used to propose delisting, additional monitoring or TMDL development as appropriate. 303d Evaluation Monitoring for conventional constituents (nutrients, dissolved oxygen) is being used to define the spatial extent and severity of the problem to plan TMDL development. Flow data are also being collected to facilitate interpretation of results. The monitoring plan for WMA 02 is provided as Appendix Table A3.6-3.

Data from the 303d Evaluation Monitoring will be used to finalize the TMDL scope of work for stream water quality constituents and will be integrated into this Surface Water Quality Characterization and Assessment. Remaining impairments will be addressed through other venues.

3.7 Public Community Water Supply in WMA 02

In contrast to the large number of groundwater withdrawals for Public Community Supply Wells (PCSWs) in WMA 02 (Figure 3.7-1) there are only three permitted surface water intakes (i.e., Colesville, Morris Lake (2)) and three potable reservoirs (i.e., Rutherford Lake, Franklin Pond and Morris Lake).

4.0 Contributing Factors

Numerous point and nonpoint sources of pollution contribute to surface water quality conditions and trends; these factors are collectively called “contributing factors”. Point sources discharge from a pipe or a ditch and include DEP regulated facilities (i.e., require operating permits). Nonpoint sources of pollution emanate from diffuse sources that are often dispersed and difficult to control. Factors that contribute to water quality concerns (i.e., both point and nonpoint sources) are summarized in Table 4-1.

Water Quality Contributing Factors: Point sources emanate from a pipe and include industrial and municipal wastewater treatment plant effluents, cooling water discharges and industrial stormwater. Industrial and municipal discharges to surface and ground water are regulated through permits. Nonpoint sources of pollution emanate from diffuse sources that are often dispersed and difficult to control. Nonpoint sources of pollution include municipal stormwater and contaminated runoff from construction, urban, suburban, agricultural lands, golf courses, waste disposal, contaminated sites, small septic systems, aquatic pesticide applications, sediment fluxes and air deposition. In New Jersey, municipal stormwater is categorized as a type of nonpoint source pollution even though it is discharged from a pipe because nonpoint sources pollute municipal stormwater. Naturally occurring radon affects ground water used for potable supplies, poor quality of some surface and ground water sources affects potable supplies and water treatment costs. In addition, naturally occurring and anthropogenic total organic carbon contributes to trihalomethane formation in drinking water from surface sources. Multi-media transfer of pollutants occurs as a result of physical and chemical processes, air deposition to lakes and land, hydraulic connections between ground and surface water, pollutant transfer between water, sediment, and biota contribute to water quality concerns.

Nonpoint sources within WMA 02 may include stormwater and runoff from developed or disturbed lands; contaminated sites; improperly placed or malfunctioning septic systems; atmospheric deposition; landfill runoff and leachate. Figure 4.0-1 locates the point source dischargers in WMA 02, land uses and areas of total phosphorus exceedances (i.e., exceed SWQSSs). It also identifies point and non-point sources and their areas of influence. Physical, chemical and ecological processes can transport toxics, nutrients and pathogens to surface water, ground water, sediments and plants and animals.

Water Quantity Contributing Factors: Water quantity can affect water quality in various ways but primarily through flow (i.e. scour) and volume changes (i.e., dilution/concentration) both on a geographically distributed (e.g., high ridge vs. valley gradients) and a seasonal basis (e.g., spring floods, summer droughts). Factors that contribute to water quantity concerns include: increasing demands in WMA 02 for water as population increases; current and future water demand pressures external to WMA 02; decreased recharge as development occurs; balancing water supply and ecological considerations, especially during dry conditions; and water quality degradation. In addition, future TMDL decisions may affect water management measures such as minimum passing flow requirements.

Table 4.0-1: Water Quality Concerns and Contributing Factors

Concern	Surface Water Quality	Ground Water Quality	Drinking Water Quality
Nutrients	Domestic sewage effluent Municipal stormwater Runoff Sediment flux Air deposition Contaminated groundwater	Septic systems Municipal stormwater Infiltration	Source water quality degradation
Pathogens	Municipal stormwater Runoff Domestic/ wild animals Sediment flux Environmental regrowth Domestic sewage effluent	**Not identified as a GW issue	**Not identified as a DW issue
Suspended Sediment	Runoff Erosion Dredging?	**Not identified as a GW issue	**Not identified as a DW issue
Salts	Domestic sewage effluent Municipal stormwater Runoff Industrial effluent?	**Not identified as a GW issue	**Not identified as a DW issue
Metals	Industrial effluent Domestic sewage effluent Municipal stormwater Runoff Industrial stormwater? Sediment flux Air deposition	**Not identified as a GW issue	**Not identified as a GW issue
Organics	**Not identified as a SW issue	Contaminated sites Septic systems Contaminated surface water?	Source water quality degradation (VOCs in GW; TOC in SW)
Radon	**Not identified as a SW issue	Naturally occurring	Naturally occurring in GW sources
Benthic Impairment	Poor surface water quality Poor sediment quality Poor habitat quality Natural conditions	NA	NA
Fish Tissue Contamination	Poor sediment quality Air deposition	NA	NA
Sediment Quality	Historical discharges, spills Air deposition Current discharges, spills Contaminated groundwater		

4.1 Point Sources in WMA 02

As of December 1996 there were 16 regulated point sources (i.e., existing NJPDES Permitted discharges.) in WMA 02 that discharged treated wastewater to surface water (See Figure 4.1-1). Regulated point source discharges are further broken down into major and minor facility types (Table 4.1-1) including:

- 9 municipal wastewater permits: typically a combination of municipal and industrial wastewater;
- 5 industrial wastewater/industrial stormwater permits;
- 1 petroleum clean-up permit; and
- 1 non-contact cooling water permit.

On December 26, 1996, the flow to the Sussex Boro STP (Papakating Creek) was re-routed to the Sussex County MUA (Wallkill River) for treatment. Even though this discharge was terminated and the flow routed to another plant, the facility was active during the time the water quality trends were monitored and therefore is included in the discussion and located on the maps. These facilities are regulated by effluent limitations specific to the type of facility, the type discharge, or if necessary as a means to protect site specific water quality. For example, all municipal treatment plants at a minimum are regulated for oxygen demanding substances, total suspended solids, pH, oil and grease and fecal coliform. Effluent flow is usually monitored.

There is also one closed solid waste landfill (SWL) in WMA 02 and no other solid waste facilities (e.g., composting or recycling Facilities).

4.1.1 Point Source Compliance (Placeholder)

Information on permitting and enforcement actions for permitted facilities are reported annually by NJDEP in the Clean Water Enforcement Act Report. None of the dischargers in WMA 2 have been identified as being in Significant Non-compliance (SNC). A facility may be identified as SNC when it violates a permit limitation by 40% twice in a six-month period. For all facilities located in WMA 2, there have been a total of 3 fecal coliform violations and 2 total phosphorus violations during the period 1991 to 1999. Permit violations are summarized in Table 4.1-2.

4.2 Non Point Sources in WMA 02

Increasing urban development (Figure 2.3-2) and population densities (See Figure 2.4-1) in certain areas of WMA 02 and the conversion of summer homes to year-round dwellings can result in localized nonpoint source contamination from home and road construction (e.g., suburban runoff, septic leachate, etc.). In addition agricultural runoff may act as a non-point source of pollution (See Figure 2.3-1) as much of the agricultural lands are along the stream corridors. Some areas in WMA 02 have been experiencing runoff associated with suburban land development including housing construction site runoff, suburban surface runoff, as well as winter road salting.

Nonpoint sources have also contributed to eutrophication in many of the lakes in WMA 02. Although the Department has identified only two lakes as eutrophic, Clove

Lake and Wawayanda Lake (Figure 3.3-3), there are numerous private lakes throughout WMA 2 which are experiencing some eutrophication. The Department does not receive data for these lakes and therefore does not list them as being eutrophic. However, there are Lake Management programs in effect for many of these lakes which infers that they are experiencing some eutrophication. Septic systems may also be a source of nutrients and/or fecal coliform. Much of the development that is clustered around lakes is not located in a sewer service area (Figure 4.2-1).

4.2.1 Land Use Sources

Forested area comprises the main landuse (57%) in WMA 02 (Figure 2.3-1). Forested lands can be associated with fecal coliform contamination (i.e., from wildlife) and possible sedimentation effects dependant on what types of forestry and management practices are employed industries (e.g., timber harvest, lumberyards, paper pulping, etc.). Agriculture is the second highest landuse (21%). It is not possible at this time to differentiate between types of agriculture (i.e., row crops, pasture or dairy herd) and the type of pesticides applied in WMA 02 agricultural areas are those usually associated with fruit and vegetable crops. Agriculture can be associated with non-point sources of pollution (e.g., nutrients from fertilizers, toxics from pesticides, coliforms from farm animals). In WMA 02 which straddles the Highlands - Ridge and Valley Physiographic Provinces represented by high topographic relief (Figure 2.1-3), these agricultural areas tend to follow tillable river valleys (Figure 2.3-1) that are in close contact with surface waters.

There also exist built or urban land areas that cluster along stream corridors and around lakes throughout WMA 02 (See figure 2.4-1). These built lands include urban, suburban, industrial and commercial uses. Land development contributes to nutrient and toxic contamination from municipal stormwater and runoff, septic systems and higher flows at municipal treatment plants.

4.2.2 Stormwater Sources

Stormwater and runoff also negatively affects stream hydrology and aquatic habitat through erosion, flooding, and loss of healthy stream bed and corridor structure and ecological communities.

4.2.3 Impervious Surfaces

The amount and location of impervious surface coverage can be used to indicate potential water quality problems caused by patterns of land development. Pollution and reduced ground water recharge begin to occur when 12 to 17% of the land surface is covered by impervious surfaces. Impervious surface cover analyses for watersheds in New Jersey and WMA 02 are being developed and will be available in 2000.

4.3 Wallkill River

4.3.1 Point Sources of Pollution

In the past, the Wallkill River had poorer water quality in the warm weather months, leading to the conclusion that point or continuous sources may be (or have been) significant contributors to stream degradation. There are presently 10 NJPDES permitted dischargers in the Wallkill River (Figure 4.1-1), five of which are municipal sanitary discharges. Three municipal minor dischargers do not have phosphorus limits at this time. Two of these dischargers will be eliminated in the near future as the flow from the Sparta Twp. BOE's high school and middle school are sent to Sussex County MUA for treatment. For the three facilities with permit limitations (1mg/l), there have been only two violations in the period 1991-1999 (Table 4.1-2).

Nonpoint Sources of Pollution

Urban landuse has been increasing (see Figure 2.3-2). In the Upper Wallkill River, deleterious effects of both urbanization and agricultural activities are on the rise. Several golf courses are located along the Wall Kill, which could be a source of pesticides and nutrients. (Figure 4.0-1) Increasing construction and urban surface runoff have resulted in sediment loading and stormwater contamination, respectively. The Lower Wallkill River is also experiencing the effects of increased urbanization - largely in the form of construction site runoff. Crop production, pasturelands, and a zinc mine at Franklin are all suspected of affecting water quality in the lower segment of the Wallkill.

4.4 Papakating Creek (Clove Brook)

4.4.1 Point Sources of Pollution

There is one monitoring station in this sub-watershed located on Papakating Creek below the confluence with Clove Brook. Surface water quality data from 1995-1997 exceeded SWQS for total phosphorus and fecal coliform. A wastewater discharge, Sussex Boro Treatment Plant, which had been under enforcement action and was suspected of causing water pollution problems, was eliminated in 1996. Flow from the Sussex Boro STP is now treated at the Sussex County MUA facility, which discharges into the Wallkill River. As mentioned in Section 3.4.1, phosphorus data showed an improvement during 1995 to 1997 over the previous 4-yr. period. (See Figure 3. 3-1) Some of this improvement may be attributed to the removal of the Sussex Boro facility. Only one discharge remains the Regency at Sussex Apt. (Figure 4.1-1) which did not have any permit violations during 1999. The Regency, however, does not monitor for total phosphorus.

4.4.2 Nonpoint Sources of Pollution

The primary source contributing to the elevated phosphorus and fecal coliform levels is agricultural, including feedlot, pastureland, and crop runoff. Feedlot runoff has been identified as the reason for the closure of bathing beaches in Clove Lake. Increasing

agricultural runoff (crop production, pastureland, and animal holding) along Papakating Creek is suspected as having contributed to eutrophic conditions in this stream.

4.5 Black Creek (Pochuck)

4.5.1 Point Sources of Pollution

There are four point source discharges to the creek: a petroleum clean up at the Mobile S/S site; municipal discharges from the Vernon Twp BOE (Lounsberry Hollow Middle School) and Legends Resort & Country Club and a cooling water discharge from Ames Rubber Company. Legends is a seasonal discharge operating from November through March and has a phosphorus limit of 1.0 mg/l. The Middle School has a limit of 0.5 mg/l. Neither facility has had any violations from 1991 to 1999 for total phosphorus or fecal coliform.

4.5.2 Nonpoint Sources of Pollution

Black Creek receives some agricultural runoff; however, its principal nonpoint source problem is believed to be suburban/urban in nature. Construction activities coupled with surface runoff are suspected in sediment loading and stormwater contamination. There are areas of dense population near streams, which are not located in a sewer service area (Figure 4.2-1).

4.6 Known Contaminated Sites in WMA 02

At present it is unclear how sites on the Department's Known Contaminated Sites List (KCSL) (Figure 4.6-1) may affect surface water quality on a watershed basis (i.e., affects may be localized requiring insitu remedial/abatement actions). Outside of the data presented here on the general complexity of site contamination there are clear digital data gaps on immediate access to important information such as the nature (i.e., contaminant) and extent (e.g. surface water, sediments) of contamination. This is due primarily to a lack of computerized information in NJDEP's Site remediation Program (SRP). This data gap is being dealt however, through the development of a digital database submittal system called EQUIS. All future site data will be readily accessible and available for assessment.

There are 97 known contaminated sites identified in WMA 02 (Table 4.6-1). These sites are managed by different elements within DEP's Site Remediation Program (SRP) based on the type of site (e.g., underground storage tank, federal facility, etc.), and the funding source for cleanup (e.g., public vs. private). These sites have been also been classified into remedial groups based on their level of complexity. The 97 known contaminated sites in WMA 02 fall into the following classifications:

- C1: Single source/single contaminants affecting both soil and groundwater (52 sites);
- C2: Multiple sources/contaminants affecting soil/groundwater - moderate (34 sites);
- C3: Multiple sources/contaminants affecting soil/groundwater - severe (4 sites);
- C4/D: Superfund –severe and complex (7 sites).

This classification of site complexity into different levels is based on the SRP's 1989 Case Assignment Manual. The intent of the remedial level determinations are to reflect the overall degree of contamination at a site recognizing that individual areas of concern may involve remedial actions of varying levels which are explained below.

Level C-1: A remedial action, which does not involve formal design where source is known/identified. May include the potential for (unconfirmed) ground water contamination. Examples of C-1 cases are regulated or unregulated storage tanks containing gas or heating oil; septic tanks etc.

Level C-2: A remedial action, which consists of a formal engineering design phase, and is in response to a known source or release. Since the response is focused in scope and address a known, presumably quantifiable source, this remedial level is of relatively shorter duration than responses at sites with higher remedial levels. Usually involves cases where ground water contamination has been confirmed or is known to be present.

Level C-3: A multi-phase remedial action in response to an unknown and/or uncontrolled source or discharge to the soils and/or ground water. In this remedial level the contamination is unquantifiable (or presumed unquantifiable) and, therefore, no determinable timeframe for the conclusion of the remedial action is known.

Level C-4/D: A multi-phase remedial action in response to multiple, unknown and/or uncontrolled sources or releases affecting multiple medium which includes known contamination of groundwater. In this remedial level the contamination is unquantifiable (or presumed unquantifiable) and, therefore, no determinable timeframe for the conclusion of the remedial action is known.

4.7 Pesticide Uses in WMA 02

Pesticide usage data are collected by DEP on a Municipal basis summarizing agricultural applications as well as applications to golf courses. These areas have been delineated in Figure 4.7-1. This data has been summarized in Tables 4.7-1 and 4.7-2. Further data analysis needs to be performed on a WMA basis. Data from pesticide use surveys conducted by NJDEP between 1993 and 1995 show that over 12,000 pounds of active pesticide ingredients were applied to land in WMA 02 annually. Approximately 4000 pounds (33%) were applied to golf courses and 8,000 pounds (66%) to agricultural lands. Tables 4.7-1 and 4.7-2 list the more common pesticides used. Although some pesticide monitoring has been conducted, the chemicals used have varied with time and those chemical monitored do not cover the full spectrum of pesticides applied. Those pesticides which have been applied and have also been monitored are identified on the Tables.

5.0 Preliminary Assessment

5.1 Aquatic Life Use Assessment

Currently, aquatic life designated use assessments are based on benthic macroinvertebrate data. Based on 1998 data, 3 of 17 (17.6%) of benthic macroinvertebrate monitoring sites were not impaired and the remaining 14 of 17 (82.4%) were moderately impaired. This represents a decline from 1990 conditions. In 1990, 10 of 14 (71.4%) sites were not impaired and 4 of 14 (28.6%) were moderately impaired. In general, the factors that influence benthic macroinvertebrate communities include water and sediment quality, habitat quality (e.g., substrate, canopy, etc), hydrologic conditions (e.g., stream flashiness, storms, drought, etc.), natural conditions (e.g., recent hatch).

Review of water quality data in WMA02 indicates few or no exceedences of SWQS criteria for conventionals and metals. Habitat quality was optimal or suboptimal at 16 of 17 stations; only 1 station exhibited marginal habitat and no station exhibited poor habitat quality. This direct evaluation is limited because benthic communities may be affected by chemicals in water or sediment that were not detected or perhaps not monitored. The habitat quality assessment was based on a compilation of many habitat factors. In addition, it was not possible to evaluate hydrologic or natural conditions with available data. Interpretation is also confounded by small sample size (17 stations) and because only 3 of 17 were not impaired, leaving a very small data set to characterize unimpaired locations.

Despite these limitations, land use and land use change may provide useful information regarding general environmental disturbances that can affect benthic communities. Figure 5.1-1 and Table A5.1 are useful to evaluate the relationship between AMNET and land use. These data were provided courtesy of Mr. Mark Ayers of the Long Island New Jersey NAWQA Program. Some general observations from this dataset include:

- 3 of 3 unimpaired locations have small drainage areas; most but not all moderately impaired locations have larger drainage areas
- 3 of 3 unimpaired locations have optimal habitat scores; moderately impaired locations have optimal, suboptimal and 1 marginal habitat scores
- unimpaired locations have large percentages of forest and wetland, less urban land. However, 1 or more moderately impaired locations had similar characteristics to unimpaired locations.
- Most moderately impaired locations were adjacent to or just downstream of urban development, potentially indicating the importance of proximal effects.

In order to better evaluate the many potential causes of benthic impairment, NJDEP and USGS are cooperatively conducting a study over the next 2 years: "Development of Watershed Indicators and Realistic Stream Restoration Goals". This study will include advanced statistical and spatial analyses using many datasets to identify factors that contribute to benthic impairment. Many factors that will be considered, including point sources, golf courses, lake outlets, contaminated sites, landfills, stream flow, habitat quality, water quality, sediment quality, etc. The Department is also exploring other indicators to use in combination with benthic macroinvertebrate data to better characterize the health of aquatic systems, including fisheries

and algal indicators. In addition, field investigations by NJDEP and watershed partners are expected to lend additional insight into factors that contribute to impairment.

5.2 Recreational Use Assessment

Currently, recreational use assessments for streams consider fecal coliform data collected 5 times per year. Based on the 1995-97 data reviewed for this report, the streams sampled for fecal coliform do not support swimmable uses. In addition, 1998 data reviewed for TMDL planning also indicate lack of support for swimmable status, although data are considered preliminary because only 5 samples available for the assessment. See Appendix A3.6-2 for additional information.

Currently, recreational uses in public lakes are evaluated using trophic status, since eutrophic conditions may interfere with swimming, boating or fishing. The two public lakes evaluated in WMA 02 were classified as eutrophic, although available data were not considered sufficient to include these lakes on List 1- Confirmed Impairment in the 1998 Impaired Waterbodies List. See Appendix A3.6-1 for additional information.

Recently, NJDEP began working with state, county and local health agencies to compile lake bathing beach data. These data will provide a more direct assessment of recreational uses for swimming in New Jersey lakes, including those in WMA 02.

5.3 SWQSS and Stream Classifications

As noted in Section 3.1 the 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. Issues and/or concerns in a given stream reach occur when SWQS are not met or are threatened. A draft map of the SWQS as they apply to stream classifications in WMA 02 is provided on Figure 3.1-1. In addition, Figure 5.3-1 depicts Stream Classifications overlain on Open Space (i.e., preserved or protected land) and Land Use/Land coverage in WMA 02. Regardless of their Classifications waterways may be impacted by changes in surrounding or/or upstream land uses within each reach.

Table 5.1-1 shows the linear miles and percentage of stream lengths in WMA 02 subdivided by major land use/land classes. For example, 81 % of FW 1 waters are in areas Classified as Open Space or areas, which are restricted from development. [Note: These analyses are based only on State-Owned Open Space and may not reflect the true range of County and Municipal protected Open Space not accessible in the NJDEP database]. FW1 waters are 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. FW1 waters in WMA 02 should be managed so as to ensure low probability of pollution sources from current and future landuses. All FW 1 waters are also listed as Nondegradation (ND) waters, which are set aside for posterity because of their clarity, color, scenic setting, and other characteristic of aesthetic value, unique ecological significance, or exceptional water supply significance.

In addition, 98 % of the Trout Production (TP) waters (i.e., fresh waters designated for trout spawning or nursery during their first year and 99 % of the Trout Maintenance (TM) waters (i.e., fresh waters designated for the support of trout throughout the year) in WMA 02's are also in preserved open space areas. Table 5.1-1 indicates similar breakdowns for all other Water Classification areas in WMA 02.

5.4 Relative Contribution of Point and Nonpoint Sources of Total Phosphorus

Under contract to NJDEP, USGS conducted a study to evaluate the relative contributions of point and nonpoint sources of pollution to freshwater streams. (USGS, 1999) The study included a statistical evaluation of water quality data collected between 1976 and 1993 in the Ambient Stream Monitoring Program at 79 stations. Water quality data for 20 parameters were grouped by samples collected under high and low flow conditions and the relationships between load and flow and concentration and flow was used to indicate the relative contribution of constant sources (i.e., point sources and groundwater inflow) and intermittent sources (i.e., nonpoint and stormwater sources). For this assessment, total phosphorus results from this study were combined with municipal wastewater point source locations and permit limits for total phosphorus (TP).

Figure 4.0-1 shows % exceedences of TP at the four (4) Ambient Stream Monitoring Network stations in WMA 02. See Chapter 3 for additional discussion. Results of the USGS study described above are shown to indicate relative contribution of point and nonpoint sources. The figure also includes known or potential sources of TP in WMA 02, including major and minor municipal discharges, golf courses and land uses. The following assessment is based on this figure and data provided in Chapters 3 and 4.

As shown on Figure 4.0-1, SWQS for TP were met between 1995 and 1997. However, exceedences occurred between 1990 and 1994. Results of the USGS study indicate that constant sources (e.g., point sources and ground water) were relatively more important at the Wallkill River at Sussex monitoring station between 1976 and 1993. As shown on Table A4.1-1 in the appendix, there are 4 municipal point sources discharging to waters above the monitoring station on the Wallkill at Sussex. Of these, 2 facilities (1 major and 1 minor) have effluent limits for TP. Two (2) minor facilities, which will be regionalized into Sussex County MUA in the near future, do not have effluent limits for TP. Major land uses above this monitoring location include urban lands and golf courses. This very preliminary assessment indicates that the current attainment of the SWQS for TP at this monitoring location may be due to the implementation of the effluent limits.

Results of the USGS study indicate that the Papakating Creek at Sussex monitoring station was affected by constant sources between 1976 and 1993. This station exhibited a downward trend in in-stream concentration of TP. The SWQS criterion for total phosphorus exceeded in 31% of samples between 1990 and 1994 and in 21% of samples collected between 1995 and 1997. The downward trend may be attributed to removal of the Sussex Boro facility discharge from Papakating Creek to Sussex County MUA on the Wallkill in 1996. Currently only 1 minor municipal treatment facility above this monitoring station, and land uses are predominantly agriculture and forest. This location may now be affected primarily by nonpoint sources and residual phosphorus in sediments.

Results of the USGS study indicate that the Wallkill River near Unionville monitoring station was affected by both constant and intermittent sources between 1976 and 1993 and the SWQS criterion for total phosphorus was met between 1995 and 1997. Regulated municipal discharges above this monitoring location include the four (4) facilities that discharge to the upper Wallkill River, 1 remaining minor discharge on the Papakating Creek and 1 minor discharge to a lower Wallkill River tributary. Land uses are predominantly agriculture and forest.

Results of the USGS study indicate that the Black Creek at Vernon monitoring station was affected by both constant and intermittent sources between 1976 and 1993 and the SWQS criterion for total phosphorus was met between 1995 and 1997. One minor municipal facility discharges seasonally (during winter months) to Black Creek above the monitoring point. In-stream TP appears higher during summer months. Land uses include wetland, agriculture and urban land.

This very preliminary assessment indicates that the relative contribution of point sources of TP has declined in importance on a WMA basis and that nonpoint sources of TP should be carefully examined. Clearly, a more detailed analysis is needed, including an evaluation of TP loads from regulated facilities and land uses, a review of site-specific studies done by regulated facilities and incorporation of any additional in-stream concentration and load data collected at additional points in WMA02. These additional analyses may be done as TMDLs are planned and developed.

5.5 Data and Data Assessment Needs

- Additional data and information are needed to provide a more comprehensive overview of Lake Resources. Data needs include trophic status, management measures at eutrophic lakes and sanitary quality at lake bathing beaches. Recently, NJDEP began working with state, county and local health agencies to compile lake bathing beach data. These data will provide a more direct assessment of recreational uses for swimming in New Jersey lakes, including those in WMA 02.
- Additional investigations and data assessments are needed to evaluate the apparent decline in biological health as indicated by increased benthic macroinvertebrate impairment. Data included in the NJDEP report on stream substrate and bank stability, etc. could be further evaluated. Site specific investigations (e.g., stream walks) that consider locations of storm drains, erosion could be used to identify potential contributor(s) to impairment. Flow assessments may be useful (i.e., large storms prior to sampling, stream flashiness). Water chemistry data collected at or near AMNET sampling locations would also be very useful.
- Chapter 2 discussed the presence in WMA 02 of GIS polygons labeled under the category "extraction mining" (see 2.3.5). This coverage can indicate open pit or below ground mining, either currently active or closed. The precise nature of these locations in WMA 02 would be helpful in assessing their potential as pollution sources, either as mines, pits or as unpermitted landfills.
- The assessment of relative contributions of point and nonpoint sources of total phosphorus provided in this report is very preliminary. Additional assessment should include review of site-specific studies conducted by regulated facilities and a comparison of point source and in-stream loads of TP if sufficient data are available. Also, in-stream TP data collected by other entities should be included in the assessment.

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**Table 2.4-1 1990
Total population and
Population Density
by Municipality**

MUNICIPALITY	AREA SQ. MILE	1990 POPULATION TOTAL	1990 POPULATION DENSITY
Morris County			
Jefferson Twp	42.348	17825	421
Passaic County			
West Milford Twp	80.010	25430	318
Sussex County			
Montague Twp	46.101	2832	61
Wantage Twp	67.257	9487	141
Vernon Twp	70.804	21211	300
Frankford Twp	35.293	5114	145
Sussex Boro	0.621	2201	3544
Hardyston Twp	32.579	5275	162
Lafayette Twp	18.342	1902	104
Hamburg Boro	1.153	2566	2225
Franklin Boro	4.559	4977	1092
Sparta Twp	39.970	15157	379
Ogdensburg Boro	2.289	2722	1189
Andover Twp	20.862	5438	261
Byram Twp	21.708	8048	371

**Table 2.4-2a
Historic Total
Population By
Municipality**

MUNICIPALITY	POPULATION						
	1930	1940	1950	1960	1970	1980	1990
Andover Twp.	496	591	1,052	2,177	3,040	4,506	5,438
Byram Twp.	245	373	761	1,616	4,592	7,502	8,048
Frankford Twp.	1,074	1,244	1,530	2,170	2,777	4,654	5,114
Franklin Boro	4,176	4,009	3,864	3,624	4,236	4,486	4,977
Hamburg Boro	1,160	1,116	1,305	1,532	1,820	1,832	2,566
Hardyston Twp.	946	1,034	1,279	2,206	3,499	4,553	5,275
Lafayette Twp.	735	803	836	1,100	1,202	1,614	1,902
Montague Twp.	581	621	602	879	1,131	2,066	2,832
Ogdensburg Boro	1,138	1,165	1,169	1,212	2,222	2,737	2,722
Sparta Twp.	1,316	1,729	3,021	6,717	10,819	13,333	15,157
Sussex Boro	1,415	1,478	1,541	1,656	2,038	2,418	2,201
Vernon Twp.	1,279	1,407	1,548	2,155	6,059	16,302	21,211
Wantage Twp.	2,075	2,376	2,543	3,308	4,329	7,268	9,487
Jefferson Twp.	1,254	1,548	2,744	6,884	14,122	16,413	17,825
West Milford Twp.	1,901	2,501	3,650	8,157	17,304	22,750	25,430

**Table 2.4-2b
Change in Total
Population Over
Time**

MUNICIPALITY	CHANGE IN POPULATION		PERCENT CHANGE	
	change 1970-1990	%change 1970-1990	change 1980-1990	%change 1980-1990
Andover Twp.	2398	79%	932	21%
Byram Twp.	3456	75%	546	7%
Frankford Twp.	2337	84%	460	10%
Franklin Boro	741	17%	491	11%
Hamburg Boro	746	41%	734	40%
Hardyston Twp.	1776	51%	722	16%
Lafayette Twp.	700	58%	288	18%
Montague Twp.	1701	150%	766	37%
Ogdensburg Boro	500	23%	-15	-1%
Sparta Twp.	4338	40%	1824	14%
Sussex Boro	163	8%	-217	-9%
Vernon Twp.	15152	250%	4909	30%
Wantage Twp.	5158	119%	2219	31%
Jefferson Twp.	3703	26%	1412	9%
West Milford Twp.	8126	47%	2680	12%

Table 2.4-3 Population Projections By Municipality

MUNICIPALITY	POPULATION					
	1990	2005*	2010*	2020 *	Population Change	Percent Change
Jefferson Twp.	17825	21144	20737	22517	4692	26%
West Milford Twp.	25430	29457	35533	40901	15471	61%
Andover Twp.	5438	5493	6853	7786	2348	43%
Byram Twp.	8048	8238	8276	8987	939	12%
Frankford Twp.	5114	6853	6749	8069	2955	58%
Franklin Boro	4977	4830	5360	5729	752	15%
Hamburg Boro	2566	3855	4316	4969	2403	94%
Hardyston Twp.	5275	5904	6970	7998	2723	52%
Lafayette Twp.	1902	1753	2111	2555	653	34%
Mantague Twp.	2832	3855	3931	4621	1789	63%
Ogdensburg	2722	2129	2280	2309	-413	-15%
Sparta Twp.	15157	15228	16871	18557	3400	22%
Sussex Boro	2201	1916	1861	1766	-435	-20%
Vernon Twp.	21211	29442	30209	34896	13685	65%
Wantage Twp.	9487	10721	11039	13133	3646	38%
Note: * - 1994 NJDOT Baseline Trend						

**Table 2.4-4 Historic and Projected
Total Population by Municipality**

MUNICIPALITY	POPULATION									
	1930	1940	1950	1960	1970	1980	1990	2005 [†]	2010 [†]	2020 [†]
Andover Twp.	496	591	1,052	2,177	3,040	4,506	5,438	5493	6853	7786
Byram Twp.	245	373	761	1,616	4,592	7,502	8,048	8238	8276	8987
Frankford Twp.	1,074	1,244	1,530	2,170	2,777	4,654	5,114	6853	6749	8069
Franklin Boro	4,176	4,009	3,864	3,624	4,236	4,486	4,977	4830	5360	5729
Hamburg Boro	1,160	1,116	1,305	1,532	1,820	1,832	2,566	3855	4316	4969
Hardyston Twp.	946	1,034	1,279	2,206	3,499	4,553	5,275	5904	6970	7998
Jefferson Twp.	1,254	1,548	2,744	6,884	14,122	16,413	17,825	21144	20737	22517
Lafayette Twp.	735	803	836	1,100	1,202	1,614	1,902	1753	2111	2555
Montague Twp.	581	621	602	879	1,131	2,066	2,832	3855	3931	4621
Ogdensburg Boro	1,138	1,165	1,169	1,212	2,222	2,737	2,722	2129	2280	2309
Sparta Twp.	1,316	1,729	3,021	6,717	10,819	13,333	15,157	15228	16871	18557
Sussex Boro	1,415	1,478	1,541	1,656	2,038	2,418	2,201	1916	1861	1766
Vernon Twp.	1,279	1,407	1,548	2,155	6,059	16,302	21,211	29442	30209	34896
Wantage Twp.	2,075	2,376	2,543	3,308	4,329	7,268	9,487	10721	11039	13133
West Milford Twp.	1,901	2,501	3,650	8,157	17,304	22,750	25,430	29457	35533	40901
[†] 1994 NJDOT Baseline Trend Data										

Excerpted from : **1998 IDENTIFICATION AND SETTING OF PRIORITIES FOR SECTION 303(d) WATER QUALITY LIMITED WATERS IN NEW JERSEY. NJDEP Sept 15, 1998**

NOTES:

- Reach numbers with parentheses around the last three digits do not have their own reach number but have been identified by the reach number of the reach to which they are tributary.
- Numbers preceding watershed names refer the watershed numbers illustrated in Figure 1.
- Watershed are aggregated by Watershed Management Areas (WMA) denoted in Figure 2.
- Letters in parentheses, (H, M, L) denote ranking for TMDL determinations: High, Medium, Low.
- Entries in **bold** denote additions to the Final List which were not present in the proposed draft. These additions are oversights and should have been present in earlier 303(d) Lists and carried over to this 1998 List.
- River Reach File 3 codes for macroinvertebrate monitoring sites and 314 lakes are listed in Appendix B.
- Comment fields will denote candidates for delisting, either full or partial (see section III of is Report).
- Key for the information sources delineated under the column labeled *Data Source* are as follows:
 - A. Based on 304 (l) Mini List waterbodies
 - B. In-stream macroinvertebrate assessments
 - C. Fixed-location physical/chemical monitoring
 - D. Shellfish-growing water classification monitoring
 - E. Fish tissue analysis
 - F. New York-New Jersey Harbor Estuary Program
 - G. Delaware Estuary Program
 - H. Clean Lakes Program
 - I. Site Specific Intensive Monitoring

APPENDIX A

Sub-list 1

Known Water Quality Impairment: Violations of SWQS known or expected.

- Violations of chemical/physical criteria (minus metals and ammonia)
- Violations of chemical/physical criteria obtained from the Harbor Estuary Programs (minus metals)
- Fish and shellfish consumption advisories
- Shellfish harvesting restrictions
- Public lakes having undergone detailed assessments under the Clean Lakes Program

Wallkill, Passaic and Hackensack River Watersheds

Watershed: 3 Papakating Creek WMA 2 (M)

Waterbody Name	Reach #/Location	Pollutant/Impact: Water Quality Violation	Pollutant/Impact: Biological	Use Impairment	Comments	Data Sour
Papakating Creek	02020007-027-020/at Sussex	fecal coliform, total phosphorus		Primary Contact, Aquatic Life Support		C

Watershed: 5 Pochuck Creek WMA 2 (L)

Waterbody Name	Reach #/Location	Pollutant/Impact: Water Quality Violation	Pollutant/Impact: Biological	Use Impairment	Comments
Black Creek	02020007-031-040/nr Vernon	fecal coliform, total phosphorus		Primary Contact Aquatic Life Support	

Watershed: 2 Wallkill River WMA 2 (M)

Waterbody Name	Reach #/Location	Pollutant/Impact: Water Quality Violation	Pollutant/Impact: Biological	Use Impairment	Commen
Wallkill River	02020007-028-010/at Franklin	temperature, fecal coliform, total phosphorus		Primary Contact, Aquatic Life Support	
Wallkill River	02020007-026-030/nr Sussex	fecal coliform, total phosphorus		Primary Contact, Aquatic Life Support	
Wallkill River	02020007-026-030/nr Unionville	fecal coliform, total phosphorus		Primary Contact, Aquatic Life Support	

APPENDIX A

Sub-list II: Candidate TMDL Waters Sub-List

A. Known Water Quality Impairment Sub-list

Use Impairment Known - Violations of SWQS not known

- All Severely Impaired AMNET sites
- AMNET sites indicating the presence of toxic substances

Wallkill, Passaic and Hackensack River Watersheds

Watershed: 3 Papakating Creek WMA 2 (M)

Waterbody Name	Reach #/Location	Pollutant/Impact: Water Quality Violation	Pollutant/Impact: Biological	Use Impairment	Comments
Papakating Ck	02020007-027 West Br		unknown toxicity	Aquatic Life Support	
Clove Brook	02020007-027		unknown toxicity	Aquatic Life Support	

APPENDIX A

Sub-list II: Candidate TMDL Waters Sub-List

B. Suspected Water Quality Impairment Sub-List

Use Impairment Not Known – confirmation needed

- Moderately impaired AMNET sites
- 304(l) listings
- Metals and ammonia violations recorded through ambient monitoring
- Heavy metal violations obtained through the Harbor Estuary Programs
- Public lakes having undergone cursory assessments under the Clean Lakes Program

Wallkill, Passaic and Hackensack River Watersheds

Watershed: 3 Papakating Creek WMA 2 (M)

Waterbody Name	Reach #/Location	Pollutant/Impact: Water Quality Violation	Pollutant/Impact: Biological	Use Impairment	Comments
Papakating Ck	Rt 565, Pelletstown		moderately impaired	Aquatic Life Support	
Clove R	Loomis Ave, Sussex		moderately impaired	Aquatic Life Support	

Watershed: 5 Pochuck Creek WMA 2 (L)

Waterbody Name	Reach #/Location	Pollutant/Impact: Water Quality Violation	Pollutant/Impact: Biological	Use Impairment	Comments
Lk Lookout Bk	Wawayanda St Pk, Wawayanda		moderately impaired	Aquatic Life Support	

Watershed: 2 Wallkill River WMA 2 (M)

Waterbody Name	Reach #/Location	Pollutant/Impact: Water Quality Violation	Pollutant/Impact: Biological	Use Impairment	Comments
Wallkill River	02020007-028	arsenic, beryllium, cadmium, chromium, lead, mercury		Aquatic Life Support	
Wallkill River	02020007-026	lead		Aquatic Life Support	
Beaver Run	Cemetery Rd, Wantage Twp		moderately impaired	Aquatic Life Support	

- The following are public lakes assessed by the Clean Lakes Program as use-impaired but the sources of pollution are as yet not determined. Water quality data for many of these lakes are old, with assessments having been performed in the late 1970's and early 1980's. Other lakes in this listing are judged to be impaired based upon cursory surveys covering only a single year of data collection.

Clove Lake

Lake Waywayanda

Appendix 3.6-2: Preliminary TMDL Parameter Recommendations for WMA02

Division of Science, Research and Technology
401 East State Street, PO Box 409
Trenton, New Jersey 08625-0409

MEMORANDUM

TO: Ken Klipstein, Chief, Upper Delaware Water Region, DWM

FROM: Karen Schaffer, Team Lead, Water Assessment Team, DSRT
Kevin Berry, Water Assessment Team, DSRT

SUBJECT: Preliminary TMDL Parameter Recommendations for WMA02

DATE: October 6, 1999

As requested, the Water Assessment Team has developed preliminary recommendations for parameters to consider in the WMA02 TMDL project. These recommendations were developed based on review of 1998 Impaired Waterbodies List (303d List), Ambient Stream Monitoring Network status data for pH, TP, DO, and FC from the 1992 through 1998. (USGS, Water Resources Data, Water Year 199X). Trends analyses for flow, TP, DO, FC, and NO₃ were obtained from USGS and Coastal Environmental Services (USGS, 1999; CES, 1997).

Recommendations Summary

Note that the recommendations provided are preliminary, pending SWQS determinations for TP and pending receipt of 303d Evaluation Monitoring Data. Development of these recommendations is described in detail in Attachment 1.

Total Phosphorus . (Note that de-listing discussed below does not preclude consideration of TP from the TMDL project.)

- **Wallkill River:** No further actions are recommended at Sparta; new data are needed at Franklin to develop TMDL recommendations; de-listing can be proposed based on existing data at Sussex and Unionville
- **Papakating Creek:** TMDL development is recommended based on historical exceedences and currently elevated levels.
- **Black Creek:** De-listing can be proposed based on existing data from Vernon
- **Double Kill:** No further actions are recommended at Wawayanda.

Nitrate: Due to levels indicative of human disturbance and increasing concentration trends, it may be appropriate to include NO₃ in the Wallkill from Sussex to Unionville as a proactive component of the TMDL project.

Pathogen Indicators (Fecal Coliform, Enterococcus). Nonpoint source management of pathogen indicators is recommended throughout the WMA.

Metals: Recommendations will be developed based on 303d Evaluation Monitoring data. Beryllium can be proposed for de-listing statewide due to lack of a SWQS criteria.

Dissolved Oxygen: Diurnal monitoring is recommended in the Wallkill at Unionville and Papakating at Sussex due to periodically depressed levels and historical excursions of the SWQS criteria.

Temperature: Recommendations will be developed for the Wallkill at Franklin based on 303d Evaluation Monitoring data.

pH: No further action is recommended.

I hope these preliminary recommendations are useful. I am looking forward to receipt of the 303d Evaluation Monitoring data for this WMA and SWQS information to finalize the recommendations. Also, status and trends data on additional parameters are available, and can be assessed if needed based on recommendations from DWM, DWQ or others.

Attachments

Attachment 1: Development of Preliminary TMDL Recommendations for WMA02

Table 2: SWQS criteria for selected conventionals and metals

Table 3: Preliminary 303d Recommendations in WMA02

Figure 1: Monitoring locations in WMA02

cc:

Leslie McGeorge, Director, DSRT

Lance Miller, Director, DWM

Jeff Reading, DWQ

Al Korndoerfer, Chief, Freshwater and Biological Monitoring, DWM

Phil Liu, Team Lead, Watershed Modeling Team, DWM

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Attachment 1: Development of Preliminary TMDL Recommendations for WMA02

Background Information

The 1998 Impaired Waterbodies List (303d List) provides the starting point for TMDL development. This list is based upon ambient water quality data collected in recent years and impaired waterbodies carried over from earlier Impaired Waterbodies Lists, including 304(l) and 1992, 1994 and 1996 303(d) Lists.

The 304(l) List pre-dated the 303d Lists and was based on potential exceedences of Surface Water Quality Standards for toxics discharged from point sources. The 304(l) List was developed using effluent data and ambient water quality data have not been collected to evaluate 304(l) listings. Federal regulations require that existing lists form the basis for the updated list. Thus, reaches may have been listed based on effluent and/ or water quality data collected from the mid-1980's through 1995.

Reaches with ambient water quality data were typically listed if more than 5% of the samples collected in a 5 year period exceeded applicable SWQS criteria. Table 1 summarizes chemical listing for the 1998 Impaired Waterbodies List (303d)

Table 1: 1998 Impaired Waterbodies List for WMA02 (chemical listings only)

Reach	Pollutants
Papakating Creek at Sussex	fecal coliform, total phosphorus
Black Creek near Vernon	fecal coliform, total phosphorus
Wallkill River at Franklin	temperature, fecal coliform, total phosphorus, arsenic, beryllium, cadmium, chromium, lead, mercury *
Wallkill River near Sussex	fecal coliform, total phosphorus, lead *
Wallkill River near Unionville	fecal coliform, total phosphorus, lead *
Note: metals are from 304(l) list and the reach, not specific monitoring location, is listed on 303d	

Data Review and Preliminary Recommendations

USGS Water Year Reports were reviewed for exceedences of SWQS at stations sampled in the Ambient Stream Monitoring Network. Additional data (3 samples at base flow) have been collected as part of the 303d Evaluation Monitoring program. Results for WMA02 are pending from Department of Health and Senior Services laboratory. The purpose of this monitoring is to evaluate current concentrations of metals and nutrients for 303d listed reaches with out-dated data and to estimate the spatial extent of TMDL projects. Since FC exceedences are wide-spread and are proposed to be managed through nonpoint source controls, FC was not included in 303d Evaluation Monitoring.

Given current EPA policy to de-list based on comparable data used for listing, the most recent 5 Water Years of data were reviewed. (Water Year is equivalent to Federal Fiscal Year- 10/97 through 9/98 is Water Year 98). If less than 5% of samples exceed applicable criteria in the previous 5 years (including Ambient Stream Monitoring Network data and 303d Evaluation Monitoring data), de-listing will be proposed in the 2000 303d List. SWQS criteria for selected conventionals and metals are summarized on Table 2. Trends reports by USGS (1998) and Coastal Environmental Services (1997) were reviewed to evaluate likely future conditions. Results are summarized below and on Table 3. Station numbers are included to facilitate reference to USGS and CES reports.

The following recommendations may be modified based on pending SWQS classification and TP criterion information for 3 stations from the SWQS Team. Modifications may also be needed pending receipt and analysis of 303d Evaluation Monitoring data. Therefore, these recommendations are preliminary.

NOTES: All evaluation dates are inclusive; Water Year = Federal Fiscal Year (WY98 = 10/97-9/98)

01367625 Wallkill at Sparta (FW2-NT, TP 0.1 mg/l)

This location was added to the ASMN as a Forest Land Use Indicator station in WY 98.

Results of Data Review:

- COMPLIANCE: Review of WY98 (i.e., 10/97-9/98) data (n=4) show compliance with SWQS for Temp, pH, DO, NO3, TP.
- PATHOGEN INDICATORS: FC and EC exceeded the SWQS criteria. This location is not on the 1998 303d List.

Recommendation: Efforts to manage FC and EC in the Wallkill River should include this reach. Review WY 99 data to determine if FC and EC should be added to the 2000 303d List.

01367700 Wallkill at Franklin (FW2-NT, TP 0.1 mg/l)

This location is included on the 1998 303d List for Temp, FC, TP, As, Be, Cd, Cr, Pb, Hg.

Results of Data Review: This location was monitored through 1990. Review of WY90 (i.e., 10/89-9/90) data (n=4) showed SWQS criteria for Temp, pH, DO, NO3 and TP were met and exceedences of FC and EC occurred. Current concentrations of conventionals and metals are being assessed through 303d Evaluation Monitoring.

Recommendations: Base recommendations on 303d Evaluation Monitoring data. De-list Be (statewide) due to lack of SWQS criterion.

01367770 Wallkill at Sussex (FW2-NT, TP 0.1 mg/l)

This location is included on the 1998 303d List for FC, TP, Pb. This location was included in the previous ASMN (1976-1997) and is monitored in the redesigned ASMN as a Watershed Integrator station (1997-98). Current concentrations of conventionals and metals are being evaluated through 303d Evaluation Monitoring.

Results of Data Review:

- COMPLIANCE: Review of WY 94-98 data (n=24) show compliance with SWQS criteria for Temp, pH, DO, NO3, TP. Statistically significant trends in DO, TP, FC concentrations were not found by USGS or CES.
- TP: There was 1 exceedence (0.15 mg/l TP, 4% of 24 samples) of the TP criterion of 0.1 mg/l in the 1993-94 Water Year.
- NO3: Maximum NO3 concentrations in WY 94-98 were between 1.15 mg/l NO3 and 2.7 mg/l NO3. Nationally, 3 mg/l is considered indicative of human contributions in non-coastal watershed (M. Ayers, pers. comm.) In addition, CES found a statistically significant increasing trend in NO3 concentrations between 1975 and 1994. USGS did not identify a NO3 trend between 1986 and 1995.
- PATHOGEN INDICATORS: Criteria for FC and EC were exceeded.

Recommendations: Propose de-listing for TP; base recommendations for Pb on 303d Evaluation Monitoring data. Proactive TMDL efforts should consider NO3 in this reach. Efforts to manage FC and EC in the Wallkill River should include this reach.

01368000 Wallkill at Unionville (FW2-NT, TP 0.1 mg/l)

This location is included on the 1998 303d List for FC, TP, Pb. This location was included in the previous ASMN (1963-78, 1991-97) and was discontinued in the redesigned ASMN. Current concentrations of conventionals and metals are being evaluated through 303d Evaluation Monitoring.

Results of Data Review:

- COMPLIANCE: Review of WY 93-97 data (n=25) showed compliance with Temp, pH and NO3 SWQS criteria.

- DO: One sample in WY 93 exceeded the SWQS for DO (4% of 25 samples). A value of 4.5 mg/l DO was recorded, and a second sample in WY 95 approached the SWQS criteria with a value of 5.1 mg/l DO. In WY 97, the DO range was 6.0-12.7 mg/l. USGS and CES did not identify statistically significant trends in DO concentrations.
- TP: One sample (0.2 mg/l) in WY 93 exceeded the TP criterion (0.1 mg/l, 4% of 24 samples) and CES identified a statistically significant increasing trend in TP concentrations (1975-94). USGS did not identify a trend (1986-95). TP concentrations have approached, but not exceeded, the SWQS for TP in WY 96 and 97.
- NO3: NO3 concentrations above 2 mg/l were found in WY 96 and 97 and USGS identified a statistically significant increasing trend.
- PATHOGEN INDICATORS: Concentrations of FC and EC exceeded SWQS in all 5 years and USGS and CES did not identify statistically significant trends.

Recommendations: Propose de-listing for TP, base recommendations for Pb on 303d Evaluation Monitoring data. Diurnal DO data would be useful at this location. Proactive TMDL efforts should consider NO3 in this reach. Efforts to manage FC and EC in the Wallkill River should include this reach.

01367860 Papakating Creek near Sussex (FW2-NT, TP 0.1 mg/l)

This location was included in the redesigned ASMN (WY 98) as a Agricultural Land Use Indicator and Statewide Status station. This location is included in 303d Evaluation Monitoring.

Results of Data Review:

- COMPLIANCE: Review of WY 98 data (n=4) show compliance with SWQS criteria for Temp, pH, DO, NO3, TP. TP ranged from 0.02 to 0.06 mg/l TP.
- PATHOGEN INDICATORS: Criteria for FC and EC were exceeded.

Recommendations: Additional evaluation is needed to determine if TP from this reach, and upstream, contribute to historical exceedences and currently elevated concentrations in the downstream station (01367910). Include in TMDL. Additional FC and EC data are needed to determine if downstream 303d listings for FC should be extended up to this reach. Efforts to manage FC and EC in the Papakating Creek should include this reach.

01367910 Papakating Creek at Sussex (FW2-NT, TP 0.1 mg/l)

This location is included on the 1998 303d List for FC and TP. This location was included in the previous ASMN (1976-1997) and was discontinued in the redesigned ASMN. This location is addressed in 303d Evaluation Monitoring through upstream station 01367860 Papakating Creek near Sussex.

Results of Data Review:

- COMPLIANCE: Review of WY 93- 97 data (n=25) show compliance with SWQS criteria for Temp, pH and NO3.
- DO: One DO sample (4.5 mg/l DO, 4% of 25 samples) exceeded the SWQS of 5 mg/l in WY 93. In WY 97 values ranged from 5.8 to 13.4 mg/l DO. USGS identified a statistically significant increasing DO concentration trend (1986-95); CES did not identify a DO trend (1975-1994).

- TP: The TP criterion of 0.1 mg/l TP was exceeded in 1 sample collected during 1992-93, in 2 samples per year in WY 94-96, and approached but did not exceed the SWQS criterion in WY 97. TP in WY 97 ranged from 0.02 to 0.09 mg/l TP. USGS found a statistically significant decreasing TP concentration trend (1986-95); CES did not find a statistically significant TP trend.
- NO3: NO3 levels were below 2 mg/l during the review period, but CES found a statistically significant increasing concentration trend (1975-94). USGS did not identify a NO3 trend at this location (1986-95).
- PATHOGEN INDICATORS: FC and EC criteria were exceeded in all 5 years.

Recommendations: Use 303d Evaluation Monitoring data to develop a recommendation for TP. Efforts to manage FC and EC in the Papakating Creek should include this reach. Collection of diurnal DO data is recommended to better characterize DO.

01368950 Black Creek at Vernon (FW2-NT, TP 0.1 mg/l)

This location is included on the 1998 303d List for FC and TP. This location was included in the previous ASMN (1976-1997) and was discontinued in the redesigned ASMN. This location is included in 303d Evaluation Monitoring.

Results of Data Review:

- COMPLIANCE: Review of data collected WY 93-97 data (n=25) showed compliance with SWQS criteria for Temp, pH and NO3.
- DO: One sample (3.8 mg/l DO) exceeded the DO criteria of 5 mg/l DO in WY 95. In WY 97, measured DO concentrations ranged from 6.5-11.2 mg/l DO.
- TP: One sample (0.16 mg/l TP, 4% of 25 samples) exceeded the TP criteria of 0.1 mg/l TP in WY 95 and a value of 0.9 mg/l TP occurred in WY 97. USGS found a statistically significant decreasing TP concentration trend.
- NO3: Levels of NO3 were below 1.5 mg/l NO3, and no trends were found.
- PATHOGEN INDICATORS: Exceedences of FC and EC occurred in all 5 years and USGS did not identify a statistically significant concentration trend.

Recommendation: Propose de-listing for TP. Due to recent elevated result, use 303d Evaluation Monitoring data to develop a TMDL recommendation for TP. Efforts to manage FC and EC in the Black Creek should include this reach.

01668820 Double Kill at Wawayanda (FW1?)

This location was included in the redesigned ASMN in WY 98 as one of 6 reference locations in the state. (This station should be located in FW1 water)

Results of Data Review:

- COMPLIANCE: Review of WY 98 data (n=4) for show compliance with numerical SWQS criteria for Temp, pH, DO, NO3, TP. Since FW1 waters are also precluded from changes in water quality except toward natural conditions, trend evaluations are needed to ensure compliance with SWQS.
- PATHOGEN INDICATORS: FC and EC show compliance with all numerical SWQS criteria except EC.

Recommendations: Efforts to manage EC in the Double Kill should include this reach. Evaluate additional data to determine if this reach should be listed for EC. Once sufficient data are collected, evaluate trends for compliance with SWQS.

References:

Ayers, M., USGS, NAWQA Program Lead, Sept. 22, 1999, *pers. comm.*

Coastal Environmental Services (CES), 1997. Statistical Analyses of Trends in Water Quality Stations in the Ambient Streams Monitoring Program.

United States Geological Survey (USGS), 1999. Trends in Water Quality of New Jersey Streams, Water Years 1986-95. Water Resources Investigations Report 98-4204.

Table 4.1-1 Point Source Dischargers to Surface Waters In WMA 2

<u>SUB-WATERSHED</u>	<u>FACILITY NAME</u>	<u>FACILITY TYPE</u>	<u>NJPDES ID NO.</u>	<u>MAP ID NUMBER</u>
Upper Wallkill River				
	Ames Rubber Corporation	Industrial Minor	NJ0085561.001	3
	Accurate Forming Division	Industrial Minor	NJ0002275.001	1
	Southdown Inc (Lime Crest)	Industrial Minor	NJ0035564.001	9
	Tri-County Water Cond. Co	Industrial Minor	NJ0033472.001	15
	Sussex County MUA - Upper Wallkill	Municipal Major	NJ0053350.001	14
	Sparta Twp BOE - High School 1 *	Municipal Minor	NJ0027073.001A	11
	Sparta Twp BOE- High School 2 *	Municipal Minor	NJ0027081.001	12
	Ames Rubber Corporation	Industrial Major	NJ0000141.004B	4
	Sparta Twp - Sparta Plaza	Municipal Minor	NJ0027057.001A	10
Lower Wallkill River				
	Regency At Sussex Apts.	Municipal Minor	NJ0029041.001	8
Pochuck Creek/Black Creek				
	Legends Resort & Country Club	Municipal Minor	NJ0023949.001	6
	Mobil S/S 15-BFQ	Petroleum Cleanup	NJ0132365.001	7
	Vernon Twp BOE	Municipal Minor	NJ0023841.001A	16
	Ames Rubber Corporation	Contact Cooling	NJ0069621.001	2
Papakating Creek				
	High Point Regional High School	Municipal Minor	NJ0031585.001	5
	Sussex Boro MUA [†]	Municipal Minor	NJ0021857	13
* -Because of their close proximity, Sparta Twp. HS #1 and HS #2 share the same location point on the map.				
[†] - Sussex Boro MUA ceased flow 12/26/96. Flow was routed to the Sussex County MUA.				

**Table 4.1-2 Permit Violation for Facilities Discharging to Surface Water in WMA 2
Fecal Coliform and Total Phosphorus (1991 - 1999)**

-

Permittee	NJPDES No.	Fecal Coliform		Total Phosphorus		
		Violations	Limit	Violation	Limit	
Legends Resort	NJ0023949	none	200/400	none	1mg/l	
Sparta Plaza	NJ0027057	2400 (3/94)	200/400	1.39 (7/98)	1mg/l	
			200/400	1.13 (2/99)	1mg/l	
Spart Twp BOE	NJ0027073	none	200/400		monitor only	
Spart Twp BOE	NJ0027081	900 (6/98)	200/400		no limit	
Regency Apts	NJ0029041	none	200/400		no limit	
High Point High School	NJ0031585	234.9 (2/96)	200/400		no limit	
Sussex County MUA	NJ0053350	none	200/400	none	1mg/l	

Table 4.6-1 Known Contaminated Sites in WMA # 2

MUNICIPALITY	LEVEL *	SITE NAME	ID NO.
FRANKLIN BOROUGH	C1	210 SCOTT ROAD	NJL000046193
FRANKLIN BOROUGH	C1	NJ DEP PARKS & FORESTRY GARAGE	NJL000070458
FRANKLIN BOROUGH	C2	49 ROUTE 23 SOUTH	NJL000058628
FRANKLIN BOROUGH	C2	JOHN & BILLS AUTO REPAIR	NJD986611804
FRANKLIN BOROUGH	C2	MOBIL SERVICE STATION FRANKLIN BOROUGH	NJL600236145
FRANKLIN BOROUGH	C2	EXXON SERVICE STATION FRANKLIN BOROUGH	NJD982792087
FRANKLIN BOROUGH	C2	SPARTAN OIL COMPANY	NJL800027849
FRANKLIN BOROUGH	C2	NJ DIVISION OF PARKS & FORESTRY	NJL800076192
FRANKLIN BOROUGH	C2	STATE PARK SERVICE REGION III OFFICE	NJL800135154
FRANKLIN BOROUGH	C2	HESS SERVICE STATION FRANKLIN BOROUGH	NJD986586022
FRANKLIN BOROUGH	D	BAKING MACHINERY DESIGN COMPANY INC	NJD982738965
FRANKLIN BOROUGH	D	METALTEC AEROSYSTEMS	NJD002517472
FRANKLIN BOROUGH	D	NORTHERN FINE CHEMICAL COMPANY	NJD980529150
FRANKLIN BOROUGH	NA	FRANKLIN TWP REGIONAL MINE CONTAMINATION	NJL000070615
HAMBURG BOROUGH	C1	FALCON RIDGE DEVELOPEMT	NJL800191926
HAMBURG BOROUGH	C1	RIC MAST MOTORS	NJL600195663
HAMBURG BOROUGH	C2	RAIA INDUSTRIES INCORPORATED	NJD986600849
HAMBURG BOROUGH	D	AMES RUBBER CORPORATION	NJD002389468
HAMBURG BOROUGH	D	PLASTOID CORPORATION	NJD040736779

*Definitions:

Remedial Level: Level of site complexity (i.e., to remediate). Based on the Site Remediation Program's 1989 (SRP) Case Assignment Manual.

The intent of the remedial level determinations are to reflect the overall degree of contamination at a site recognizing that individual areas

of concern may involve remedial actions of varying levels.

A: Emergency or single phase, short-term cleanup

C1: Single source/single contaminants affecting both soil and groundwater (126 sites);

C2: Multiple sources/contaminants affecting soil/groundwater - moderate (255 sites);

C3: Multiple sources/contaminants affecting soil/groundwater - severe (48 sites);

C4/D: Superfund –severe and complex (29 sites); and

Table 4.6-1 Known Contaminated Sites in WMA # 2 (cont.)

MUNICIPALITY	LEVEL *	SITE NAME	ID NO.
HARDYSTON TOWNSHIP	C1	44 DEER TRAIL	NJL800220410
HARDYSTON TOWNSHIP	C1	YMCA CAMP PATERSON	NJL000048801
HARDYSTON TOWNSHIP	C1	34 WHITE BIRCH TRAIL	NJL800236077
HARDYSTON TOWNSHIP	C1	55 SILVER GROVE ROAD	NJL800259004
HARDYSTON TOWNSHIP	C1	7 HARRISON SHAUGER TERRACE	NJL800019465
HARDYSTON TOWNSHIP	C2	HARDYSTON TOWNSHIP DEPT OF PUBLIC WORKS	NJL000068494
HARDYSTON TOWNSHIP	C2	GULF SERVICE STATION HARDYSTON TOWNSHIP	NJD982796674
HARDYSTON TOWNSHIP	C3	HARDYSTON TOWNSHIP SANITARY LANDFILL	NJL000030130
HARDYSTON TOWNSHIP	C3	LAKE TAMARACK WATER COMPANY WELL 3	NJL000033985
OGDENSBURG BOROUGH	C1	3 RIDGE COURT	NJL800000580
OGDENSBURG BOROUGH	C1	18 LINCOLN AVENUE	NJL800202103
OGDENSBURG BOROUGH	C1	21 PASSAIC STREET	NJL800219974
OGDENSBURG BOROUGH	C1	31 GLENBROOK ROAD	NJL800047268
OGDENSBURG BOROUGH	C1	AAA 330 MAIN STREET	NJL800152993
OGDENSBURG BOROUGH	C2	25 JEFFERSON DRIVE	NJL000052589
OGDENSBURG BOROUGH	C2	15 P HADOWANETZ DRIVE	NJL000067397
SANDYSTON TOWNSHIP	C3	19 MOUNTAIN TRAIL	NJL800012882
SPARTA TOWNSHIP	C1	34 WOODLAWN ROAD	NJL800108391
SPARTA TOWNSHIP	C1	26 HEIGHWOOD TRAIL	NJL800185845
SPARTA TOWNSHIP	C1	13 GRAPHIC BOULEVARD	NJL800133647
SPARTA TOWNSHIP	C1	13 CEDAR FALLS TERRACE	NJL800247116
SPARTA TOWNSHIP	C1	221 STANHOPE ROAD	NJL800027427

Definitions:

Remedial Level: Level of site complexity (i.e., to remediate). Based on the Site Remediation Program's 1989 (SRP) Case Assignment Manual.

The intent of the remedial level determinations are to reflect the overall degree of contamination at a site recognizing that individual areas of concern may involve remedial actions of varying levels.

A: Emergency or single phase, short-term cleanup

C1: Single source/single contaminants affecting both soil and groundwater (126 sites);

C2: Multiple sources/contaminants affecting soil/groundwater - moderate (255 sites);

C3: Multiple sources/contaminants affecting soil/groundwater - severe (48 sites);

C4/D: Superfund -severe and complex (29 sites); and

Table 4.6-1 Known Contaminated Sites

in WMA # 2 (cont.)			
MUNICIPALITY	LEVEL *	SITE NAME	ID NO.
SPARTA TOWNSHIP	C1	J & S PETROLEUM	NJL600057327
SPARTA TOWNSHIP	C1	SPARTA GARDENS	NJL600144356
SPARTA TOWNSHIP	C1	SUSSEX CNTY ASSOC FOR RETARDED CITIZENS	NJL800092793
SPARTA TOWNSHIP	C1	CITGO SERVICE STATION SPARTA TOWNSHIP	NJL800271652
SPARTA TOWNSHIP	C2	SPARTA TOWNSHIP MUNICIPAL BUILDING	NJL600051866
SPARTA TOWNSHIP	C2	CAMP SACAJAWEA	NJL000046771
SPARTA TOWNSHIP	C2	ACME SUPERMARKET	NJL800002685
SPARTA TOWNSHIP	C2	475 WEST SHORE TRAIL	NJL000042309
SPARTA TOWNSHIP	C2	35 ISLAND TRAIL	NJL820000271
SPARTA TOWNSHIP	C2	MIDLANTIC NATIONAL BANK	NJL800053670
SPARTA TOWNSHIP	C2	SHELL SERVICE STATION SPARTA TOWNSHIP	NJL600061279
SPARTA TOWNSHIP	C3	A O POLYMER	NJD030253355
SUSSEX BOROUGH	C1	17 CLOVE AVENUE	NJL800185910
SUSSEX BOROUGH	C1	S & M PONTIAC BUICK OLDSMOBIL GMC TRUCK	NJL800234973
SUSSEX BOROUGH	C1	76 UNIONVILLE AVENUE	NJL800225567
SUSSEX BOROUGH	C1	AGWAY INCORPORATED	NJD986578979
SUSSEX BOROUGH	C1	NJ DEPARTMENT OF CORRECTIONS SUSSEX BORO	NJL800022030
SUSSEX BOROUGH	C1	ROUTE 23 NORTH	NJL800153801
VERNON TOWNSHIP	C1	VERNON TOWNSHIP MUNICIPAL GARAGE	NJD982533614
VERNON TOWNSHIP	C1	11 RIDGE ROAD EAST	NJL800162349
VERNON TOWNSHIP	C1	11 TALLAHATCHIE DRIVE	NJL820001295
*Definitions:			
Remedial Level: Level of site complexity (i.e., to remediate). Based on the Site Remediation Program's 1989 (SRP) Case Assignment Manual.			
The intent of the remedial level determinations are to reflect the overall degree of contamination at a site recognizing that individual areas			
of concern may involve remedial			
actions of varying levels.			
A: Emergency or single phase, short-term cleanup			
C1: Single source/single contaminants affecting both soil and groundwater (126 sites);			
C2: Multiple sources/contaminants affecting soil/groundwater - moderate (255 sites);			
C3: Multiple sources/contaminants affecting soil/groundwater - severe (48 sites);			
C4/D: Superfund -severe and complex (29 sites); and			
Table 4.6-1 Known Contaminated Sites			

in WMA # 2 (cont.)			
MUNICIPALITY	LEVEL *	SITE NAME	ID NO.
VERNON TOWNSHIP	C1	515 TANGLEWOOD DRIVE	NJL000068817
VERNON TOWNSHIP	C1	TEXACO SERVICE STATION VERNON TOWNSHIP	NJL000051557
VERNON TOWNSHIP	C1	491 BUSHWICK LANE	NJL800200073
VERNON TOWNSHIP	C1	PLEASANT VALLEY COUNTRY CLUB INC	NJL800239485
VERNON TOWNSHIP	C1	5 MOUNTAIN TOP COURT	NJL800253700
VERNON TOWNSHIP	C1	6 BLUE HERON TERRACE	NJL800255267
VERNON TOWNSHIP	C1	340 LAKESHORE DRIVE WEST	NJL800166126
VERNON TOWNSHIP	C1	COLDWELL BANKER SCHLOTT REALTORS	NJL800234221
VERNON TOWNSHIP	C2	DOROTHY HENRY MEMORIAL LIBRARY	NJL600246979
VERNON TOWNSHIP	C2	1325 CEDAR TREE DRIVE	NJL800072662
VERNON TOWNSHIP	C2	109 BUSHWICK LANE	NJL000066464
VERNON TOWNSHIP	C2	1 LAKE STREET	NJL000070177
VERNON TOWNSHIP	C2	12 JUNIPER ROAD	NJL800233413
VERNON TOWNSHIP	C2	MOBIL SERVICE STATION VERNON TOWNSHIP	NJD986604734
VERNON TOWNSHIP	C2	ROUTE 515 ISLAND TRANSPORTATION	NJL820003226
VERNON TOWNSHIP	C2	VERNON GARAGE	NJL600238877
VERNON TOWNSHIP	D	BARRIER CHEMICAL INDUSTRIES	NJD980206130
*Definitions:			
Remedial Level: Level of site complexity (i.e., to remediate). Based on the Site Remediation Program's 1989 (SRP) Case Assignment Manual.			
The intent of the remedial level determinations are to reflect the overall degree of contamination at a site recognizing that individual areas			
of concern may involve remedial			
actions of varying levels.			
A: Emergency or single phase, short-term cleanup			
C1: Single source/single contaminants affecting both soil and groundwater (126 sites);			
C2: Multiple sources/contaminants affecting soil/groundwater - moderate (255 sites);			
C3: Multiple sources/contaminants affecting soil/groundwater - severe (48 sites);			
C4/D: Superfund –severe and complex (29 sites); and			
Table 4.6-1 Known Contaminated Sites in WMA # 2 (cont.)			
MUNICIPALITY	LEVEL *	SITE NAME	ID NO.
WANTAGE TOWNSHIP	C1	WANTAGE TOWNSHIP MUNICIPAL BUILDING	NJL000054205
WANTAGE TOWNSHIP	C1	ROUTE 519 & ROUTE 23	NJL000068825

WANTAGE TOWNSHIP	C1	EXXON SERVICE STATION WANTAGE TOWNSHIP	NJL800134314
WANTAGE TOWNSHIP	C1	COUNTY CONCRETE CORPORATION	NJD986601144
WANTAGE TOWNSHIP	C1	TENNESSEE GAS PIPELINE	NJL800082083
WANTAGE TOWNSHIP	C1	29 SHERMAN RIDGE ROAD	NJL800259863
WANTAGE TOWNSHIP	C1	CARNEGIE INDUSTRIES	NJD980771505
WANTAGE TOWNSHIP	C1	12 GLENN ROAD	NJL800097479
WANTAGE TOWNSHIP	C1	TENNESSEE GAS PIPELINE	NJD982531451
WANTAGE TOWNSHIP	C1	1547 ROUTE 565	NJL800249559
WANTAGE TOWNSHIP	C1	VORELAND PROPERTY	NJL000042663
WANTAGE TOWNSHIP	C2	AMES RUBBER CORPORATION	NJD000818518
WANTAGE TOWNSHIP	C2	SUSSEX AIRPORT INCORPORATED	NJL600017107
WANTAGE TOWNSHIP	C2	MOBIL SERVICE STATION WANTAGE TOWNSHIP	NJD986606010
WANTAGE TOWNSHIP	C2	IKES CAR WASH & DISCOUNT GAS	NJL600046429
WANTAGE TOWNSHIP	C2	REGENCY AT SUSSEX APARTMENTS	NJD000549501
WEST MILFORD TOWNSHIP	C1	99 BAYONNE DRIVE	NJL800256992
WEST MILFORD TOWNSHIP	C2	WEST MILFORD PUBLIC WORKS DEPOT	NJL820001618
*Definitions:			
Remedial Level: Level of site complexity (i.e., to remediate). Based on the Site Remediation Program's 1989 (SRP) Case Assignment Manual.			
The intent of the remedial level determinations are to reflect the overall degree of contamination at a site recognizing that individual areas			
of concern may involve remedial			
actions of varying levels.			
A: Emergency or single phase, short-term cleanup			
C1: Single source/single contaminants affecting both soil and groundwater (126 sites);			
C2: Multiple sources/contaminants affecting soil/groundwater - moderate (255 sites);			
C3: Multiple sources/contaminants affecting soil/groundwater - severe (48 sites);			
C4/D: Superfund –severe and complex (29 sites); and			

Table A5.1: Drainage Area and Land Uses above Benthic Macroinvertebrate Sampling Stations

Site	NJIS98	Habitat	Area mi	%Urb-95 mi	%ISC	Ag%	FOR %	WET %	WAT %
AN0309A	30	196	8.12	7.43	3.31	10.77	63.73	15.95	2.12
AN0303	30	193	2.27	6.74	3.63	27.57	51.27	14.10	0.32
AN0305	27	184	5.00	9.09	3.80	30.05	49.32	10.86	0.68
AN0302	21	156	60.59	19.19	6.53	13.27	51.38	11.67	4.49
AN0306	21	190	11.26	13.61	4.74	31.30	43.16	10.60	1.32
AN0297	21	191	6.76	42.24	13.28	1.18	33.63	4.56	18.38
AN0301	21	141	5.86	7.44	2.72	33.25	49.92	8.75	0.63
AN0294	21	164	4.29	0.22	0.96	0.00	78.02	20.49	1.26
AN0295	21	135	not available						
AN0299	18	174	39.91	22.20	7.41	8.37	51.75	11.43	6.25
AN0307	18	90	37.07	9.63	3.66	35.16	42.32	11.88	1.01
AN0298	18	142	19.41	27.68	9.06	2.28	50.52	10.75	8.77
AN0308	18	167	4.60	8.72	3.24	38.94	37.32	14.53	0.49
AN0300	15	163	45.96	20.97	6.99	8.95	52.83	11.53	5.72
AN0309	15	113	19.35	9.63	3.67	26.56	48.60	13.71	1.49
AN0304	12	122	15.89	8.21	3.31	39.72	38.99	12.63	0.45
AN0296	9	148	17.24	23.57	5.70	14.10	47.87	12.80	1.66

NJIS: New Jersey Impairment Score

Habitat: Habitat Assessment Score

Area: Estimated drainage area above AMNET monitoring point

%URB-95: OSP New Urban coverage, based on 95-97 aerial photography

%ISC: Estimated Impervious Surface Coverage based on buffered roads and non-road impervious area

Ag %: Percent Agricultural Land Use in AMNET Drainage Area, 1995-97 estimate

For %: Percent Forest Land Cover in AMNET Drainage Area, 1995-97 estimate

Wet %: Percent Wetland Land Cover in AMNET Drainage Area, 1995-97 estimate

Wat %: Percent Water in AMNET Drainage Area, 1995-97 estimate

Data provided courtesy of M. Ayers USGS LI-NJ NAWQA Program

Table 5.1-1 Stream Classifications of Waterways in WMA 02 Subdivided by Land Classes

CATEGORY	LAND CLASS	LENGTH (miles)	PERCENTAGE
FW1	1	1.37	10.25
FW1	4	1.06	7.97
FW1	5	0.08	0.57
FW1	6	0.00	0.02
FW1	8	10.83	81.20
FW1-Trout Maintenance	4	0.01	0.51
FW1-Trout Maintenance	8	1.76	99.49
FW1-Trout Production	4	0.07	1.04
FW1-Trout Production	5	0.01	0.14
FW1-Trout Production	8	6.69	98.81
FW2-Non Trout	1	14.75	6.26
FW2-Non Trout	2	33.45	14.20
FW2-Non Trout	4	93.79	39.81
FW2-Non Trout	5	49.57	21.04
FW2-Non Trout	6	35.30	14.98
FW2-Non Trout	7	0.59	0.25
FW2-Non Trout	8	8.12	3.45
FW2-Non Trout Cat 1	1	0.18	0.82
FW2-Non Trout Cat 1	2	0.29	1.35
FW2-Non Trout Cat 1	4	3.46	15.93
FW2-Non Trout Cat 1	5	0.74	3.41
FW2-Non Trout Cat 1	6	1.91	8.79
FW2-Non Trout Cat 1	7	0.05	0.22
FW2-Non Trout Cat 1	8	15.11	69.49
FW2-Trout Maintenance	1	7.42	8.47
FW2-Trout Maintenance	2	9.99	11.41
FW2-Trout Maintenance	4	52.44	59.87
FW2-Trout Maintenance	5	9.07	10.35
FW2-Trout Maintenance	6	8.67	9.90
FW2-Trout Maintenance Cat 1	8	6.30	100.00
FW2-Trout Production Cat 1	1	2.94	13.03
FW2-Trout Production Cat 1	2	1.45	6.42
FW2-Trout Production Cat 1	4	9.44	41.87
FW2-Trout Production Cat 1	5	0.89	3.95
FW2-Trout Production Cat 1	6	0.31	1.39
FW2-Trout Production Cat 1	8	7.52	33.34

Note:

Land Classes

1 - Urban

2 - Agriculture

4 - Forest

5 - Wetland

6 - Water

7 - Barren

8 - Open Space

APPENDIX 2

GLOSSARY

"Ambient Water Quality" means water quality of a water body measured immediately upstream (or outside) of the influence of a particular source of pollutants or pollutant parameters during average flow conditions. This is the water quality that the Department shall utilize as the means water quality when implementing the antidegradation policies on a site-specific basis as defined in N.J.A.C. 7:9B 1.1.

"Annual average flow" means the calculated mean of the reported monthly average flow discharge from a wastewater treatment facility and the eleven preceding monthly average flow discharges.

"Antidegradation" means the limitation of changes in mean water quality or quantity to protect existing and designated uses, to maintain that quality which is better than the applicable criteria, and to prevent any additional lowering of water quality or quantity where those levels are already below the criteria or levels necessary to support the existing or designated uses.

"Aquifer" means. a geologic formation, group of geologic formations, or a portion of geologic formations cable of yielding a significant amount of groundwater to wells or springs.

"Assimilative capacity" means the total assimilative capacity of a watershed, water body or a water body segment to receive natural and anthropogenic sources of pollutants (from point and nonpoint sources), while maintaining surface water quality standards, use classifications and the designated use(es) of the watershed, water body or water body segment. When, derived, the Total Maximum Daily Load represents, or defines, the total assimilative capacity of a water body segment. (OK definition?)

"Baseflow" means that quantity of streamflow contributed by ground water sources. It is estimated by employing a hydrograph separation method whereby long-term streamflow records are reconstructed so that the majority of stormwater flows are subtracted from those records to theoretically arrive at the ground water contribution to the stream, or through other methods approved by the Department.

"Best Management Practices" or "BMPs" for purposes of this chapter means:

1. Schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of the waters of State; or
2. Methods, measures or practices selected by an agency to meet its nonpoint source control needs. BMPs also include treatment requirements, operating procedures, and techniques to control site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. BMPs include, but are not limited to, structural and nonstructural controls and operation and maintenance procedures. BMPs can be applied before, during, and after pollution producing activities to reduce or eliminate the introduction of pollutants into receiving waters.

"Category One Waters" means those waters designated in the tables in N.J.A.C. 7:9B-1.15(c) through (h), for purposes of implementing the antidegradation policies as set forth at N.J.A.C. 7:9B-1.5(d), for protection from changes in water quality that fall outside of the 95% confidence interval of the existing, appropriate, mathematical mean water quality because of their clarity, scenic setting, other characteristics of aesthetic value, exceptional ecological significance, exceptional recreational significance, exceptional water supply significance, or exceptional fisheries resource(s). These waters may include, but are not limited to:

1. Waters originating wholly within Federal, Interstate, State, County, or Municipal parks, forest, fish and wildlife lands, and other special holdings that have not been designated as FW1 at N.J.A.C. 7:9B-1.15(h) Table 6;
2. Waters classified at N.J.A.C. 7:9B-1.15(c) through (g) as FW2 trout production waters and their tributaries;
3. Surface waters classified in this subchapter as FW2 trout maintenance or FW2 Nontrout that are upstream of waters classified in this subchapter as FW2 trout production;
4. Shellfish waters of exceptional value; or
5. Other waters and their tributaries that flow through, or border, Federal, State, county or municipal parks, forest, fish and wildlife lands, and other special holdings.

"Category Two Waters" means those waters not designated as Outstanding National Resource Waters or Category One in N.J.A.C. 7:9B-1.15 in the SQWS for purposes of implementing the Antidegradation Policies.

"Clean Water Act" (CWA) means as the Federal Act or Federal Clean Water Act (33 U.S.C. 1251 et seq.) including all subsequent supplements and amendments.

"Combined sewer overflow," means the excess flow from the combined sewer system that is not conveyed to the domestic treatment works for treatment, but transmitted by pipe or other channel directly to waters of the State.

"Combined sewer system" means a sewer system that is designed to carry sanitary sewage at all times and that also is designed to collect and transport stormwater from streets and other sources, thus serving a combined purpose

"Commissioner" means the Commissioner of the New Jersey Department of Environmental Protection or. an authorized representative.

"Community onsite subsurface disposal system" means an onsite subsurface disposal system which serves five or more realty improvements as defined in N.J.S.A. 58:11-23 et seq. or any onsite subsurface disposal system receiving domestic waste and serving one or more realty improvements where the design flow is greater than 2,000 gpd.

"Confined aquifer," means an aquifer bounded above and below impermeable beds or by beds of distinctly lower permeability than that of the aquifer itself: an aquifer containing confined groundwater.

"Consumptive water use" means any use that permanently removes water from a watershed or a confined aquifer from which it is withdrawn by activities that result in substantial evaporation and evapo-transpiration. Agricultural activities, irrigation and industrial cooling operations often result in substantial evaporation and evapo-transpiration [GM2].

"Conventional pollutant" means a pollutant designated under Section 304(b)(4) of the Federal Act.

"Department" means the New Jersey Department of Environmental Protection

"DEP Bulletin" means the publication issued by the Department designed to provide public notice of certain Department actions.

"Depletive water use" means any use that permanently removes water from a watershed or a confined aquifer from which it is withdrawn by activities that result in the exportation, or transfer, of water and sewage.

"Designated use," means that surface water or ground water uses both existing and potential, that have been established by the Department for waters of the State. [DJVA3]

"Design flow" means the average daily volume of wastewater, which a domestic treatment works was designed to treat or convey, or the maximum permissible volume of flow to a domestic treatment works as established by a NJPDES permit or a treatment works approval, whichever is more stringent.

"Development" means [DJVA4] the division of a parcel of land into two or more parcels, the construction, reconstruction, conversion, structural alteration, relocation or enlargement of any building or structure, or of any mining excavation or landfill, and any use or change in the use of any building or other structure, or land or extension of use of land, for which permission may be required under the Municipal Land Use Law, N.J.S.A. 40:55D-1 et seq.

"Discharge" means an intentional or unintentional action or omission resulting in the releasing, spilling, leaking, pumping, pouring, emitting, emptying, or dumping of a pollutant into the waters of the State, onto land or into wells from which the pollutant might flow or drain into such waters, or into waters or onto lands outside the jurisdiction of the State which pollutant enters the waters of the State, and shall include the release of any pollutant into a municipal treatment works. A leak into a secondary containment system which does not involve a release into the waters or lands of the state is not a discharge for purposes of applying the rules under this subchapter to violations of the Underground Storage of Hazardous Substances Act, N.J.S.A 58:11-49 et seq. and the rules promulgated pursuant thereto, 7:14B-

"Discharge to surface water" or "DSW" means a direct discharge to surface water as defined in N.J.A.C. 7:9B. DSW does not include a discharge to a DTW.

"Divert" or "diversion" means the taking of water from a river, stream, lake, pond, aquifer, well, other underground source, or other waterbody, whether or not the water is returned thereto, consumed, made to flow into another stream or basin, or discharged elsewhere.

"Domestic treatment works" or "DTW" means all publicly owned treatment works as well as privately owned treatment works processing primarily domestic wastewater and pollutants together with any ground water, surface water, storm water or process wastewater that may be present.

"Effluent" means the treated liquids discharged by a treatment works.

"Effluent limitation" means any restriction on quantities, quality, discharge rates, concentration of chemical, physical, thermal, biological, radiological, and other constituents of pollutants established by permit, or imposed as an interim enforcement limit pursuant to an administrative order, including an administrative consent order. .

"Environmentally sensitive areas" means those areas identified in a Statewide or areawide WQM plan as land areas possessing characteristics or features that are necessary for the maintenance or improvement of water quality, or to the conservation of the natural resources of the State and are stringently regulated by the Department or another State agency. Environmentally sensitive areas include, but are not limited to: areas inhabited by threatened and endangered species, FW1 watersheds, floodways and floodplains, Pinelands ground and surface waters, Class I-A ground waters, watershed buffer areas for public community water supply systems, and coastal and freshwater wetlands.

"Environmentally Sensitive Features" means, according to the State Development and Redevelopment Plan, the following natural and cultural resources, the disturbance of which tends to impair the physical, biological, social, or aesthetic quality of the resource:

1. Aquifer recharge areas;
2. Coastal dunes, beaches, barrier islands, and shoreline;
3. Critical slope areas;
4. Flood plains;
5. Habitats of endangered and threatened species;
6. Habitats with wide diversity of resident species;
7. Historic areas;
8. Public water supply reservoirs;
9. Ridge lines;
10. Scenic corridors;
11. Staging areas for migratory species;
12. Stream corridors;

- 13. Wetlands; and
- 14. Wildlife corridors.
- 17. (Wellhead protection areas?)

"Environmentally sensitive watershed" means a watershed that includes and is predominantly characterized by environmentally sensitive areas and environmentally sensitive features.

Erosion means the detachment and movement of soil or rock fragments by water, wind, ice and gravity.

"Existing discharge" means a permitted discharge which is not a new source.

"Existing water quality" means the water quality in a water body at the time a water body was designated for its current level of antidegradation protection, as modified to reflect permitted loadings not actually being discharged on the date of designation, provided that such loadings were contained in issued permits prior to the effective date of the designation. This is the water quality that the Department shall utilize as mean water quality when implementing a watershed approach to water quality management for a particular waterbody.

"Federal Act" means the Federal Water Pollution Control Act, commonly known as the Clean Water Act, 33 U.S.C. §§1251 et seq. including all subsequent supplements and amendments.*

"FW1" means those fresh waters, as designated in N.J.A.C. 7:9B-1.15(h) Table 6, that are to be maintained in their natural state of quality (set aside for posterity) and not subject to any man-made wastewater discharges in runoff from anthropogenic activities. These water are set aside for posterity because of their clarity, color, scenic setting, other characteristics of aesthetic value, unique ecological significance, exceptional recreation significance, or exceptional water supply significance.

"FW2" means the general surface water classification applied to those freshwaters that are not designated as FW1 or Pinelands Waters.

"Governmental entity" means a Federal, state, interstate, county or municipal government or school district whose jurisdiction is partially or entirely within the State.

"Governor" means the Governor of the State of New Jersey.

"Governor's designee" means the Department.

"GPD" or "gpd" means gallons per day.

"Ground water" means water that portion of water beneath the land surface that is within the saturated zone.

"Ground Water Quality Standards" means the New Jersey rules at N.J.A.C. 7:9-6 which set forth a designated use or uses for the ground waters of the State, use classifications, water quality criteria for the State's waters based upon such uses, and the Department's policies concerning these uses, classifications and criteria.

"High quality water" means any water, where, for a particular pollutant or pollutant parameter, the water quality exceeds that quality necessary to support the existing or designated uses, or which supports an exceptional use. At a minimum, the water quality criteria at N.J.A.C. 7:9B-1.14(c) and (d), and N.J.A.C. 7:9C-1.7, are criteria necessary to support the designated and existing uses. These waters are determined on a case-by-case basis.

"Impoundment" means a body of water confined by a dam dike floodgate or other barrier.

"Individual subsurface sewage disposal system" means a system for the disposal of 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 discharge the liquid effluent to a disposal field.

"Industrial/commercial" means any project or activity engaged in manufacturing, production or sales of services or products.

"Industrial flow" means wastewater flows from manufacturing sites, including process, cooling, pre-treated and other wastewater.

"Industrial treatment works " means a treatment works which treats primarily process wastewater and/or other industrial pollutants as determined by the percentage of process wastewater, or mass loading of BOD, COD, or suspended solids in the wastewater flow. Industrial treatment works shall also include any treatment works, whether publicly or privately owned, which treats primarily wastewater or leachate from a municipal solid waste facility or potable water treatment plant. This definition includes SIU pretreatment works.

"Institutional flow" means wastewater flows from public, non-profit and other sites related to the provision of health services, correctional services and similar activities.

"Intermittent stream" means a stream with a MA7CD10 flow of less than one-tenth (0.1) cubic foot per second.

"Lake, pond or reservoir" means any impoundment, whether naturally occurring or created in whole or in part by the building of structures for the retention of surface water, excluding sedimentation control, stormwater retention/detention basins and ponds designed for the treatment of wastewater. Lakes, ponds and reservoirs are characterized by a long-term or permanent downgradient restriction of surface water flow from the impoundment and areas of quiescent water within the body of the impoundment. Lakes,

ponds and reservoirs are frequently characterized by greater water depths within the impoundment than either the upgradient or downgradient surface water flow and by shallow water lateral edges containing emergent or submerged plant species. For regulatory purposes, the upgradient boundary of a lake, pond [DJVA5] or reservoir shall be considered to be the point at which areas of greater depth and relatively quiescent water can be differentiated from the upgradient surface water input into the impoundment under average flow conditions.

"Load allocation" means the portion of a receiving water's total maximum daily load (TMDL) for a specific pollutant that is allocated to existing or future nonpoint sources of pollution.

"Lowering of water quality" means a change in water quality from either existing water quality or ambient water quality, as appropriate, toward water quality which does not protect the designated and existing uses.

"MA7CD10" means the minimum average seven consecutive day flow [DJVA6] with a statistical recurrence interval of ten years.

"MGD" or "mgd" means million gallons per day.

"Monthly average flow" means the sum of all daily wastewater discharge flow measured during a calendar month, divided by the number of daily wastewater discharges measured during that month.

"Municipal authority" means a municipal authority as defined in the Municipal and County Utilities Authorities Law at N.J.S.A. 40:14B-3(5), and shall include a municipal utilities authority created by one or more municipalities and a county utilities authority created by a county.

"Municipal government" means a city, town, borough, village, township or other municipal government created by State law, which has an elected governing body, a chief executive, and municipal public officials including a municipal clerk, tax assessor, and tax collector.

"NJPDES" means the New Jersey Pollutant Discharge Elimination System established in N.J.A.C. 7:14A.

"NJPDES discharge permit" means a permit issued by the Department under N.J.A.C. 7:14A for discharges to waters of the state.

"Non-conventional pollutant" means any pollutant not defined as a conventional pollutant or a toxic pollutant.

"Nonpoint pollution" means pollution from any source other than from any discernible, confined and discrete conveyances, and shall include, but not be limited to, pollutants

from agricultural, silvicultural, mining, construction, subsurface disposal and urban runoff sources.

"Non-point source" means, 1. Any man-made or man-induced activity, factor, or condition, other than a point source, from which pollutants are or may be discharged; 2. Any man-made or man-induced activity, factor, or condition, other than a point source, that may temporarily or permanently change any chemical, physical, biological, or radiological characteristic of waters of the State from what was or is the natural, pristine condition of such waters, or that may increase the degree of such change; or 3. Any activity, factor, or condition, other than a point source, that contributes or may contribute to water pollution.

"Nutrient" means a chemical element or compound, such as nitrogen or phosphorus, which is essential to and promotes the growth and development of organisms.

"Permit" means, for the NJPDES program, an authorization, license, or equivalent control document issued by the Department or a delegated local agency to implement the requirements of the Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq., even where any or all of the conditions of the permit have been stayed. Permit does not include any permit which has not yet been the subject of final agency action, such as a "draft permit." Permit includes a letter of agreement entered between a delegated local agency and a user of its municipal treatment works, setting effluent limitations and other conditions on the user of the agency's municipal treatment works. Permit also includes a general permit and a permit-by-rule.

"Permit by rule" means, for the NJPDES program, a provision of N.J.A.C 7:14A stating that a "facility or activity" is deemed to have a NJPDES permit if it meets the requirements of the applicable regulations.

"Permitted flow" means a treatment work's maximum allowable flow (usually in million gallons per day, or other appropriate unit of flow such as gallons per day) as stated in the facility's NJPDES Permit or TWA, whichever is more stringent.

"Permittee" means any person authorized to conduct activity pursuant to a permit.

"Person" means any individual, corporation, company, partnership, firm, association, political subdivision of this State and any state or interstate agency.

"Pinelands waters" means all waters within the boundaries of the Pinelands Area, except those water designated as FW1 in N.J.A.C. 7:9B-1.15(h) Table 6, as established in the Pinelands Protection Act (N.J.S.A. 13:18A-1 et seq.) and shown on Plate 1 of the "Comprehensive Management Plan" adopted by the New Jersey Pinelands Commission in November 1980.

"Point source" means any discernible, confined and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container,

rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft, from which pollutants are or may be discharged. Return flows from irrigated agriculture are not considered point sources.

"Pollutant" means any dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, refuse, oil, grease, sewage sludge, munitions, chemical wastes, biological materials, medical wastes, radioactive substance (except those regulated under the Atomic Energy Act of 1954, as amended (42 U.S.C. §§2011 et seq.)), thermal waste, wrecked or discarded equipment, sand, cellar dirt and industrial, municipal, agricultural and construction waste or runoff or their residue discharged to the land, ground waters or surface waters of the State, or to a domestic treatment works. "Pollutant" includes both hazardous and nonhazardous pollutants.

"Pollutant parameter" means a chemical compound, indicator of the presence or effects of chemical compounds, or indicator of the presence or effects of aggregates of chemical compound (for example, whole effluent toxicity, dissolved oxygen, biochemical oxygen demand, carbonaceous oxygen demand) that may be used to assess the presence of pollutants or aggregates of pollutants.

"Public water supply" means a water supply providing piped water to the public for human consumption, if such system has at least 15 service connections or regularly serves at least 25 individuals, as defined by N.J.A.C. 7:15.

"Purveyor" or "water purveyor" means any person who owns or operates a public water supply, as defined by N.J.A.C. 7:15.

"Recharge" means the replenishment of ground water.

"Runoff" means any rainwater, leachate, or other liquid that drains overland from any part of a facility.

"Sanitary sewage" means any liquid waste containing animal or vegetable matter in suspension or solution of the water carried wastes resulting from the discharge of water closets, laundry tubs, washing machines, sinks, dishwashers, or any other source of water-carried waste of human origin or containing putrescible material. This term specifically excludes industrial, hazardous or toxic wastes and materials.

Sediment means solid material, mineral or organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water or gravity as a product of erosion.

"Sewage" means any wastes, including wastes from humans, households, commercial establishments, industries, and stormwater runoff, that are discharged to or otherwise enter a DTW.

"Sewerage authority" means a sewerage authority created pursuant to the Sewerage Authorities Law, N.J.S.A. 40:14A-1 et seq.

"Shellfish waters" "Shellfish waters" means waters classified as Approved, Seasonally Approved, Special Restricted. Seasonally Special Restricted or Condemned that support or possess the potential to support shellfish which are within the Coastal Area Facility Review Act (CAFRA) zone as delineated in 1973, (excluding 1-The Cohansey River upstream of Brown's Run; 2-the Maurice River upstream of Route 548; 3-The Great Egg harbor river upstream of Powell Creek; 4-the Tuckahoe river upstream of Route 50; 5-The Mullica River upstream of the Garden State Parkway) plus the adjacent areas between Route 35 (from its juncture with the CAFRA zone just north of RedBank to its juncture with the CAFRA zone just south of Keyport) and the CAFRA zone and the area from the C.A.F.R.A. zone on the south northwesterly along Route 35 to the northern shore of the Raritan River, then easterly along Route 35 to the northern shore of the Raritan River to the southeast point of Perth Amboy, then due east to the New Jersey jurisdictional line, and seaward along the jurisdictional limit to the Atlantic Ocean.

"Significant modification" means an alteration, expansion or other change that may reasonably be expected to effect the quantity of flow treated or the quality of the effluent discharged to the waters of the State or to a publicly owned treatment works.

Site means the lot or lots upon which a proposed development is to be constructed

"Site specific allocation" means a wasteload allocation for a specific pollutant to an existing or future point source based on site specific considerations rather than from a total maximum daily load (TMDL).

"Site-specific pollution control plan" means a plan that details necessary measures designed to control one or more specified pollutants or sources of pollution from a site.

"State" means the State of New Jersey.

"State Act" means the New Jersey "Water Pollution Control Act," N.J.S.A. 58:10A-1 et seq., as amended.

"State Development and Redevelopment Plan" means the statewide plan that is used as a guide for municipal and county master planning, State agency functional planning and infrastructure decisions prepared and adopted pursuant to the New Jersey State Planning Act (N.J.S.A. 52:18A-196 et seq.).

"State Development and Redevelopment Plan Center" means a compact form of development with a core or a node (focus of residential, commercial and service development) and a Community Development Area that ranges in scale from an Urban Center, to a Regional Center, Town, Village, and Hamlet.

"State Development and Redevelopment Plan Planning Area" means an area of greater than one square mile, that is described by the presence or absence of a set of existing conditions, such as population density, Urban or Community Infrastructure systems, level

of development, or natural resources and sets forth policy objectives that guide growth in the context of those conditions. Planning Areas are also intended to guide the application of the State Development and Redevelopment Plan's Statewide Policies, as well as to guide local planning and decisions on the location and size of Centers within the Planning Area.

"State Water Quality Inventory Report" means the biennial report prepared by the Department, pursuant to Section 305(b) of the Clean Water Act, 33 U.S.C. 1315, which inventories and assesses the quality of surface and ground waters of the State.

"Statewide Water Quality Management Plan" or "Statewide WQM Plan" (formerly known as the Statewide Water Quality Management Program Plan) means the plan that, together with this chapter, directs and coordinates water quality planning and implementation activities for the entire State, and contains the written provisions of the CPP pursuant to Section 7 of the Water Quality Planning Act (N.J.S.A. 58:11A-7).

"Stormwater management basin" means an embankment and associated space for impoundment of water or, alternatively, the space for impoundment partially or entirely created by excavation rather than by embankment, in either case designed to retain stormwater runoff. A stormwater management basin may either be normally dry (that is, a detention basin or infiltration basin) or retain water in a permanent pool (a retention basin).

"Stormwater management facility" means any structural stormwater management measure, including stormwater management basins and filtration or other treatment systems.

"Stormwater management measure," means any structural or nonstructural practice, technology, process, program, or other method intended to control or reduce stormwater runoff, or to promote the control or reduction of stormwater runoff.

Stormwater management planning agency means a municipality, county, county governing body, county planning agency, county planning board as defined at N.J.S.A. 40:27-6.1, county water resources agency or association, areawide agency, designated planning agency under N.J.A.C. 7:15, watershed management group recognized by the Department under N.J.S.A. 58:29-3, or Soil Conservation District, or the Delaware River Basin Commission, the Pinelands Commission, the Delaware and Raritan Canal Commission, the Hackensack Meadowlands Development Commission, the Department, or other regional or State agency authorized to prepare stormwater management plans.

Stormwater management planning area means the geographic area for which a stormwater management-planning agency is authorized to prepare stormwater management plans, or a specific portion of that area identified in a stormwater management plan prepared by that agency.

" "Stormwater or stormwater runoff" means water flow on the surface of the ground or in storm sewers, resulting from precipitation.

[GM7]"Surface water" means water at or above the land's surface which is neither ground water nor contained within the unsaturated zone, including, but not limited to, the ocean and its tributaries, all springs, streams, rivers, lakes, ponds, wetlands, and artificial waterbodies.

"Surface water classifications" means names assigned by the Department in N.J.A.C. 7:9B to waters having the same designated uses and water quality criteria (for example FWI, PL, FW2-NT, SE1, SC ZONE 1C).

"Surface water quality standards" means the rules at N.J.A.C. 7:9B which set forth, for the surface waters of the State, designated uses, use classifications and water quality criteria, and the Department's policies concerning these uses, classifications and criteria.

"Thermal discharge" means the component of any discharge which is comprised of heat, and which shall be limited in accordance with Sections 301, 306, 316 of the Federal Act, Section 6 of the State Act.

"TMDL Project Work Plan," means a detailed plan for the development of a Basic TMDL or a Complex TMDL in full conformance with the requirements of N.J.A.C. 7:15-7.

"Total allocable capacity" means the total assimilative capacity minus any applicable reserve capacity or margin of safety. It is the total loading that may be allocated to both point and nonpoint sources in a specific waterbody and includes pollution credits held for future use or trading and permitted but not yet utilized loading capacity of existing point source discharges.

"Total assimilative capacity" means the product of the applicable surface water quality criterion multiplied by the applicable stream design flow (or designated mixing volume in the case of embayment), expressed as a mass loading rate for site-specific allocations where regulatory mixing zones are permitted. The total assimilative capacity may also be determined by a model developed for the purpose of calculating a TMDL for a waterbody (see N.J.A.C. 7:15-7).

"Total maximum daily load" or "TMDL" means a total maximum daily load formally established pursuant to Section 7 of the Water Quality Planning Act (N.J.S.A. 58:11A-7) and Section 303(d) of the Clean Water Act, 33 U.S.C. 1251 et seq. A TMDL is the sum of individual wasteload allocations for point sources, load allocations for nonpoint sources of pollution, other sources such as tributaries or adjacent streams, and allocations to a reserve or margin of safety for an individual pollutant.

"Total suspended solids" or "TSS" means the total nonfilterable residue as determined by analytical procedures set forth in the Manual of Methods for Chemical Analysis of Water and Wastes (USEPA Office of Technology Transfer, Washington, D.C. March, 1983).

"Trout maintenance waters" means waters designated in N.J.A.C. 7:9B) for the support of trout throughout the year.

"Trout production waters" means waters designated in N.J.A.C. 7:9B- by trout for spawning or nursery purposes during their first summer.

"Unconfined or semi-confined aquifer" means an aquifer that is either exposed to atmospheric pressure or bounded by layers of materials which do not serve as an effective barrier to upward water migration.

"USEPA" means the United States Environmental Protection Agency.

"USGS quadrangle map" means any of the set of topographic maps published by the United States Geological Survey at 1:24,000 scale, also known as "quadrangles" or "quads."

"Wasteload allocation" or WLA means the portion of a receiving water's total maximum daily load for a specific pollutant that is allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality-based effluent limitation [DJVA8].

"Wastewater" means residential, commercial, industrial, or agricultural liquid wastes, septage, stormwater runoff, or any combination thereof or other residue discharged or collected [GM9].

"Wastewater management agency" means a governmental entity or sewerage agency designated in an areawide WQM Plan to plan, construct, or operate domestic treatment works.

"Water quality-based effluent limitations" means effluent limitations established so that the quality of the waters receiving a discharge will meet the Surface Water Standards of NJAC 7:9B after the introduction of the effluent

"Water quality limited segment" means any segment of a water body that does not or is not expected to meet surface water quality standards, identified in accordance with N.J.A.C. 7:15-6.2. Each WQLS shall be entirely contained within a watershed, and may be configured using the USEPA stream segments data base or the US Geological Survey 14-digit Hydrologic Unit Code mapping of New Jersey surface water bodies (USGS Water Resources Investigation Report 95-4134).

"Water quality management plans" or "WQM plans" means the plans prepared pursuant to Sections 208 and 303 of the Clean Water Act, 33 U.S.C. 1251 et seq., and the Water

Quality Planning Act, N.J.S.A. 58:11A-1 et seq., including the Statewide, areawide, and county WQM Plans.

"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.

"Watershed" means a geographic area within which water, sediments, and dissolved materials drain to a particular receiving waterbody or to a particular point along a receiving waterbody.

"Watershed management" means the protection and restoration of a watershed through integrated and holistic efforts.

"Water supply allocation permit" means the document issued by the Department to a person granting that person the privilege, so on as the person complies with conditions of the document, to divert 100,000 or more gallons of water per day for more than 30 days in a consecutive 365 day period, for any purpose other than agricultural or horticultural purposes, as defined in N.J.A.C. 7:15.

"Water table aquifer" means a geological formation which carries water at atmospheric pressure at the top of the unsaturated zone, as defined in N.J.A.C. 7:15.

"Well" means a bored, drilled, or driven shaft, or a dug hole, whose depth is greater than the largest surface dimension.

"Well head protection area" means the surface and subsurface area which surrounds a water well or wellfield that supplies a potable water supply system, through which pollutants are reasonably likely to move toward and reach such a water well or wellfield. This area shall be designated by the Department.

"Freshwater wetlands" or wetland means an area that is inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation: provided, however, that the Department, in designating a wetland, shall use the three-parameter approach (that is, hydrology, soils and vegetation) enumerated in the Federal Manual for Identifying and Delineating Wetlands. "WMP" means wastewater management plan.

"Work programs and plans," mean those documents that detail the specific work activities proposed as part of a water quality management program.

"WQM plan" means water quality management plan.

NJDEP Strategic Watershed Monitoring Program

Many of the criteria used in ranking watersheds, as well as multi-media and other environmental criteria and objectives developed through the watershed management process, rely on water quality data generated by the state's ambient surface water monitoring network, operated cooperatively by NJDEP and the US Geological Survey (USGS), New Jersey District. NJDEP and USGS have operated a cooperative, ambient surface water quality network for over twenty years. This network has provided a historic database for water quality assessment and the tracking of water quality trends over time. USGS also collects stream flow data through its stream-gauging network (see section 4.1.2). NJDEP is already using the ambient surface water-monitoring network to develop water quality data on a watershed basis. In 1997 a joint DEP/USGS Workgroup revised the ambient surface water-monitoring network to better serve the needs of the statewide watershed management framework. The strategic watershed-monitoring program is crucial to the success of the statewide watershed management framework. Specific features incorporated in the redesigned monitoring network, under this new program, include:

1. Randomly – located monitoring stations to provide generalized water quality data for statewide assessment.
2. Landuse indicator stations selected using GIS landuse data.
3. Alignment of ambient water quality and ambient biological monitoring networks.
4. Development of regional background/reference water quality stations.
5. Expansion of the network into tidally impacted areas.

The revised surface water-monitoring network provides WMA specific monitoring of New Jersey's surface waters. Fixed stations are located in subwatersheds (landuse indicator stations) and near the downstream boundary of each WMA (watershed integrator stations). Water quality data collected from the landuse indicator stations provides information on water quality associated with the dominant landuses in the WMA. Water quality data collected at the watershed integrator stations represent the overall impact of pollution sources (point and non-point) within the WMA. A final type of fixed station (reference/background) measures water quality at six "undisturbed" locations statewide. These locations represent New Jersey's major physiographic provinces. Water quality data is collected from network stations seasonally. The network provides the baseline data for trend analysis and establishes relationships between water quality and watershed characteristics (including landuse).

The AMNET program has established a network of lotic (running water) stations in every watershed in the state (i.e., 815 stations statewide). Under the current AMNET program, each watershed will be monitored for benthic macroinvertebrate populations on a five-year rotation schedule. At least one monitoring station is located on every second-order stream and all first-order streams at least three miles in length (First-order streams are those with no tributaries; second-order streams are those that have only first-order streams as tributaries). Furthermore, the network was designed with mainstem (second or third-order) stations located before the confluence of major tributaries and with stations located so as to assess the impacts of larger lakes. Known sources of contamination, and significant natural features (e.g. freshwater wetlands, preserves, Fish and Game Management Areas, etc.) are also considered when selecting sampling locations. All stations are positioned via Global Positioning

System (GPS) units, and are mapped using NJDEP's Geographic Information System (GIS) capabilities.

The combination of a fixed monitoring network with an intensive monitoring network, including both ground water and biological monitoring capabilities will significantly expand and enhance the state's water quality database, which is needed for implementation of the statewide watershed management framework. Monitoring on a watershed basis will also result in more efficient use of data and data collection resources by first collecting baseline information for watershed characterization and assessment, screening for issues of concern, and targeting more intensive data collection efforts for assessing issues, developing remediation strategies and evaluating strategy effectiveness.

Watershed-based monitoring should also result in increased reliability of data, through stakeholder collaboration and oversight of data collection and assessment methodologies, as well as provide opportunities for data and resource sharing; all of which should result in more thorough investigation and analysis of priority issues and solutions. This will provide a database for assessing "average" water quality in New Jersey. To expand the assessment potential of the ambient surface water network's database, it must also be integrated with other information sources such as biomonitoring data, NJPDES compliance data, rainfall data, GIS data coverages, and air deposition data.

Action Steps:

Accurate monitoring data are needed for several purposes, including establishing use support status, identifying positive or negative water quality trends, screening existing or emerging water quality problems, locating and quantifying pollutant sources, characterizing the extent of environmental contamination, evaluating the effectiveness of management actions, and calibrating models for use in defining and distributing a watershed's assimilative capacity (i.e., TMDL development). The strategic watershed monitoring program will coordinate data collection activities within and across NJDEP programs and with other monitoring efforts, such as discharger, purveyor and volunteer water monitoring activities, as well as air deposition monitoring, to meet watershed management objectives and to maximize efficient use of resources.

Ambient monitoring is being conducted, as described above, at strategically located sites for the purpose of assessing, documenting trends, screening problems, and evaluating the overall effectiveness of management controls. Intensive surveys will be integrated with watershed monitoring and modeling to identify adverse impacts from conventional and toxic pollutants or other stressors. Intensive surveys will be targeted as needed to locate and quantify pollutant sources, measure the effect and fate of pollutants, and characterize and assess watershed management areas. Biological monitoring will be employed as an indicator and screening tool to target areas where actual adverse water quality impacts or use impairments are evident. Chemical monitoring will be used to identify the location and relative amounts of specific contaminants in the water column so that inferences regarding the source(s) of the water quality impairments can be made. Targeted sediment sampling will be conducted as a screening tool to identify where more intensive monitoring for toxics may be necessary. Physical monitoring may also be used to

provide additional information about adverse impacts to the aquatic ecosystem (e.g. habitat loss, erosion) or use impairment.

The strategic monitoring program will help NJDEP and stakeholders develop the water quality, flow and other data needed to identify priority water quality and quantity issues. The strategic watershed monitoring program will also provide data to support watershed modeling efforts that will facilitate development of watershed goals (e.g. TMDLs) and management strategies to be implemented through watershed management plans and NJPDES permits. Finally, the strategic watershed-monitoring program will address any special studies needed to address impaired waters for purposes such as problem quantification, TMDL development, and measuring program success. In certain cases, special studies may need to be performed in watersheds outside their designated monitoring period. Examples include nonpoint source (NPS) pollution control demonstration projects evaluating long-term NPS impacts or evaluating best management practice (BMP) effectiveness (such as for the Barnegat Bay Watershed Estuary, Musconetcong River, and Whippany River Watershed projects) or long-term TMDL development studies (such as the New York/New Jersey Harbor Estuary and the Delaware Estuary projects) that may take several years to complete.

The strategic watershed monitoring program will also explore and develop opportunities for coordinating and supplementing NJDEP monitoring resources through a variety of arrangements, including discharger monitoring consortiums, integration of compliance and ambient monitoring, and volunteer monitoring efforts. Examples of additional monitoring opportunities include biological screening conducted by qualified watershed associations and non-regulatory agencies, experimental monitoring where detection limits are too low for traditional monitoring applications. The South Branch Watershed Association has been conducting a volunteer monitoring program, based on NJDEP field training protocol and USEPA program guidance, for several years. The New Jersey Harbor Dischargers (draining to the New York/New Jersey Harbor), in cooperation with NJDEP, USEPA and New York agencies, have conducted sensitive experimental monitoring for polychlorinated biphenyls (PCBs) and other organic chemicals of concern in discharge systems and ambient waters of the Harbor as part of a non-regulatory “track down and clean up” effort that parallels the regulatory TMDL/WLA approach. This approach has been used extensively in New York State ambient waters (e.g. the Great Lakes Program) and recently in the New York City discharge system.

The DEP/USGS Ambient Ground Water Network is currently being redesigned in a manner similar to the surface water network. The revised ground water network will monitor water quality in a series of shallow wells and attempt to: (1) establish watershed specific relationships between landuse and water quality and (2) assess ground water impacts on surface water quality.

Figure 1.1-1 New Jersey Watershed Management Areas

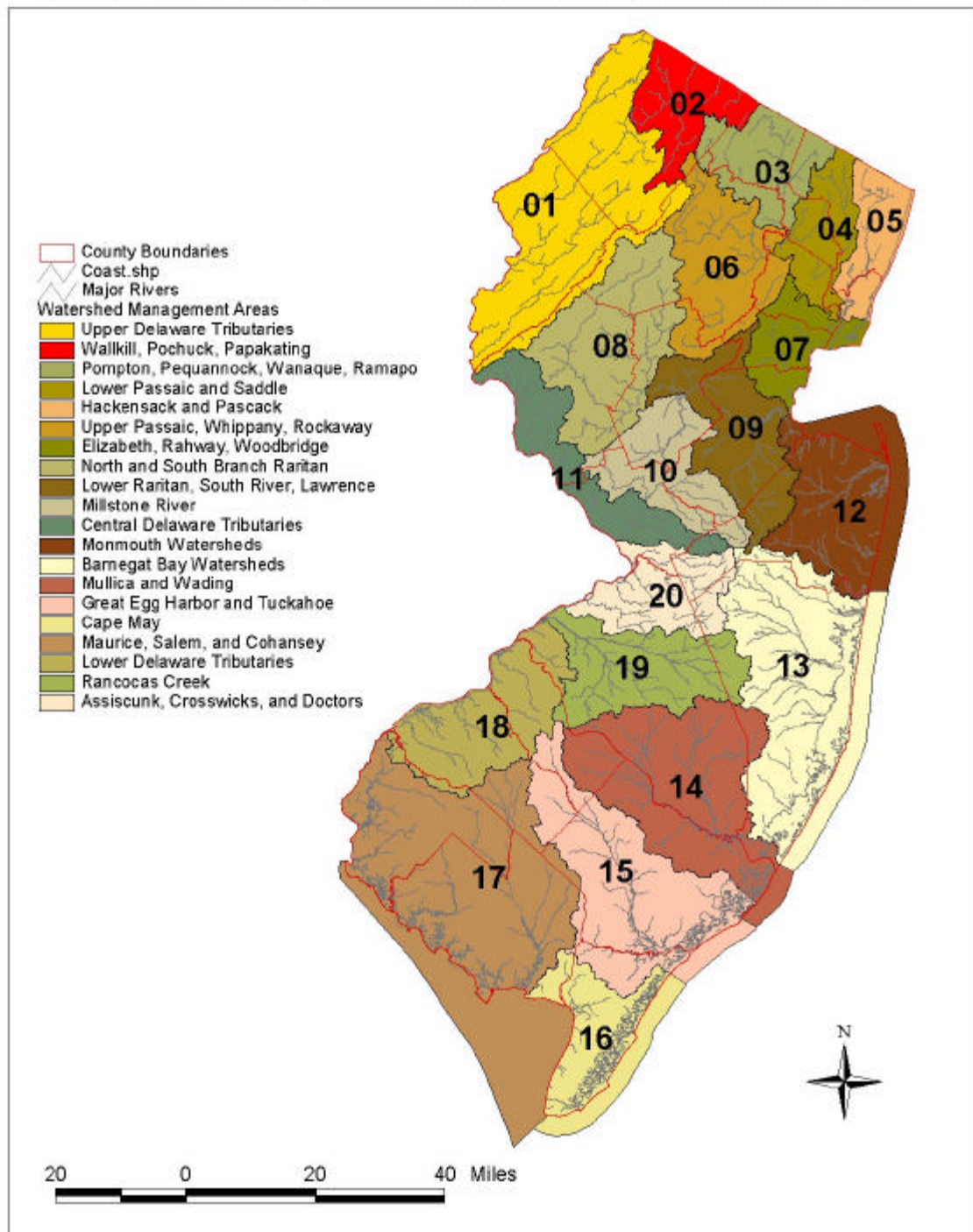


Figure 2.1-1 Municipalities and Counties in WMA 02

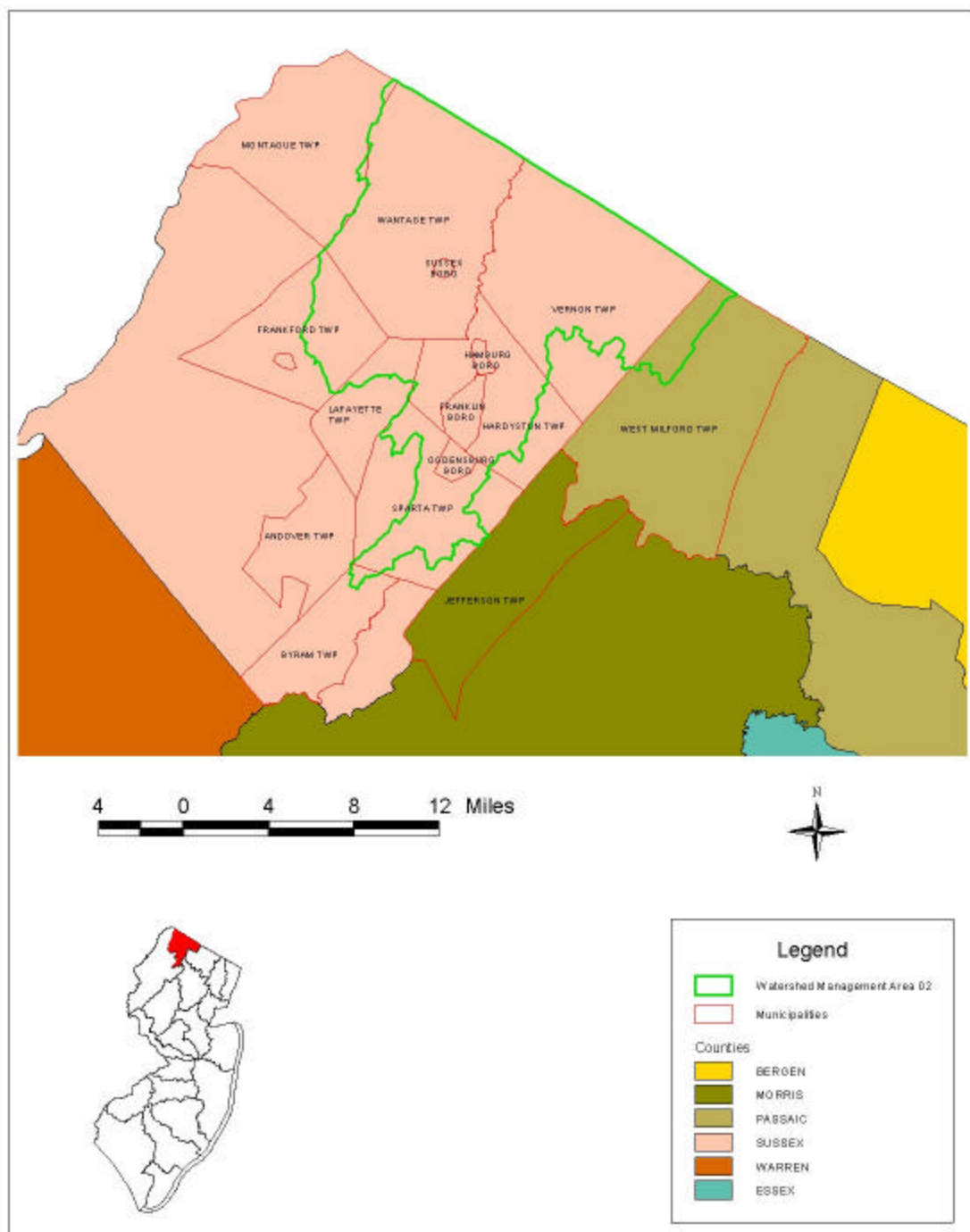


Figure 2.1-2 Watersheds and Hydrology in WMA 02

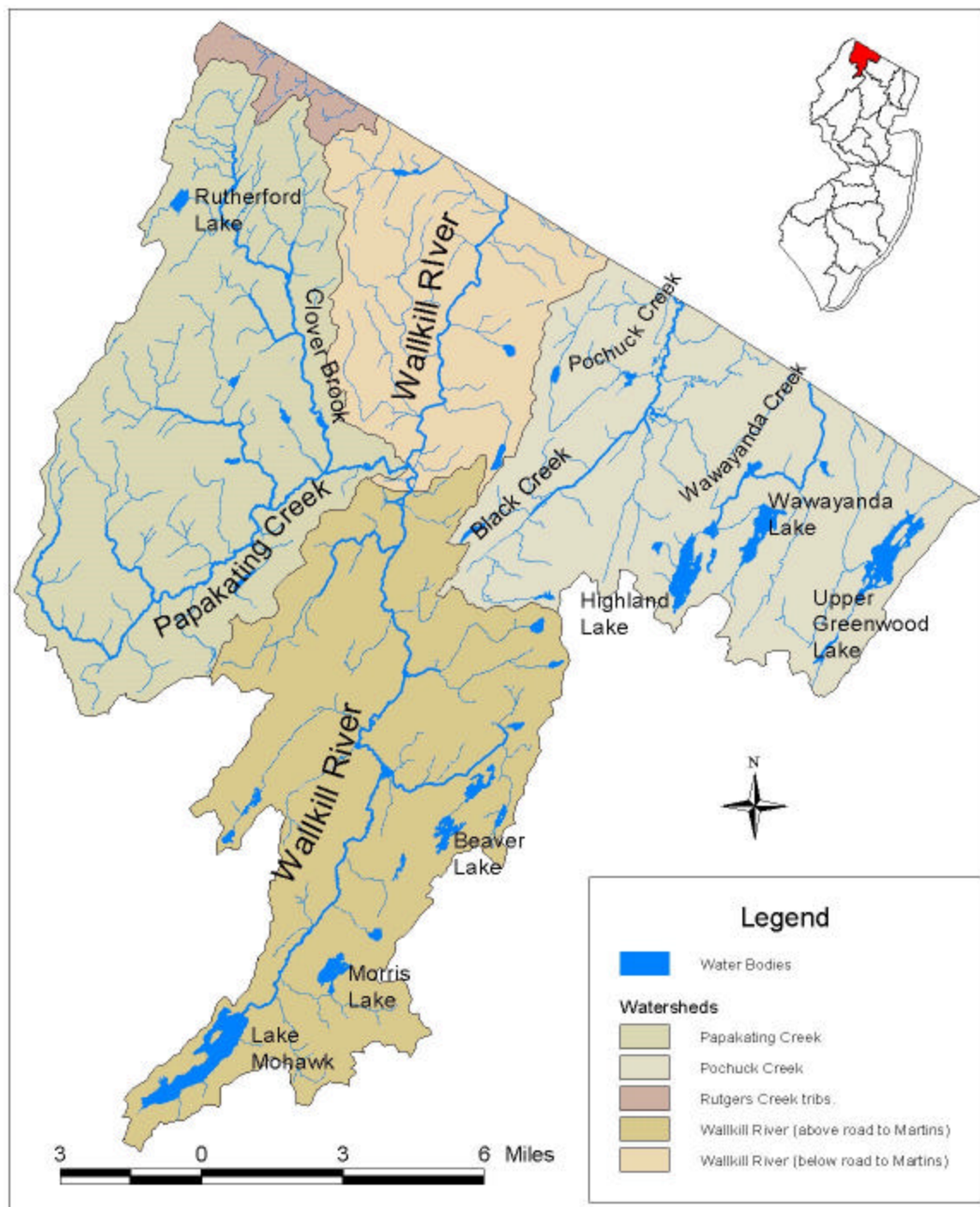


Figure 2.1-3 Topography in WMA 02

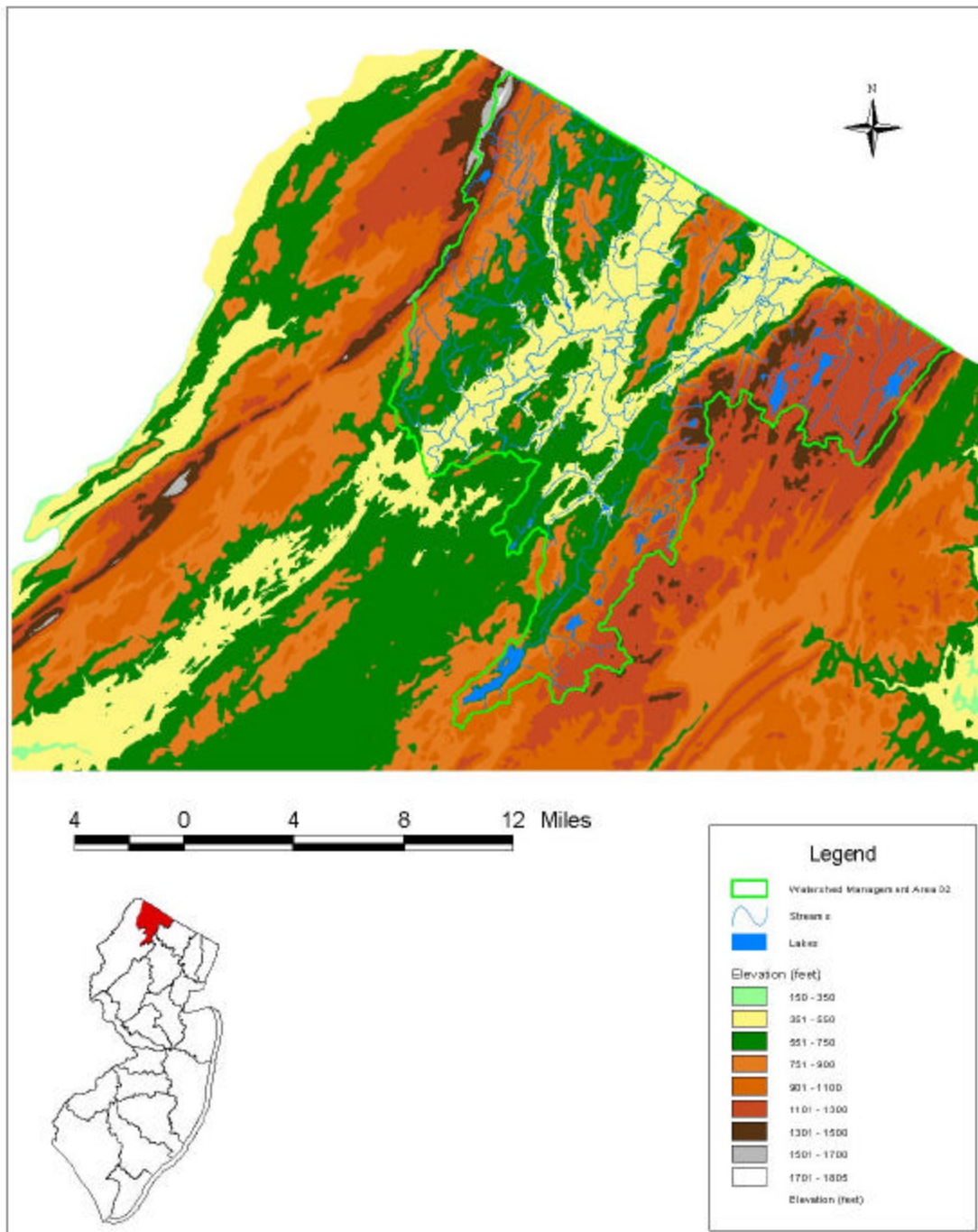


Figure 2.1-4 Dams in WMA 02

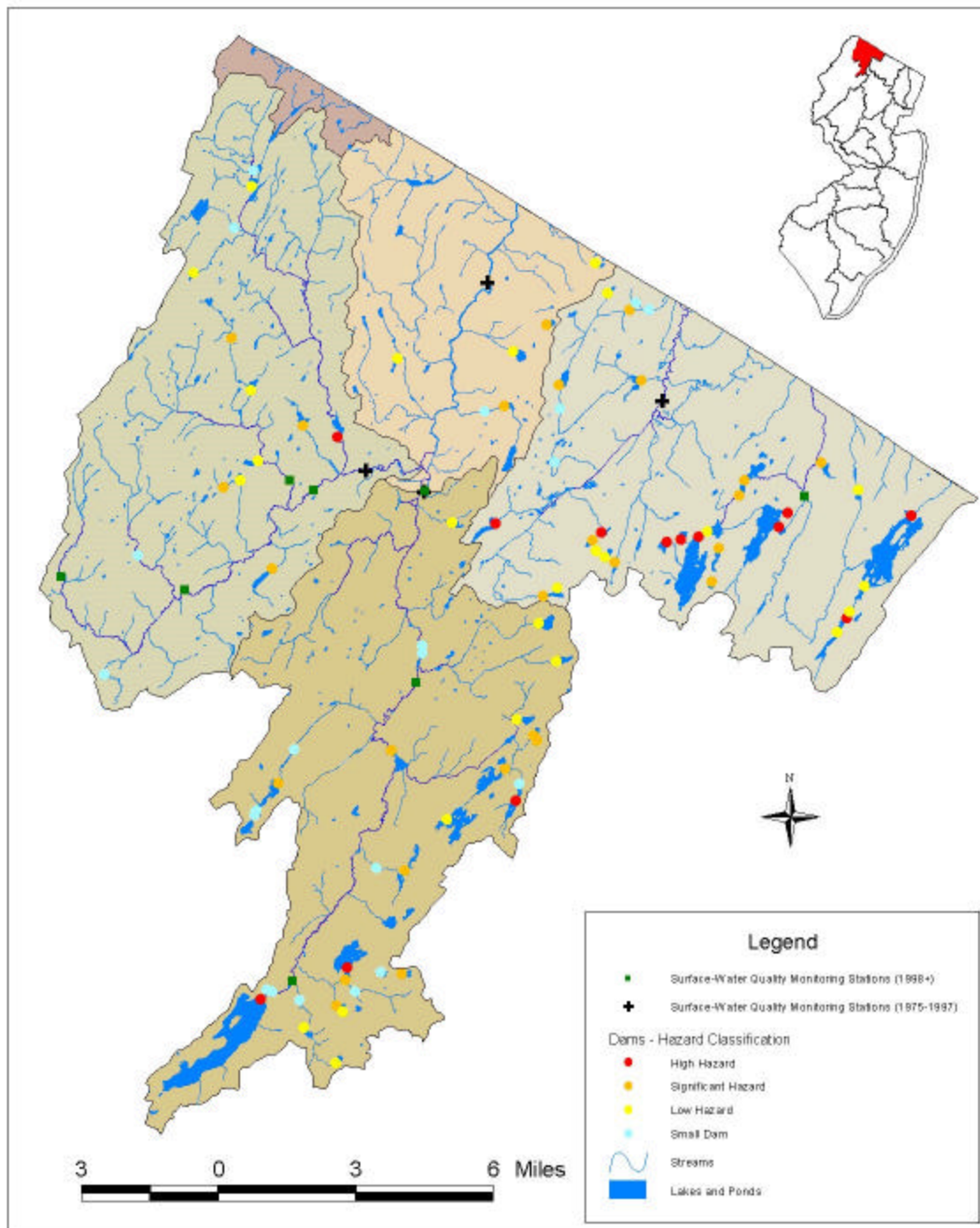


Figure 2.2-1 Walkill River Watershed

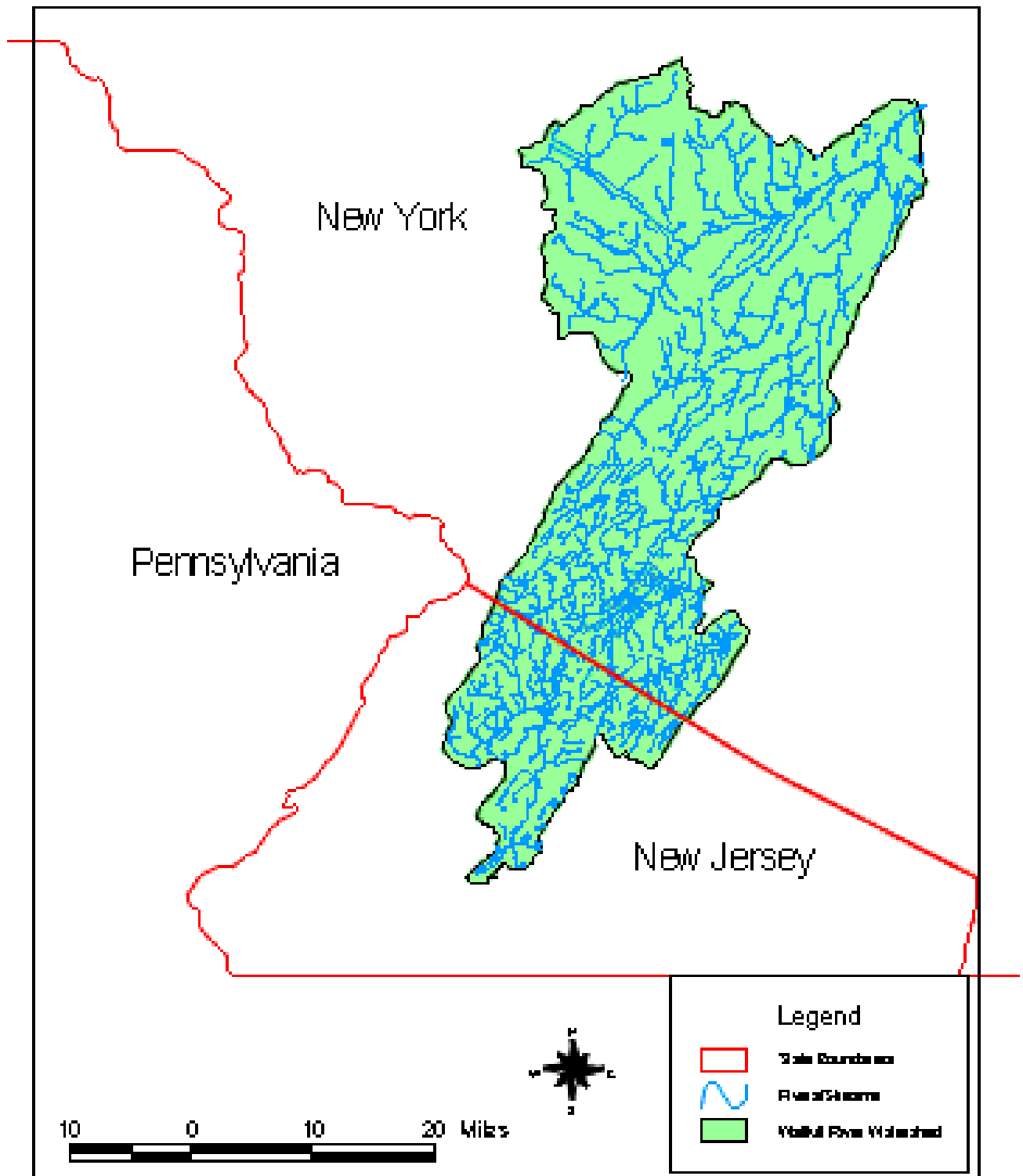


Figure 2.3-1 1986 Land Use and Land Cover Classes in WMA 02

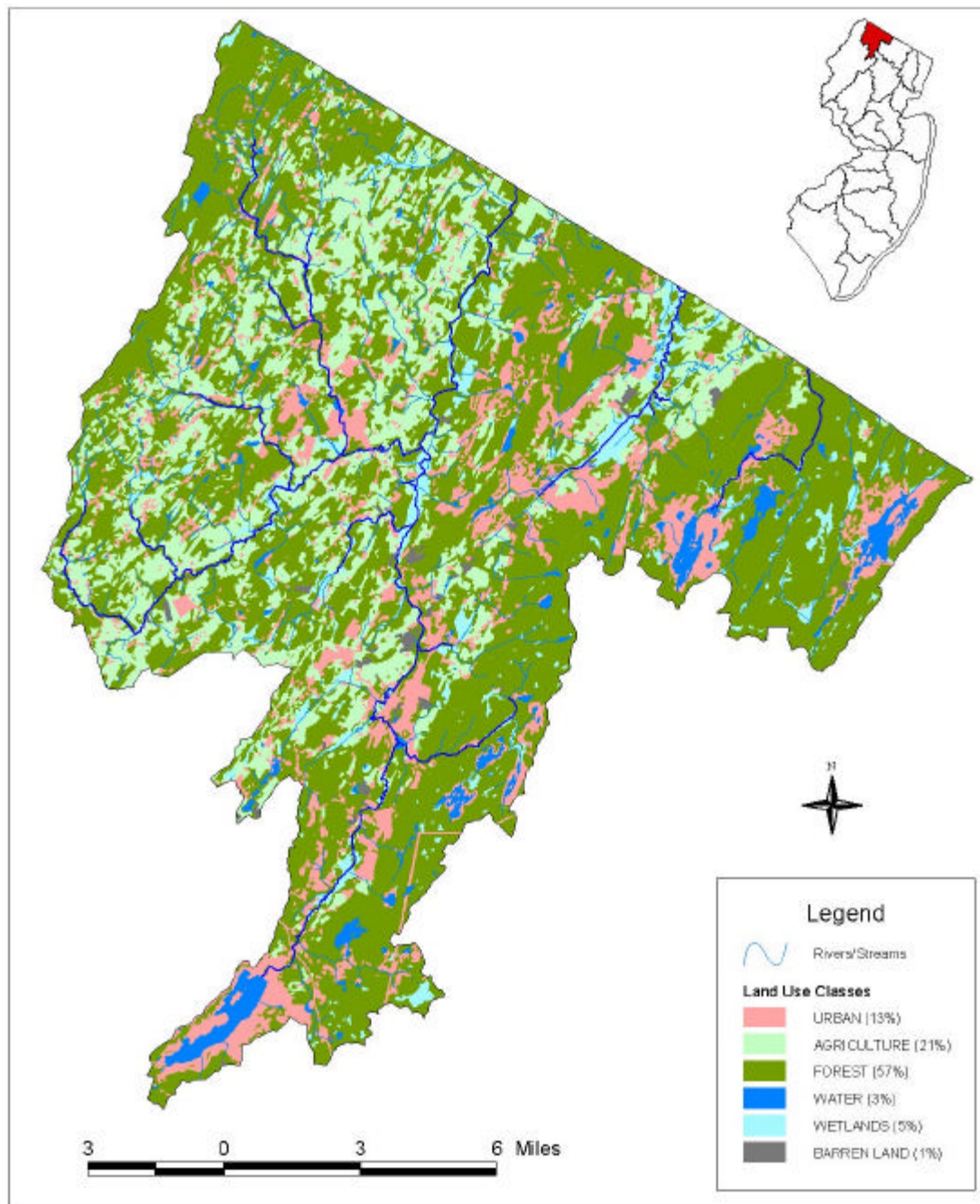


Figure 2.3-2 New Urban Development From 1987-1995 in WMA 02

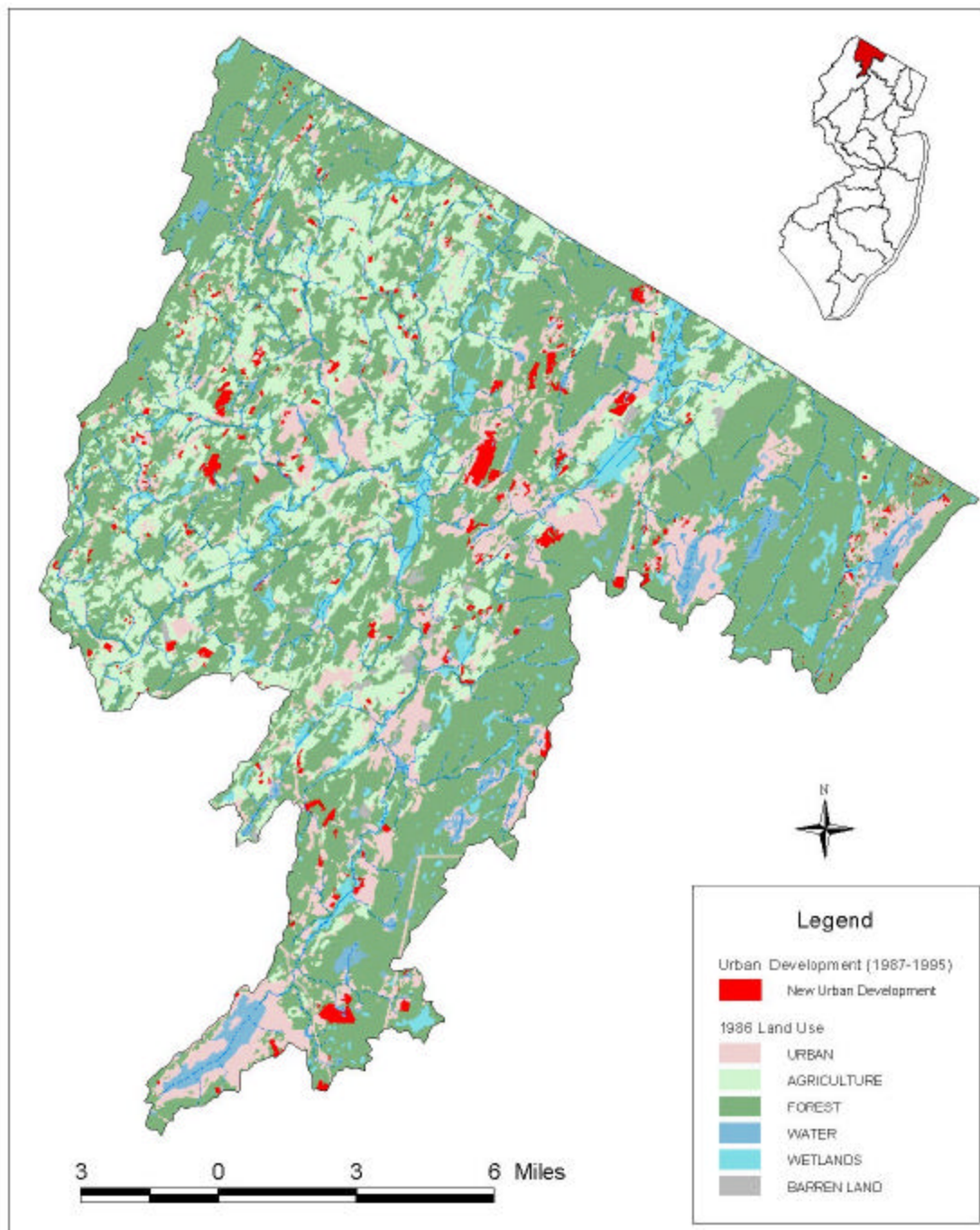


Figure 2.4-1 1990 Population Density in WMA 02 (Census Blocks)

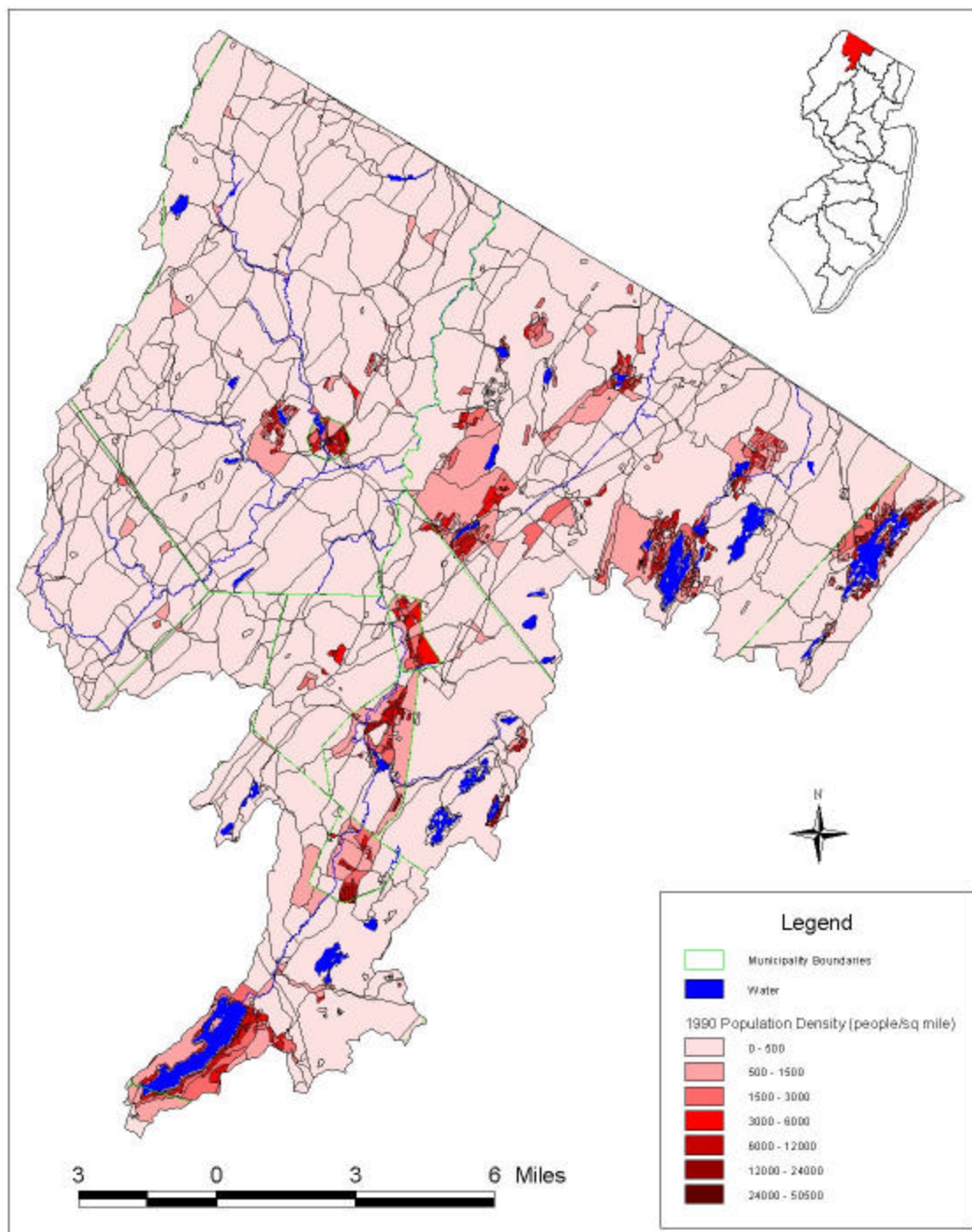


Figure 2.4-2 Historical Population Change for Municipalities in WMA 02

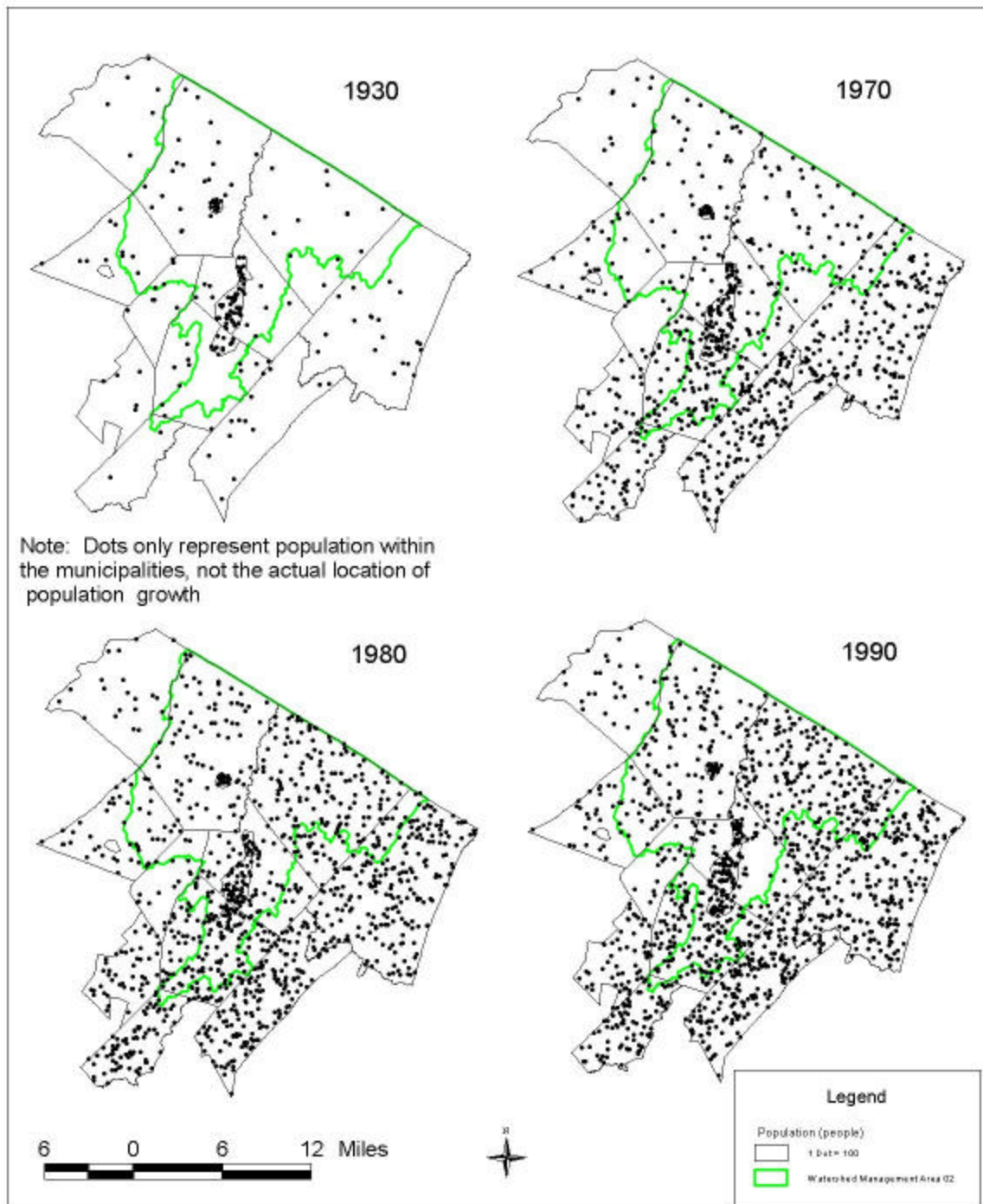


Figure 2.4-3 Population Projection for Municipalities in WMA 02

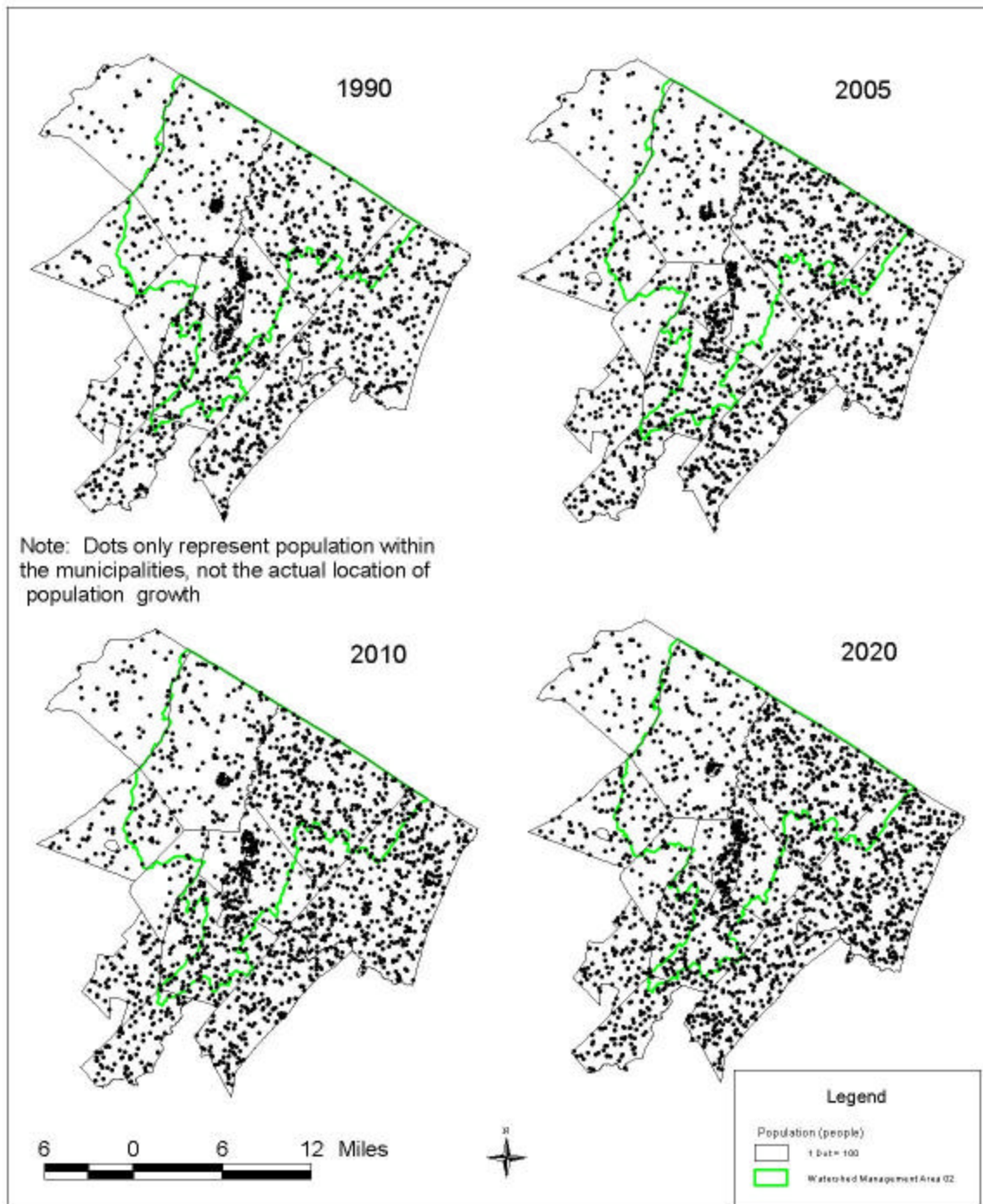


Figure 2.4-4 Municipality Population Change and Projections in WMA 02 From 1930 - 2020

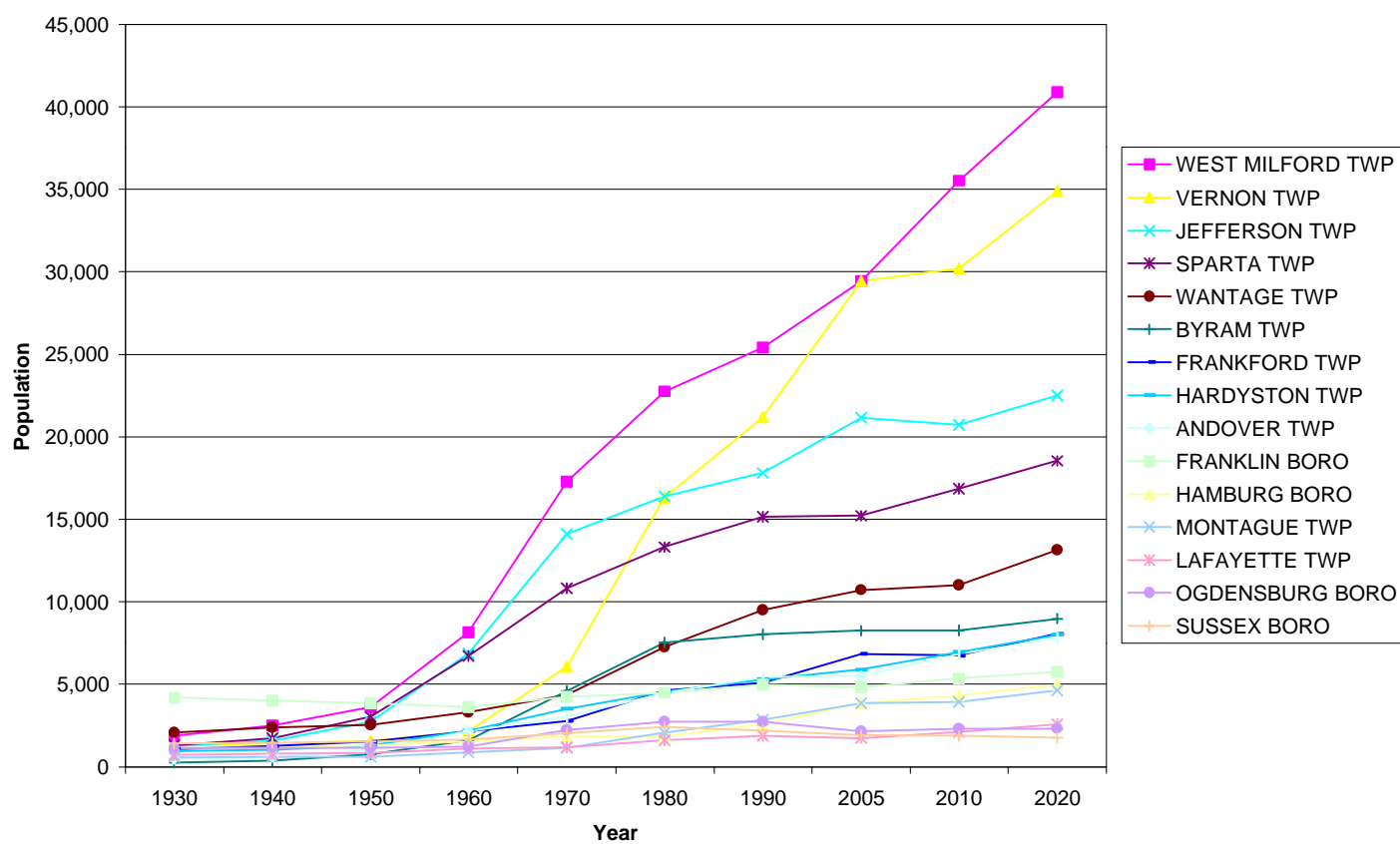


Figure 3.1-1 Surface Water Quality Standards - Stream Classifications (Draft)

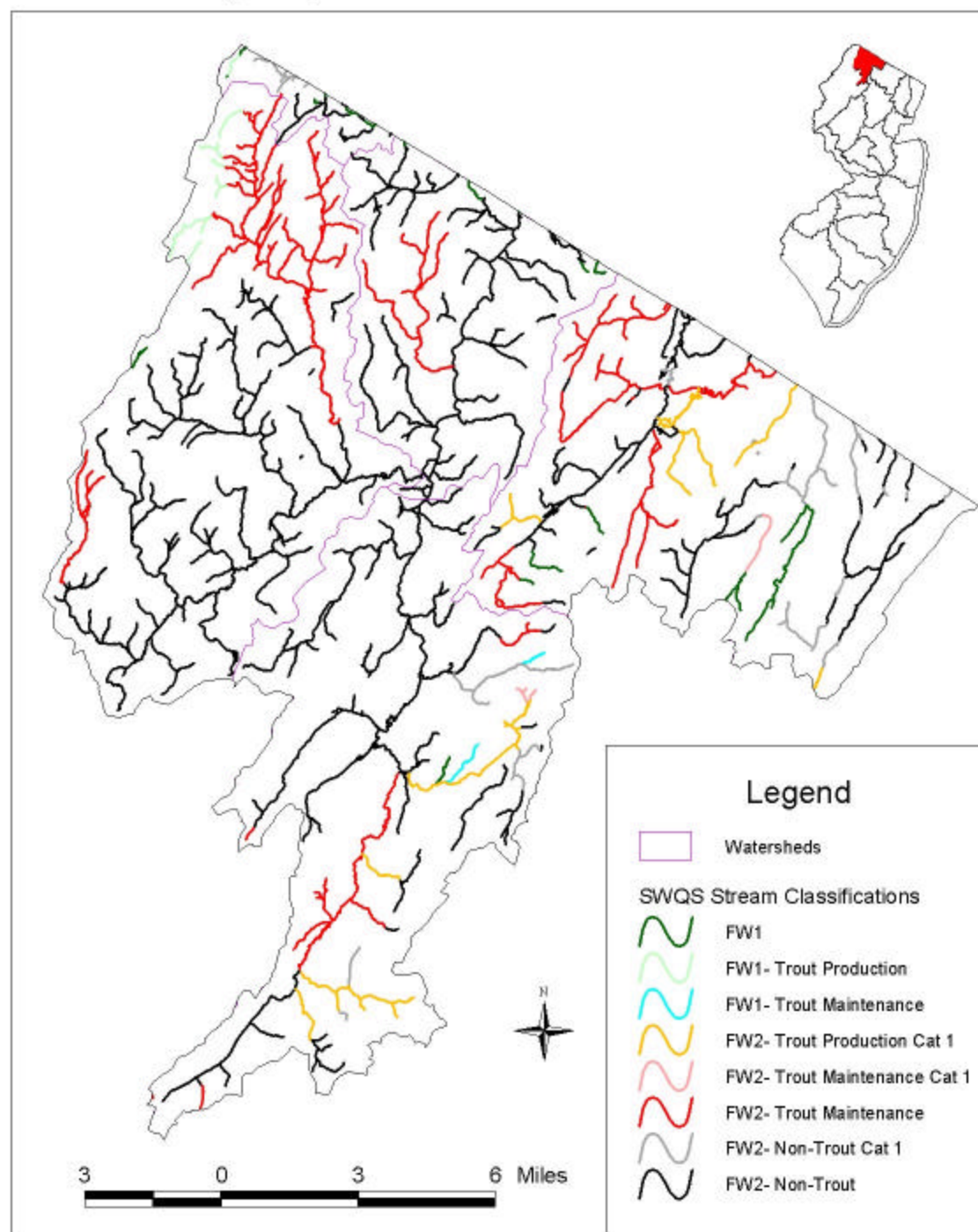


Figure 3.2-1 Ambient Stream Monitoring Network (ASMN) and Ambient Biomonitoring Network (AMNET) in WMA 02

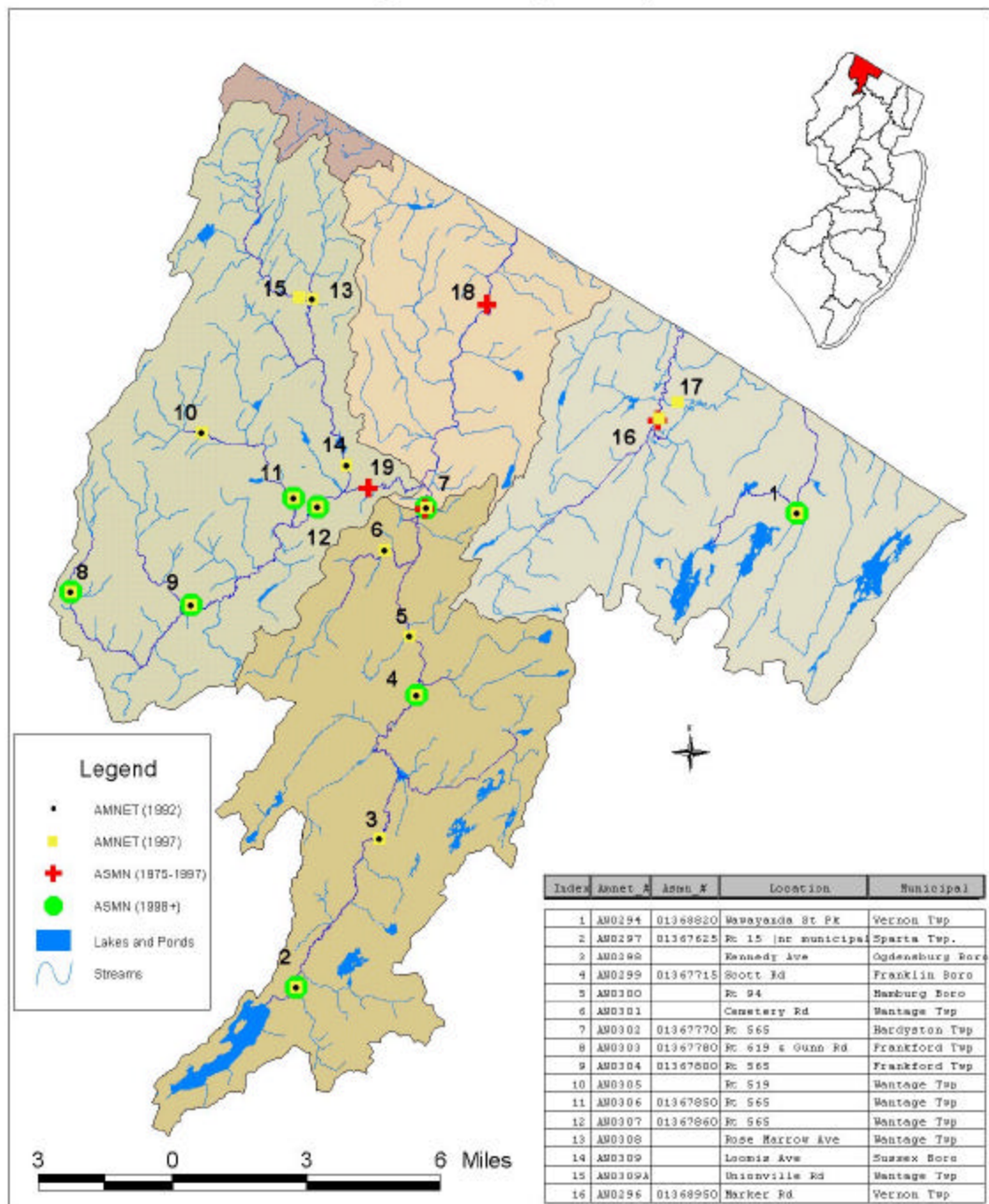


Figure 3.3-1 Surface Water Quality Status and Trends in WMA 02

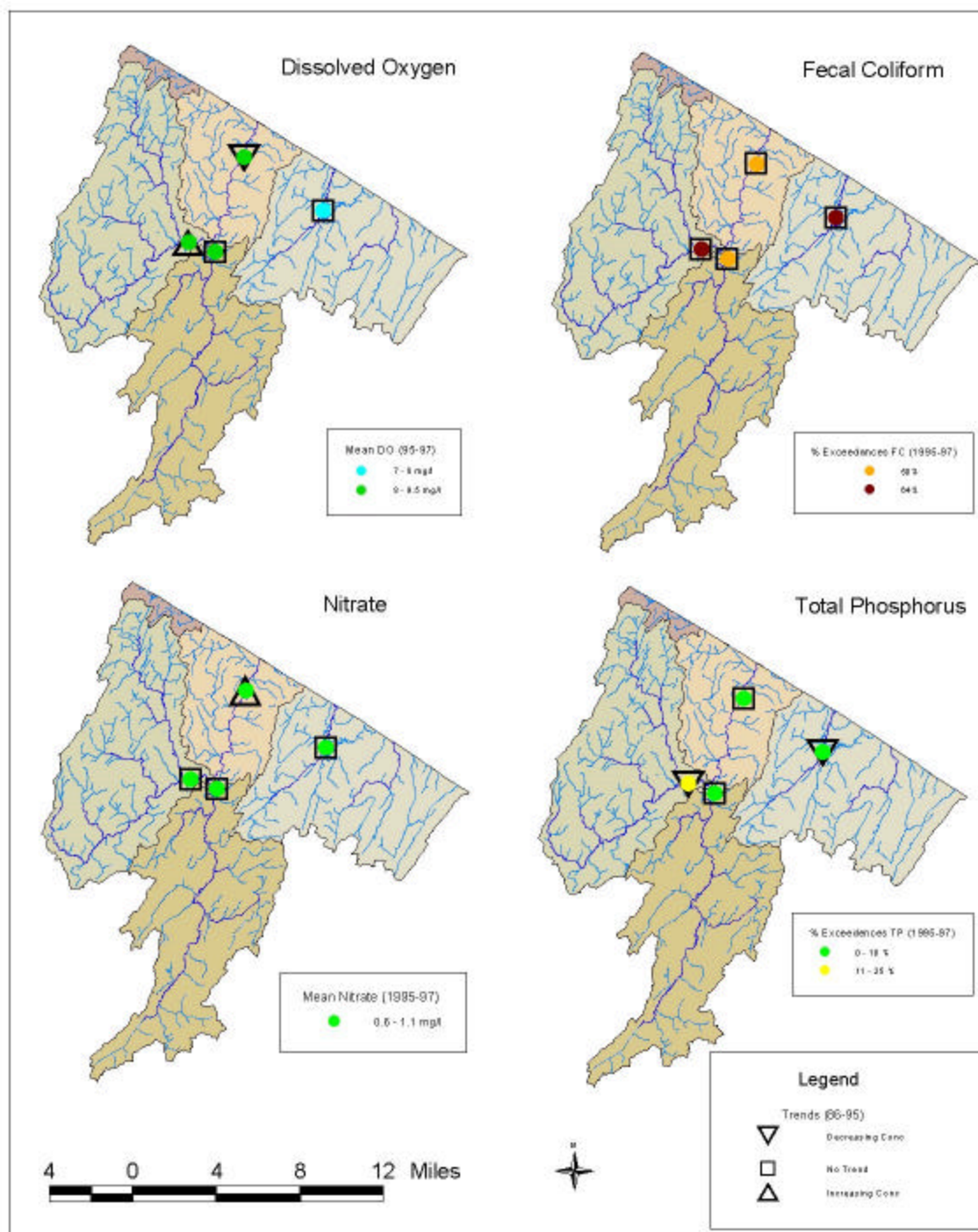


Figure 3.3-2 Benthic Macroinvertebrate Status and Trends in WMA 02

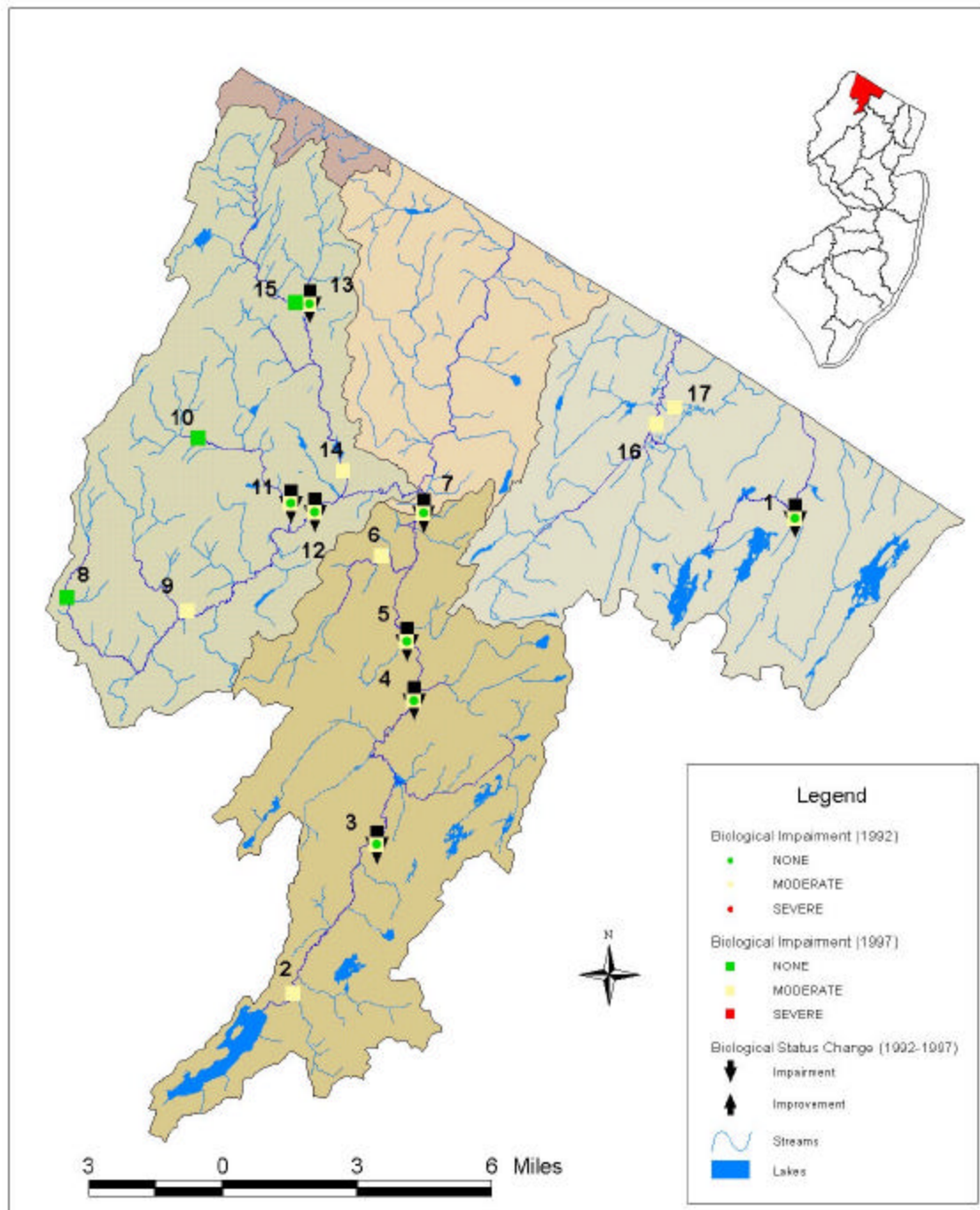


Figure 3.3-3 Total Phosphorus in Bottom Sediments and Known Eutrophic Public Lakes in WMA 02

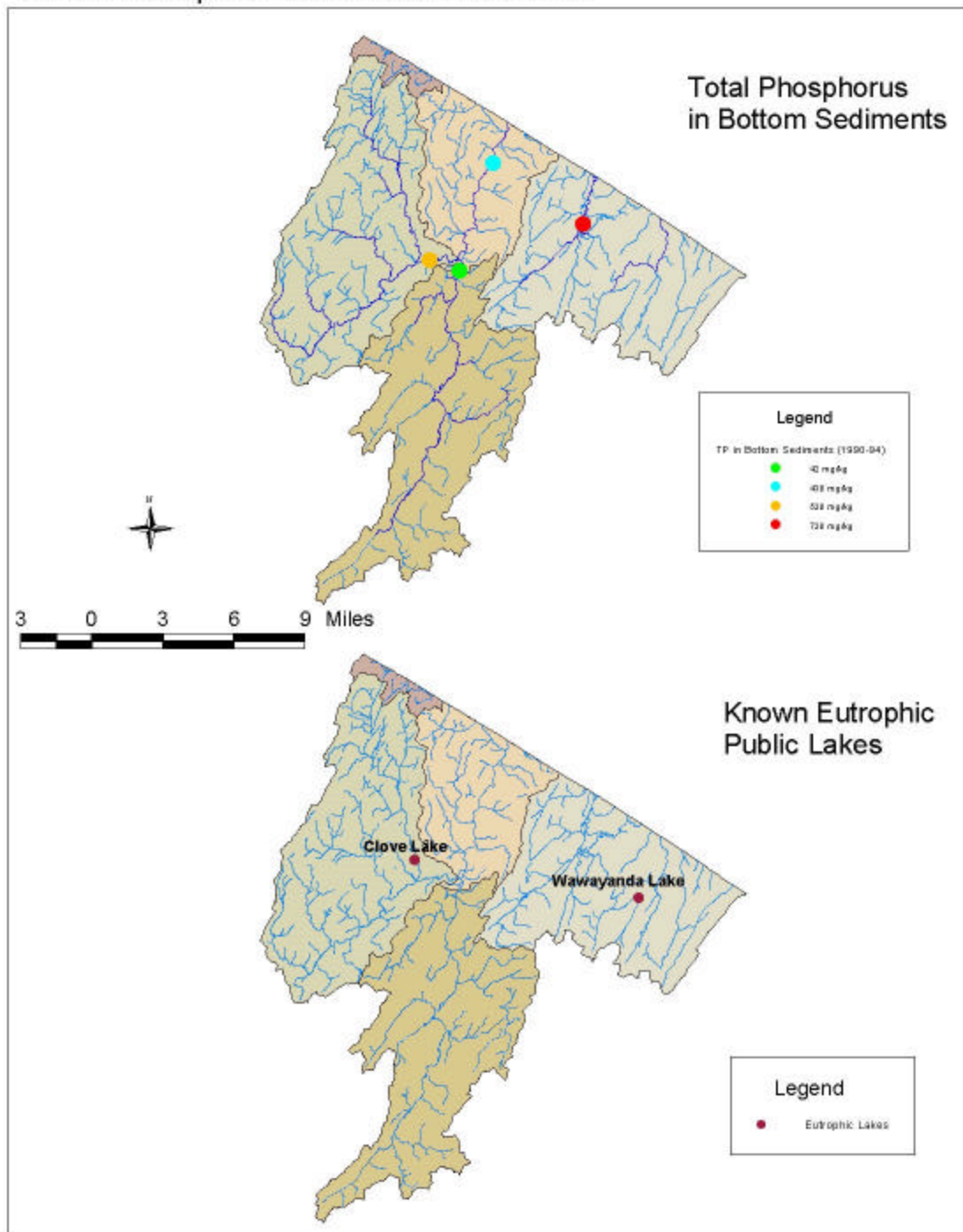


Figure 3.7-1 Surface Water Intakes, Public Community Supply Wells, and Reservoirs in WMA 02

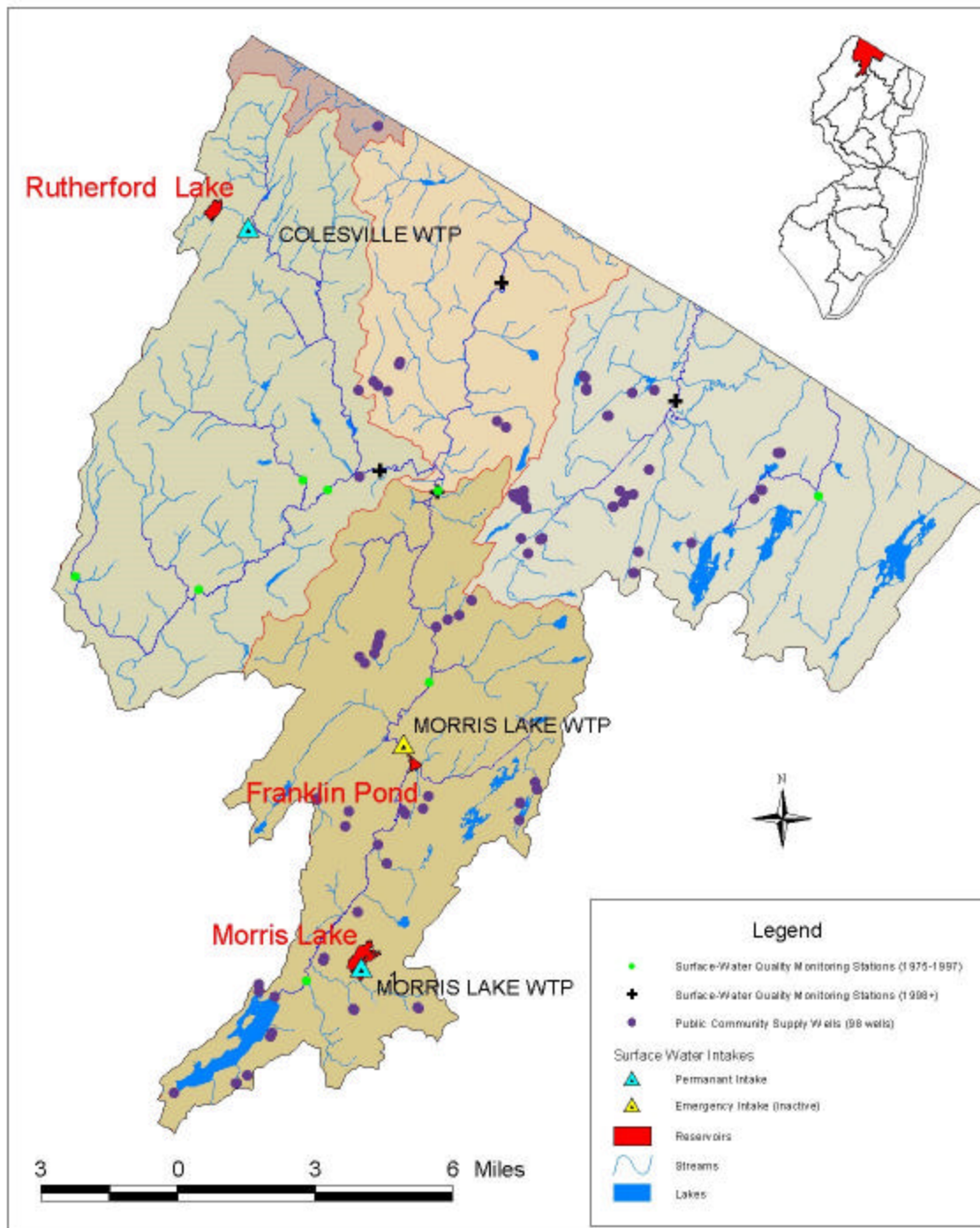


Figure 4.0-1 Point Source and Nonpoint Source Influences on Total Phosphorus Concentrations in WMA 02

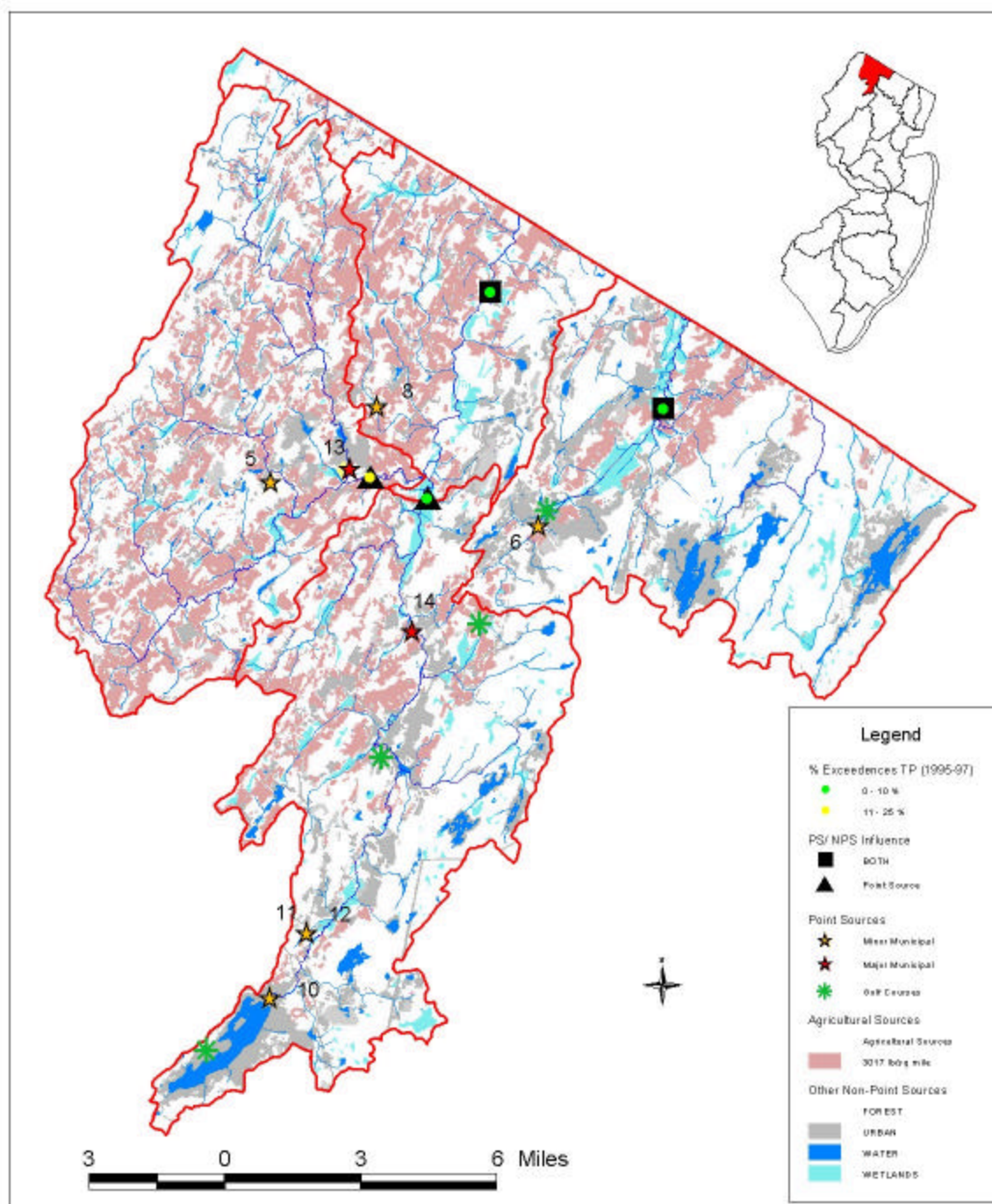


Figure 4.1-1 NJPDES Point Source Discharge Facilities in WMA 02

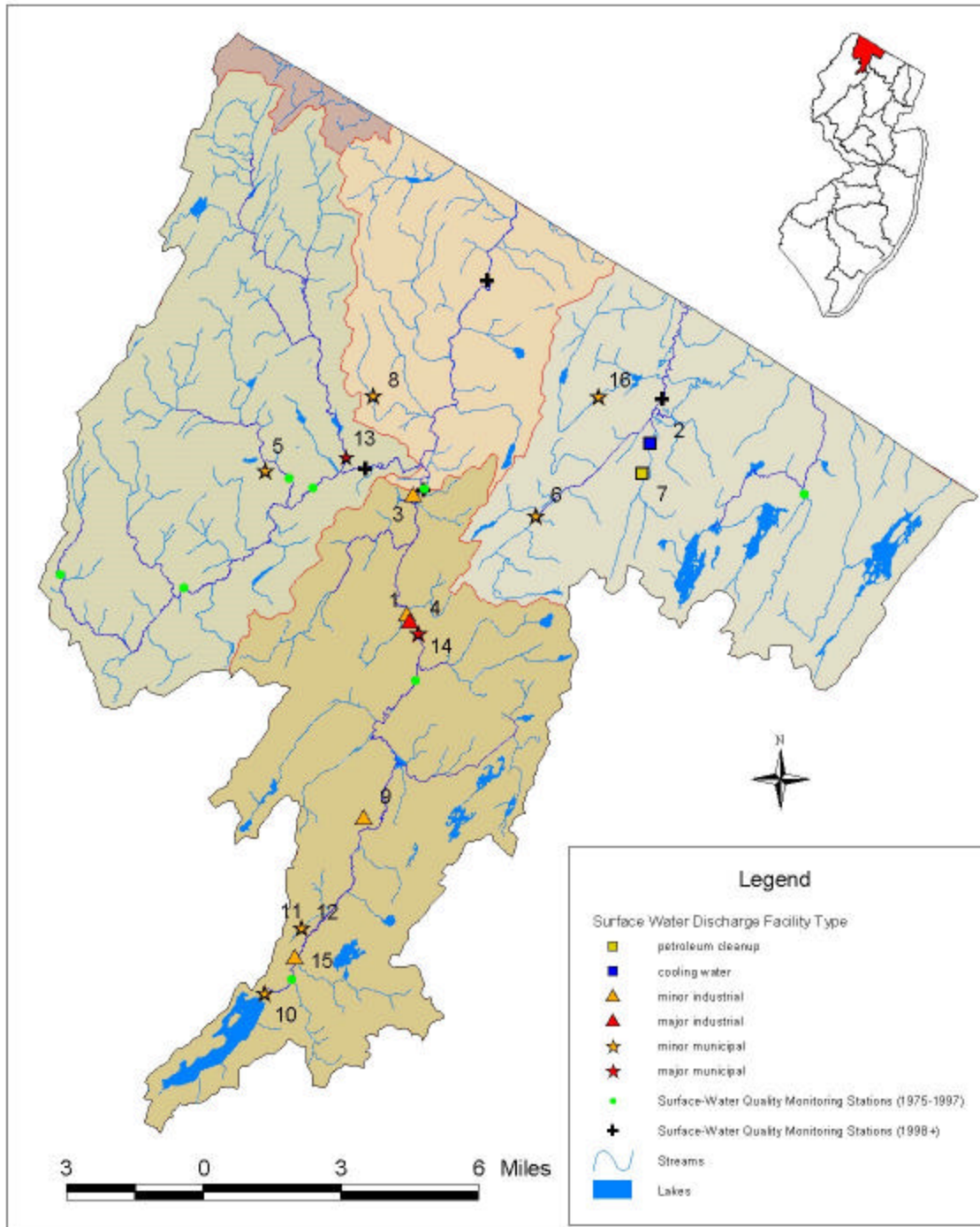


Figure 4.2-1 Sewer Service Type and Population Density in WMA 02

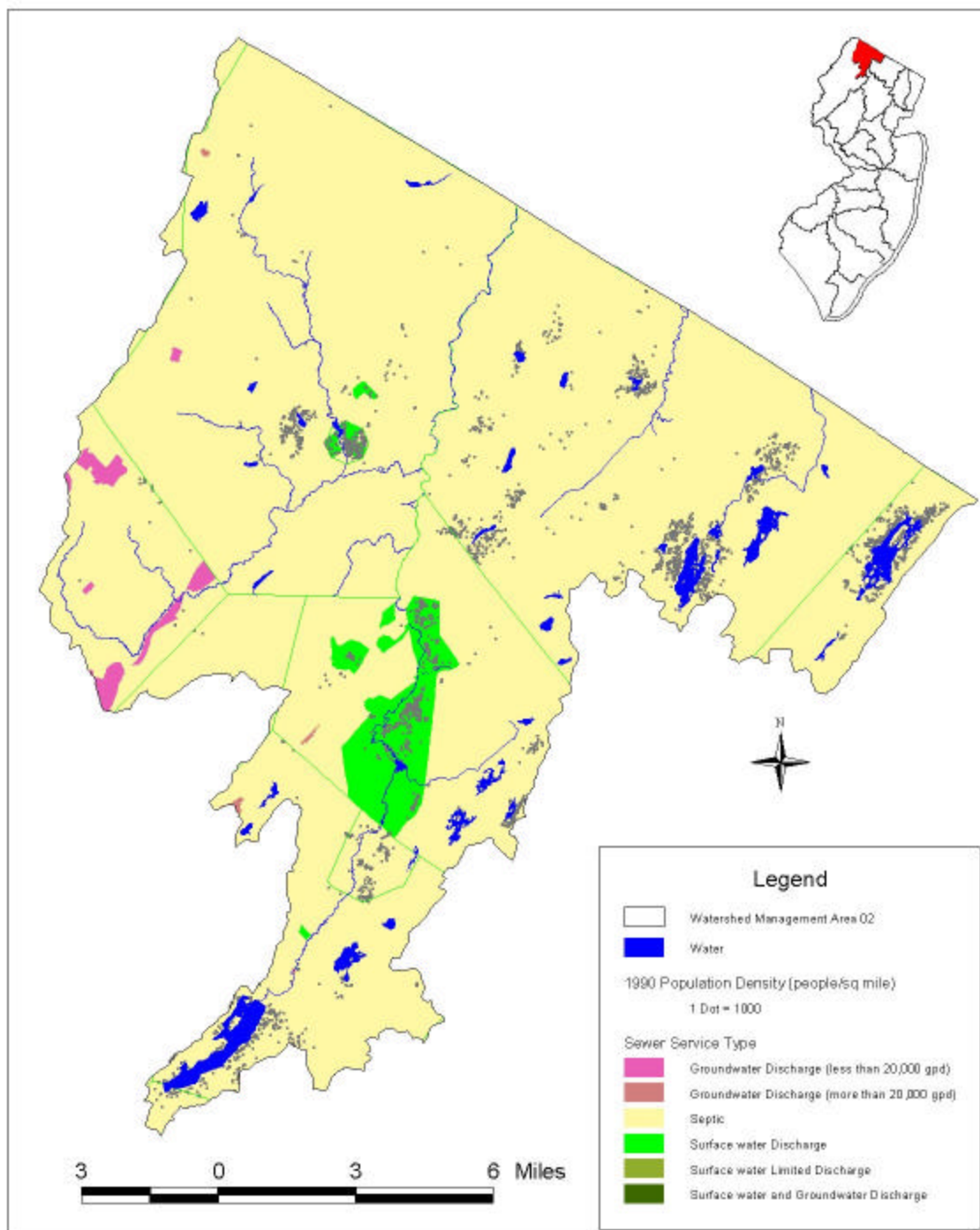


Figure 4.6-1 Known Contaminated Sites in WMA 02

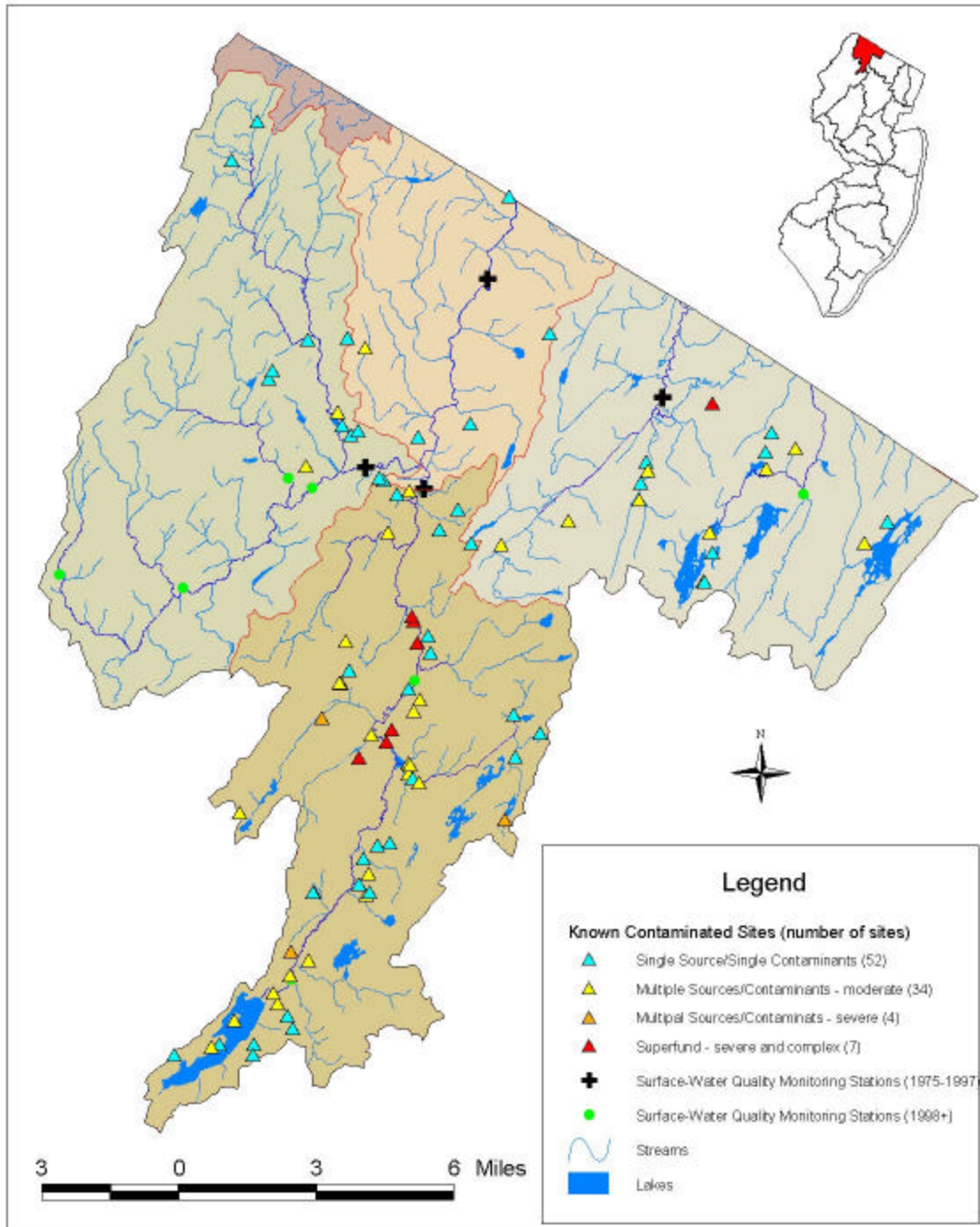


Figure 4-7.1 Total Pesticides Application by Agriculture and Golf Courses in WMA 02

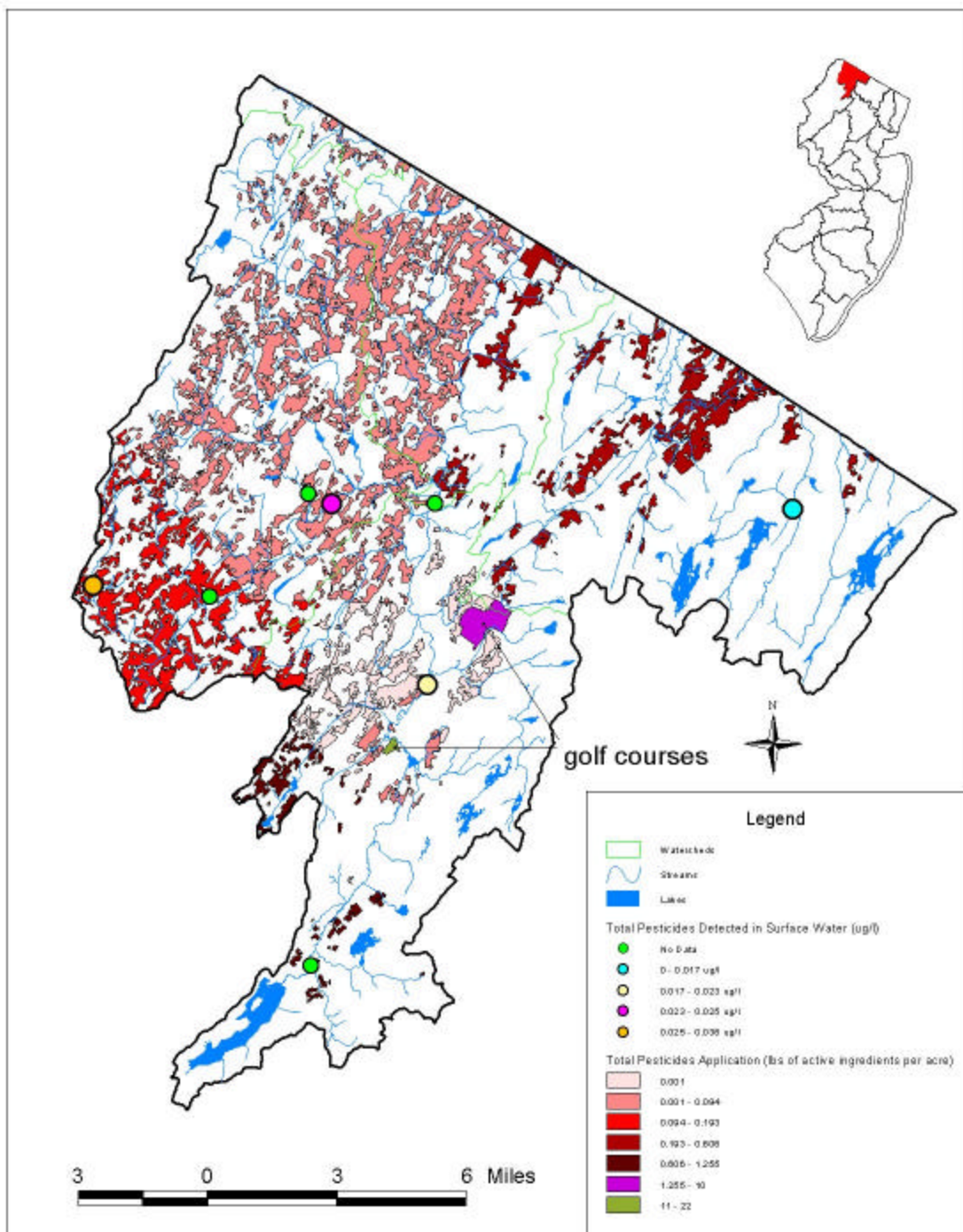


Figure 5.1-1 Land Use Upstream of Ambient Biomonitoring Sampling Sites in WMA 02

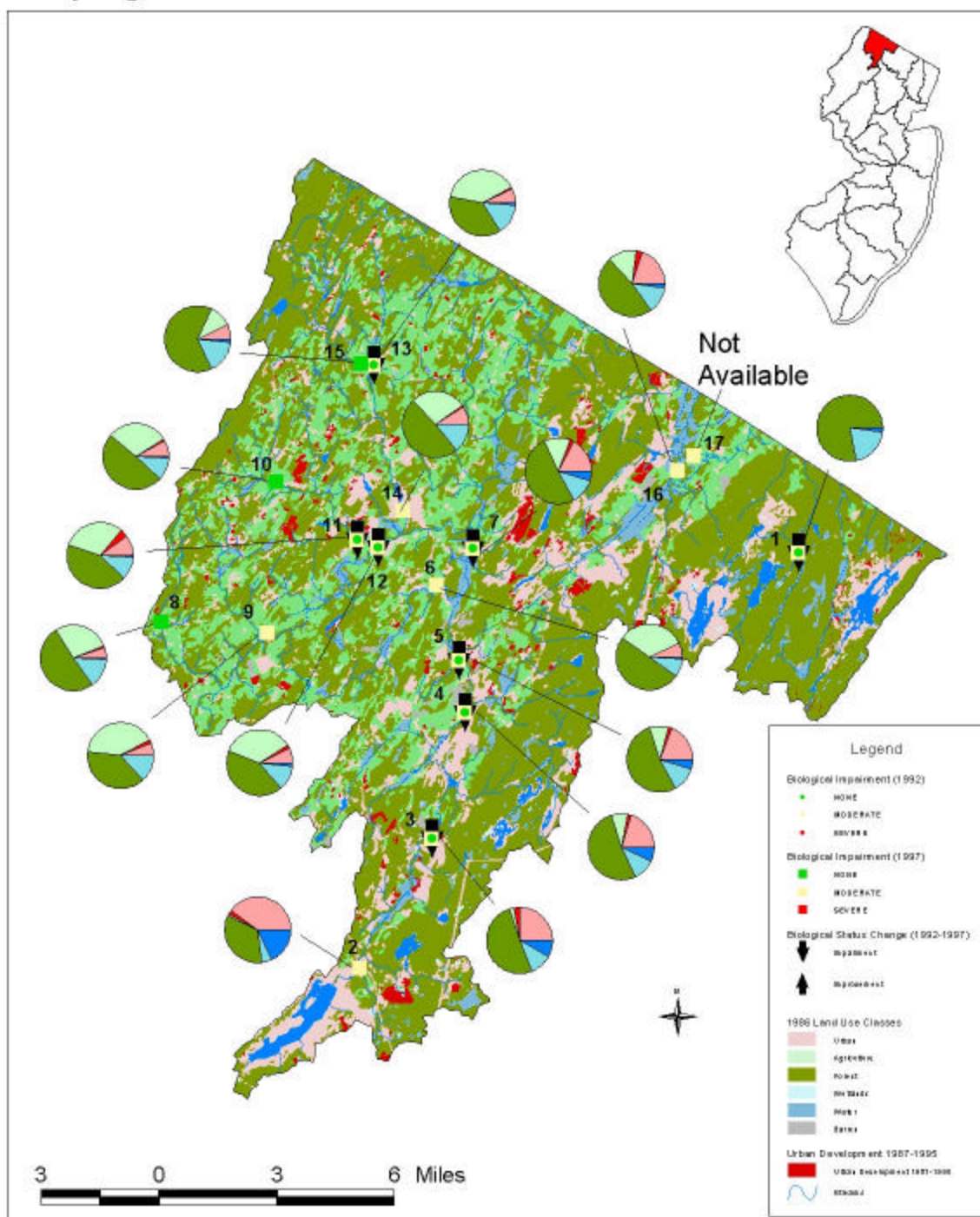


Figure 5.3-1 Stream Classifications Within Open Space and Other Land Uses in WMA 02

