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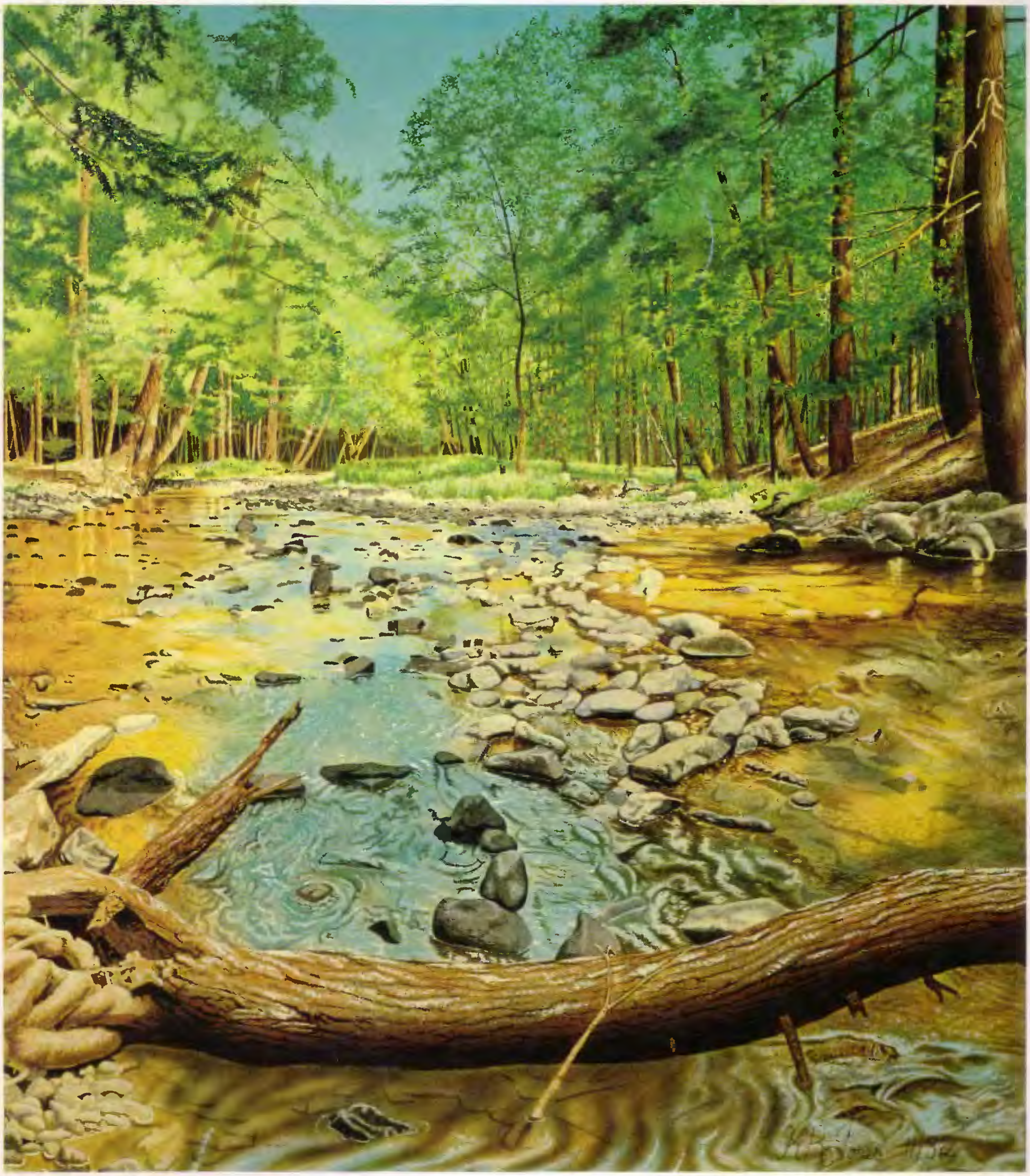
New Jersey 1990

State Water Quality Inventory Report

New Jersey Department of Environmental Protection • Division of Water Resources



New Jersey 1990 State Water Quality Inventory Report

A Report on the Status of Water Quality in New Jersey Pursuant to the New Jersey Water Pollution Control Act and Section 305(b) of the Federal Clean Water Act

State of New Jersey
Department of Environmental Protection
Division of Water Resources
Bureau of Water Quality Planning
Trenton, New Jersey

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COVER ART:
"Big Flatbrook" is a water color painting produced by Keith R. Jones of Trenton, New Jersey. The Department of Environmental Protection is grateful to Mr. Jones for allowing us the use of his art for the cover of this report.

TABLE OF CONTENTS

V. New Jersey's Surface Water Quality Management Programs

Prologue

"We never miss the water till the well runs dry"

English Proverb

CHAPTER I

EXECUTIVE SUMMARY

CHAPTER I.

EXECUTIVE SUMMARY

A. Purpose

The New Jersey 1990 State Water Quality Inventory Report is an assessment of current water quality conditions in the State's major rivers, lakes, estuaries, ocean waters, and ground water. In addition, the report describes which waters are attaining state designated water uses and national clean water goals; the pollution problems identified in surface waters; and the suspected and known sources of water pollution. A statewide listing of waters where toxics are suspected or known to be elevated because of wastewater discharges is also included, as required by the Water Quality Act of 1987.

This report is prepared every two years pursuant to Section 305(b) of the federal Clean Water Act and is the eighth in a series of state water quality inventory reports since 1975. Five chapters are included in this report; they include:

I. Executive Summary
II. Introduction and Background
III. Surface Water Quality in New Jersey
IV. Ground Water Quality and Management in New Jersey
V. New Jersey's Surface Water Quality Management Programs

B. Principal Findings

The following major conclusions and findings from the 1990 State Water Quality Inventory Report are grouped by chapter.

Chapter II - Introduction and Background

- New Jersey has 6,450 miles of rivers, 24,000 acres of public lakes, 900,000 acres of freshwater and tidal wetlands, 120 miles of ocean coast line and 420 square miles of open estuarine waters. New Jersey had 7.4 million residents in 1980.

- Freshwaters of the State should be able to support primary contact recreation, and the maintenance and propagation of natural and established biota (clean water goals). Most estuarine and ocean waters should also meet these uses, as well as support the harvesting of uncontaminated shellfish. However, certain interstate waters between New Jersey and New

York, and New Jersey and Pennsylvania do not have to have sufficient water quality for these uses.

Chapter III - Surface Water Quality in New Jersey

- The report uses two assessment methodologies to evaluate water quality and pollution sources: monitored assessments (based on actual in-stream monitoring) and evaluated assessments (based on professional judgement, land uses, known pollution sources, and other non-water quality information).

- Water quality has been assessed in nearly 1,900 freshwater stream miles (only 740 estimated miles are monitored); public lakes (all public lakes are evaluated but not monitored); 620 square miles of estuarine waters (almost all monitored); and 430 ocean square miles (mostly monitored).

- Approximately 30 percent of New Jersey monitored freshwater rivers and streams meet both the swimmable and fish propagation/maintenance clean water goals. Of these 221 miles which meet both goals, 130 (or nearly 60 percent) are the Delaware River alone. The fishable goal is supported in 77 percent of the assessed waters, while approximately 17 percent partially support the goal and 6 percent do not support it. Sixty-four percent of monitored freshwaters are not swimmable.

- All of New Jersey's public lakes are classified as threatened for attainment of clean water goals. Current monitoring information on public lakes is limited to a few dozen; hence accurate determination of goal attainment on a state-wide basis is presently difficult. Based upon lakes which have been assessed, it is determined that the most frequent pollution problems are nutrients, siltation, depressed dissolved oxygen, and excess primary productivity. Nonpoint source pollution is cited as the principal source of contaminants.

- New Jersey's estuarine waters achieve State designated water uses in approximately 76 percent of the waters, partially achieve use in 21 percent, and do not meet uses in 3 percent.

- Ocean waters meet designated uses and clean water goals in 61 percent of the waters; and partially support uses in the remaining 39 percent.

- Pollutants commonly found in excessive amounts in the State's waters include total coliform bacteria, fecal coliform bacteria (in 81 percent of the freshwaters), nutrients (also in 81 percent), reduced dissolved oxygen levels, siltation, road salts, and oil and grease (all suspected).

- Toxic substances in water, sediments, shellfish and fish tissue are generally found in low amounts in the State, although in certain regions they are more elevated. Areas with higher concentrations of toxic substances include New Jersey - New York interstate waters, rivers in the urbanized northeast part of the State, and certain tributaries to the Delaware River in the Camden area.

- Other types of known or suspected water quality problems consist of thermal modification/elevated stream temperatures, habitat alterations, pH fluctuations, and chlorine levels.

- Point sources of wastewater have a significant effect on many of the State's waterways.

- Nonpoint sources of pollution are suspected to be a major cause of water quality degradation in the State. However, very little monitoring data exists to quantify their extent. Nonpoint sources include stormwater outfalls; construction, urban and agricultural runoff; land disposal practices; hydrologic/habitat modification; and marinas located in lakes and coastal waters.

- Available evidence suggests that sensitivity to acid precipitation in New Jersey is restricted to undisturbed portions of the Pinelands area in the southern part of the state, and to portions of the Highlands and Ridge and Valley Provinces of northern New Jersey. In northern New Jersey, some lakes are thought to be experiencing increased acidity through acid deposition. In the Pinelands some small declines in pH are suspected, however evidence is not conclusive. Studies suggest that acid rain may be shifting the principal acid producing constituents in the undisturbed portions of Pinelands from organic to mineral acids. The former chelate with toxic metallic ions reducing their toxicity, the latter facilitate the release of free metallic ions enhancing their toxicity. Of greater visibility (and perhaps masking the impacts of acid rain) is a rise in pH occurring in the disturbed portions of the Pinelands brought about anthropogenic pollution.

Chapter IV - Ground Water Quality and Management in New Jersey

- Ground water quality is considered naturally good in the State, however treatment for some undesirable constituents of natural origins is warranted in some areas due to the physical/chemical nature of the geologic materials comprising the aquifer. The most common of these naturally occurring contaminants include iron, dissolved solids, sulfate and hardness. Other less common yet significant contaminants are radium, lead, barium.

- Anthropogenic contaminant discharges to ground water have a significant undesirable impact on water quality in New Jersey as evidenced by the 3,086 ground water pollution investigations underway as of December, 1989. The most common pollutants found in these investigations are volatile organic compounds (VOs), metals, base neutrals, acid extractables, and PCB's/pesticides. Other contaminants included miscellaneous landfill contaminants, undifferentiated petroleum hydrocarbons, gasoline, and fuel oil. Of the pollution sources determined, underground storage tanks account for the largest percentage of known sources. Landfills, surface spills, and industrial/commercial septic systems all comprise the next most common source of contaminants.

- There appears to be a direct correlation between population density throughout the state and the distribution of ground water pollution investigations.

- Regarding ground water quantity, present data suggest that there is an ample supply of good quality ground water in the state. Local/regional quantity problems do exist, however, usually in areas where the greatest demands on ground water supplies occur. Demand can lead to over pumping which in turn can lead to aquifer recharge from undesirable sources such as seawater, polluted surface waters, or highly contaminated shallow ground water.

- Regarding the management of ground water resources, the NJDEP has recently formulated a strategy to coordinate the many ground water management programs in order to upgrade overall effectiveness of resource management.

Chapter V - New Jersey's Surface Water Quality Management Programs

- Since 1972 New Jersey has obligated more than $3.2 billion in federal and State funds for the construction of wastewater treatment works. But approximately $3.3 billion is still necessary to meet current State wastewater treatment needs.

- New Jersey has instituted a wastewater loan fund program. Low interest loans were issued in State Fiscal Years 1988, 1989, and 1990 for approximately $240 million, $190 million, and 147 million respectively.

- New Jersey has permitted approximately 1100 surface water wastewater discharges. Two-thirds of these are industrial. There are also about 600 permitted ground water discharges.

- An update of the State's approach for managing nonpoint sources, stormwaters, etc. is included.

- Programs to protect wetlands in the State are explained with emphasis on the new State Freshwater Wetlands Act.

- Monitoring activities are summarized for both ambient and intensive purposes.

- The Department's Surface Water Use Rating System results, updated for this report, are included.

C. <u>Recommendations</u>

The recommendations listed below are designed to help further identify known and potential pollution problems impacting our waterways, as well as aid in their management or control. The recommendations are spelled out in detail in Chapter III.

- Increase water quality and pollutant source monitoring.

- Improve the identification of nonpoint sources of water pollution.

- Upgrade the level of ambient monitoring of estuaries and tidal rivers.

- Direct greater emphasis towards nonpoint source management.

- Water quality management planning should be made with greater consideration to water supply impacts

- Improve the level of coordination of watershed management activities.

- Achieve the necessary effluent quality from point sources.

CHAPTER II

INTRODUCTION AND BACKGROUND

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INTRODUCTION AND BACKGROUND

A. Introduction

The New Jersey 1990 State Water Quality Inventory Report is the ninth in a series of State Water Quality Inventory Reports that have been prepared by the New Jersey Department of Environmental Protection (NJDEP) since 1975. The State Water Quality Inventory Report is due every two years, and is prepared pursuant to Section 305(b) of the federal Clean Water Act (P.L. 95-217). The Report, commonly referred to as the 305(b) report, addresses the following issues:

- The quality of the State's surface and ground waters.

- An analysis of the extent to which surface waters will attain the fish propagation and maintenance and swimmable goals of the Clean Water Act, and the designated uses outlined by the State.

- A description of water pollution sources that are adversely affecting surface and ground water quality.

- The actions that are necessary to improve water quality in the State's waters so that clean water goals are achieved, and the estimated costs of such actions.

The State Water Quality Inventory Report serves two major functions. First, it is the main public reporting document produced by the NJDEP that describes water quality conditions, trends or changes, and whether progress is being achieved in meeting designated uses and clean water goals. Second, the report notifies Congress on what is necessary to clean our waters. New Jersey's report is incorporated into a National Water Quality Inventory Report by the United States Environmental Protection Agency (USEPA), and is then submitted to Congress. The report, therefore, is instrumental in shaping national policy regarding water pollution control mandates and priorities. This report also has much value to the State's citizens and interested public as an information source on water quality conditions and water pollution sources.

The 1990 State Water Quality Inventory Report serves to update the water quality assessments presented in the 1988 edition of the Inventory Report. Whereas the 1988 report summarized the water quality of freshwaters by means of the Water Quality Index, this 1990 edition updates these evaluations through information other than the Index summations, such as biomonitoring data, fishkill reports, etc., whenever such information is available. The 1990 report cycle has available to it only an additional two years of water data since the 1988 assessments were performed. In view that the Index requires a five year spread of data, the next Index-based assessments will be reevaluated for the 1992 Inventory Report.

The 1990 State Water Quality Inventory Report focuses on developments in water quality management programs, and presents an expanded chapter discussing ground water quality and quantity issues in the state. This report presents an update of the Water Use Index, initially presented in the 1986 report. In addition, the Water Quality Act of 1987 requires states to submit assessments of their lake water quality as part of section 314(a)(2) of the Clean Water Act. In response, New Jersey has completed an intensive trophic assessment of twenty-one public lakes and the results are presented in this report.

This report serves as the initial submittal vehicle of certain information required by the Federal Water Quality Act of 1987. This includes a continuation of efforts begun under section 304(l) of the Federal Clean Water Act as amended by the Water Quality Act of 1987 requiring states to identify waters adversely affected by toxic, conventional, and nonconventional pollutants. Included here also are water quality limited reaches slated for Total Maximum Daily Loading determinations (TMDL). These assessments will be used as a basis for the development of water quality management programs.

The 1990 State Water Quality Inventory Report contains five chapters. Besides Chapter I - Executive Summary, and Chapter II - Introduction and Background, they are: Chapter III - Surface Water Quality in New Jersey, Chapter IV - Ground Water Conditions in New Jersey, and Chapter V - New Jersey's Surface Water Quality Management Programs. The information provided in this report, as well as its general layout, has been designed to follow USEPA's Guidelines for the Preparation of the 1990 State Water Quality Assessment. Much of the narrative in this report was originally prepared for the 1986 and 1988 reports, and has been updated accordingly.

Chapter III - Surface Water Quality in New Jersey presents major conclusions regarding the quality of the State's waterways, and summarizes water quality conditions in the State's major rivers and streams using physical/chemical data collected between 1983 and 1987. Water quality assessments were updated using supplemental information such as fishkill reports and instream biolgical monitoring performed through 1989. The quality of the State's lakes, estuaries and ocean waters are assessed in this chapter, including the percentage of each type of waterbody that will meet the fish propagation/maintenance and swimmable clean water goals and State designated uses. Causes of nonsupport of designated uses are reviewed. The results of the State's ongoing determination of waters impacted by toxics, as required by the new Water Quality Act of 1987, is also included in this chapter. In addition, Chapter III contains detailed waterbody specific information in the Water Quality Inventory, which is an assessment of the water quality, pollution sources, and use support determination for approximately 50 streams throughout the State and interstate waters. Chapter III also presents a discussion of acid precipitation impacts on state waterways.

Chapter IV - Ground Water Conditions in New Jersey is a detailed discussion of groundwater quality and quantity conditions in the State, current management efforts, and management strategies for the future. Also included are topics regarding ground-water in New Jersey currently under investigation, and their most recent finding.

The State's surface water quality management activities for the control of both point and nonpoint sources are presented in Chapter V - New Jersey's Surface Water Quality Management Programs. Highlights from these management programs are described, as are our needs (projected to the year 2000) for improving municipal wastewater treatment. This chapter also contains a description of monitoring activities and results of the updated Surface Water Rating System which was first presented in the 1986 305(b) report. The rating system has been used to prioritize certain pollution control activities in the State. Recommendations for further achievement of the Clean Water goals and designated use are also presented in this chapter.

B. Background

New Jersey, despite being the fourth smallest state in the nation, contains a wide variety of land use types, water resources, geologic characteristics, and natural biota and fauna. Within the State's 8,204 square miles are sections of the Appalachian Mountains, 120 miles of coastline, large cities and industrial centers, rich crop-producing lands and a largely undeveloped Pinelands region. New Jersey has approximately 6,450 miles of rivers and streams, and 24,000 acres of lakes and ponds. In addition, there are 1400 square miles of fresh and saline marshes and wetlands, and 420 square miles of open estuarine waters.

There are five major drainage basins in the State. The largest is the Delaware River Basin (3000 sq. miles), followed by the Atlantic Coastal Basin (approximately 2000 sq. miles), the Passaic/Hackensack Basin (1200 sq. miles), the Raritan River Basin (1100 sq. miles) and the Wallkill River (210 sq. miles), which drains to the Hudson River in New York State. Figure II-1 shows these basins and the many smaller watersheds within the State: Delaware Bay as the southern border, Delaware River as the western border and the Atlantic Ocean, Raritan Bay, Arthur Kill, Kill Van Kull and Hudson River as the eastern boundary.

The waters of New Jersey are heavily influenced by the land uses and population centers in the State. In 1980, New Jersey had a population of slightly over 7.3 million people. By the year 2000, the NJ Department of Environmental Protection estimates that the State's population will climb to over 8.5 million. Although New Jersey is the most densely populated state in the nation, the State's population is not equally distributed. Densities are greatest in the regions surrounding New York City and Philadelphia, and along the northern Atlantic Coast. Many scattered towns and cities are found throughout the remainder of the State. Most watersheds in the State flow through a variety of land uses, usually within short distances. Generally, streams and rivers originate in rural, undeveloped and agricultural lands before entering suburban/urbanized areas.

Accurate figures on the percentage of the various land uses that currently exists in New Jersey are not available. Undeveloped forests and other vacant lands are still the predominant land uses in the State. The remainder is divided fairly equally between agricultural, suburban and urban (including industrial) uses. Many areas of New Jersey have been undergoing extensive and rapid growth during the past seven years. This growth consists of light industry/corporate centers, commercial facilities and suburban development. The development, encouraged by a favorable economy and improved transportation corridors, is encroaching upon prime agricultural and vacant lands in most of northern and central portions of the State, in the northern coastal counties, and in the southern Delaware River drainage area near Philadelphia.

Waterfront development and redevelopment is also occurring in an intense manner in New Jersey. Along the Lower Hudson River and the Delaware River, former piers and docks are being converted to commercial and residential centers. In older urban cities, redevelopment along available waterways is serving as the basis for entire urban renewal projects. Vacant buildable space along the State's coast and estuaries/bays is rapidly diminishing. Inland, lake-front property or land near lakes is in prime demand.

New Jersey's surface waters are utilized for a variety of purposes. Water diversions are so great that the State's three largest rivers, the Delaware, Passaic and Raritan Rivers, all have passing flow requirements. Diversion of stream flow for

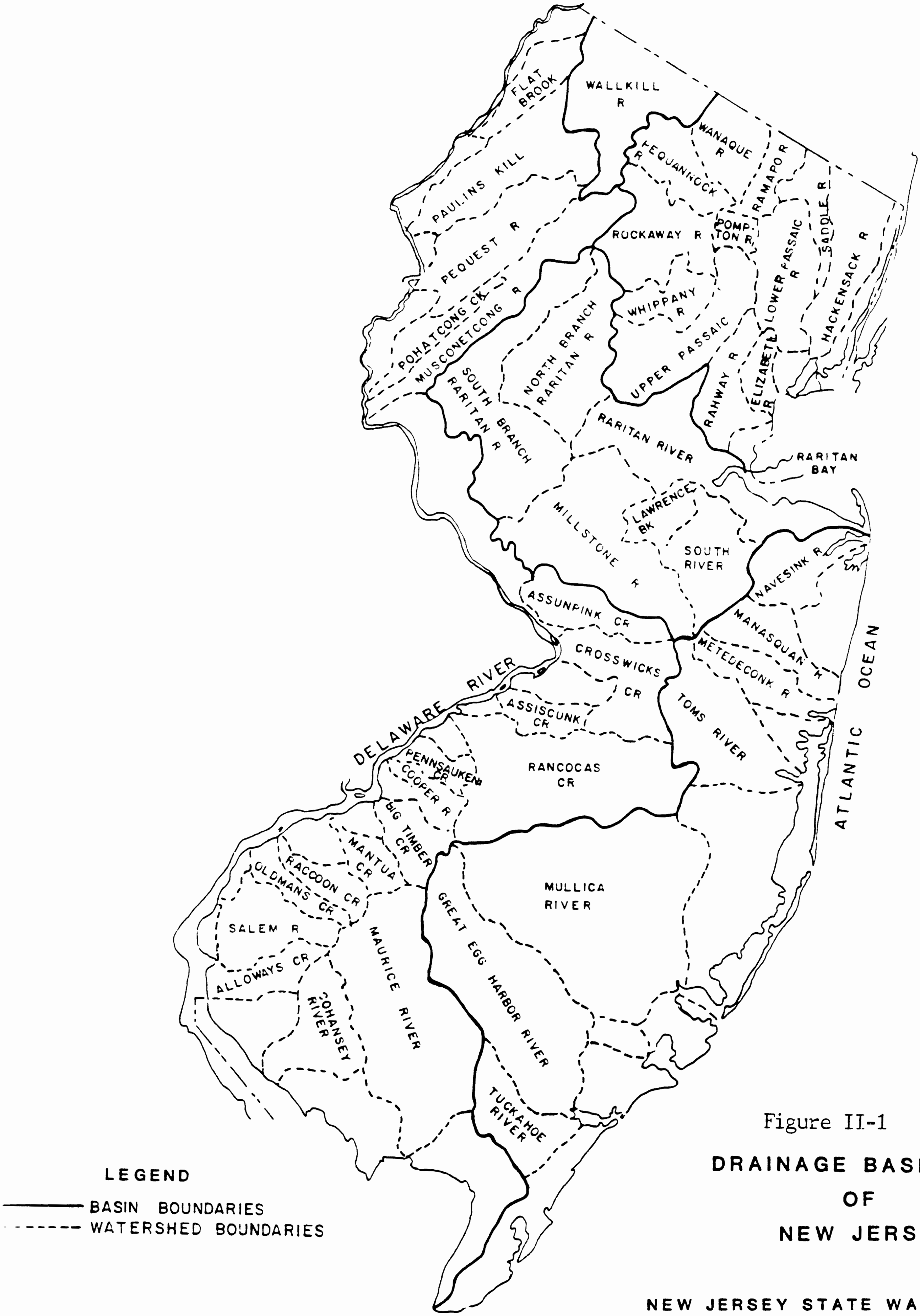

Figure II-1

DRAINAGE BASIN MAP OF NEW JERSEY

NEW JERSEY STATE WATER QUALITY INVENTORY REPORT

potable water supply, industrial process and cooling purposes, agricultural irrigation, and maintenance of reservoir/impoundment water levels is common throughout the State. NJDEP's Bureau of Water Allocation, as mandated in the State Water Supply Management Act (N.J.S.A. 58A:1 et. seq.), requires water diversion permits for all withdrawals of more than 100,000 gallons per day. As of April 1988, allocations have been issued in amounts of approximately 2,700 million gallons per day (mgd) for potable supply, 1,100 mgd for agricultural use, and nearly 6,000 mgd for industrial purposes.

Surface waters also serve as an important foundation for recreation in the State. NJDEP (1984) estimates that combined peak day demand for swimming, motor boating, and fishing in New Jersey in 1980 was 2,959,986 activity days. Freshwater swimming composed 40 percent of the total, saltwater swimming 47 percent, freshwater boating and fishing 3 percent, and saltwater boating and fishing 10 percent. By the year 2000, the combined peak day demand for these activities is expected to be over 3,550,000 activity days (NJDEP, 1984). Overall, swimming is the second most popular outdoor recreation activity in the State; fishing is seventh and motor boating is seventeenth. Maintenance and improvement of water quality in the State is critical from a recreational standpoint. As recreational demand increases, so will our demand for clean water.

A variety of aquatic habitats are found throughout New Jersey. Freshwaters vary from cool trout waters in northern New Jersey, to acidic Pinelands streams in southern areas of the State. Tidal streams and rivers, along with coastal bays and estuaries, are used by anadromous fish, and various ocean fishes migrate past and through the State's coastal waters. Figure II-2 indicates the extent of Trout Production waters, that is waters designated for the support of trout throughout the year. Figure II-3 denotes Trout Maintenance waters: waters designated for trout spawning and nursery purposes within the State. The remaining freshwaters of the State are classified as Nontrout, meaning that warm water fish predominate. Trout and nontrout classifications are outlined in New Jersey's Surface Water Quality Standards (N.J.A.C. 7:9-4.1 et. seq.) (NJDEP, 1983 and 1985). The NJ Division of Fish, Game and Wildlife also stocks sport fishes in many streams and lakes. Both trout species and warm water lake fishes are stocked annually.

New Jersey's estuarine and coastal waters also contain viable commercial shellfisheries. The health of this resource is especially dependent upon clean waters. Disruption of shellfish beds by dredging and siltation combined with bacterial pollution has threatened the ability of the shellfish to reproduce and grow. This has hindered or prevented harvesting. New Jersey's

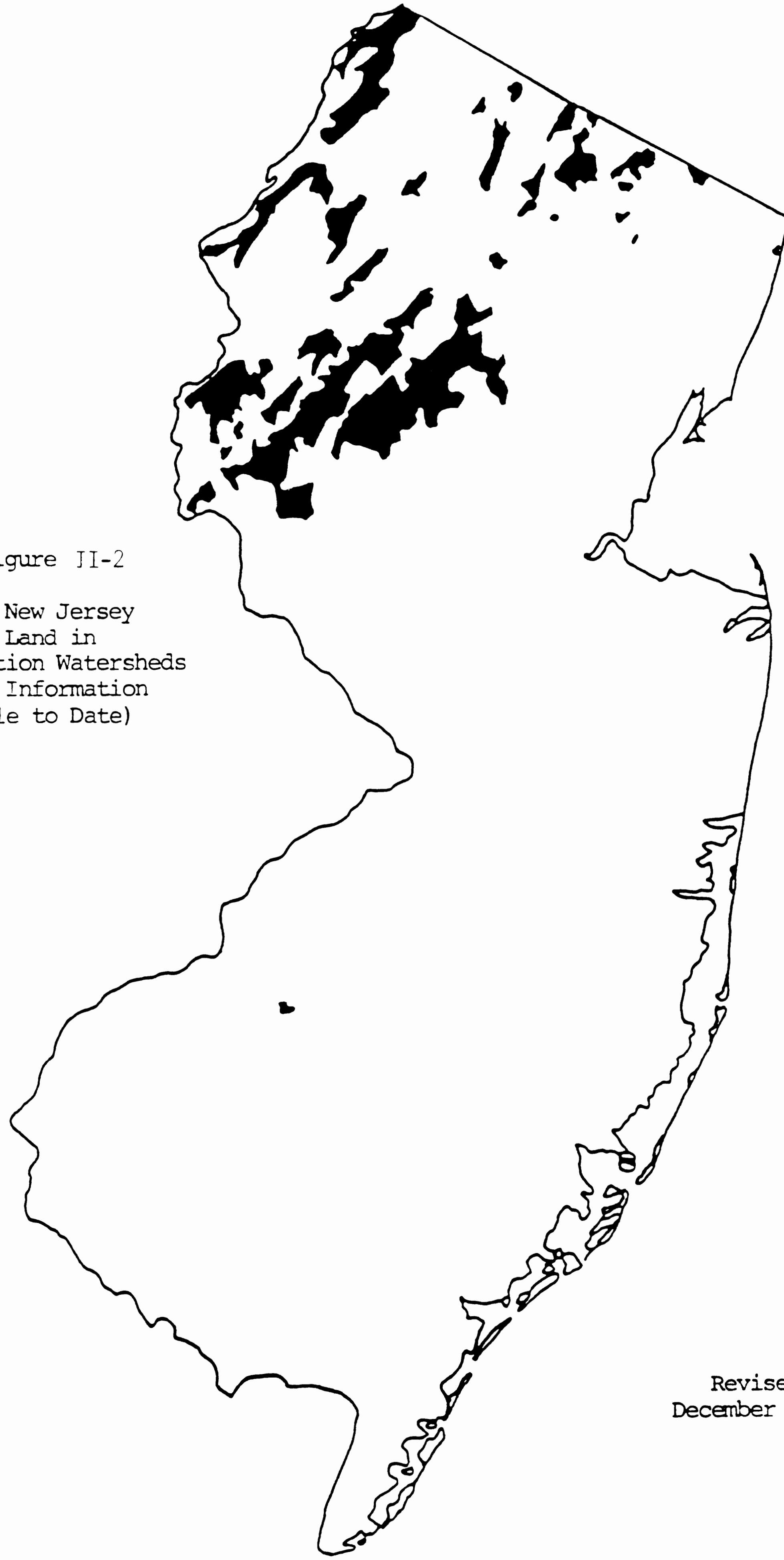

Figure II-2

Areas of New Jersey
With Land in
Trout Production Watersheds
(Based on Information
Available to Date)

Revised
December 1987

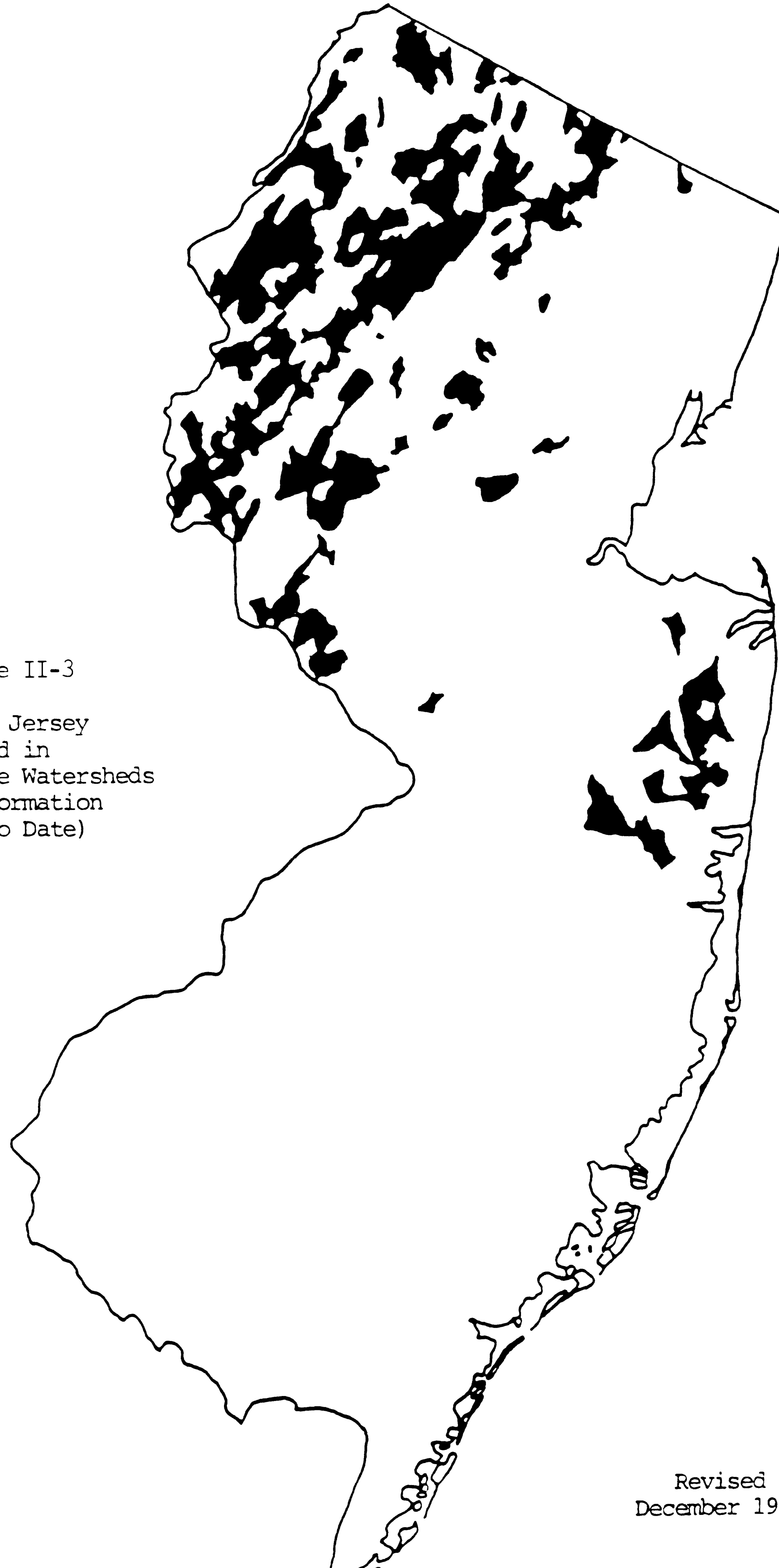

Figure II-3

Areas of New Jersey
With Land in
Trout Maintenance Watersheds
(Based on Information
Available to Date)

Revised
December 1987

environmental protection efforts have made maintenance of this resource a statewide priority.

Ground water is an extremely important resource in New Jersey. It provides approximately 50 percent of the State's potable water, with 39 percent coming from public-supply wells and 11 percent from domestic-supply wells. It also provides baseflow to streams, and is intimately associated with the ecology of the State's wetlands. New Jersey maintains regulations and programs aimed at protecting this resource. The available data suggest that at present there is an ample supply of good quality ground water in the State of New Jersey. However, ground-water quantity (and quality) problems are usually concentrated in areas where the greatest volumes of ground water are needed.

C. Water Classifications and Designated Uses in New Jersey

In New Jersey, all surface waters have been assigned a set of "designated uses" that the waters should be able to support throughout the year. These designated uses are defined in the State's Surface Water Quality Standards regulations and are generally based on a set of numeric and narrative water quality criteria (NJDEP, 1985). In most areas of the State, the designated uses correspond to the swimmable and fish propagation and maintenance goals of national clean water legislation. The swimmable goal is intended to have all possible surface waters be of sufficient quality to allow for primary contact recreation. The fish propagation and maintenance (fishable) goal is designed to have all possible waters supporting healthy and reproducing aquatic biota (usually both indigenous and introduced).

All freshwaters of New Jersey are assigned designated uses that reflect the national clean water goals (except for freshwater tidal portions of the Delaware River tributaries from Rancocas Creek to Big Timber Creek inclusive). Certain tidal and estuarine saline waters of the State are classified for less than these goals. SE-2 (Saline estuarine) waters only have to meet water quality criteria for secondary contact recreation, while SE-3 waters only have to allow for secondary contact recreation and the maintenance/migration of fish (not propagation). Waters in New Jersey assigned SE-2 and SE-3 classifications are found in the urbanized northeast and the Philadelphia/Camden region. They include the tidal Passaic, Hackensack, Elizabeth and Rahway Rivers, and specific tidal tributaries to the Delaware River from Big Timber Creek to Oldman Creek. All interstate waters between New Jersey and New York do not have to meet clean water goals, as defined by the Interstate Sanitation Commission. This is also true for the Delaware River from mile point 118 downstream to mile point 60, based on criteria established by the Delaware River Basin Commission.

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 must be maintained in their natural state, and are not to be subject to any manmade wastewater discharges.

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Ibid. 1984. Outdoor Recreation Plan of New Jersey. Green Acres Program; Trenton, New Jersey.

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CHAPTER III

SURFACE WATER QUALITY IN NEW JERSEY

CHAPTER III

Surface Water Quality in New Jersey

A. INTRODUCTION

This chapter presents a review of current water quality conditions in New Jersey's streams, rivers, lakes, estuaries and ocean waters. The types of pollutants found in the State's surface waters, and known and potential sources of these pollutants are also discussed. A determination of waters that are achieving State designated uses and the national clean water goals is presented.

Chapter III is divided into nine sections. Besides this introduction, sections include:

B. River and Stream Quality, C. Lake Quality, D. Estuarine and Ocean Water Quality, E. Acid Deposition and Water Quality in New Jersey, F. New Jersey Waters Impacted by Toxic Substances Originating From Point And Nonpoint Sources, G. Recommendations, and H. Water Quality Inventory.

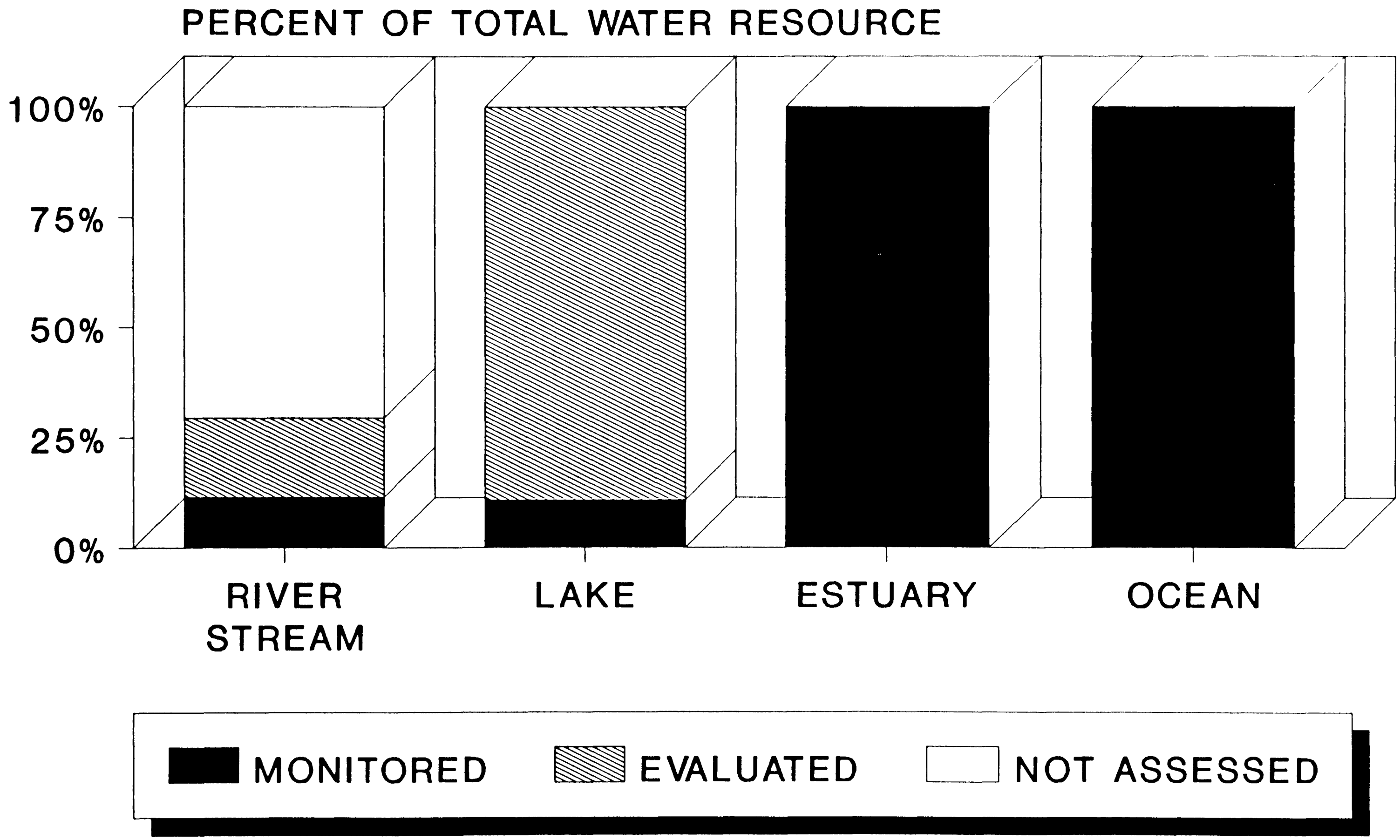
Assessment Methodologies

This State Water Quality Inventory Report uses two main assessment methodologies, monitored and evaluated, to determine the quality of surface waters and sources impacting them. The US Environmental Protection Agency (USEPA) defines these terms as follows:

Evaluated waters are those waterbodies for which the assessment is based on information other than current site-specific ambient data, such as data on land use, location of known or potential sources, predictive modeling using estimated input variables, surveys of fisheries personnel, citizen complaints, and best professional judgement. Monitored waters are those waterbodies for which the assessment is based on current site-specific ambient water quality data (USEPA, 1987). Figure III-1 illustrates the relative distribution of State waters monitored, evaluated, and waters as yet unassessed in New Jersey.

Prior NJ State Water Quality Inventory Reports were based primarily on monitoring information with limited use of best professional judgement and other non-water quality data assessments. However, the USEPA is encouraging the states to report on as many waters as possible and to use all available

FIG. III-1 PERCENTAGE OF TOTAL WATER RESOURCES ASSESSED FOR THE 1990 STATE WATER QUALITY INVENTORY REPORT



PERCENTAGES BASED UPON LINEAR MILES (RIVER/STREAMS), NUMBER OF PUBLIC LAKES, SQUARE MILES (ESTUARY AND OCEAN) sources of water quality-related information. As a result, expanded utilization of fisheries surveys and questionnaires has taken place for this report. These new evaluations serve as the basis for the nonpoint source assessments and determination of waters achieving the fish propagation and maintenance use. A more detailed description of assessment methodologies is presented in the introduction to Section H. Water Quality Inventory.

This State Water Quality Inventory Report assesses water quality, fish communities, and pollution sources in over 60 major rivers and streams, plus numerous smaller tributaries. The State's larger estuarine waterways and ocean waters are also reviewed. Over the past eight years information on lake quality has been limited due to minimal monitoring and evaluation. In 1988 and 1989, twenty-one lakes were monitored and their resource value evaluated, the results of which are presented in this report.

The primary source of monitoring data used for assessing freshwater river and stream quality are the State and federal ambient stream water quality monitoring networks. This includes approximately 115 monitoring locations across the State, all located in freshwaters. A host of water quality and pollution indicators are analyzed at each site. Indicators used in this report to characterize water quality conditions include: stream temperature, dissolved oxygen (concentration and percent saturation), biochemical oxygen demand, pH, fecal coliform, total phosphorus, nitrogen-containing compounds (ammonia, nitrite-nitrate and total Kjeldahl nitrogen), total dissolved solids, and metals (lead, mercury, cadmium and copper). Combined, these indicators can present a picture of a stream's condition at the particular time of sample collection. However, the stream environment is dynamic; what is found in a stream one day, may or may not be found the next day, or in much different levels. chemical data used in this 1990 inventory was collected over a five year period between 1983 through 1987.

Ambient chemical monitoring is supplemented by biological assessments of in-stream macroinvertebrate communities at eighteen selected stations. These biological assessments are useful in revealing the impact of toxic contaminants, as well as detecting chronic water quality conditions which may be overlooked by the short-term "snapshot" view provided by ambient chemical sampling discussed previously.

The results of monitoring activities were also utilized in characterizing estuarine and ocean water quality. These activities consist of shellfish harvesting water classification monitoring, summertime bay and ocean beach sampling, bay and ocean phytoplankton monitoring, and EPA's summer ocean monitoring program. The interstate agencies also perform monitoring of their respective waters. Other monitoring activities used to assess surface waters were intensive surveys (usually for wasteload allocation and enforcement purposes), and special studies.

As mentioned above, evaluated assessments were also used to determine general water quality conditions and potential pollution sources. Evaluations of the fish communities and their health were performed by biologists in the NJ Division of Fish, Game and Wildlife. These evaluations served as the prime determinant of which waters support fish propagation/maintenance uses and goals. Information from county planning agencies, local soil conservation districts, and fisheries biologists was the basis of nonpoint source assessments and which waters are impacted by nonpoint sources. This "evaluated" assessment was necessary because little or no monitoring of nonpoint sources has been conducted in the State. Evaluations were also based on the presence of point sources or hazardous waste sites, land uses, stream disturbance activities, and the lack of certain water uses occurring in a stream.

Determination of designated use support and achievement of clean water goals was based on both monitored and evaluated data. Swimmable status was determined where monitoring for fecal coliform took place; or in the absence of data, where gross pollution levels occur.

The fish propagation and maintenance (fishable) use and clean water goal was based primarily on the fisheries surveys provided by State biologists. Water quality data was also factored into the decision-making process where no fisheries survey was completed, or when the water quality data identified specific problems. A more thorough description of how designated uses were determined is presented in the introduction to Section H of this chapter.

B. RIVER AND STREAM QUALITY

This section summarizes the quality of the freshwater rivers and streams in New Jersey. This summary is based on the detailed watershed assessments in Section H Water Quality Inventory. Described below are the amount of fresh waters in New Jersey meeting the State's designated uses, the amount achieving the clean water goals set forth in national legislation, the pollutants found, and the source categories causing water degradation.

1. Water Quality Conditions

The amount of freshwater river and stream mileage in the State which is achieving the swimmable and fish propagation and maintenance designated uses/clean water goals is presented in Table III-1 and Fig.'s III-2, III-3, III-4, and III-5. This report has evaluated 740 monitored freshwater miles, and nearly 1600 evaluated freshwater miles. Of the 740 monitored miles, 148 are the Delaware River. Table III-2 shows the quality of the major rivers and streams in the State and their current (1988) use attainment.

Approximately 30 percent of New Jersey's freshwater streams (as measured in miles) can be considered to be meeting both the swimmable and fish propagation and maintenance clean water goals. Generally, streams classified as swimmable are also of sufficient quality for supporting healthy fishlife. Of the total 740 monitored stream miles, 221 miles or 30 percent are swimmable. However, 130 of these 221 miles occur in the Delaware River; therefore, when excluding the Delaware River only 91 monitored miles (15 percent) are judged swimmable. Forty-two of the 91 swimmable miles are further thought to be threatened by the presence of potential pollution sources. This 30 percent figure given for 1990, represents a 31 percent increase since 1972. Waters classified as swimmable are those primarily in protected watersheds or directly downstream of an impoundment where the settling action of the impoundment likely reduces the instream bacteria levels. High fecal coliform concentration is the principal reason why so many waterways are not of swimmable quality. Figures III-2 and III-3 summarize swimmability in New Jersey waters, both including and excluding the Delaware River.

The proportion of New Jersey's freshwaters supporting healthy and reproducing fish populations is considerably better. Of over 1850 stream miles evaluated and monitored, including the Delaware River, 1441 or 77 percent are believed to be fully supporting the

TABLE III-1 DESIGNATED USE SUPPORT AND CLEAN WATER ACT GOAL ATTAINMENT: NEW JERSEY FRESH WATER RIVES AND STREAMS[1]

A. FISH PROPAGATION AND MAINTENANCE

DELAWARE RIVER (DRBC): Port Jervis, N.Y. to Marcus Hook, Pa

CATEGORY	MILES EVALUATED	MILES MONITORED	TOTAL MILES ASSESSED
Fully Supports	0	126	126
Threatened[3]		126	
Partially Supports	0	0	0
Does Not Support	0	22	22

NEW JERSEY STATE WATERS

CATEGORY	MILES EVALUATED	MILES MONITORED	TOTAL MILES ASSESSED[2]
Fully Supports	1207	108	1315
Threatened[3]	340	16	356
Partially Supports	297	112	307[2]
Does Not Support	72	30	97[2]

B. SWIMMABLE

DELAWARE RIVER (DRBC): Port Jervis, N.Y. to Marcus Hook, Pa

CATEGORY	MILES EVALUATED	MILES MONITORED	TOTAL MILES ASSESSED
Fully Supports	0	130	130
Threatened[3]		130	
Partially Supports	0	0	0
Does Not Support	0	18	18

NEW JERSEY STATE WATERS

CATEGORY	MILES EVALUATED	MILES MONITORED	TOTAL MILES ASSESSED
Fully Supports	0	91	91
Threatened[3]		42	42
Partially Supports	0	48	48
Does Not Support	0	453	453

footnotes:

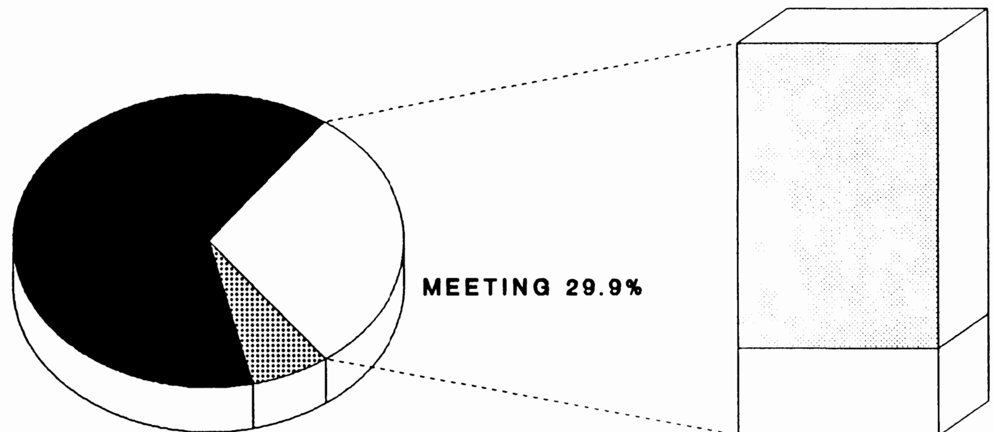
1 Designated use for New Jerseys freshwaters are equivalent to the swimmable and fish propagation/maintenance Clean Water Act goal.

2. Total miles for assessing fishable use is less than the total evaluation and monitored due to the elimination of double counting.

3. Threatened waters are considered a subset of fully supports.

FIGURE III-2
CLEAN WATER ACT GOAL SUPPORT
FRESH WATER RIVERS AND STREAMS

SWIMMABLE GOALS

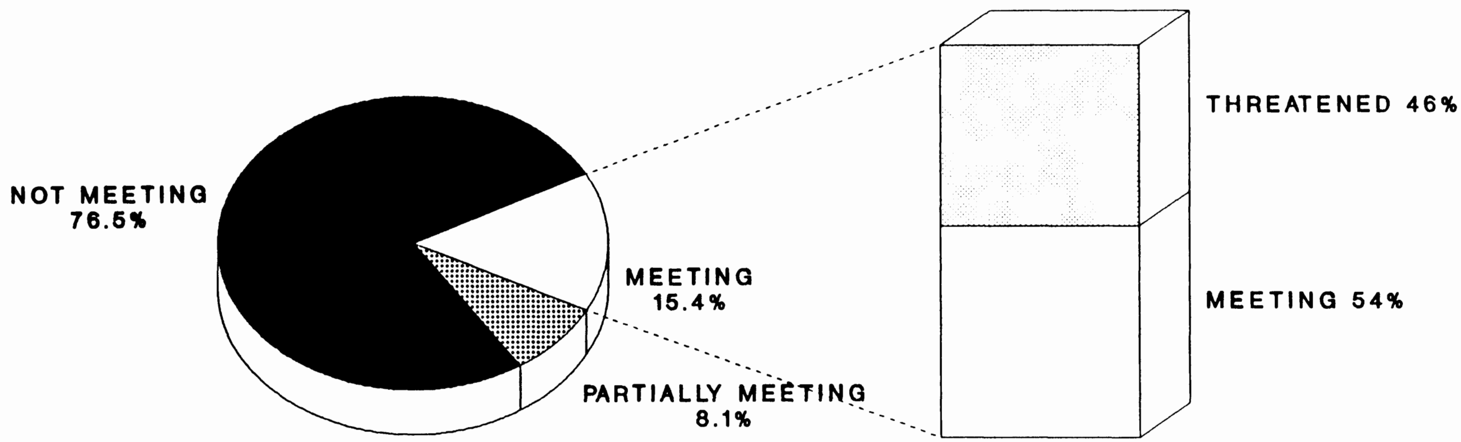


INCLUDES DELAWARE RIVER

PERCENTAGES REPRESENT PROPORTION
OF LINEAR MILES ASSESSED

FIGURE III-3
CLEAN WATER ACT GOAL SUPPORT
FRESH WATER RIVERS AND STREAMS

EXCLUDING DELAWARE RIVER

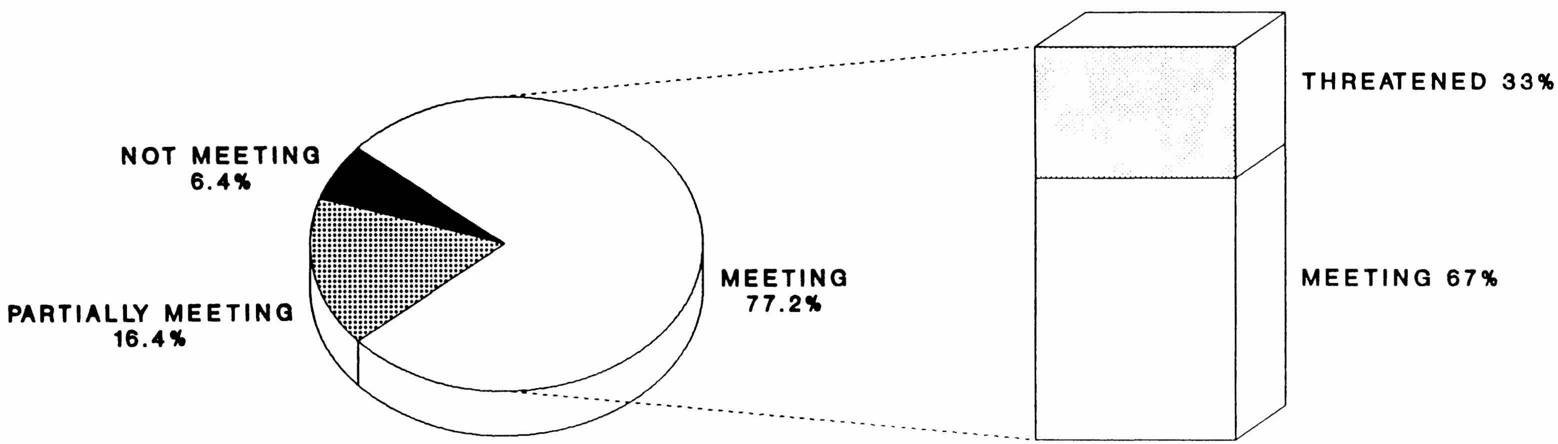


SWIMMABLE GOALS

PERCENTAGES REPRESENT PROPORTION
OF LINEAR MILES ASSESSED

FIGURE III-4
CLEAN WATER ACT GOAL SUPPORT
FRESH WATER RIVERS AND STREAMS

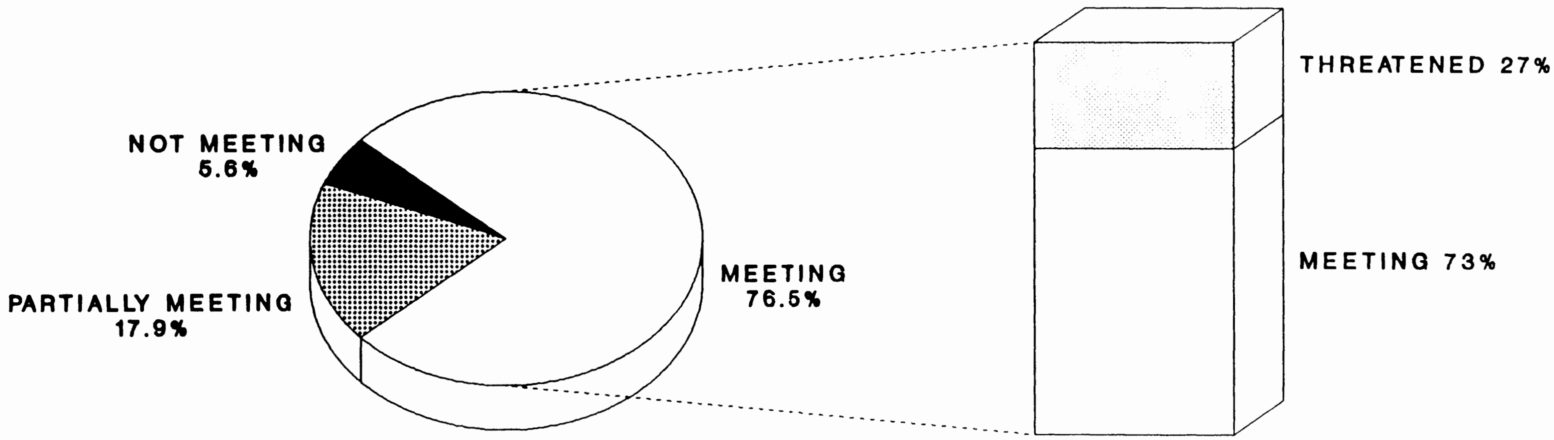
INCLUDES DELAWARE RIVER
FISHABLE GOALS



PERCENTAGES REPRESENT PROPORTION
OF LINEAR MILES ASSESSED

FIGURE III-5
CLEAN WATER ACT GOAL SUPPORT
FRESH WATER RIVERS AND STREAMS

EXCLUDING DELAWARE RIVER



FISHABLE GOALS

PERCENTAGES REPRESENT PROPORTION
OF LINEAR MILES ASSESSED

TABLE III-2. PAST AND CURRENT STATUS OF FRESHWATER STREAMS MEETING THE SWIMMABLE AND FISHABLE DESIGNATED USES/CLEAN WATER GOALS

Waterway	Swimmable Status		Fishable Status		Current Quality
	1977	1990 (1988)	1977	1990 (1988)	
Wallkill River	No	No	Yes	Yes*	Good
Flat Brook	Yes	Yes	Yes	Yes	Good
Paulins Kill	No	No	Yes	Yes	Good/Fair
Pequest River	No	No	Yes	Yes	Good
Musconetcong River	Yes*	Yes*	Yes	Yes	Good/Fair
Pohatcong Creek	No	No	Yes	Yes	Fair
Wickecheoke Creek	No	No	Yes	Yes*	Fair
Assunpink Creek	No	Yes*	Yes*	Yes*	Good/Fair
Crosswicks Creek	No	No	Yes	Yes*	Good/Fair
Rancocas Creek	No	Yes*	No	Yes	Good/Fair
Pennsauken Creek	No	No	No	Yes*	Fair/Poor
Cooper River	No	Yes*	No	Yes*	Good/Very Poor
Big Timber Creek	No	No	No	Yes	Fair
Raccoon Creek	No	No	Yes	Yes*	Good
Oldmans Creek	No	No	Yes	Yes	Good
Salem River	No	Yes	No	Yes	Good/Fair
Cohansey River	No	No	Yes	Yes	Fair
Maurice River	No	Yes*	Yes	Yes	Excellent/Good
Great Egg Harbor R.	Yes*	Yes*	Yes	Yes*	Fair/Poor
Mullica River	Yes	Yes*	Yes	Yes	Excellent
Toms River	Yes*	No	Yes	Yes	Good
Manasquan River	No	No	Yes	Yes	Fair
Shark River	-	Yes*	-	Yes	Good
So. Branch Raritan	No	Yes*	Yes	Yes	Good/Fair
Lamington River	-	No	-	Yes	Good/Fair
No. Branch Raritan	No	No	Yes	Yes	Good/Fair
Millstone River	No	No	Yes	Yes*	Good/Fair
So. River Tributaries	No	No	Yes	Yes	Good/Fair

* Portions Only

TABLE III-2 (Continued) PAST AND CURRENT STATUS OF FRESHWATER STREAMS MEETING THE SWIMMABLE AND FISHABLE DESIGNATED USES/CLEAN WATER GOALS

Waterway	Swimmable Status 1977	Swimmable Status 1990 (1988)	Fishable Status 1977	Fishable Status 1990 (1988)	Current Quality
Raritan River	No	No	No	Yes*	Good/Fair
Rahway River	No	No	Yes	Yes*	Fair
Elizabeth River	No	No	Yes*	No	Fair
Upper Passaic River	No	No	Yes	Yes*	Fair/Poor
Whippany River	No	No	Yes	Yes*	Fair/Poor
Rockaway River	Yes*	No	Yes	Yes*	Good/Fair
Pequannock River	-	Yes	-	Yes*	Good
Wanaque River	-	Yes	-	Yes*	Excellent
Ramapo River	Yes*	No	Yes	Yes	Fair
Pompton River	Yes*	No	Yes	Yes*	Good
Lower Passaic River	No	No	No	Yes*	Fair
Hackensack River	No	No	No	Yes*	Good
Delaware River (freshwater)					
Zone 1	Yes*	Yes*	Yes	Yes	Excellent/Good
Zone 2	Yes*	Yes	Yes	Yes	Good/Fair

* Portions Only

fish propagation and maintenance designated use and clean water goal. Thirty-three percent of waters meeting this use may be threatened, however, because of the existence of known or potential pollution sources. Waters which have moderately degraded fish communities are considered to be partially meeting the fish propagation and maintenance use. Sixteen percent of the assessed waters fall into this category. Only six percent are classified as not meeting the use, or to have severely degraded communities. The percentages for fishability change very little when the Delaware River is excluded from the data (see Figures III-4 and III-5).

In comparison with prior assessments of the proportion of waters meeting the fish propagation and maintenance use, 13 percent more waters are now meeting the use than in 1972. But such direct comparisons are not encouraged because different assessment methodologies are now employed to determine attainment of the fishable goal. Actual fisheries surveys are currently utilized to determine "fishable" status. Earlier editions of this report relied principally on water quality data.

2. Causes of Water Quality Degradation

The great majority of New Jersey's monitored freshwater streams contain elevated nutrients (phosphorus and nitrogen compounds) and bacteria (fecal coliform) levels. Table III-3 summarizes which pollutants are found in the State and their relative impact. The table shows that nutrients and pathogens/bacteria are excessive in 81 percent of the monitored freshwaters (excluding the Delaware River). Other pollutants which are suspected of having statewide and significant impacts on water quality include organic enrichment/dissolved oxygen levels, salinity from road salts, and oil and grease.

A number of other pollutant types are either known or suspected problems in the State. Known pollutants/water quality problems occurring in moderate to low levels statewide (or are locally significant) are certain pesticides, priority organics, metals, ammonia, pH deviations, and temperature or thermal modifications. These problems have been detected in monitoring activities, and their extent range from being elevated in one percent of the monitored waters for metals to 14 percent for ammonia. Most other categories of pollutants, as defined by EPA and presented Table III-3, are suspected of being present in New Jersey's surface waters in small quantities. They include unknown toxic substances, nonpriority organics, and chlorine. Habitat modifications and flow alterations also have impacts locally.

The actual cause of these water quality problems is less clear. Table III-4 shows those pollutant source categories which are

TABLE III-3 SUMMARY OF POLLUTANTS FOUND IN NEW JERSEY'S FRESHWATERS

Numbers denote the percentage of monitored freshwaters containing the pollutant in elevated amounts. Based on a total of 590 monitored miles; does not include Delaware River Basin Commission interstate waters.

Pollutant Categories	Major/Statewide Impacts	Moderate/Localized/Minor Impacts
Unknown Toxicity		?
Pesticides		3
Priority Organics		3
Nonpriority Organics		?
Metals		1
Ammonia		14
Chlorine		?
Nutrients	81	
pH		8
Siltation	?	
Organic Enrichment/Dissolved Oxygen	11	
Salinity/Road Salts	?	
Thermal Modification		13
Flow Alteration		?
Habitat Alterations		?
Pathogens	81	
Radiation		?
Oil and Grease	?	

Key:
? = Impact is suspected; a lack of monitoring data exists to substantiate the conclusion and its extent.

TABLE III-4 SUMMARY OF THE SEVERITY OF POLLUTANT SOURCES IMPACTING NEW JERSEY'S FRESHWATERS

Source Category	Major/Statewide Impacts	Moderate/Local/Minor Impacts
Point Sources		
Industrial	X	
Municipal	X	
Combined sewer outfalls		X
Stormwater outfalls	X	
Nonpoint Source		
Agriculture	X	
Silviculture		X
Construction	X	
Urban Runoff	X	
Resource Extraction		X
Land Disposal	X	
Hydrologic/Habitat Modifications		X

Note: Insufficient information exists to quantify the extent of these pollutant source categories.

adversely affecting the State's freshwaters. No accurate quantification of the extent of these sources is currently available. This is because both point and nonpoint sources are present to some degree in practically every watershed in the State, and unless monitoring or predictive modelling is performed specifically for the purpose of defining pollutant inputs and stream response, such a determination can not be correctly made. Even when modelling activities are conducted in New Jersey they are usually for wasteload allocations, and analyze low flow conditions.

Generally, the 1100 industrial and municipal wastewater discharges have significant impacts to water quality statewide. Nonpoint sources coming from urban runoff, construction activities, agricultural practices, and land disposal practices (including septic systems), are also extensive. In many instances pollutants from these sources are released via stormwater outfalls. Other types of nonpoint sources found in New Jersey in limited scope include silvicultural activities, resource extraction, and hydrologic/habitat modification. Combined sewer outfalls, surcharging sewage conveyance lines/pump stations, illegal discharges, and facilities in permit noncompliance are all fairly common sources of water pollution in New Jersey. The wet and dry deposition of air pollutants, including acid rain, is a pollution source whose significance is as yet unclear because of a lack of data. Additional discussion of the State's point source control programs can be found in Chapter V.

C. LAKE QUALITY

Introduction

The State of New Jersey has approximately 1,200 freshwater lakes totaling 51,000 acres. Of these lakes, 381 lakes with a total of 24,000 acres are publicly owned. While New Jersey's lakes provide recreational opportunities, aesthetic value, and wildlife habitat, only limited monitoring and assessment has occurred within the last ten years. Lake assessments have included the 1985 Nonpoint Source Assessment, which was a review of existing data; the 1989 Lakes Classification Report (an examination of 21 lakes, discussed below), funded through a Grant from the United States Environmental Protection Agency (USEPA); and Phase I Diagnostic-Feasibility Studies (assessments performed under the Clean Lakes Program) for specific lakes. The findings of these studies provides a general overall picture of lake quality in New Jersey. They indicate that;

- The most frequent pollution problems impacting lakes in New Jersey are nutrients, siltation, depressed dissolved oxygen levels, organic enrichment, and pH fluctuations due to low alkalinity. Oil and grease are also suspected of adversely impacting many lakes. Excess nutrients and sedimentation lead to excessive biological productivity and accelerated eutrophication.

- Water diversions (flow alterations) are suspected of adversely impacting many lakes.

- Nonpoint source pollution is the primary cause of water quality degradation in all lakes monitored and/or assessed. Nonpoint sources are the principal source of excess nutrients and sediments in lakes. All lakes studied under Phase I studies revealed sedimentation problems either from erosion in the watershed, or from a combination of erosion and the accumulation of decaying macrophytes. Remedial measures recommended include stormwater drain diversions or repair, septic system repair, and erosion control.

Another indicator of the nutrient enrichment/sedimentation problem in New Jersey's lakes is the number of aquatic herbicide application permits issued by the State. In 1989, the NJDEP's Division of Environmental Quality, Bureau of Pesticides Control, issued approximately 420 permits for herbicide application for the control of excessive aquatic weeds and algae. This represents approximately one-third of the State's lakes.

1989 Lakes Classification Study:

In 1989, the State of New Jersey received a Lake Water Quality Assessment Grant from USEPA in order to assemble a Lakes Classification Report. This information is a prerequisite for eligibility in the USEPA Clean Lakes Program (discussed in Chapter 5). The objectives of the project were to acquire limited water quality data for 21 public lakes. The data was analyzed to determine baseline trophic status for each lake and to provide baseline data from which to monitor future trends in lake water quality .

Twenty-one lakes totaling 1316 acres were chosen to be monitored during 1989. Criteria used in selecting the lakes included the amount of public access provided, recreational use such as swimming and fishing, and the lake's value as a local resource. An effort was made to select lakes from different regions throughout the State.

The monitoring period for the project ran from March to November of 1989. During this period, each selected lake was sampled three times, once each for the Spring, Summer and Fall. Lake samples were taken at a station that best represented the whole lake. Samples were also taken at each main tributary entering the lake. The lake and tributaries were sampled for the following parameters:

Total phosphorus	Temperature
Ortho phosphorus	pH
NO2	Dissolved oxygen
NO3	TKN
NH4	Alkalinity

Bacteria (Fecal coliform, Fecal strep, Total coliform)

Secchi Disk	(In-lake only)
Chl a	(In-lake only)
Algal I.D.	(In-lake only)

An aquatic macrophyte survey was also conducted to determine the dominant species and percent areal coverage of the lake.

Three criteria were used to determine the trophic status of each lake monitored during 1989. Any lake that met or exceeded any one of the criteria was considered to be eutrophic. The criteria were:

1. Any lake with a total phosphorus level equal to or greater than 0.02 mg/l.

2. Any lake that had an areal coverage of aquatic macrophytes significant enough to impair the recreational uses of the lake.

3. Any lake that had a Chlorophyll a level of 10.0 mg/M^3 or higher during the monitoring period.

Lake sampling was limited to three times during the year, however assumptions using this data are extrapolated to represent the status of the lake throughout the year.

Summary of Findings:

- All twenty-one lakes studied are considered to be eutrophic. Each lake met or exceeded at least two criteria used to determine eutrophic status.

- Two lakes, Cooper River Lake and Smithville Lake, representing a combined surface area of 175 acres, are known to have point source discharges of pollution. These two lakes consistently had the highest levels of total phosphorus (0.15 mg/l- 0.36 mg/l). Three secondary sewer treatment plants with a combined discharge of 2.86 million gallons per day (MGD) were discharging into the tributary that fed Cooper River Lake. One active secondary sewer treatment plant discharges 2.05 MGD into the stream feeding Smithville Lake.

- Nonpoint source pollution was the suspected cause of water quality degradation in the other nineteen lakes, which total 1141 acres. Nonpoint sources may have included urban, agricultural, construction or land disposal runoff. Several of these lakes including Brainerd, Farrington, Mac's, Narriticon and Rosedale had elevated total phosphorus levels that were consistently around 0.10 mg/l. All of these lakes except Mac's Pond had a watershed that was a combination of agricultural and developed land. Mac's Pond's watershed was primarily developed land.

- Those lakes with the lowest levels of total phosphorus were found in the most rural parts of the State. They included Shepherd Pond, Lake Absegami, East Creek Lake, and Lake Nummy, each of which are situated within a State Parklands. The watersheds for each of these lakes primarily consisted of undeveloped woodlands. Although the total phosphorus levels were comparatively low for these lakes (<0.02 mg/l-0.03 mg/l), each of them supported moderate to heavy aquatic macrophyte growth. The macrophytes were present in the shallowest areas of the lakes, where light penetration is greatest.

- While macrophytes and algae were both prevalent in a majority of the lakes monitored, it is macrophyte growth that imposed the most direct impact to recreational use. Problems resulting from algal blooms were generally limited to aesthetics. Only when blooms became so extensive as to produce floating filamentous algal mats was recreational use degraded (see individual lake summations).

- A total of eight lakes had depressed levels of dissolved oxygen in their hypolimnion. Four of these; Greenwich Lake, Mercer County Lake, Rosedale Lake, and Shepherd Lake had dissolved oxygen levels of less than 1.0 mg/l in their hypolimnion.

- Several lakes are believed to be experiencing severe sedimentation problems due to high productivity and erosion within the watershed. Below is a list of some of these shallower lakes and their maximum depths recorded this year and from past data:

	Maximum Depth	Maximum Depth
Absegami	8 feet in 1978	4.5 feet in 1989
Evans		3.5 feet in 1989
Indian Mills	8 feet in 1975	4.0 feet in 1989
Iona	9 feet in 1975	4.0 feet in 1989
Smithville		3.5 feet in 1989

- Five lakes; Lake Ames, Cooper River Lake, Evans Pond, Farrington Lake and Mac's Pond had fecal coliform counts above 200 mpn/100ml on one or more sampling dates. Since 200 mpn/100ml is the maximum limit allowed for swimmable waters, these lakes would have been considered unswimmable on these days. Sources of pollution were undetermined due to the limited scope of the project.

The following are brief summations of each of the 21 lakes surveyed and a description of the various problems that have affected each lake's recreational use.

Lake Absegami, Burlington County

Lake Absegami, located in part of the Bass River State Park, is a 92 acre body of water with a maximum depth of 4 feet. The lake has a beach with a guarded swimming area, a boat rental and launching area, and many areas along the shoreline from which to fish. There are also several log cabins and 178 campsites situated near the lake. Sedimentation and one-hundred percent areal coverage by macrophytes are degrading the condition and recreational use of the lake. Fishing and boating are restricted to the center-most part of the lake. The heaviest weed growth and shallowest depths are where the inlets enter the lake.

Lake Ames, Morris County

Lake Ames is a 14 acre body of water with a maximum depth of about 8 feet. The lake has a small beach area which is believed to be no longer in use. The lake does provides some limited shoreline fishing opportunities. The lake's condition and recreational use are severely impacted by the heavy growth of macrophytes (100% areal coverage). Aquatic plants restrict both swimming and most shoreline fishing opportunities.

Brainerd Lake, Middlesex County

Brainerd Lake is a 15 acre body of water with a maximum depth of about 8 feet. A park, bordering the eastern side of the lake, provides access to the lake. The lake lacks both a designated swimming area and boat launching area; the park does provide shoreline fishing access however, this use is hampered by heavy macrophyte growth along a certain percentage of the shoreline. High nutrient levels support macrophyte growth (50% areal coverage) and algal blooms (chlorophyll a up to 49.10 mg/M^3).

Lake Carasaljo, Ocean County

Lake Carasaljo is a 67 acre body of water with a maximum depth of 11 feet. The lake is surrounded by township property. It has a large beach with a guarded swimming area and a boat launching area. Some of the recreational uses of the lake are severely impacted by macrophyte growth. The upper half of the lake is completely weed choked. Since the boat launch is located here, boating opportunities are severely hampered. Sixty percent of the lower half of the lake is inundated with macrophyte growth, especially the shoreline; hence, bank fishing is hampered. Aquatic plant growth however, does not degrade the swimming area.

Cooper River Lake, Camden County

Cooper River Lake is a 150 acre body of water with a maximum depth of about 8 feet. The lake is surrounded by a county park and is heavily utilized by both boaters and fishermen. This Lake is affected by high levels of nutrients which enhance excess algal productivity (chlorophyll a up to 82.31 mg/M^3). During monitoring, the lake's water was observed to be turbid and had an unpleasant odor. Summertime dissolved oxygen levels were depressed near the lake bottom (2.6 mg/l).

Crystal Lake, Burlington County

Crystal Lake is a 20 acre body of water with a maximum depth of about 17 feet. The lake is stocked with trout by the State, and recreational use is limited to shoreline fishing. Elevated nutrient levels support heavy blue-green algal productivity (chlorophyll a up to 78.48 mg/M^3). A possible source of nutrients may be the close proximity of the township's composting leaf collections. Depressed levels of dissolved oxygen were present in the hypolimnion during the summer.

East Creek Lake, Cape May County

East Creek Lake, part of the Belleplain State Park, is a 62 acre body of water having a maximum depth of about eight feet. The lake has a boat launching area and is utilized for fishing from both the shoreline and boats; however, many areas are restricted to these activities due to heavy macrophyte growth. Most of the upper half of the lake is weeded with macrophytes, as are much of the shoreline and the shallower coves in the lower half of the lake. Sedimentation from dying aquatic plants and/or erosion appears to be a problem in the upper portion of the lake.

Evans Pond, Burlington County

Evans Pond is an eight acre body of water with a maximum depth of 3.5 feet. The lake provides fishing opportunities from the shoreline but is not utilized for either swimming or boating. The lake is impaired by filamentous blue-green algae growth; heavy, floating mats of algae restrict shoreline fishing at the lower end of the lake. During the summer, depressed dissolved oxygen levels were observed throughout the water column (4.0 mg/l).

Farrington Lake, Middlesex County

Farrington Lake is a 203 acre body of water with a maximum depth of about 20 feet. The lake is heavily utilized by both fishermen and boaters. There are several day camps for children located on the lake. Elevated levels of nutrients enhance macrophyte growth (30% to 40% areal coverage) and algal production (chlorophyll a up to 19.97 mg/M^3). Macrophyte growth is restricted to the shallower sides and coves and hence its impact to recreational use is minimal.

Greenwich Lake, Gloucester County

Greenwich Lake, part of the Gloucester County park system, is a 35 acre body of water with a maximum depth of about 20 feet. The lake has a beach with guarded swimming area, a boat launching area, and many points along the shoreline from which to fish. It is also stocked with trout by the State. Moderate levels of nutrients have led to elevated algal production (14.28 mg/M^3) during the summer. Low dissolved oxygen levels (0.11 mg/l) were present in the hypolimnion during the fall. This lake provides excellent recreational opportunities.

Indian Mills Lake, Burlington County

Indian Mills Lake is a 42 acre body of water with a maximum depth of about 4 feet and is primarily surrounded by homes and sod farms. The southern end of the lake is accessible to shoreline fishing. There are no designated swimming areas. High nutrient levels enhance filamentous algal and macrophyte growth. Together they form dense, floating mats (40% areal coverage) that severely hamper fishing opportunities. Sedimentation from dying plants and/or erosion is a problem throughout the lake.

Iona Lake, Gloucester County

Iona Lake is a 60 acre body of water with a maximum depth of 4 feet. The lake has a beach with guarded swimming area, a boat launching area, areas along the shoreline from which to fish, and is stocked with trout by the State. Recreational use of the lake is degraded by heavy macrophyte growth. Areal coverage of the lake by macrophytes is 60% with the heaviest concentrations occurring in the upper region. The macrophytes limit fishing opportunities, and the floating mats are a nuisance to swimmers. Sedimentation from dying plants and/or erosion are filling in the lake.

Jefferson Lake, Burlington County

Jefferson Lake is a 60 acre body of water with a maximum depth of 4.5 feet. The lake has a swimming area and parts of the lake are accessible to fishing from the shoreline. Recreational use is impaired by heavy macrophyte growth (50% areal coverage). Fishing is hampered in the upper region and along the shallow sides, where the growth is heaviest. Floating mats of aquatic plants are also a nuisance to bathers. Sedimentation from dying macrophytes and/or erosion are filling in the lake.

Mac's Pond, Ocean County

Mac's Pond is a 1 acre body of water with a maximum depth of about 6 feet. It is surrounded by a small park and provides fishing opportunities for children. A restoration project was implemented at Mac's Pond in 1988, with the financial assistance of the NJDEP. The work included dredging, shoreline stabilization, outlet structure repair, and supplemental groundwater supply. Heavy algal productivity, observed during the summer, is supported by high levels of nutrients. Fecal coliform counts were often above 200 mpn/100ml. The Monmouth County Health Department investigated the pond's watershed to determine the source of pollution but results are not conclusive at this time. A large duck population frequents the pond.

Mercer County Park Lake, Mercer County

Mercer County Park Lake is a 270 acre body of water with a maximum depth of about 15 feet. The lake is partially surrounded by a park and is heavily utilized by both fishermen and boaters. While the lake's physical uses are not impacted, elevated levels of nutrients did enhance heavy algal productivity (chlorophyll a up to 51.52 mg/M^3). Anoxic conditions are present in the hypolimnion during the summer.

Mount Hope Pond, Morris County

Mount Hope Pond is a 17 acre body of water with a maximum depth of about 13 feet. The lake has a beach with a guarded swimming area and part of the lake is accessible to fishing from the shoreline. Macrophyte growth (25% to 30% areal coverage) impairs the fishing opportunities provided by the lake. Most of the weed growth is along the western side of the lake - the most accessible part of the lake to fishing. The swimming use, however, is unaffected by this macrophyte growth. Dissolved oxygen levels are depressed in the hypolimnion during the summer.

Lake Narriticon, Gloucester County

Lake Narriticon is a 37 acre body of water with a maximum depth of about 10 feet. The lake is bordered by a park on one side and homes on the other. There are areas along the shoreline from which to fish and the lake is stocked with trout by the state. High levels of nutrients support heavy algal production (chlorophyll a up to 73.36 mg/M^3). The water has a turbid appearance which detracts from the lake's aesthetic appearance. Dissolved oxygen levels are depressed in the hypolimnion during the summer.

Lake Nummy, Cape May County

Lake Nummy, which is part of the Belleplain State Park, is a 26 acre body of water with a maximum depth of about 10 feet. The lake has a beach with guarded swimming area; a boat rental and launching area; and areas along the shoreline from which to fish. Heavy macrophyte growth (70% areal coverage) is degrading some of the lake's recreational use. Fishing from a boat and/or the shoreline is precluded from parts of the upper lake and along the shoreline due to shallow depth and weed growth. The swimming area is not impaired by the macrophyte growth because it is located near the deepest end of the lake.

Rosedale Lake, Mercer County

Rosedale Lake, part of a county park system, is a 38 acre body of water with a maximum depth of about 10 feet. The lake is utilized for fishing purposes and is stocked with trout by the State. Fishing from some areas of the lake is impaired by filamentous algal growth. High levels of nutrients enhance this growth resulting in the formation of floating mats of algae (20% to 30% areal coverage). The nutrients also promote the growth of planktonic algae (chlorophyll a up to 69.90 mg/M^3). Anoxic conditions are present in the hypolimnion during the summer.

Shepherd Pond, Passaic County

Shepherd Pond, part of Ringwood State Park, is a 74 acre body of water with a maximum depth of about 30 feet. The lake has a large beach with guarded swimming area, a boat rental and launching area, and areas along the shoreline from which to fish. While much of the lake is weed free, the shallow areas in the upper region and along some of the shoreline have sufficient macrophyte growth to slightly hamper fishing (20% areal coverage). The swimming area however, is unaffected by the macrophyte growth. Anoxic conditions are present in the hypolimnion during the summer. Overall, the lake provides a variety of unimpaired recreational opportunities.

Smithville Lake, Burlington County

Smithville Lake, part of the historic Smithville Park, is a 25 acre body of water with a maximum depth of 3.5 feet. The lake has a boat launching area and several docks from which to fish. The condition and recreational uses of the lake are severely degraded by the proliferation of aquatic plants. High levels of nutrients enhance heavy algal production (chlorophyll a up to 123.37 mg/M^3). Heavy macrophyte growth (70% areal coverage) and shallow depth have cut off the boat launch from the main part of the lake. Sedimentation from these dying macrophytes and/or erosion is filling in the lake. To illustrate the decline in water quality that has occured here through time; a fisheries survey performed in 1982 found populations of panfish, bass, and pickerel. Carp, a species associated with poor water quality, was absent. In 1989 however, carp were observed swimming throughout the lake.

D. ESTUARINE AND OCEAN WATER QUALITY

1. Water Quality Conditions

Ocean Waters

Support of designated use and attainment of national clean water goals for New Jersey ocean waters are summarized on Tables III-5, and Figure III-6. State designated use and clean water goals for ocean waters in New Jersey are the same. The Coastal Cooperative Monitoring Program (CCMP) monitoring results from the early 1980's up to 1989 indicate that the New Jersey coastal beaches from Sandy Hook south to Cape May are fully swimmable. Some beaches however are threatened by occasional short-term elevations of bacterial levels which have resulted in beach closures for brief periods (NJDEP, 1989A, 1990,).

Most (61%) of the New Jersey ocean waters are fishable but approximately 39 percent are rendered partially fishable by toxics and by pathogens. For purposes of assessing coastal waters the fishable goal is defined as the following: waters should be of sufficient quality to allow open shellfish harvesting in accordance with State regulations, to allow for safe consumption of fish free from toxic or chemical tissue contamination, and to support healthy and propagating indigenous and introduced fish populations. Of the 439 square miles of coastal waters under the jurisdiction of the State's shellfish water sanitation program; approximately 28 percent are condemned to shellfishing due to excessive levels of indicator bacteria in the water or the presence of point pollution sources. This percentage has remained relatively constant for the past six years. In addition, the NJDEP has found high levels of PCB's and certain pesticides (primarily chlordane) in finfish from New York-New Jersey interstate waters. As a result, recreational fishing advisories have been issued by the State for striped bass and bluefish taken in territorial waters from Barnegat Inlet northward (NJDEP 1986b). Hence, this portion of the New Jersey ocean waters out to 3 miles are regarded as partially fishable. Ocean waters tabled in this report as partially fishable are waters condemned to shellfish harvesting by the NJDEP and, or have fishing advisories in effect. These waters, however, are still regarded as supporting the propagation and maintenance of healthy marine communities and do contain finfish available for commercial and recreational use.

A sag in bottom dissolved oxygen levels is recorded offshore each year through the monitoring efforts of USEPA. These oxygen levels reach their minimum values along the coast during late August and early September, and are brought about by sediment

TABLE III-5 DESIGNATED USE SUPPORT AND DEGREE OF ATTAINMENT OF CLEAN WATER ACT GOALS IN STATE ESTUARINE AND OCEAN WATERS AS MEASURED IN SQUARE MILES.

ESTUARY: Designated Use Support

	Miles Evaluated	Miles Monitored	Miles Total
FULLY		530	530
PARTIALLY SUPPORTING		143	143
NOT SUPPORTING		18	18

ESTUARY: Clean Water Act (CWA) Goals

GOAL ATTAINMENT	FISHABLE	SWIMMABLE
Miles Meeting	531	420
Miles Meeting but Threatened		161
Miles Not Meeting	19	48
Miles Not Attainable	18	18
Miles Partially Meeting	126	

OCEAN: Designated Use Support

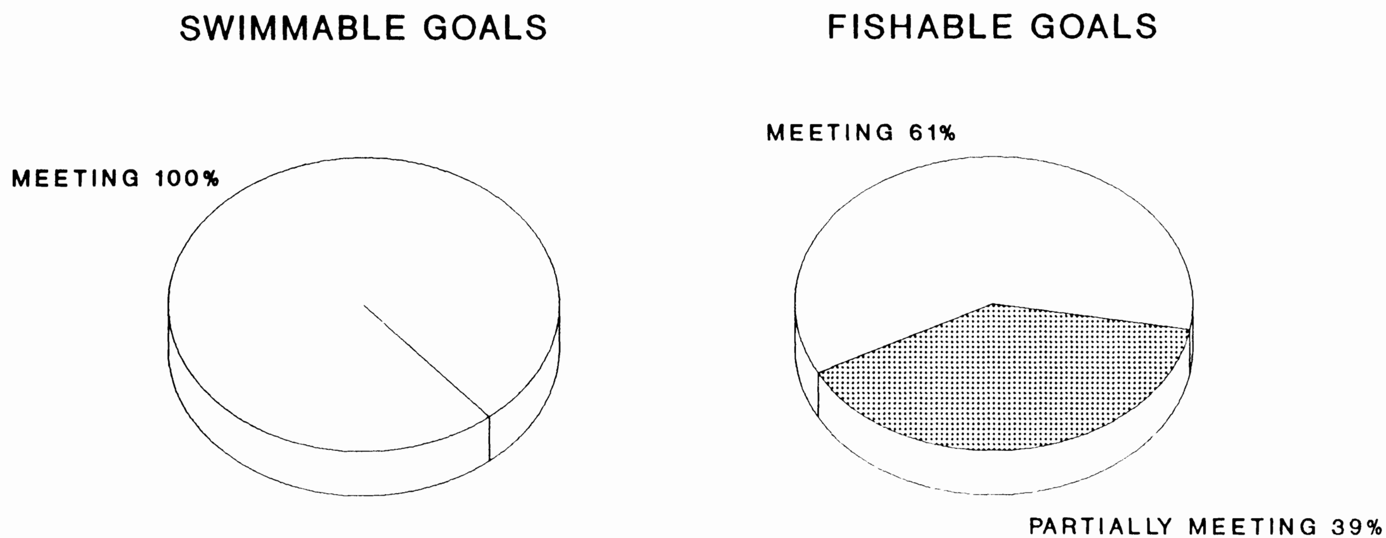
	Miles Evaluated	Miles Monitored	Miles Total
FULLY		266	266
PARTIALLY SUPPORTING		173	173
NOT SUPPORTING			

OCEAN: Clean Water Act (CWA) Goals

GOAL ATTAINMENT	FISHABLE	SWIMMABLE
Miles Meeting	266	146 (linear miles of coastline)
Miles Not Meeting		
Miles Not Attainable		
Miles Partially Meeting	173	

NOTE: Figures represent square miles unless otherwise noted.

FIGURE III-6
CLEAN WATER ACT GOAL SUPPORT:
OCEAN



SWIMMABLE GOALS EXPRESSED IN LINEAR MILES OF COASTLINE. FISHABLE GOALS REFER TO SQUARE MILES.

oxygen demand and reduced reaeration within the water column. The most critical area is usually a contained cell off of northern Ocean County. No significant benthic dissolved oxygen problems were reported during the summer of 1989 (P. Olsen, Division of Water Resources, NJDEP, personal communication). In 1990, the Marine Fisheries Administration within the Division of Fish, Game and Wildlife, and USEPA both noted dissolved oxygen sags from Belmar to Strathmere, 1 to 9 miles offshore. The lowest oxygen levels reported were 1.0 to 1.4 ppm occurring approximately 3 miles offshore (T. McCloy, personal communication).

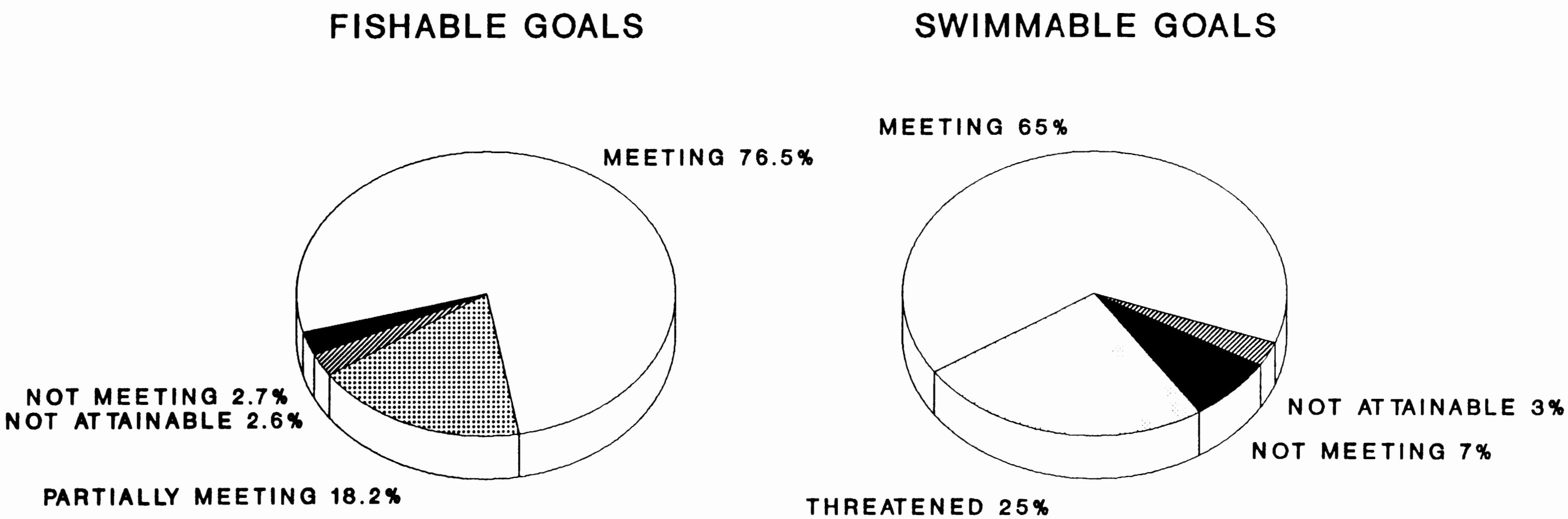
Problems of additional concern in the ocean are the incidences of phytoplankton blooms in coastal waters and wash-ups of floating garbage along bathing beaches. Phytoplankton productivity is considered high in the State's coastal waters, especially in the waters adjacent to the Raritan/Sandy Hook Bay, and the waters off Monmouth County. There are some fears, however, that phytoplankton blooms may be on the increase in southern New Jersey as well. In 1986, the NJDEP, USEPA, and the National Oceanic and Atmospheric Administration's National Marine Fisheries Service convened an interagency committee to investigate the casual factors related to the occurrence of these blooms along the coast. As a result of a subsequent study, significant progress was made in understanding the conditions that lead to some near-shore algal blooms (USEPA, 1987a). "Green tide events" did not occur during the year of the investigation (1986), nor the following years 1987 through 1989.

New Jersey ocean beaches are also aesthetically threatened with the occasional wash-up of floating garbage which was highly publicized in the summer of 1987, and resulted in discretionary beach closing from Point Pleasant through Long Beach Island in Ocean County (NJDEP 1990). A detailed discussion of this problem as well as Governmental responses to the problem are presented in the 1988 State Water Quality Inventory Report.

Estuarine Waters

Support of designated uses and the attainment of Clean Water Act goals for New Jersey's bays and estuaries are summarized in Table III-5 and Figure III-7. In regards to the Fishable CWA Goal and designated use; of the approximate 700 square miles assessed by monitoring agencies, 531 square miles are judged to be fully fishable (most of this mileage is in Delaware Bay), 126 square miles are judged to be partially fishable, 19 square miles are regarded as not fishable (all in Delaware Bay), and 18 square miles (all in New York-New Jersey interstate waters) are judged to be waters where goals are not attainable. The 126 square miles of New Jersey estuary are assessed to be partially fishable

FIGURE III-7
CLEAN WATER ACT GOAL SUPPORT
ESTUARIES



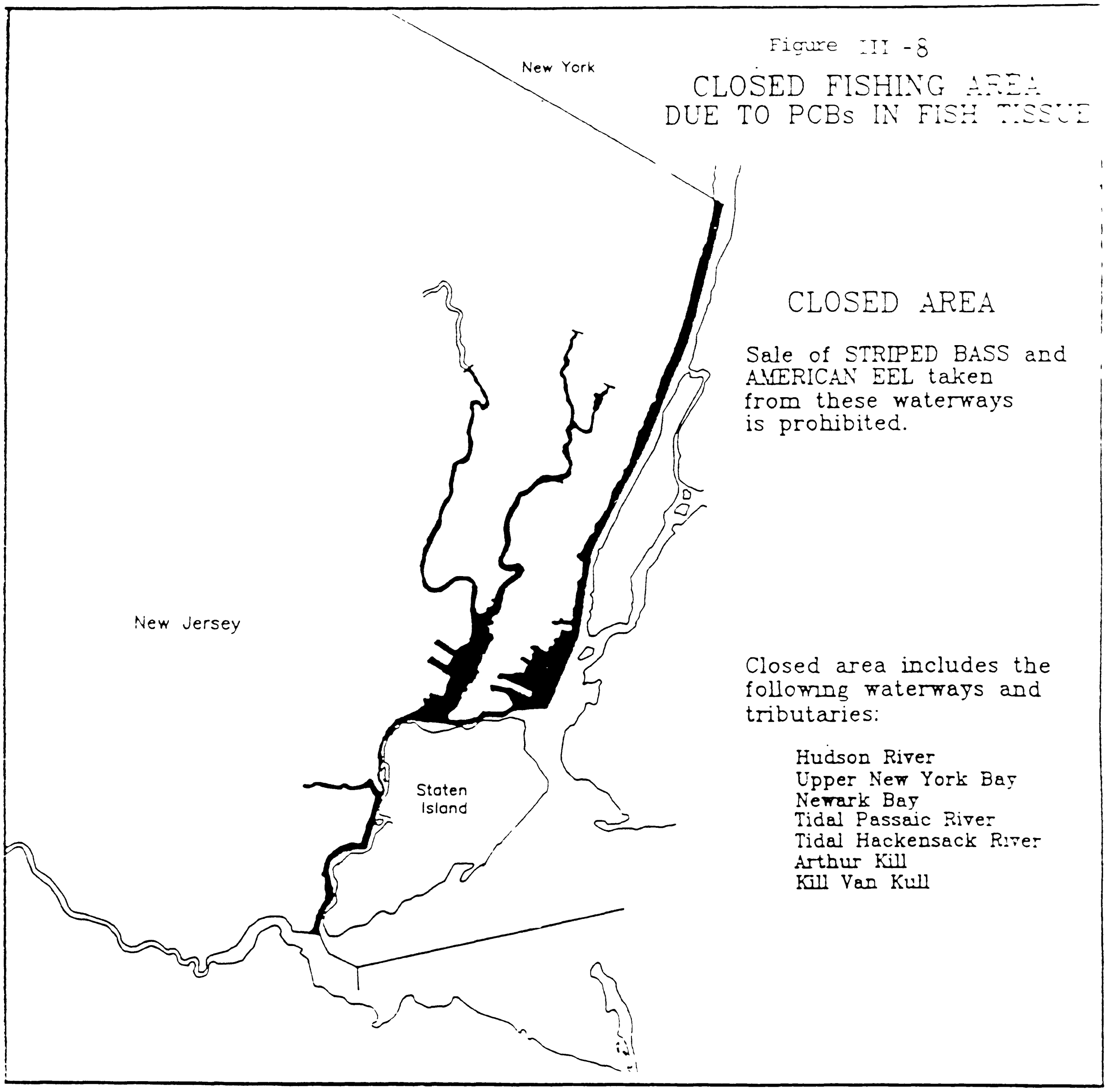
PERCENTAGES REPRESENT PROPORTION
OF SQUARE MILES ASSESSED

because, although they are condemned for shellfish harvesting, these waters do support the taking of finfish for commercial and recreational purposes and are assessed as supporting the propagation and maintenance of relatively healthy estuarine fish communities. A total of 630 square miles of estuarine waters are monitored for swimmability. Of these, 420 are fully swimmable (all in Delaware Bay). An additional 161 are fully swimmable but threatened (waters monitored by NJDEP). Forty-eight square miles are determined to be not swimmable; most of these miles being in Raritan/Sandy Hook Bay.

As stated above, a large portion of the total waters meeting clean water goals and designated uses are in Delaware Bay. The Delaware River Basin Commission (DRBC) (1990) reports the approximately 400 square miles of the Delaware Bay under New Jersey jurisdiction to be of good water quality based upon monitored fecal coliform data in 1988 and 1989. Delaware Bay in total, almost 800 square miles, is fishable with the exception of approximately 40 square miles assessed by the Commission to be not fishable. These 40 some square miles are under shellfish harvesting restrictions/prohibitions, and based upon the criteria followed by DRBC, such waters are classified as not fishable. If New Jersey's criteria are applied these waters, they would be regarded as partially fishable.

Although minimum dissolved oxygen levels were violated occasionally during the 1988 and 1989 summer seasons, the average dissolved oxygen level for the Bay remained largely above 6.0 mg/l (DRBC, 1990). The Cooperative Coastal Monitoring Program reported short term elevations in bacterial levels on the New Jersey shore facing the Bay in 1988 and 1989 (CCMP, 1989a, 1990).

The New Jersey-New York interstate waters including the Arthur Kill, Kill Van Kull, Hudson River, Newark Bay and tidal Hackensack River failed to meet designated uses or attain clean water goals due to extremely high levels of fecal coliform bacteria and severely depressed summertime dissolved oxygen concentrations. Additionally, the NJDEP has found high levels of PCBs and certain pesticides (primarily chlordane) in finfish from these interstate waters. As a result, commercial fishing bans and recreational fishing advisories have been issued by the State for these waters. Extensive sampling has turned up widespread dioxin contamination in certain fish and shellfishing species in both the tidal Passaic River and New York Bight Apex waters. Because tissue concentrations of dioxin above the US Food and Drug Administration's "level of concern" were identified (NJDEP, 1985c), the State of New Jersey has ordered a prohibition on the sale and consumption of all fish and shellfish taken from the tidal Passaic River. The ban has been extended to include striped bass and blue crabs from Newark Bay, tidal Hackensack River, Arthur Kill, and Kill Van Kull. Fish species and waters



Taken from: NJDEP, 1985 c.

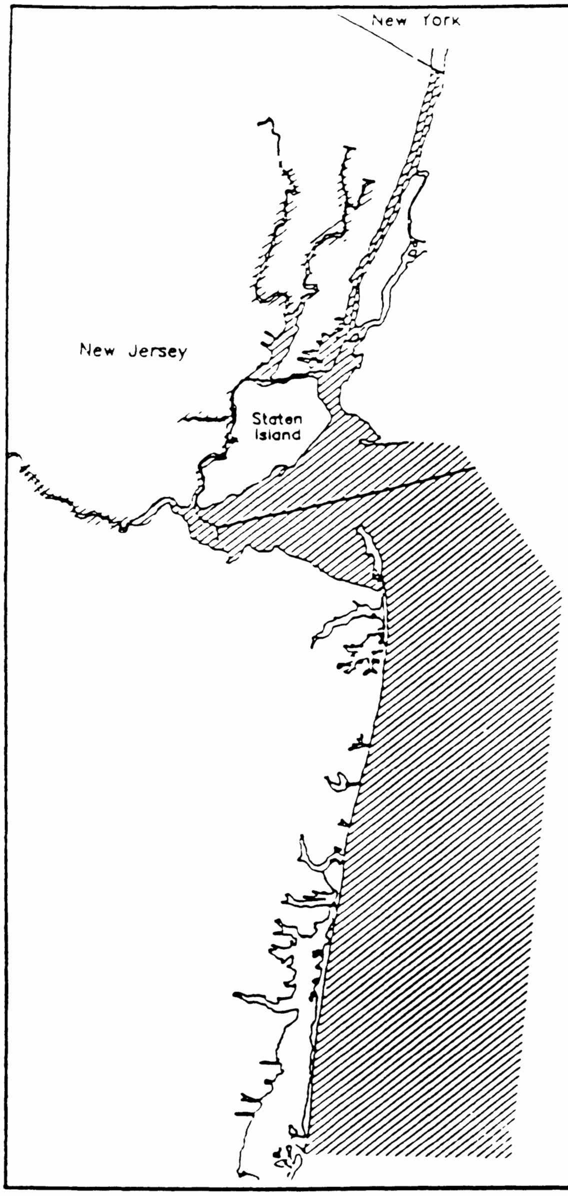


Figure III-9

FISHING ADVISORY AREA
DUE TO PCBs IN FISH TISSUE

ADVISORY AREA

Advisory in effect to limit consumption of STRIPED BASS, BLUEFISH, WHITE PERCH, WHITE CATFISH, and AMERICAN EEL.

Advisory area includes the following waterways and tributaries:

- Hudson River
- Upper New York Bay
- Newark Bay
- Tidal Passaic River
- Tidal Hackensack River
- Arthur Kill
- Kill Van Kull
- Tidal Raritan River
- Raritan Bay
- Sandy Hook Bay
- Lower New York Bay

STRIPED BASS and BLUEFISH advisory includes Offshore Waters for Northern Coastal Area.

AMERICAN EEL advisory includes all waterways statewide.

Taken from: NJDEP, 1985 c.

included in these bans and advisories are shown in Figures III-8, and III-9.

Phytoplankton blooms in the northern shores in 1988 were primarily confined to the Hudson/Raritan estuary (NJDEP,1989). Summer phytoflagellate blooms in the Raritan/Sandy Hook estuary in that year resulted in local fishkills of flounder, sea robins, crabs, and other species. Hypoxia was determined to be the cause. In May of 1989, slight nuisance conditions resulted from a bloom arising from the Raritan/Sandy Hook estuary, which extended down the coast to Long Beach Island (Paul Olsen, Division of Water Resources, NJDEP, personal communication). In the coastal regions a mixed flagellate/diatom blooms was recorded in October of 1989 extending from Asbury Park south to Barnegat Inlet and out to sea some five miles (Paul Olsen, personal communication).

Monitoring by the USEPA helicopter during the summers of 1988 and 1989 revealed nearshore bottom dissolved oxygen levels to be generally above the minimum levels (approximately 0.4 mg/l) necessary to support most forms of marine life. No significant low DO cells developed during 1989 (NJDEP, 1989a, Paul Olsen, Division of Water Resources, NJDEP, personal communication). In 1990 oxygen sags were observed from Belmar to Strathmere, extending from 1 to 9 miles offshore. The lowest levels recorded were 1 to 1.4 mg/l, occurring some 3 miles offshore (Tom McCloy, Marine Fisheries Administration, Division of Fish, Game and Wildlife, NJDEP, personal communication).

2. Causes of Water Quality Degradation

Ocean Waters

Because of the complexity of the coastal ocean system, the great variety of factors that influence ocean water quality, and the limited extent of ocean monitoring; cause and effect relationships between water quality and pollution sources are difficult to identify. In addition, determination of trends are generally limited to coliform data from shellfish harvesting areas and from bathing beaches. The principal source for elevated bacterial levels affecting coastal bathing beach closures is stormwater discharge along the coast as suggested by CCMP data (NJDEP, 1989a, 1990). This conclusion is based upon comparison of bacterial levels recorded during both dry periods and after rain events. The regionalization of sewage treatment along the New Jersey coast has improved bay and estuary water quality, yet is also responsible for greater and greater amounts of nutrients and oxygen-demanding materials being discharged to open ocean waters. There is concern that these sources, in concert with tributary inputs, the disposal of dredged materials,

TABLE III-6 SUMMARY OF POLLUTANTS FOUND IN NEW JERSEY'S OCEAN WATERS[1] (SQUARE MILES)

Pollutant Categories	Major/Statewide Impacts		Moderate/Localized/Minor Impacts	
	Monitored	Suspected	Monitored	Suspected
Unknown toxicity				?
Pesticides				?
Priority Organics	150			
Nonpriority Organics				
Metals		?		
Ammonia				
Chlorine				
Nutrients				270
pH				
Siltation				
Organics Enrichment/DO				270
Salinity/Road salts				
Thermal modification				
Flow alteration				
Habitat alterations				
Pathogens			?	
Radiation				
Oil and Grease				

Key: ? = Impact is suspected; a lack of monitoring data exists to substantiate the conclusion.

Footnote: 1 = Covers waters out to 3 miles.

TABLE III-7 SUMMARY OF THE SEVERITY OF POLLUTANT SOURCES IMPACTING NEW JERSEY'S OCEAN WATERS[1] (SQUARE MILES)

Source Categories	Major/Statewide Impacts (Suspected)	Moderate/Localized/Minor Impact (Suspected)
Point Sources		
Industrial	?	
Municipal		270
Combined sewer outfalls		120
Stormwater outfalls		
Nonpoint Sources		
Agriculture		120
Silviculture		
Construction		
Urban Runoff		120
Resource Extraction		
Land disposal		
Hydrologic/habitat modifications		

Key: ? = Impact is suspected; a lack of monitoring data exists to substantiate the conclusion.
Footnote: 1 = Covers waters out to the 3 mile limit.

and the outflow from the Hudson/Raritan estuary, are all contributing to the gradual enrichment of our coastal waters, leading perhaps to more extensive benthic anoxia in the summer, and to phytoplankton blooms of ever increasing intensity and frequency.

The specific source of floating garbage washing up on New Jersey beaches have been studied (NJDEP 1987c). The New Jersey Floatables Study has indicated that floatables arise in the Hudson/Raritan estuary, specifically the dense population centers of the New York/New Jersey metropolitan area. Significant sources of floatables were found to include raw sewage discharges, CSO's, and marine transfer stations including the Fresh Kills Landfill. The study states that currents and tidal patterns in the region are such that any floating material could become deposited on the New Jersey coast.

Tables III-6 and III-7 indicate which pollutants and pollution source categories impact ocean waters.

Estuarine Waters

The severely degraded water quality occurring in the New Jersey-New York interstate waters as well as in the tidal Delaware River near Philadelphia is due to the large amount of untreated and primary treated wastewaters still being discharged to these waters. In New York City alone, over two billion gallons per day is discharged, with ten percent being raw sewage (NJDEP, 1985b). Twice this amount may be discharged during storm events by combined sewage outfalls. In a use attainability study, NJDEP, (1985b) determined that even with the projected improvements in sewage treatment from New York and New Jersey facilities, pollution from nonpoint sources and combined sewer outflows, together with high benthic oxygen demands will continue to severely stress these waters.

Bacterial contamination in estuarine waters monitored by the CCMP, specifically the Atlantic Coastal Basin and some Delaware Bay estuaries, are closely tied with stormwater discharges (NJDEP, 1989a). In bay areas with low flushing rates, the stormwater effect can be severe and of longer duration than in areas where current circulation would support the dispersion of stormwater and its bacterial loading. This stormwater effect on the fecal coliform concentrations in the bays is often confounded by the bacterial loading from the illegal discharge of marine sanitation devices on boats, the presence of large wildlife populations, and the resuspension of sediments by boat-created turbulence (NJDEP, 1989a). Hence for bay CCMP stations which exceeded sanitary standards, the specific cause of the increased fecal coliform concentrations could not be determined. The Bureau of Marine Water Classification and Analysis concurs that stormwater serves as a significant source of bacterial contamination, and that natural sources such as waterfowl populations often are significant additional contributors to the overall problem. The Bureau, as well as other agencies, add that additional bacterial contamination is suspected to be coming from tributary inputs to the bays. These tributary inputs carry additional runoff and septic tank leachate from sources upstream.

Tables III-8 and III-9 show which pollutants and pollution source categories have an impact on estuarine water quality in the State.

TABLE III-8 SUMMARY OF POLLUTANTS FOUND IN NEW JERSEY'S ESTUARIES (SQUARE MILES)

	Major/Statewide Impacts		Moderate/Localized/Minor Impacts	
Pollutant Categories	Monitored	Suspected	Monitored	Suspected
Unknown toxicity				?
Pesticides	70			
Priority Organics	70			
Nonpriority Organics				?
Metals				?
Ammonia				
Chlorine				
Nutrients	70	?		
pH				
Siltation		140		
Organic Enrichment/DO		?		
Salinity/Road salts				
Thermal modification				
Flow alteration				
Habitat alterations				
Pathogens	142			
Radiation				
Oil and Grease				?

Key: ? = Impact is suspected; a lack of monitoring data exists to substantitae the conclusion

TABLE III-9 SUMMARY OF THE SEVERITY OF POLLUTANT SOURCES IMPACTING NEW JERSEY'S ESTUARIES (SQUARE MILES)

Source Categories	Major/Statewide Impacts (Suspected)	Moderate/Localized/Minor Impact (Suspected)
Point Sources		
Industrial	?	
Municipal	140	
Combined sewer outfalls		
Stormwater outfalls	140	
Nonpoint Sources		
Agriculture	70	
Silviculture		
Construction	140	
Urban Runoff	140	
Resource Extraction		
Land disposal		?
Hydrologic/habitat modifications		

<u>Key:</u> ? = Insufficient information exists to quantify the extent of these suspected pollutant source categories.

E. ACID DEPOSITION AND WATER QUALITY IN NEW JERSEY

This section was originally prepared for the 1986 305(b) Report. Because of frequent requests for information on acid deposition in our state, the section was updated and reintroduced into the 1990 305(b) Report. As in the original 1986 report, the principal source for information on the topic was Acidic Deposition in New Jersey, prepared by the Governors Science Advisory Committee in 1985. This report is available through the NJDEP's Division of Environmental Quality and remains the most complete source of information regarding acid deposition in New Jersey.

Introduction

Acid deposition, commonly referred to as acid rain, has been publicized as a major environmental problem that is occurring world-wide. The problem has been recently identified to be especially prevalent in the eastern areas of North America and has been suspected of causing the acidification of freshwater streams and lakes. This acidification process results in reduced biological productivity and altered communities in aquatic ecosystems. In some instances it has been linked to the creation of biologically "dead" lakes and streams because the natural biota can not tolerate the significant increase in acidity.

New Jersey lies in the path of highly acidic precipitation found to exist in eastern North America. Although rainfall naturally has some acidity, the acidity of rainfall currently present in the northeastern United States is significantly greater than what is found in remote and undeveloped areas of the world. Limited monitoring of rainfall by the NJDEP finds an average pH of 4.3 in the State. This is within the average of 4 to 4.5 for the entire northeastern United States region. The measurement of acidity is commonly determined with pH, which measures the hydrogen ion concentration on a logarithmic scale of 0 to 14 Standard Units (SU). A pH of 0 to 7 indicates acidic solution, 7 is neutral, and 7 to 14 is basic.

Acidic deposition is the result of a combination of acid precipitation in the form of rain, snow and fog, and the dry deposition of acidic aerosols and gases from the atmosphere. The primary generators of acid precipitation are excessive amounts of sulfur dioxide (SO_2), oxides of nitrogen (NOx) and other organic species. The sources of these compounds is largely the combustion of fossil fuels. A small percentage of the substances resulting from fuel combustion emissions is converted to sulfuric, nitric and organic acids and salts of these compounds. These then form aerosols which are deposited in wet (rain/snow) and dry (dust) media. New Jersey is both an emitter of the substances and a recipient of emissions from adjacent and nearby states.

New Jersey has conducted and sponsored a number of studies to determine the severity, extent, and damage from acid deposition in the State. These studies have reviewed the concentrations of sulfur and nitrogen oxides in the atmosphere, ground and surface water quality with regard to changes in pH and alkalinities in specific areas, the sensitivity of the New Jersey environment to acid deposition, crop sensitivity to acid deposition, and the impacts of acid rain on man-made structures such as buildings, roads, and bridges. In addition in 1985, the Governor's Science Advisory Committee had created a Panel on Acidic Deposition in New Jersey to coordinate and further the study of acidic deposition in New Jersey. This section summarizes the results of studies performed in New Jersey concerning acid deposition and its impacts on the State's water resources.

Known and Suspected Effects of Acid Deposition on Water Resources in New Jersey

Two areas of New Jersey appear to be most sensitive to acid deposition. These areas are the Pinelands region of southern New Jersey, and portions of the Highlands and Ridge and Valley Provinces of northern New Jersey. The Pinelands are a naturally acidic ecosystem due to the low buffering capacity of the soils and the organic acids in decaying vegetation. Pineland streams contain a variety of acid tolerant organisms, and are susceptible to changes in pH. In northern New Jersey certain areas are underlain by bedrock with low buffering capacities. Streams in northern New Jersey appear to be more adequately buffered against acid deposition impacts than are lakes in the region. Some lakes and impoundments here have experienced reduced pH levels or are extremely susceptible to these reductions in pH.

Surface waters in the Pinelands are typically acidic with pH values normally from 3.5 to 4.5. Some investigations indicate that in undeveloped areas of the Pinelands the pH of the surface waters has declined approximately 0.1 to 0.2 pH units over the last several decades (see Acidic Deposition in New Jersey for a full description of these studies). However, the declines have not been linked to acid deposition. The threat of acid deposition to Pinelands aquatic life results from the differences in chemical compounds causing acidity. The natural acidity of Pinelands streams is due to a combination of a low buffering capacity in the soils and to the fulvic, humic, and tannic organic acids released from decaying vegetation. These acids complex with toxic metal ions such as aluminium and reduce their toxicity. In contrast, the acids imported via precipitation are predominantly sulfuric and nitric (mineral acids), and these increase the level of metal toxicity by increasing the dissolution of toxic metals into surface waters. Recent studies have provided evidence that mineral acids may be gradually displacing organic acids as the principal source of acidity in the undeveloped areas of this region (USEPA, 1988; Morgan and Good, 1988).

From a stream acidity and alkalinity standpoint, an even greater concern for Pinelands streams is increasing pH and alkalinity values. Many of man's activities tend to cause streams pH levels to rise. Sewage effluent discharges, the liming of crop lands and residental/commercial landscapes, and increased aquatic plant activity all can increase stream pH levels. Many Pinelands streams that are heavily impacted by man's activities now are only slightly acidic, with pH levels 1 to 2 units above natural conditions.

Certain lakes in northwestern New Jersey are now thought to be experiencing increased acidity because of acid deposition. Studies by Rutgers University for the NJDEP show that Catfish Pond, Long Pine Pond, and Crater Lake are highly stressed due to low pH levels (from 3.5 to 4.5). All three lakes are located on the Kittatiny Ridge. Long Pine Pond and Crater Lake contain only yellow perch, an acid tolerant fish, and are regarded as particularly stressed lakes. Research at these lakes also shows that reducing pH levels results in increased levels of trace metals such as lead, aluminum, and zinc within the water column. A lack of historical data however make strong associations between lake acidity and acid rain difficult in this region although acid rain is strongly suspected as being the principal source of acidity. Most other lakes and impoundments studied in New Jersey do not show reduced pH values and appear to have adequate buffering capacities against acidic deposition. Streams in northwestern New Jersey in general appear to have sufficient buffering capacity to prevent increases in acidity under most flow condition. Research conducted by the Division of Fish, Game and Wildlife suggest that rainbow trout and perhaps other acid sensitive species may experience declines in reproductive success due to pH suppression brought about by low flow conditions (NJDEP, 1988).

Activities of man in northern New Jersey that cause water pollution, just as in the Pinelands, tend to reduce acidity, increase pH, and mask the effects of acid deposition. In waterways heavily polluted with sewage effluent and nonpoint source runoff, pH values indicate generally near-neutral conditions. This is exemplified in the results of trend analyses performed on pH data from approximately 70 ambient water quality monitoring stations Statewide for the 1986 Water Quality Inventory Report. Of the locations assessed, 14 (20 percent) showed significant (p=.1) pH increases from 1977 through 1985. Only three locations were found to have decreasing pH values. The majority of the streams with increasing pH are heavily impacted by man's activities. Those stations with decreasing pH are primarily located in watersheds where the number of wastewater discharges has been or is currently being reduced and conditions are naturally somewhat acidic.

New Jersey regards the problem of acidic deposition as a threat to its environment and citizens. The Governor's Science Advisory committee had recommended that continued monitoring is necessary in order to firmly establish both baseline conditions and trends. New Jersey is continuing to conduct and fund research activities designed to help understand acid deposition and any subsequent effects it may have on our environment.

F. WATERS IMPACTED BY TOXICS FROM POINT AND NONPOINT SOURCES

The Clean Water Act (CWA) provides broad statutory authority which mandates that programs be implemented to control the discharge of pollutants to surface waters. Under sections of the Act, the States and USEPA are required to develop and implement both technology-based and water quality-based controls of toxic pollutants (specifically EPA's list of 126 priority pollutants), as well as conventional (and what USEPA has designated as nonconventional) pollutants.

Section 304(l) of the CWA of 1987 requires states to develop lists of impaired waters, to identify point sources and amounts of pollutants they discharge that cause toxic impacts. The section also mandates the development of individual control strategies for each such point source. These individual control strategies are designed to ensure that applicable water quality standards are achieved by no later than June 1992. The result of this effort has been to focus national surface water quality protection programs immediately on addressing known water quality problems caused either entirely or substantially by point source discharges of toxic "priority pollutants".

Pursuant to Section 304(l), the NJDEP's Division Of Water Resources generated a list in 1988 of impaired waters (the Long List). A second list, a subset of this "Long List" identified waters whose impairment is suspected to be partially or entirely due to point source discharges of what USEPA has defined as the 126 Priority Pollutants. 1990 updates of these two lists are provided in this section: Table III-A,B,C and D.

Both these lists serve to identify waters in need of water quality based effluent limitations. The determination of the maximum pollutant loads which can be absorbed by a waterway and still retain its designated uses and remain within CWA goals is stipulated in section 303(d) of the Clean Water Act. Such effluent limitations are termed Total Maximum Daily Loads (TMDL). New Jersey is currently in the process of developing TMDLs for a number of priority waters. A listing of these priority waters (Table III-E) represents the third and final list in this section.

1. Comprehensive List of Impaired and Impacted Waterbodies in New Jersey ("Long List")

The impaired and impacted waters of the State are identified in Table III-A,B,C. This list, prepared pursuant to Section 304(l)(A)(ii) of the Clean Water Act Amendments of 1987, identifies surface water in New Jersey impaired or impacted by toxic, conventional, and nonconventional pollutants. Waters are considered to be impaired when their quality either does not meet or only partially meets their designated uses (i.e., fish propagation/maintenance or swimmability) based on monitored data. Impacted waters, on the other hand, are those waters in which some water quality degradation has taken place, but there has been no determination of whether designated use is effected. Therefore, impacted waters may or may not be meeting their designated uses. A determination of whether a waterbody is impacted may be based upon monitoring data or upon professional judgement (if monitoring data is not available). In cases where monitoring data is unavailable, no determination can be made as to whether or not pollutant levels have exceeded water quality standards.

The impaired and impacted waters are segregated into three sub-lists. Table III-A is a listing of waters which are impaired by a combination of point sources and nonpoint sources. Table III-B lists those waters which are impaired exclusively by nonpoint sources. Table III-C identifies those waters which are <u>impacted</u> by nonpoint sources. It should be noted that Table C consists of a narrative statement, since <u>all</u> streams and lakes in New Jersey are affected by nonpoint sources to some degree. Impaired and impacted waterbodies may or may not be affected throughout their entire length: in many instances, insufficient information presently exists to quantify the full extent of their impairment.

The waterbodies listed in Table III-A are grouped by watershed and correspond with the organization of the watershed descriptions in Chapter III of this report. The New Jersey Division of Fish, Game and Wildlife performed the fishery evaluations which were used in determining whether fish propagation/maintenance (finfish) goals are being met. For estuarine waters, shellfish harvesting classifications were also used. In determining whether "swimmable" goals are being met, the Division of Water Resources examined bacterial levels in monitoring samples. The determination of swimmable goals and designated use are based upon New Jersey state sanitary criteria for primary contact recreation.

TABLE III-A. Waterbodies Which are Impaired by a Combination of Both Point Sources and Nonpoint Sources of Pollution

Waterbody	Fish Propagation/ Maintenance	Swimmable Impaired
Wallkill River	X	X
-Papakating Creek	X	X
-Black Creek	-	X
-Clove Brook	X	-
Paulins Kill	M	X
-Paulins Kill Lake*	X	-
Pequest River	M	X
-Furnace Brook	X	-
Pohatcong Creek	M	X
Musconetcong River	M	X
-Wills Brook	X	-
Delaware River Tribs. (Hunterdon County)		
-Wickecheoke Creek	X	X
-Alexauken Creek	M	X
Assunpink Creek	X	X
Crosswicks Creek	-	X
Rancocas Creek	M	X
Pennsauken Creek	-	X
-South Branch	X	X
-Strawbridge Lake*	-	X
Cooper River	X	X
Big Timber Creek	-	X
-North Branch	M	X
-South Branch	M	X
Raccoon Creek	M	X
Salem River	M	X
-Swedes Run	X	-

Waterbody	Fish Propagation/ Maintenance	Swimmable Impaired
Cohansey River	M**	X
Great Egg Harbor River	X**	X
Mullica River		
-Hammonton Creek	X	X
Manasquan River	M**	X
-Marsh Bog Brook	M	X
South Branch Raritan River	M	X
North Branch Raritan River	M	X
Millstone River	X	X
-Stony Brook	-	X
South River		
-Matchaponix Brook	M	X
-Manalapan Brook	M	X
Raritan River and Bay	X	X
Rahway River	X	X
Elizabeth River	X	X
-Morses Creek	X	-
-Kings Creek		
Upper Passaic River (headwaters to Pompton River)	X	X
Whippany River	X	X
Rockaway River	X	X
Wanaque River		
-Belcher Creek	X	-
Ramapo River	M	X
Pompton River	X	X

Waterbody	Fish Propagation/ Maintenance	Swimmable Impaired
Lower Passaic River (Pompton River to Newark Bay)	X	X
-Saddle River	X	X
-Second River	X	-
-Deepavaal Brook	X	-
Hackensack River	X	X
-Overpeck Creek	X	X
-Berry's Creek	-	X
Tidal Estuarine Waters		
-Cape May County	-**	-
Delaware River		
-Zone 3	X	X
-Zone 4	X	X
New York-New Jersey Interstate Sanitation Commission Waters (includes: Newark Bay, Hudson River, Arthur Kill, Kill Van Kull, Raritan Bay, and Upper New York Bay)	X	X

Notes:

1. Lakes, reservoirs, and wetlands are indicated by an asterisk (*).

2. An "X" in the Fish Propagation/Maintenance (finfish) or "Swimmable" column indicate that the goal is not being fully met. For certain waters, a use may be met at specific locations, but the waterway is not meeting the use throughout its entire length or at all times. Waters where shellfish harvesting constraints are in effect are indicated by a double asterisk (**).

3. A dash (-) in the Fish Propagation/Maintenance or Swimmable column denotes that there are no assessments as to whether the goals are being met; an "M" in the column indicate that goals are met.

TABLE III-B. Waterbodies Which are Impaired by Nonpoint Sources of Pollution

Tuckahoe River: Shellfish Impairment

Navesink River: Shellfish Impairment

Shabakunk Creek: Impaired as Evidenced by the Effects on Macroinvertebrates

Coastal Waters (Monmouth, Ocean, Atlantic Counties): Shellfish Impairment

Crater Lake (Sussex County): Fish Propagation/Maintenance Impairment

Woodbury Lake (Gloucester County): Swimmable Impairment

Toms River: Swimmable and Shellfish Impairment

TABLE III-C. Waterbodies Which are Impacted by Nonpoint Sources of Pollution

It is estimated that nonpoint pollution sources are impacting the quality of all surface waters (streams, lakes, estuaries, and coastal waters) in New Jersey to some degree, with many waterbodies suffering significant degradation.

TABLE III-D. Waters where impairment is suspected due to point source discharges of what USEPA has defined as the 126 "priority pollutants". These are not waters necessarily with known problems. This list is based upon violations of USEPA's federal acute toxicity criteria as observed in Discharge Monitoring Reports in concert with ambient monitoring water quality data from the receiving water in question.

Waterbody Name	Waterbody Description
Hackensack River	From the Oradell Reservoir to the confluence with Newark Bay.(Reach #:02030103001)
Upper New York Bay	From the confluence of the East River to the confluence with the Kill Van Kull. (Reach #:02030104001)
Newark Bay/Arthur Kill	From the confluence with the Passaic and Hackensack Rivers to the confluence with the Rahway River and the confluence with the Upper New York Bay. (Reach #:02030104002)
Arthur Kill	From the confluence of the Rahway River to the confluence with the Raritan River Bay. (Reach #:02030104003)
Raritan Bay	From the confluence of the Arthur Kill/Raritan River to the confluence with the Waackaack Creek. (Reach #:02030104005)
Lower Millstone River	From the confluence with Bedens Brook to the confluence with the Raritan River. (Reach #:02030105026)
Mid Millstone	From the confluence with Stony Brook to the confluence with Bedens Brook. (Reach #:02030105028)

SEGMENT DESCRIPTION		EPA-REACH #
5.	Stony Brook-from headwaters to confluence with the Millstone River	02030105-29
6.	Upper Millstone River-from Cranbury Brook to confluence with Stony Brook	02030105-30
7.	Upper Millstone River-from headwaters to confluence with the Cranbury Brook	02030105-31
8.	Cranbury Brook-from headwaters to the confluence with the Upper Millstone River	02030105-32
9.	Pompton River-from Ramapo River to confluence with the Passaic River	02030103-013
10.	Ramapo River-from state line to confluence with the Pompton River	02030103-14
11.	Pompton River-from Wanaque Reservoirs to the Ramapo River	02030103-15
12.	Raritan River-from confluence of North and South branches to Millstone River	02030105-05
13.	North Branch Raritan River from confluence of Lamington River to confluence of South branch	02030105-06
14.	N. Branch Raritan River-from confluence of Peapack Brook to confluence of Lamington River	02030105-07
15.	N. Branch Raritan River-from headwaters to the Peapack Brook	02030105-08
16.	Saddle River-from the Passaic River to the Hohokus Brook	02030103-011
17	Passaic River-from the Whippany River to the Pompton River	02030103-021
18	Saddle River-from the state line to the Hohokus Brook	02030103-031
19.	Hohokus Brook- from the headwaters to the Saddle River	02030103-032

Waterbody Name	Waterbody Description
Lower Pequest River	From the confluence with Bear Creek to the confluence with the Delaware River. (Reach #:02040105013)
Whippany River	From the headquarters to the confluence with the Rockaway River. (Reach #:02030103024)
Passaic River	From the confluence of the Dead River to the confluence with the Whippany River. (Reach #:02030103025)
Raccoon Creek	From the confluence with the South Branch Raccoon Creek to the confluence with the Delaware River. (Reach #:02040202004)
Kings Creek	From the headwaters to the confluence with the Rahway River.

TABLE III-E. Priority List of Reaches scheduled for Total Maximum Daily Load (TMDL) Determinations.

	SEGMENT DESCRIPTION	EPA-REACH #
1.	Whippany River-from headwaters to confluence with the Rockaway River	02030103-024
2.	Millstone River-from Bedens Brook to confluence with the Raritan River	02030105-26
3.	Bedens Brook-from headwaters to confluence with the Millstone River	02030105-27
4.	Millstone River-from Stony Brook to Bedene Brook	02030105-28

	SEGMENT DESCRIPTION	EPA-REACH #
20.	Wallkill River-from the state line to the Papakating Creek	02020007-026
21.	Papakating Creek-from headwaters to the Wallkill River	02020007-027
22.	Wallkill River-from Papakating Creek to the Mohawk Lake	02020007-028

G. RECOMMENDATIONS FOR IMPROVING WATER QUALITY IN NEW JERSEY

Water quality in New Jersey has improved in some streams and declined in others, but has generally held steady in most areas and waterways. How then, can greater improvements in water quality take place across the State?

Listed below are a series of recommendations based on the conclusions in this report. Improving water quality conditions, in the face of extensive residential and commercial development, will be a major challenge for all of the State's citizens, industries, and the various levels of government. Improvements in water quality will depend upon the level of commitment we are willing to make.

1. Increased Water Quality Monitoring Activities.

Much of the current water quality monitoring conducted in New Jersey is in the form of ambient networks. These networks, such as the Primary and Basic Water Quality Monitoring Networks, utilize the collection of bimonthly or quarterly samples from a fixed number of monitoring stations located on the larger streams in the State. The major purpose of these networks are to determine long-term water quality trends and general water quality conditions for use in the 305(b) reporting process. However, these programs do not identify specific sources of water pollution, the effects of these sources on stream quality and biota, the assimilation or removal of pollution by the stream environment, and the effectiveness of specific water pollution control activities. If public resources are to be used in the most efficient manner then specific sources of pollution, which can be controlled, must be properly identified and analyzed for impacts on the receiving waters and the aquatic ecosystem.

To accomplish these objectives, it is recommended that a long-term intensive survey monitoring program be implemented in the State. This program would supplement the existing ambient monitoring networks being conducted by NJDEP and other agencies under contract. Watersheds or segments of a watershed would be intensively sampled on a periodic basis, (including lakes) with the number of monitoring sites in the watershed dependent upon water quality, land uses, known and potential pollution sources, and the amount of historical data.

An intensive survey program would have as its specific objectives the following: Determination of water quality trends; diurnal stream quality; identification of pollution sources; quantification of pollution impacts on receiving waters (both point and nonpoint sources); comparison of water quality data to flow conditions; modelling for wasteload allocation purposes; determination of assimilative capacity of the waterbody; and statistical analysis of the data gathered.

2. Increased Identification of Nonpoint Sources of Water Pollution

Nonpoint source pollution has been identified in this report as a significant impediment to achieving designated water uses and the water quality objectives of the Clean Water Act. In addition, very little instream monitoring for nonpoint sources has been performed. In order to implement nonpoint source control measures nonpoint sources must be identified. The first step must be to segregate nonpoint source (NPS) from point source pollution. This would require a substantial upgrade of monitoring efforts throughout the State for this purpose. In addition, monitoring should be directed to locate specific NPS, as best possible in order to allow an effective focus for the implementation of effective control measures.

3. Ambient Monitoring for Estuarine Waters

New Jersey's estuarine waters play a significant role in the vitality of many activities in the State; they range from supporting wildlife habitat to tourism and aesthetics. Despite their value, very little ambient monitoring is performed in these waters. With the exception of sampling for bacteria in shellfish growing waters and bathing waters and monitoring by interstate agencies of their respective regions, most estuarine waters are not routinely evaluated. It is recommended that a routine ambient monitoring program be developed for tidal waters of major rivers and the larger bays of the State. The purpose of this program would be to determine long-term trends in estuarine water quality, evaluate year-round conditions, analyze potential tributary impacts, and the critical water quality constituents.

4. Greater Emphasis in Nonpoint Source Management

Nonpoint sources are a statewide and significant pollution problem. As such a greater commitment for their control is needed. This report recommends that a nonpoint source (NPS) control policy be divided into two overall efforts: education and source control.

Education would be directed to specific audiences: from the general public to local officials to special user groups. Public education could highlight such issues as proper septic tank maintenance, disposal of household chemicals, motor oils, pet wastes, the proper use of chemicals employed in lawn and garden care, and local and state ordinances or laws. The general public needs to be aware of the contribution they make to NPS pollutants.

NPS controls should be established as part of routine road and stormwater infrastructure systems. The incorporation of municipal stormwater management laws (that include water quality control features) into local and county planning ordinances is necessary in the State for both new construction activities and existing infrastructure (retrofitting). Routine maintenance and inspections of such structures are also necessary.

5. Coordinated Watershed Management Activities

All activities in a watershed dealing with water pollution control and water resource management should be coordinated so that duplication of effort is eliminated and maximum efficiency results. This coordination should involve local, county, regional, state, and federal agencies; with special consideration given to local and county health offices or departments, in light of responsibilities designated to those agencies under the New Jersey County Environmental Health Act of 1977 (P.L. 1977, c 443).

Because water quality decisions ultimately affect water supplies, wastewater policies need to be developed that more appropriately reflect the need to conserve and protect our dwindling water supplies. Efforts should be made to integrate water supply management and planning with wastewater management and planning on both Statewide and Areawide Water Quality Management Plans, so that water supply issues are correlated with wastewater planning. For example, proposals for new wastewater discharges should be correlated with the availability of water supply sources. If a wastewater management plan (WMP) proposes a new wastewater discharge that represents a significant depletive use, the WMP should be required to include a program for conserving water supplies or obtaining other water supply sources to compensate for the depletive use.

Additional activities that would benefit from a coordinated approach include water quality monitoring, water use identification, location and recognition of pollution sources, and generation of public support for water quality management activities.

It is recommended that the NJDEP continue to pursue initiatives developed by the U.S. Environmental Protection Agency's Clean

Water Strategy. This strategy encourages watershed-by-watershed pollution control actions.

6. Achieving Necessary Effluent Quality from Point Sources

Due to the large number of point sources in many of New Jersey's watersheds, wastewater can often have profound impacts on stream water quality. In addition, streams in the State which are consistently suffering from poor water quality, have on the average, the greatest number of wastewater treatment plants that are not meeting their effluent requirements. If clean water goals are to be met in New Jersey, it is imperative that all point sources be in compliance with their discharge permit limitations. Poor discharge quality is often due to inadequate, antiquated or underdesigned treatment systems and the poor or delinquent operation of facilities. Although most primary treatment plants are now eliminated, many secondary treatment plants are discharging unsatisfactory treated wastewaters because of system overload or improper operation. These deficiencies need to be corrected at all municipal/domestic, industrial and other wastewater facilities.

H. WATER QUALITY INVENTORY

Introduction

This section of Chapter III contains waterbody specific information on water quality conditions, pollution problems, and designated use attainment in New Jersey's larger rivers and streams. An evaluation of whether Clean Water Act goals (swimmable and fish propagation/maintenance) are being achieved is also presented. Thirty-seven watershed assessments have been made for this report, as well as a summary of shellfish growing waters classifications in the State's coastal bays, estuaries and ocean waters. Summaries of the Delaware River Basin Commission 305(b) report submittal on the Delaware River, and the Interstate Sanitation Commission's assessment of their jurisdictional waters are included in this chapter. The detailed assessments in this chapter are the basis for the summaries presented earlier in the Chapter.

The primary waterways assessed in this section are listed in Table III-10. As with prior 305(b) reports, watersheds are reviewed separately and not in groups. Each watershed assessment contains the following narrative sections: Watershed Description, Water Quality Assessment, and Problem and Goal Assessment. Also included is a watershed map (certain watersheds are mapped together), a 'Water Quality Index Profile' table, and a wastewater discharge inventory.

The Watershed Description is a brief characterization of stream geography, land uses, population centers, and stream classifications according to the State Surface Water Quality Standards (N.J.A.C. 7:9-4.1 et seq.) (NJDEP, 1985a). Much of the information contained in this section is taken from prior 305(b) reports and the Areawide Water Quality Management Plans. The land use statistics are, for the most part, based on information collected in the mid-1970s, and as such should be used to obtain a general sketch of the watershed. Sub-watersheds are also mentioned in the Watershed Description. These sub-watersheds are portions of the larger, full watershed, and serve as the basis for the Waterbody System segmentation which the US Environmental Protection Agency (USEPA) has asked the States to provide. The Waterbody System is an automated data management system developed by USEPA for the information contained in this report.

This 1990 Water Quality Assessment represents an update of the information as presented in the 1988 Inventory Report, and contains a description of water quality conditions updated through January 1990 for the State's major rivers and streams. The assessment also includes fishery community descriptions provided by the NJ Division of Fish, Game and Wildlife for the 1988 Report and updates on biomonitoring summaries performed at selected locations in 1988. The primary source of data for the Water Quality Assessment is that collected at approximately 110 ambient monitoring stations around the State. The results of special or intensive surveys are also utilized when available.

Assessments based upon instream monitoring of freshwaters including swimmable assessments, fishable assessments (when Fish and Game assessments are unavailable), and Water Quality Index tables) are all based upon data collected between 1983 and 1987. In order to supply sufficient data points, the computations for the Water Quality Index (discussed in detail below) must have data coverage over a continuous five year time span. This approximately two-thirds overlap of data points between each succeeding edition of this Inventory Report can obscure significant changes in water quality should the changes occur during one or more of the "overlap" years. This has resulted in the decision to update the Water Quality Index every four years instead of every two. This would minimize data overlap to one year instead of three and render water quality changes more apparent.

This report utilizes the water quality indexing procedure presented in the New Jersey 1986 305(b) report. The Water Quality Index (WQI) was developed by the USEPA Region X for assessing water quality conditions and trends for regional and national environmental profiles. The WQI is a modified version of a WQI first developed and described by the National Sanitation Foundation in 1970 (Brown, et. al., 1970).

The Water Quality Index transforms water data to a value between 0 (best) and 100 (worst) through the use of severity curves. The severity curve is a plot of the water quality constituent concentration (i.e. dissolved oxygen, phosphorus, etc.) versus pollution assessment (the 0 to 100 scale or index). The indices for each data value are then averaged and aggregated with the indices for the other indicators assessed to get a single WQI value for a location over time. The WQI procedure aggregates indices by Pollution Category, and within each Category, by Component Parameters. Table III-11 presents the Pollution Categories and Components used to prepare the WQI for New Jersey's waters.

The WQI is based on a scale from 0 to 100, where 0 represents no pollution or best conditions, and 100 equals gross pollution or worst case conditions. Between these extremes the WQI scale is divided into excellent, good, fair, poor and very poor conditions. Table III-12 shows the WQI value and associated classifications.

TABLE III - 11 WATER QUALITY INDEX CATEGORIES, COMPONENTS, AND CRITERIA FOR ASSESSING NEW JERSEY'S RIVERS AND STREAMS

Criteria Category	Component	(Index Value of 20)
Temperature	Temp. Cold-water fishery	19°C
	Temp. Warm-water fishery	28°C
Oxygen	Dissolved Oxygen-Trout Production	7 mg/l
	Dissolved Oxygen-Trout Maintenance	5 mg/l
	Dissolved Oxygen-Nontrout	4 mg/l
	D.O. Saturation	80, 120 %
pH	pH-Non-acidic waters	6.5 - 8.5 SU
	pH-Pinelands naturally acidic	3.5 - 5.5 SU
	pH-Non-Pinelands naturally acidic	4.5 7.5 SU
Bacteria	Fecal Coliform	200 MPN/100ml
	Total Coliform	2400 MPN/100ml
Nutrients	Total Phosporus-Free flowing waters	10 mg/l
	Total Phosphorus-Above impoundment	0.05 mg/1
	Total Kjeldahl Nitrogen	2.5 mg/l
	Total Inorganic Nitrogen	2.0 mg/l
Solids	Total Dissolved Solids	500 mg/l
	Conductivity	750 micromhos
Ammonia	Un-ionized-Warm waters	0.05 mg/l
	Un-ionized-Trout waters	0.02 mg/l
Metals	Total Lead	50 ug/l
	Total Copper	50 ug/l
	Total Mercury	0.50 ug/l
	Total Cadmium	4.0 ug/l
	Total Chromium	50 ug/l

TABLE III - 12 WATER QUALITY INDEX (WQI) CLASSIFICATIONS

WQI	Classification/Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels causing severe stress to streamlife, water uses not met.

An index of 20 is equivalent to the level of water quality criteria.

WQI values are calculated for all data of each component in a category. The water quality indicator (component) with the highest WQI values in a category is then aggregated to determine the final station WQI value. Station total WQI values are given for the entire period of review and for each month in the years assessed. Two aggregation methods are available: an "additive", and a "synergistic" aggregation. The synergistic procedure is used for this report as it tends to better represent actual conditions. The synergistic aggregation procedure takes the average of each category and then adds more index "points" based on how much the data exceeds respective criterion. A total station WQI value is also determined for the worst three month period to establish what are the critical periods in the stream.

The WQI procedure is performed through STORET: USEPA's national computerized water quality database. WQI values are calculated for approximately 150 ambient water quality monitoring stations in New Jersey and interstate waters; the Delaware River Basin Commission utilizes the WQI as a supplemental assessment methodology in their 1990 305(b) report submittal. The WQI serves as the basis for the water quality component of the Surface Water Rating System presented in Chapter V and assists in performing the water quality assessments in this chapter. The WQI along with a summary statement of the raw data (number of values, mean, geometric mean and percent exceeding criterion) are the primary information used to prepare the water quality assessments. WQI results for each monitoring station are summarized in a WQI Profile table located in each watershed assessment.

Fixed-station ambient biomonitoring is also utilized in the water quality assessment when it is available; eighteen stations have had their macroinvertebrate community assessed in 1988. The stations where biomonitoring is conducted are listed in Table III-13. More information on macroinvertebrate monitoring can be found in the report by the NJ Department of Environmental Protection (NJDEP 1989).

Water quality data used for this report originates from three ambient monitoring networks in the State. Two networks are affiliated with the US Geological Survey (USGS) - the National Stream Quality Accounting Network (NASQUAN) and the NJDEP/USGS Joint Primary Network. Six NASQUAN stations are present in the State; sampling is conducted at various intervals, ranging from hourly for temperature and specific conductance to four times yearly for trace metals. Most indicators are sampled either monthly or every two months. Sampling for the NJDEP/USGS Joint Network is generally performed six times yearly for the 82 stations in this network. Certain supplemental sampling is conducted once to twice yearly.

TABLE III - 13 AMBIENT BIOMONITORING STATIONS:
Macroinvertebrate Sampling

Pequannock River at Macopin Intake
Millstone River at Blackwells Mills
Rockaway River at Boonton
North Branch Raritan River at Raritan
South Branch Raritan River at Stanton Station
Flat Brook at Flatbrookville
Musconetcong River at Bloomsbury
Pequest River at Pequest
Wallkill River at Sussex
Assunpink Creek at Trenton
Cooper River at Haddonfield
Maurice River at Millville
NB Rancocas Creek at Mounty Holly
SB Rancocas Creek at Lumberton
Salem River at Woodstown
Great Egg Harbor at Folsom
Manasquan River at Squankum
Mullica River at Green Bank
Manasquan River at Squankum
Hackensack River at Rivervale
Passaic River at Singac

Sources: NJDEP, 1989b

The third ambient monitoring program is USEPA's Basic Water Monitoring Network. There are 26 stations in this network in New Jersey and sampling is performed four times yearly (seasonally). Supplemental samples are collected yearly for metals, macroinvertebrates, and dissolved minerals.

Toxics monitoring results for each watershed are described in the 1982 305(b) report. Toxics assessment is not present in this year's report because statewide toxics monitoring is not being performed. The NJDEP used to conduct statewide ambient monitoring for toxics in the late 1970s. The monitoring program for toxics, coordinated through the NJDEP's Division of Science and Research, now performs site-specific studies. Monitoring is performed for specific problem areas as deemed necessary. The results of these studies are included in the Water Quality Assessment or Problem Assessment sections, when available.

This report carries over from the 1988 Inventory Report descriptions of the type of fish community present in the State's waterways and the healthiness of the community. This information is part of the Water Quality Assessment and is designed to supplement the results of chemical and biological monitoring. The fish community assessments are provided by regional biologists of the NJDEP's Division of Fish, Game and Wildlife. The assessment includes a determination of the primary types of fish found (warm or cold water species) and the healthiness of the fish community (healthy, moderately degraded or degraded). The three health classifications are defined as follows:

Healthy: Adequate game fish reproduction and/or adequate species diversity in relation to the natural characteristics of the water. If present, carp or goldfish compose only a minor segment of the population.

Moderately Degraded: Minimal to no game fish reproduction and/or less than adequate species diversity and/or carp or goldfish a major segment of the population.

Degraded: Population dominated by carp, goldfish, or killfish. Or fish population absent or virtually absent.

The Problem and Goal Assessment section presents known and suspected water pollution problems in a watershed, and concludes which monitored surface waters are meeting State designated uses and national swimmable and fishable clean water goals. The section is divided into Point Source Assessment, Nonpoint Source Assessment, and Designated Use and Goal Assessment.

The information used to describe pollution problems comes from a variety of sources. The point source inventory identifies the relative contribution of point source loadings to the stream.

The Department's Division of Water Resources (DWR) Enforcement Element has prepared a description of surface water dischargers currently under enforcement action which are causing deleterious impacts on surface waters, and the pollutants being discharged. This listing of enforcement cases is used to help determine pollution sources. The State's hazardous waste sites which are contaminating local surface waters, as determined by the NJDEP Division of Hazardous Site Mitigation, are also included in the point source part of the Problem and Goal Assessment. More detailed information on the sites can be found in Site Status Reports on Hazardous Waste Remediation (NJDEP, 1988a). Other sources of information used in this section are prior 305(b) reports, Construction Grants projects which have been completed, are under construction or are being planned, and other site-specific studies.

An important component of the 1988 Inventory Report was a state-wide nonpoint source pollution assessment. The National Water Quality Act of 1987 had required states to prepare assessment reports and management programs for nonpoint sources by August 1988 and that the assessment reports be presented in the state's 305(b) report. These assessments described the nature, extent, and effect of nonpoint sources of water pollution, the causes of such pollution, and the waterways impacted. From this effort grew the <u>New Jersey Nonpoint Source Assessment And Management Program</u> (NJDEP, 1989). Details of the program are reviewed in Chapter V. The initial nonpoint source assessment is described in detail in the Management Program document (NJDEP, 1989).

Two levels of assessment are performed by the Department when appraising water quality as well as determining the causes and sources of water degradation. **Monitored assessments** are those based on actual waterway sampling collected within the past five years. **Evaluated waters** are those assessed with best professional judgement, the presence of known or potential sources, fishery surveys, citizen complaints or older monitoring data. In New Jersey there has been very little monitoring specifically for nonpoint sources. In addition most of the State's larger rivers, streams and estuaries/ocean waters have one or more wastewater discharges. Therefore, it becomes very difficult to determine the source of pollutants and the contribution they make to stream degradation once identified. Even when modelling studies of streams are performed, they are usually designed for low flow analysis and/or for the purpose of point source waste load allocations.

The determination of whether or not a waterbody is meeting the State's designated uses and clean water goals is based on a variety of criteria. In New Jersey all freshwaters are assigned designated uses which reflect State and National clean water goals (swimmable and fish propagation/maintenance). Most estuaries and all ocean waters (those classified SE-1 and SC-1) also have designated uses consistent with the clean water goals. Tidal waters in the New York Harbor area and the Delaware River around Philadelphia (SE-2 and SE-3 waters) are not required to meet clean water goals; their designated uses are less stringent than the goals. Table III - 14 presents the designated uses assigned to the various surface water classifications. More information on the State's water quality standards and classifications can be found in NJDEP (1985a). Conclusions regarding attainment of the swimmable designated use/goal is based primarily on ambient monitoring results. Swimmable status is determined by the presence of fecal coliform bacteria, as identified in ambient monitoring. If monitoring finds no fecal coliform levels above the State criterion of 200 MPN/100ml, then the waters are deemed swimmable. If up to 25 percent of the fecal coliform values exceed the criterion, then waters are classified as marginally swimmable. Greater than 25 percent indicates that waters are not swimmable. It should be noted that regardless of the swimmable classification assigned to a stream, swimming is recommended only in those waters routinely monitored for bathing. Each monitoring station is thought to assess five stream miles (2.5 miles upstream and downstream).

Achievement of the fish propagation and maintenance (fishable) goal is based primarily on resource information, but water quality analysis are utilized. In this year's report, fisheries resource information is the main assessment tool for determining if the fish propagation/maintenance use is being met. The fisheries assessment presented in the Water Quality Assessment section describes the quality of the fisheries; this in turn is the basis for determining if the stream supports a fish community which is healthy and reproducing. Table III - 15 shows the different designated use definitions concerning the fish propagation/maintenance use. Because of this new methodology for determining attainment of the fish propagation and maintenance use goal, certain waters that were formally considered as meeting the use goal are now noted as threatened or partially degraded, and vice versa.

Dissolved oxygen, pH, unionized ammonia, and the presence of elevated toxic substances in aquatic life are evaluated to determine if stressful conditions to fishlife are present. Biomonitoring data is also utilized along with the water quality data. It should be noted that many factors affect the suitability of a waterway to support a healthy fish community. Not all factors are reviewed during ambient monitoring, and therefore, actual community conditions may vary from what is described in this report.

TABLE III - 14
SELECTED DESIGNATED USES AND THEIR ASSOCIATED WATER CLASSIFICATIONS

	Designated Use	Water Classification
1.	Primary and secondary contact recreation	FW-1, FW-2, SE-1, SC and PL
2.	Secondary contact recreation	SE-2, SE-3
3.	Maintenance, migration and propagation of the natural and established biota (PL) (biota indigenous to the unique ecological region)	FW-1, FW-2, SE-1, SE-2, SC,
4.	Maintenance and migration of fish populations	SE-3
5.	Shellfish harvesting in accordance with State regulations.	SE-1, SC
6.	Public potable water supply, after such treatment as required by law or regulation	PL, FW-2

Source: NJDEP, 1985a

TABLE III - 15 DEFINITION OF THE FISH PROPAGATION AND MAINTENANCE DESIGNATED USE CLASSIFICATIONS

Classification	Definition
Fully Meeting Fish Propagation/ Maintenance Use	Fish community is healthy. Water quality conditions are excellent to fair.
Fully Meeting Use, but Threatened	Fish community is healthy, but man-related pollution sources have observable impacts on the fisheries. Pollution problems may be worsening.
Partially meeting the fish propagation/maintenance use	Fish community is classified as moderately degraded. Water quality ranges from fair to very poor.
Not meeting the fish propagation/ maintenance use	Fish community is classified as degraded or severely degraded. Water quality ranges from fair to very poor.

1. WALLKILL RIVER

Watershed Description

The Wallkill River drains from New Jersey into New York and has a 203 square mile watershed in New Jersey. The 27 mile length of this river in New Jersey is located in Sussex County. This area is predominantly rural, the largest towns being Vernon, Sparta, Franklin, and Sussex. Major tributaries flowing into the Wallkill include the Papakating (15 miles long) and Pochuck (8 miles long) Creeks. Lakes and impoundments in this watershed include Lake Mohawk (at the headwaters), Newton Reservoir, Lake Grinnell, Wawayanda Lake, and many others. Four sub-watersheds have been delineated for the Wallkill watershed: Upper and Lower Wallkill, Papakating Creek and Black Creek.

The land use in this watershed is primarily forested and agricultural, although the amount of developed land is increasing. There are 23 New Jersey Pollution Discharge Elimination System (NJDPES) permits here, of which 15 are municipal and 8 are industrial/commercial. Most of the Wallkill River is classified FW-2 Nontrout, except for the stretch from Sparta Glen Brook to the Rt. 23 bridge, which is classified as FW-2 Trout Maintenance. Papakating Creek and Clove Brook contain both FW-2 Trout Maintenance and Nontrout waters.

Water Quality Assessment

Five monitoring stations are present in the Wallkill River watershed: Wallkill River at Franklin, Sussex and near Unionville, New York, Papakating Creek at Sussex, and Black Creek near Vernon. They represent approximately 30 stream miles. Water quality of the Wallkill River is generally good at all three stations, although conditions degrade somewhat during summer months to fair quality. Total phosphorus and fecal coliform are often found at problematic levels. Black and Papakating Creeks have somewhat poorer water quality than the Wallkill because of higher bacterial and nutrient levels.

The Wallkill at Franklin is impounded to form Franklin Pond. Below the Franklin Pond outlet the Wallkill can experience severely reduced flow during the summer months, resulting in high stream temperatures that may cause stress to cold water fish. Nutrients, notably total phosphorus, increase in the Wallkill as one travels downstream. This is also true of fecal coliform, with geometric means going from 84 MPN/100ml at Franklin to 236 MPN/100ml at Sussex and 283 MPN/100ml at Unionville. Papakating Creek contain levels of phosphorus and fecal coliform that exceed state criteria in 61 and 77 percent, respectively, of all samples collected. Water quality in Papakating Creek is fair to poor in late summer/early fall. Black Creek has conditions similar to Papakating Creek, but pollutant levels are not quite as high. Metals were generally within acceptable levels throughout the watershed, but one elevated cadmium concentration was detected in the Wallkill River at Franklin.

Biomonitoring conducted in the Wallkill River at Unionville in 1986 had confirmed the results of the chemical data taken at approximately the same time. Macroinvertebrate and periphyton indicated generally healthy and favorable conditions, although some organic enrichment was however suggested. Macroinvertebrate sampling since 1977 here has found no appreciable changes. Biomonitoring at Sussex in 1988 also suggest some nutrient enrichment at this station, in contrast to chemistry data obtained the previous year.

The Upper Wallkill is described by the New Jersey Division of Fish, Game and Wildlife as supporting a healthy cold water fishery. The lower 18 miles in contrast, is characterized as partially degraded, stretches of which have had histories of fish kills. Fish species present in the Lower Wallkill are principally warm water forms. Franklin Pond and Black Creek support healthy cold water fish communities. Wawayanda and Pochuck Creeks, tributaries to Black Creek, also contain healthy fisheries; the former contains both cold and warm water species, the latter is limited to cold water forms. Clove Brook is characterized as partially degraded and contains both cold and warm water fish. Papakating Creek, having a cold water fishery, is also found to be partially degraded.

<u>**Problem and Goal Assessment**</u>

Point Source Assessment

The water quality problems identified in the Wallkill Watershed are due to a variety of point and nonpoint sources. The Wallkill River, Papakating Creek, and Black Creek all appear to have poorer water quality in the warm weather months, indicating that point or continuous sources may be the main cause for stream degradation. Two wastewater discharges continue to be under enforcement action and are suspected of causing water pollution problems. The Sussex Boro Treatment Plant (Clove Brook) is in noncompliance for excess BOD, chlorine, and suspended solids in their discharge. At times of heavy flow (rain events) this facility experiences raw sewage overflows. Discharge treatment under these conditions is limited to chlorination. Ames Rubber Corporation remains under enforcement action for the release of excess suspended solids, COD, volatile organic compounds, as well as pH violations. Two additional minor discharges into tributaries of the Wallkill are reported out of compliance: Sparta Plaza STP and the Alpine School STP. One hazardous waste site, Metaltec, is suspected of discharging volatile organics and metals to Wildcat Brook, a Wallkill tributary.

Nonpoint Source Assessment

Evaluated nonpoint pollution in the Wallkill Watershed, in general, shows a shift from agricultural sources to those created by increasing urbanization. In the Upper Wallkill River, deleterious effects of both urbanization and agricultural activities are on the rise. Increasing construction and urban surface runoff have resulted in sediment loading and stormwater contamination, respectively. Local officials have stressed the need for stormwater management such as the use of large dentention ponds in the region. In addition, agricultural runoff from crop production, pasture lands, and animal holdings are believed to have contributed to widespread eutrophic conditions in the Upper Wallkill. 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.

Clove Brook suffers from excessive nutrient loading which causes low dissolved oxygen levels and algal growth. The known sources are agricultural; including feedlot, pasture land and crop runoff. Feedlot runoff has been identified to be the reason for the closure of bathing beaches in Clove Lake. Increasing agricultural runoff (crop production, pasture land, animal holding) along Papakating Creek is suspected as having contributed to severe eutrophic conditions in this stream and in turn, a degradation of the stream's fishery potential. 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. Some tributaries in the Black Creek sub-watershed are so severely impacted that they are described as being devoid of aquatic life. This sub-watershed has been sited by local officials as needing storm water management.

The control of animal waste (bacteria and nutrients) is currently the purpose of a Soil Conservation Service project in the Clove Brook watershed. Sheet and rill erosion in the Wallkill watershed averaged 3.6 tons/acre, less than the statewide average.

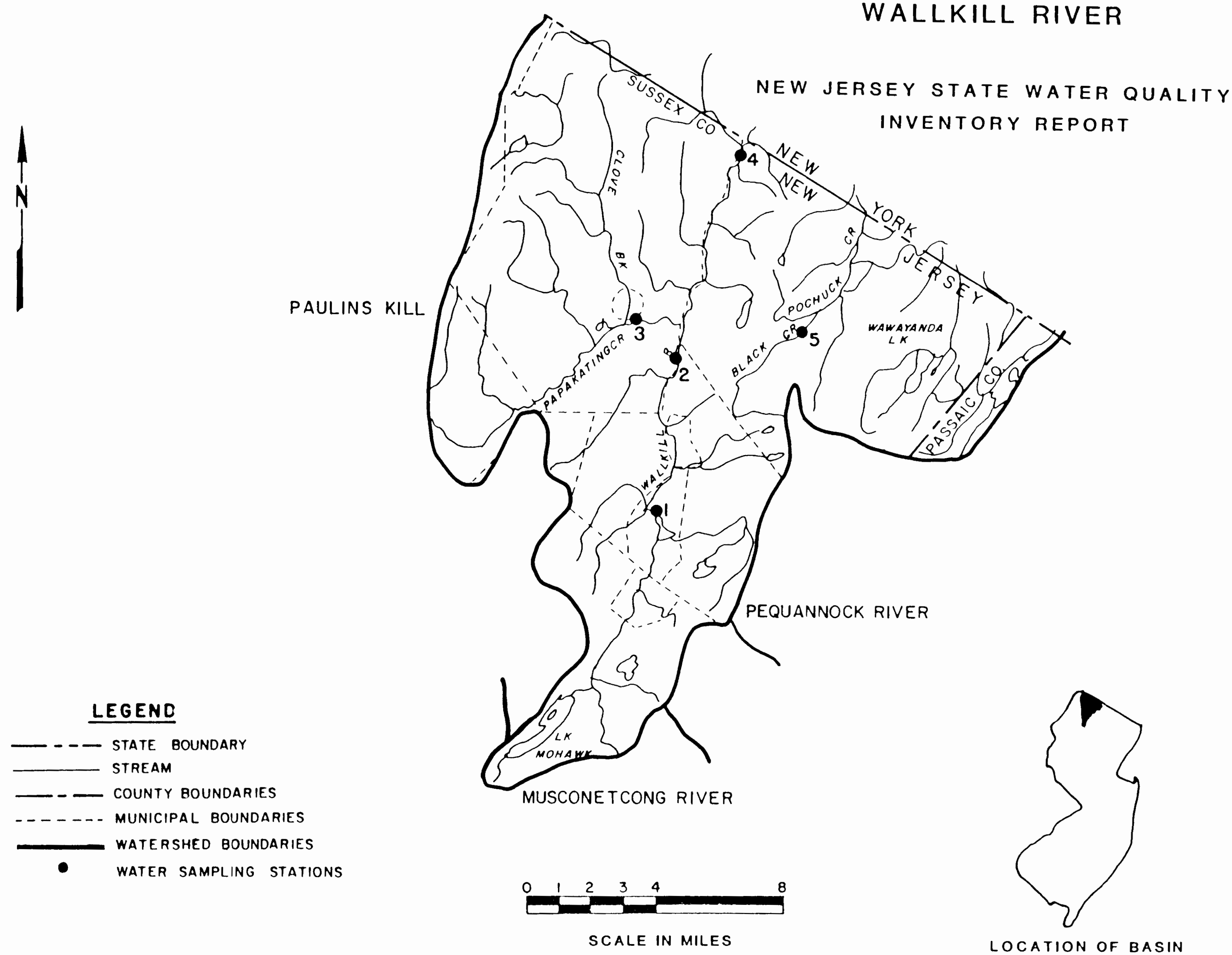
Designated Use and Goal Assessment

Attainment of the fish propagation and maintenance designated use and goal is occurring in portions of the watershed. The Upper Wallkill (9 miles), Wawayanda Creek and Pochuck Creek are supporting the goal, while Black Creek (7 miles) is currently supporting but threatened by wastewater discharges. The Lower Wallkill (18 miles), Clove Brook (5 miles), Papakating Creek (15 miles) can be classified as partially meeting the fish propagation and maintenance use because of moderately degraded fisheries. All 25 monitored stream miles contain excessive fecal coliform and as a result will not meet the swimmable use and goal. However, this use attainment is occurring throughout many headwater lakes.

Monitoring Station List

Map Number	Station Name and Classification
1	Wallkill River at Franklin, NJ, FW-2 Trout Maintenance,
2	Wallkill River near Sussex, NJ, FW-2 Nontrout,
3	Papakating Creek at Sussex, NJ, FW-2 Nontrout
4	Wallkill River near Unionville, NY, FW-2 Nontrout
5	Black Creek near Vernon, NJ, FW-2 Nontrout

WALLKILL RIVER



WATER QUALITY INDEX PROFILE

Wallkill River

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Wallkill River at Franklin	AVG WQI	14	6	15	20	13	10	8	18	24 Good
	WORST3 MONTHS	June-Aug	May-July	Sept-Nov	June-Aug	April-June	Sept-Nov	July-Sept	June-Aug	42 Fair Jun-Aug
Wallkill River near Sussex	AVG WQI	1	9	7	26	13	12	5	8	16 Good
	WORST3 MONTHS	June-August	June-August	March-May	June-August	June-August	August-Oct	July-Sept	March May	26Good/Fair June-August
Wallkill River near Unionville	AVG WQI	1	19	5	28	17	10	3	ID	23 Good
	WORST3 MONTHS	June-August	July-Sept	August Oct	May-Nov	Nov-January	Sept-Nov	June-August		35 Fair June-August
Papakating Creek At Sussex	AVG WQI	2	25	3	39	21	7	4	8	35 Fair
	WORST3 MONTHS	June-August	August-Oct	April June	August-Oct	Sept-Nov	Sept-Nov	August-Oct	Sept-Nov	60Fair/Poor August-Oct
Black Creek near Vernon	AVG WQI	1	37	5	25	16	15	6	7	32 Fair
	WORST3 MONTHS	July-Sept	Sept-Nov	April June	July-Sept	June-August	August Oct	August-Oct	April June	51 Fair July-Sept

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts, water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels, severe stress to stream life; water uses not met.
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: WALLKILL RIVER**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
High Pt. Rg. H.S. Wantage	0031585	Papakating Creek	Wantage/Sussex	Municipal
Accurate Forming Corp	0002275	Wallkill River	Hamburg/Sussex	Ind/Comm
Plastoid Corp	0006661	Wallkill River	Hardyston/Sussex	Ind/Comm
Sparta-Plaza STP	0027057	Trib to Wallkill	Sparta/Sussex	Municipal
Sparta-Alpine	0027065	Trib. to Wallkill	Sparta/Sussex	Municipal
Franklin Boro - Hemlock STP	0022055	Wallkill River	Franklin Boro/Sussex	Municipal
Franklin DPW	0029220	Wallkill River	Franklin Boro/Sussex	Municipal
NJ Zinc Co. , Inc	0004596	Wallkill River	Ogdensburg/Sussex	Ind/Comm
Franklin Board of Public Work	0031038	Wallkill River	Franklin/Sussex	Municipal
Regional Oil Com	0026115	Swampy Area TO D	Franklin/Sussex	Ind/Storm
Ames Rubber Corp	0000141	Wallkill River	Hamburg/Sussex	Mun/Ind/Thm
Vernon Valley Recreational	0021814	Trib to Black Creek	Mcafee/Sussex	Municipal
Great Gorges Mountain View	0023949	Black Creek	Mcafee/Sussex	Ind
Pope John XXIV HS	0027049	Trib to Wallkill	Sparta/Sussex	Municipal
Sparta BD of ED HS	0027073	Trib to Wallkill	Sparta/Sussex	Municipal
Tri-Cty Water Condition Co	0033472	Wallkill	Sparta/Sussex	Ind
Sussex Borough	0021857	Wallkill	Sussex/Sussex	Municipal
Regency Apartments	0029041	Trib to Wallkill	Wantage/Sussex	Municipal
Stonehill Corp	0032841	Black Creek	Vernon/Sussex	Municipal
Vernon Twp School Board	0023841	Black Creek	Vernon/Sussex	Municipal
Newton Subaru	0063819	Wallkill River	Hampton/Sussex	Ind
Sussex County MUA	0053350	Wallkill River	Sussex	Municipal

2. FLAT BROOK

Watershed Description

The area drained by the Little Flat Brook, the Big Flat Brook (15 miles long) and the Flat Brook (10 miles long) is 65 square miles. This brook runs along the western boundary of Sussex County into the Delaware River 1.5 miles downstream of Flatbrookville. Sub-watersheds include Little Flat Brook, Big Flat Brook and Flat Brook. There are no major population centers, as most of this area is undeveloped mountainous forests within state parks, state forests, and the Delaware Water Gap National Recreation Area.

There are many lakes and ponds to accommodate bathing beaches and recreational fishery resources. There are no point sources in the watershed. The Flat Brook and its tributaries are classified, for the most part, FW-1 and FW-2 Trout Maintenance. There are also FW-2 Trout Production and Nontrout waters.

Water Quality Assessment

The Flat Brook and tributaries contain among the highest quality surface waters in the state. Much of the Flat Brook watershed lies within state park and forest boundaries, thereby affording the streams protection from development. Monitoring is conducted on the Flat Brook near Flatbrookville, which generally represents the 10 mile stretch of the Flat Brook. Data collected from this station between 1983 and 1987 indicates water quality is good. Periodic summertime problems exist because of elevated stream temperature for the protection of cold water fisheries. Dissolved oxygen, fecal coliform and nutrients were all within appropriate State criteria throughout the period of review.

An overall improvement in Flat Brook water quality has been identified between 1977 and 1987. This improvement is the result of increasing dissolved oxygen, and decreasing nitrogen-containing compounds and total mercury concentrations. pH values have also shown significant increases. The 1986 305(b) report stated that water quality degraded to fair conditions in the summer months. No such seasonal degradation is now detected. The improvement can possibly be tied to the Annandale Correctional Institution sewage treatment plant discharge which was under enforcement action in the early 1980s. This surface water discharge has been eliminated and a return to more natural stream conditions has resulted.

Biomonitoring at Flatbrookville had indicated some water quality improvements in the past. The benthic macroinvertebrate community was indicative of a healthy stream with improving community structure and diversity from 1977 to 1984. From 1984 to 1988 however, the percentage of pollution tolerant forms have increased suggesting that nutrient enrichment may be on the rise at this location.

The New Jersey Fish, Game, and Wildlife describe Little Flat Brook, Bears Creek, Flatbrook, Mill Brook, Shimers Brook, Big Flat Brook, Parker Brook, Tuttles Brook and Stony Brook as all supporting healthy cold water fish communities (Flat Brook supports both cold and warm water species). Flat, Parker, Tuttles and Stony Brooks are noted as maintaining natural trout reproduction throughout the year.

Problem and Goal Assessment

Point Source Assessment

A limited number of point sources are present in the Flat Brook watershed. One reported point source, the Mountainview Stokes Youth Correctional Institute STP in Montaque Twp., discharges wastewater into a tributary of the Big Flatbrook. This facility is unable to consistently meet it's effluent limits for BOD and suspended solids.

Nonpoint Source Assessment

The waters of the Flat Brook watershed are among the least polluted in the state. The conversion of summers homes to year-round dwellings has resulted in some local nonpoint source contamination from home and road construction, suburban runoff and septic system leachate. Only Little Flat Brook was noted as receiving some minor agricultural runoff.

Goal Assessment

Approximately 30 stream miles of this watershed is categorized as fully meeting fish propagation and maintenance goals. Monitoring indicates that the Flat Brook appears to meet the swimmable designated use.

Monitoring Station List

Map Number	Station Name and Classification
1	Flat Brook near Flatbrookville, FW-2 Trout Maintenance

See page III-86 for a map of the Flat Brook watershed.

WATER QUALITY INDEX PROFILE

Flat Brook

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Big Flat Brook at Flatbrookville	AVG WQI	10	3	10	10	7	5	6	21	12 Good
	WORST 3 MONTHS	June-August	July-Sept	July-Sept	July-Sept	June-August	Sept-Nov	August-Oct	Nov-Jan	19 Good July-Sept.

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts, water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria

3. PAULINS KILL

Watershed Description

The Paulins Kill drains an area of 172 square miles, of which 110 square miles are in Sussex County and 62 square miles are in Warren County. This 39 mile long river runs through western Sussex and northern Warren Counties to the Delaware River at Columbia. Newton and Blairstown are the most developed centers of this rural area, but there is development along Route 15. Major tributaries to the Paulins Kill include Yards Creek, Trout Brook, Blair Creek, Morses Brook, and Culver Brook. Swartswood Lake, and the Upper and Lower Paulins Kill are delineated sub-watersheds. Impoundments include Paulins Kill Lake (3 miles long, 0.4 square mile surface area), Swartswood Lake, Little Swartswood Lake, Culvers Lake, and Lake Owassa.

The land use in this watershed is primarily agricultural and forested, but there are increasing amounts of developed suburban and commercial lands. There are 11 NJPDES permitted discharges, of which 6 are municipal and 5 are industrial/commercial. The stream classifications for the Paulins Kill and tributaries have been identified as FW-2 Trout Production, FW-2 Trout Maintenance, and FW-2 Nontrout.

Water Quality Assessment

Water quality of the Paulins Kill improves in a downstream direction, going from fair quality in the upper watershed to good conditions in the lower portions. This is based on ambient monitoring conducted at Balesville (upper watershed) and Blairstown (lower watershed) representing 10 stream miles. The Paulins Kill at Balesville experiences water quality problems due to excessive fecal coliform and phosphorus concentrations. Fecal coliform counts averaged 430 MPN/100 ml over the period of assessment, with 69 percent of all values exceeding the primary contact recreation criterion. Ninety-five percent of all phosphorus values exceeded the 0.05 mg/l criterion and averaged 0.14 mg/l. This suggests that the stream is moderately enriched at this location. The Paulins Kill at Balesville experiences deteriorated water quality during warm weather months, approaching poor conditions. Stream temperatures at this time may cause periodic stress to the cold-water fishlife present.

Reduced levels of phosphorus and fecal coliform bacteria in the Paulins Kill at Blairstown indicate better water quality. Fecal coliform violated state criterion 31 percent of all values from

1983 to 1987. This signifies that primary contact recreation in the stream is doubtful, although other chemical parameters show generally good conditions with little nutrient enrichment and oxygen demands. Elevated stream temperature during warm weather is common, possibly causing stress to cold water fisheries.

In the upper most reaches of the Paulins Kill, the East Branch has been evaluated by the New Jersey Fish, Game, and Wildlife as supporting a healthy cold water fish community. The West Branch in contrast, has a moderately degraded warm water fishery. The main stem of the Paulins Kill contains healthy fish communities of both warm and cold water species. Melden Brook and Yards Creek both contain healthy cold water fish populations; while Culvers Creek support healthy cold and warm water fish communities. Of the assessed lakes in the watershed; Swartswood, Little Swartswood, and Paulins Kill Lake, all support warm and cold water fisheries. Swartswood Lake and Little Swartswood Lake are judged to support healthy fish communities; Paulins Kill Lake contains moderately degraded fish populations due to eutrophication.

Problem and Goal Assessment

Point Source Assessment

The Upper Paulins Kill, from Newton to Paulins Kill Lake, is significantly impacted by the Newton sewage treatment facility which is discharging inadequately treated effluent into Moores Brook. Previous modelling analyses have estimated that up to 95 percent of the nutrient loading in the Upper Paulins Kill is from this facility. A number of swampy areas from which the Paulins Kill flows and the contribution of suburban/agricultural runoff act to overload the assimilative capacity of the stream. This results in fair water quality at Balesville and the eutrophication of Paulins Kill Lake below Balesville. In the Lower Paulins Kill reduced point source loadings and increased reaeration and dilution tend to improve water quality.

Enforcement actions in the watershed include: Blair Academy's discharge (excessive phosphorus) to Blair Brook, the Newton STP (discussed above), and the Kittatiny Regional Board of Education STP discharge (elevated phosphorus to the Paulins Kill.

Nonpoint Source Assessment

The Paulins Kill watershed is assessed to be experiencing an increase in runoff associated with rapid suburban land development. Housing construction site runoff, suburban surface runoff, as well as heavy winter road salting, are all suspected to be on the increase. This is coupled with a decline in agricultural runoff from crop production activities. Additional water quality degradation has resulted from leachate coming from Hamms landfill, a problem which although is described as severe at times, is believed to be on the decline. Nonpoint sources have caused eutrophication in many of the lakes in this watershed, including Swartswood Lake.

Designated Use and Goal Assessment

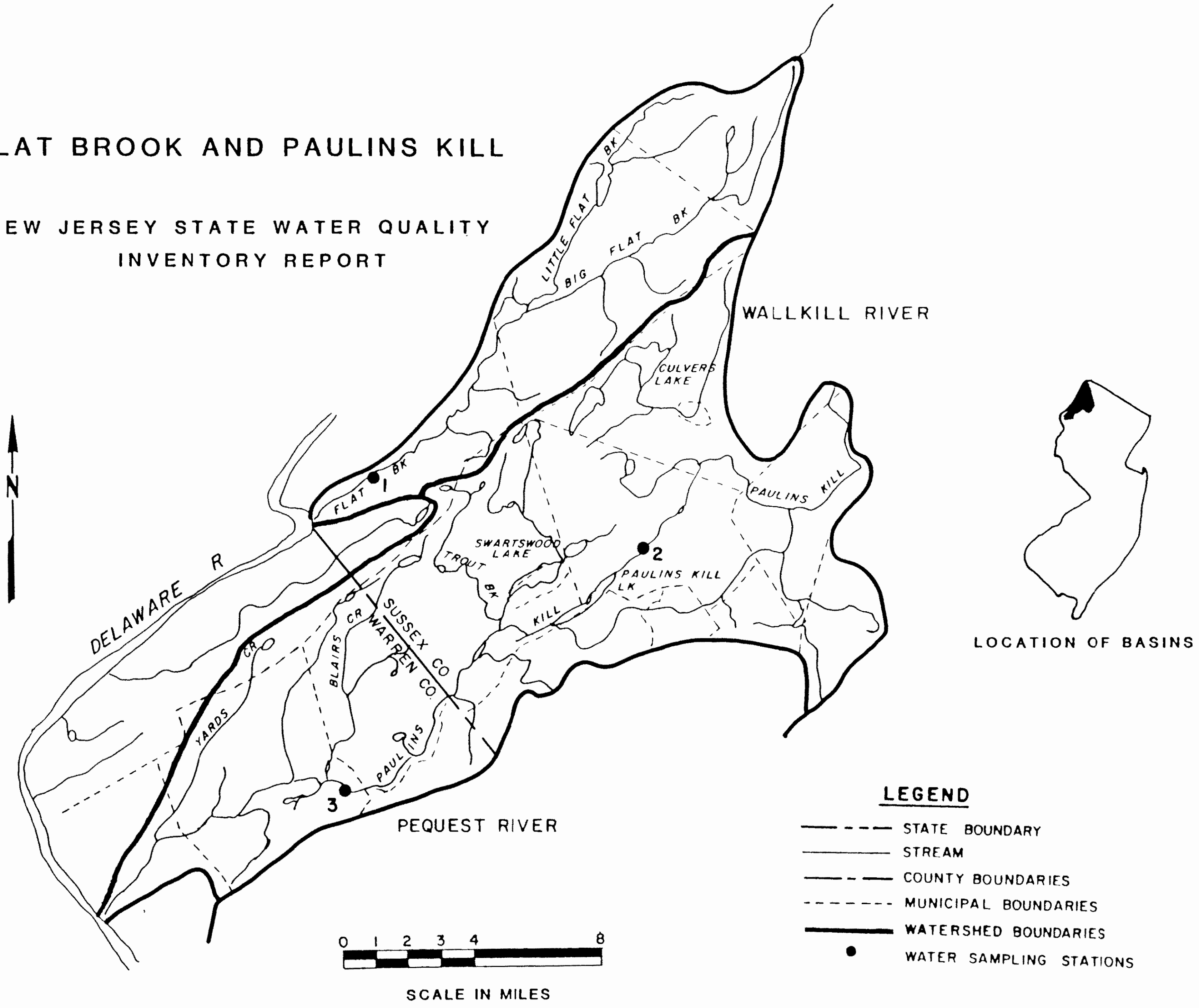
The Paulins Kill is not considered swimmable where monitoring takes place. However, all waters appear to be meeting the fish propagation and maintenance designated use/goal. However, some stress to cold water fishlife (trout and smallmouth bass populations) from high water temperature in summer months may be occurring. Increased residential and commercial development forecasted for the watershed will undoubtedly impact water quality.

Monitoring Station List

Map Number	Station Name and Classification
2	Paulins Kill at Balesville, FW-2 Trout Maintenance
3	Paulins Kill at Blairstown, FW-2 Trout Maintenance

FLAT BROOK AND PAULINS KILL

NEW JERSEY STATE WATER QUALITY INVENTORY REPORT



Paulins Kill

WATER QUALITY INDEX PROFILE

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Paulins Kill at Balesville	AVG WQI	10	7	8	30	42	12	9	17	39 Fair
	WORST3 MONTHS	July-Sept	June-August	August-Oct	July-Sept	August-Oct	August-Oct	Nov-Jan	August-Oct	58 Fair July-Sept
Paulins Kill at Blairstown	AVG WQI	14	6	11	16	13	10	6	17	17 Good
	WORST3 MONTHS	July-Sept	August-Oct	August-Oct	May-July	June-August	August-Oct	August-Oct	Sept-Nov	32 Fair July-Sept

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: PAULINS KILL**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Sussex Co. MUA-Sussex Serv. CT.	0022063	Paulins Kill	Frankford Twp./Suss	Municipal
Kittatinny Reg. Bd. of Ed.	0028894	Paulins Kill	Newtown Town/Sussex	Municipal
Schering Corp.-Safety Eval. CT.	0005711	Paulins Kill	Lafayette Twp./Suss	Ind./Comm.
Newton STP	0020184	Moore's Brook	Newtown Town/Sussex	Municipal
Hart+Illif Fuel Oil Co.,Inc.	0028819	Hyper Humus Swan	Newton Town/Sussex	Ind./Comm.
Limestone Products of America	0004791	Paulins Kill Trib.	Lafayette Twp./Suss	Ind./Comm.
N. Warren Reg. H.S. STP	0031046	Paulins Kill	Blairstwn. Twp/Warr	Municipal
Blair Academy	0022101	Blair Creek	Blairstwn. Twp/Warr	Municipal
Sussex Co. BRD Freeholders	0026701	Paulins Kill Trib.	Frankford Twp./Suss	Municipal
Kennedy Construction Co.	0024163	Paulins Kill	Newtown/Sussex	Industrial
Sussex CO MUA	0050580	Paulins Kill	Hamton/Sussex	Mun
Rhone-Poulenc	0052272	Paulins Kill	Sussex	Ind

4. PEQUEST RIVER

Watershed Description

The Pequest River drainage basin is 158 square miles. The river itself is 32 miles long and flows from southern Sussex County southwest through Warren County to the Delaware River, downstream of Belvidere. The major tributaries to the Pequest include Trout Brook, Beaver Brook, Furnace Brook, and Bear Creek. Sub-watersheds consist of the Upper and Lower Pequest and Bear Creek. While there are many small lakes and ponds in the watershed, there are no major impoundments on the Pequest River.

The Pequest River watershed contains many recreational areas, with land use being heavily forested and agricultural. As with the other watersheds in the northwestern section of the state, residential and commercial development is intensifying. There are 9 NJPDES permitted discharges here, of which 3 are municipal and 6 are commercial/industrial. The water quality classifications are FW-2 Trout Maintenance and FW-2 Nontrout, except for the waterways within the Whittingham Tract, which are classified FW-2 Trout Production.

Water Quality Assessment

The Pequest River is monitored at the town of Pequest, located in the lower watershed. Overall water quality of the Pequest at this location from 1983 through 1987 can be characterized as good, although conditions degrade to fair quality during warm-weather months. The Pequest River in the lower watershed is a cool, fast moving stream with numerous riffles. Therefore, oxygen reaeration results in sufficient in-stream dissolved oxygen levels during critical periods. Fecal coliform contamination, elevated phosphorus and inorganic nitrogen, and summer water temperatures are the significant water quality problems for the Pequest River at Pequest. Forty-one percent of all fecal coliform values exceeded 200 MPN/100ml, and all values resulted in a geometric mean of 110 MPN/100ml during the period of review. Total phosphorus was above the state water quality criterion for 33 percent of all values, indicating moderate nutrient enrichment. Inorganic nitrogen exceeded 2.5 mg/l in 25 percent of the samples collected, and periodic high warm-weather unionized ammonia levels were detected. Stream temperatures averaged above the 19 degrees Celsius criterion for trout maintenance waters during July and August; further indicating some stress to cold water fisheries.

Biological monitoring of the Pequest River at Pequest from 1977 to 1984 for macroinvertebrates has shown some improvements in species diversity and the percentage of pollution intolerant individuals; however, the stream community is indicative of somewhat enriched conditions. 1988 biological sampling revealed the presence of chemical toxicity impacting the biota and reducing the numbers of taxa present. Oxford Textile is a suspected source of the contamination (see Point Source Assessment below).

Almost all 32 miles of the Pequest are evaluated as supporting a healthy cold water fish community. An exception is a channelized stream in the Vienna-Great Meadows area. Another exception is Furnace brook and the region on the lower Pequest just below Furnace Brook where a fish kill occurred in 1988 (see Point Source Assessment below).

Other streams in the watershed assessed include: Kymers's Brook, Barkers Mill Brook, Andover Junction Brook, Bear Creek, Jacksburg Creek, Beaver Brook, Furnace Brook, and Harney Run. They were found to support healthy fisheries, comprised largely of cold water species.

Bear Creek is further described by the N.J. Division of Fish, Game, and Wildlife as one of the best streams in the state for native brown trout.

Problem and Goal Assessment

Point Source Assessment

Point source impacts to the Pequest River are thought to be limited. Enforcement action continues to be underway with the Pequest Sewer Co. because of excessive chlorine in their discharge to the lower reach of the river. The Warren County Resource Recovery project in Oxford Twp. discharges stormwater into a tributary to the Pequest. This discharge is in violation for excess suspended solids and hydrocarbons. A pollution induced fishkill occurred in the lower Pequest in December of 1988; Oxford Textiles Inc. (discharge to Furnace Brook) is suspected of being the pollution source. One hazardous waste site is suspected of contributing volatile organics to the Pequest. This is the Southland Corporation site at Great Meadows.

Nonpoint Source Assessment

The Pequest is impacted by the increasing suburban development occurring throughout the watershed. The Soil Conservation Service has identified the Pequest system as having serious sheet and soil erosion rates. In the upper half, pollution from agricultural activities such as runoff from crop lands and animal holdings is believed to be on the decline. In its stead are the increasing effects of housing construction, suburban runoff, and heavy winter road salting. The overall result has been a combination of nutrient enrichment, pesticide and sediment loading, flooding, and elevated chloride levels in the stream. Nonpoint source pollution in the lower half of the Pequest is known to arise principally from housing construction activities. Flooding has been documented as a problem in Belvidere (Warren Co.). The most degraded section of the Pequest is in the Vienna-Great Meadows area where channelization has resulted in complete habitat destruction. Many tributaries in the watershed which support healthy fisheries do receive some minor agricultural runoff; two such streams are Andover Junction Brook and Beaver Brook.

Designated Use and Goal Assessment

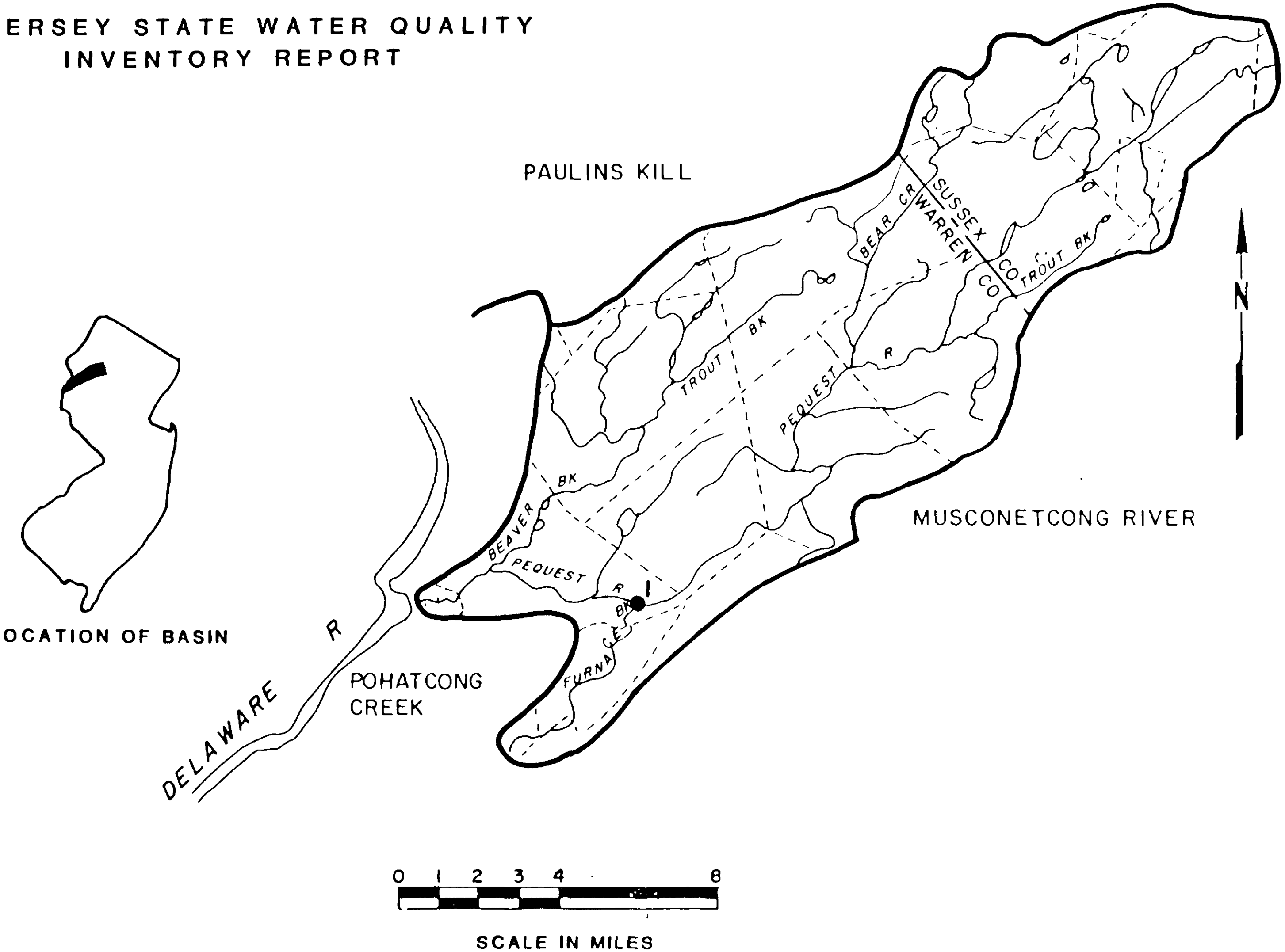
Because of bacterial contamination, the Lower Pequest cannot be considered swimmable. The Pequest River contains both Trout Maintenance and Nontrout waters. Where natural trout populations exist, summer water quality conditions may cause periodic stress to the fishlife because of high stream temperature and nutrient enrichment. Overall, fish communities of approximately 80 stream miles are assessed as healthy and therefore will meet fish propagation and maintenance goal/designated use. Furnace Brook (approximately 10 miles) currently has a healthy fish community, but it is considered threatened.

Monitoring Station List

Map Number	Station Name and Classification
1	Pequest River at Pequest, FW-2 Trout Maintenance

PEQUEST RIVER

NEW JERSEY STATE WATER QUALITY INVENTORY REPORT



WATER QUALITY INDEX PROFILE

Pequest River

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Pequest River at Pequest	AVG WQI	9	4	12	21	18	12	10	I.D.	19 Good
	WORST3 MONTHS	June-August	Jan-March	Jan-March	July-Sept	Nov-Jan	Oct-Dec	July-Sept		34 Fair July Sept.

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: PEQUEST RIVER**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Southland Corp.-Fine Chems.	0005291	Pequest River	Independence Twp/Wrn	Ind./Comm.
Pequest Water Co.	0029033	Pequest River	Allamuchy Twp/Warren	Municipal
Pequest Sewer Co.	0020605	Pequest River	Allamuchy Twp/Warren	Municipal
Brockway IMCO, Inc.	0005665	Pophandusing Creek	Belvidere Town/Wrn.	Ind./Comm.
Oxford Tex. Finishing Co.	0004901	Furnace Brook	Oxford Twp./Warren	Ind./Comm.
Oxford Area Wastewater-TF	0035483	Pequest River	Oxford Twp./Warren	Municipal
A Gross Candle Co.	0031631	Delaware River	Hope Twp./Warren	Thermal
Pequest Fish Hatchery	0033189	Pequest River	Liberty Twp./Warren	Industrial
Newton T&M Corp.	0050954	Pequest River	Fredon Twp./Sussex	Thermal

5. POHATCONG CREEK

Watershed Description

The 28 mile long Pohatcong Creek stretches from Independence Township to the Delaware River south of Phillipsburg. It drains a 57 square mile area of southwestern Warren County. The population in this area is centered in the Boroughs of Alpha and Washington. Major tributaries include Brass Castle Creek, Shabbecong Creek, and Merrill Creek. The only notable impoundment in the watershed is the Roaring Rock Brook Reservoir, although a reservoir for low-flow augmentation in the Delaware River is being constructed on Merrill Creek.

The land use in this watershed is predominantly agricultural. There are 6 NJPDES permitted discharges here, 3 of which are municipal and 3 are commercial/industrial. Pohatcong Creek and its tributaries are classified as FW-2 Trout Production and FW-2 Trout Maintenance.

Water Quality Assessment

Pohatcong Creek is monitored at New Village for determination of ambient water quality conditions. Monitoring at this location is thought to represent approximately five stream miles. This station is located midway along the stream's length and has found water quality to be marginal, with high concentrations of fecal coliform, especially during the warmer seasons, moderate levels of total phosphorus and elevated stream temperatures from June through August. Because of these problems, overall water quality approaches poor conditions during the summer.

Fecal coliform concentrations averaged nearly 670 MPN/100ml with 71 percent exceeding the 200 MPN/100ml criterion. Summer and early fall values for fecal coliform often exceeded 2000 MPN/100ml. Total phosphorous amounts averaged two times the .1 mg/l state criterion and were above this level in 80 percent of all samples collected. Other water quality indicators that show periodic problems are elevated readings of stream temperatures, inorganic nitrogen and un-ionizied ammonia. Stream temperatures above the 19 degrees Celsius criteria for trout maintenance streams were frequent throughout the June to August period. Fourteen percent of the unionized ammonia values were also greater that the state criterion for protection of coldwater fisheries. These high temperatures and unionized ammonia levels indicate possible adverse conditions for the native and stocked trout populations.

Pohatcong Creek, Merrill Creek, Brass Castle Brook, Buckhorn Creek, and Pohandusing Creek are all assessed as supporting healthy cold water fish populations. Lopatcong Creek, adjacent to Pohatcong Creek, contains a healthy warm water fishery. An intensive survey of Pohatcong Creek conducted in 1984 found elevated lead, manganese and nickel in fish tissue. The potential source of the metals was not identified. A decrease in macroinvertebrate populations as one travels downstream was due to habitat changes, not to water quality changes.

Problem and Goal Assessment

Point Source Assessment

Pohatcong Creek and tributaries drain a predominantly agricultural area with one population center, Washington Borough, Warren County. The creek is fairly small and it appears from the water quality data that it cannot assimilate the pollution loads that drain into the stream. The municipal wastewater discharges in the watershed may likely have significant impact on water quality. The High Point Landfill in Washington Twp., Warren County, is suspected of contaminating Pohatcong Creek with landfill leachate. No other permitted facilities are reported to be out of compliance within this watershed as of the end of 1989.

Nonpoint Source Assessment

Pohatcong Creek is believed to be impacted by agricultural runoff from croplands and chicken farms. The Pohatcong Creek watershed is known to have among the highest soil erosion rates in the state. Coupled with this is intensive suburban development fueled by one acre zoning. Housing construction, urban surface runoff, plus runoff from storm sewers is suspected to be contributing to local flooding and the decline in water quality. Merrill Creek was reported by local officials to have had non-point source pollution problems in the recent past during the construction of a reservoir.

Lopatcong Creek is reported to have had severe water quality problems in the past below Harmony which had led to fish kills. The suspected cause was industrial pollution. As in the Pohatcong Creek, Lopatcong Creek is impacted by the increasing degree of suburban development within the watershed, receiving ever increasing quantities of urban surface runoff and storm sewer outflow. These are suspected to cause some water quality degradation as well as flooding. New residential and commercial development in many areas of the watershed will contribute additional runoff problems.

Designated Use and Goal Assessment

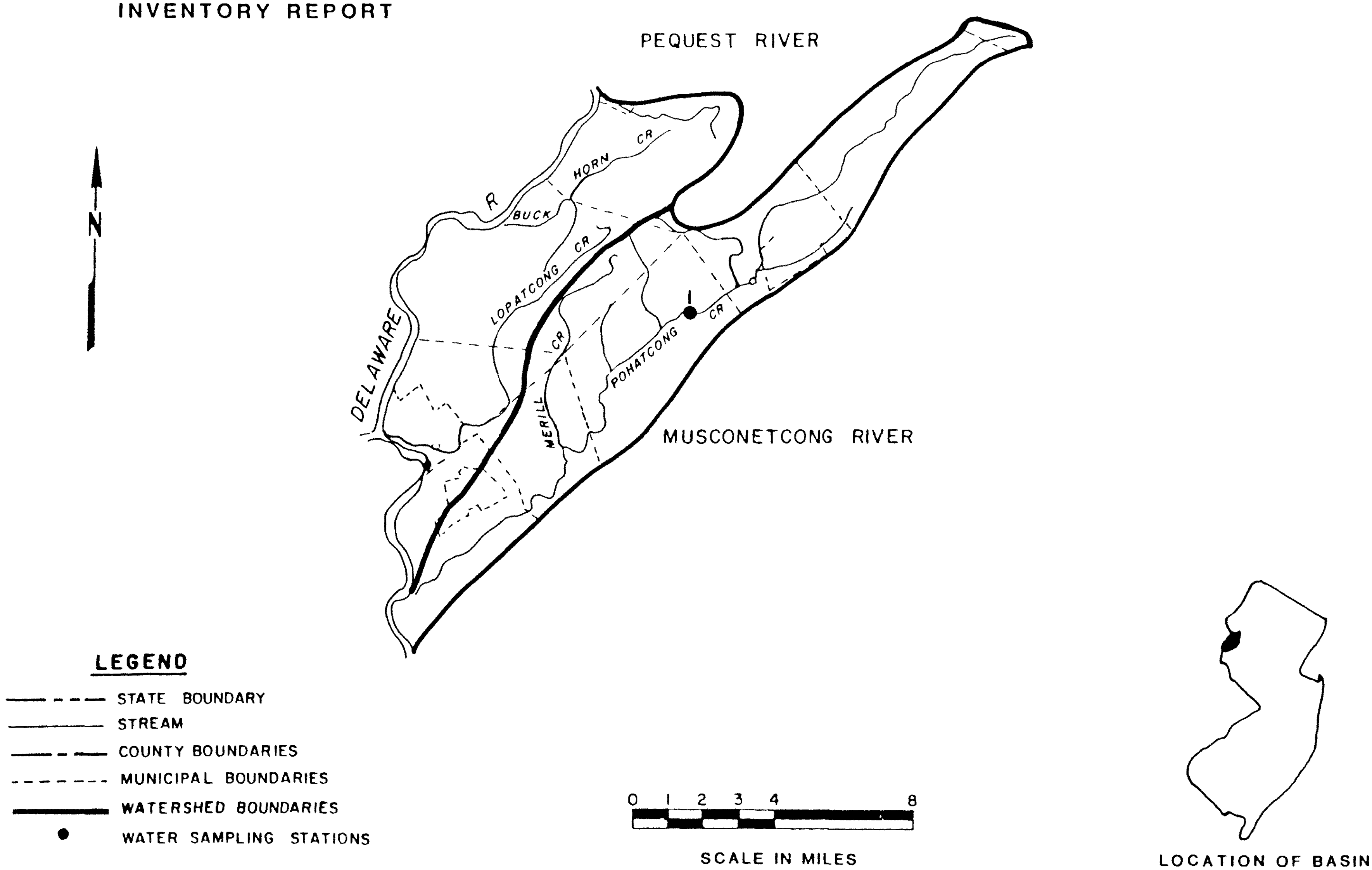
The monitored waters of Pohatcong Creek will not meet the swimmable designated use/goal because of high fecal coliform levels. All streams will meet the fish propagation/maintanence goal, but some waters appear to be threatened. In the area of Washington, Pohatcong Creek's fisheries are threatened because of wastewater discharges, while Merrill Creek's fish community is threatened during the construction of the reservoir.

Monitoring Station List

Map Number	Station Name and Classification
1	Pohatcong Creek at New Village, FW-2 Trout Maintenance

POHATCONG CREEK

NEW JERSEY STATE WATER QUALITY INVENTORY REPORT



WATER QUALITY INDEX PROFILE

Pohatcong Creek

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Pohatcong Creek at New Village	AVG WQI	10	11	10	37	26	6	11	18	37 Fair
	WORST3 MONTHS	July-Sept	March-May	March-May	June-August	Nov-Jan	August-Oct	March-May	April-June	55 Fair July-Sept.

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria

N.J.P.D.E.S. DISCHARGE INVENTORY	WATERSHED: POHATCONG RIVER

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Pearsall Corp.	0008460	Pohatcong Creek	Phillipsburg Tn./Wrn	Ind./Comm.
Windtrust Apts.	0030007	Pohatcong Creek	Mt. Laurel/Warren	Ind./Comm.
Washington Borough STP	0021113	Shebbecong Crk. Trib	Washington Boro/Wrn.	Municipal
Warren Co. Tech School	0020711	Pohatcong Creek	Franklin Twp./Warren	Municipal
Belford Seafood Cooperative	0004049	Lopatcong Creek	Phillipsburg/Warren	Ind-Thermal
Phillipsburg, Town of	0024716	Lopatcong Creek	Phillipsburg/Warren	Municipal

6. MUSCONETCONG RIVER

Watershed Description

The Musconetcong River drains an area of about 156 square miles. It is 42 miles long, stretching from its headwaters at Lake Hopatcong to the Delaware River at Riegelsville. Parts of Sussex, Warren, Hunterdon, and Morris Counties are in the Musconetcong drainage basin. The Upper and Lower Musconetcong sub-watersheds comprise the entire watershed. The population centers in this watershed are the towns of Hackettstown, Mt. Olive, and Stanhope. There is also significant development along the shores of Lakes Hopatcong and Musconetcong. The two major tributaries to the Musconetcong River are Lubbers Run and Beaver Brook. Major impoundments include Lake Hopatcong (the largest lake in New Jersey), Lake Shawnee, Lake Musconetcong, and Cranberry Reservoir.

Aside from the aforementioned developed areas, the rest of the watershed is mostly forests or used for agriculture, although significant development pressures are occurring. There are 22 NJPDES permitted discharges here, 10 municipal and 12 commerical/industrial. The water quality of the Musconetcong and tributaries are classified, at various locations as FW-1, FW-2 Trout Production, FW-2 Trout Maintenance, and FW-2 Nontrout.

Water Quality Assessment

Ambient water quality monitoring of the Musconetcong River is performed at five locations. This monitoring represents most of the river's length. They are, in downstream order, at the outlet of Lake Hopatcong, at Lockwood, Beattystown, near Bloomsbury and at Riegelsville. Results from these stations show that the Musconetcong River degrades in the downstream direction, going from good overall quality to fair quality in the lower watershed. The Musconetcong originates at the outlet of eutrophic Lake Hopatcong before flowing into Lake Musconetcong. While these two lakes have excessive nutrients and aquatic weed growth, they act to remove nutrients from the river. The only water quality problems in the Musconetcong River at the outlet of Lake Hopatcong are elevated stream temperatures during the summer months that pose a threat to the cold-water fish populations, and periodic phosphorus concentrations that exceed state criterion.

The Musconetcong River at Lockwood, although having good overall quality, experiences greater water pollution problems with higher phosphorus and fecal coliform concentrations. Fecal bacteria levels are highest during periods of warm weather. At this location stream temperatures exceed trout maintenance criterion during summer months. The moderately enriched conditions at Lockwood cause summer water quality to be classified as fair. The quality of the Musconetcong at Beattystown is similar to that at Lockwood, but higher concentrations of fecal coliform and total phosphorus exceeded water quality criteria in 39 and 73 percent, respectively, of all samples collected from 1983 through 1987. There are occasionally high unionized ammonia levels at this location. Elevated warm weather stream temperatures are also found at Beattystown.

The two monitoring stations in the lower watershed, near Bloomsbury and at Riegelsville, contain fair quality waters, having excessive amounts of fecal coliform and total phosphorus. Other water quality indicators are not at problematic levels, although stream temperatures in warm weather and supersaturated oxygen conditions occasionally exceed their respective criterion. In addition, one high copper reading was identified at Riegelsville during the period of review. Biomonitoring in the Musconetcong near Bloomsbury confirms the presence of enriched stream conditions. In 1986 a high percentage of filter feeders (64 percent) were observed suggesting enrichment, while typical clean water organisms had accounted for 59 percent of the total sample. Subsequent biological monitoring in 1988 has indicated that enrichment continues and that instream water quality has further declined since 1986.

All 42 miles of the Musconetcong is evaluated as supporting a healthy fish community. The area below Bloomsbury however, has had fish kills in the past caused by industrial pollution. The upper approximately 18 miles of the Musconetcong are categorized as a cold water fishery; the lower 36 or so miles are classified as containing both warm and cold water forms. Other streams in the watershed including Hances Brook, Stephensburg Brook, Bingalor Brook, Trout Brook, and Lubbers Run were all assessed to be healthy cold water fisheries. Willis Brook in Morris County, also a cold water fishery, is evaluated as moderately degraded. Cranberry Lake, Lake Musconetcong, and Lake Hopatcong were regarded as supporting healthy fish communities. All three support warm water species, while Cranberry Lake also contains populations of cold water fish.

Problem and Goal Assessment

Point Source Assessment

The Upper Musconetcong is impacted by industrial point sources in the Hackettstown region. Two point sources are presently under DEP enforcement action for discharging inadequately treated wastewater: Diamond Hill Estates STP in Manfield Twp., and the Byram Twp. Intermediate School STP.

Nonpoint Source Assessment

The upper reaches of the Musconetcong are believed to be receiving increasing amounts of pollution as a result of areawide suburban development. Moderate to severe urban runoff and runoff from construction activities are suspected as causing a decline in stream water quality and an increase in lake eutrophication. Heavy winter road salting is also an areawide problem. Increasing runoff from urban surfaces and from storm sewers has been singled out as a problem in the Hackettstown area. In the lower reaches of the Musconetcong, chemical and bacterial contamination from agricultural crop production and pasture land are on the decline. In contrast, siltation and erosion from construction activities, nutrients and bacteria from septic systems, as well as road salt, and oil and grease from highway runoff are all on the increase.

Wills Brook, in addition to point sources, also suffers from the impacts of construction, urban runoff, road runoff, and channelization. They are all assessed to be at severe and ever growing levels. These have brought about flooding as well as a decline in water quality. Mine Brook likewise suffers from water quality and flooding problems brought about by growing levels of construction, highway maintenance runoff, and channelization. Mine Brook additionally receives agricultural runoff from animal holdings, crop land, and pasture land, all of which appear to be on the decline. The runoff arising from the increasing amounts of housing construction activity in the areas around Trout Brook is believed to be a significant threat to the Hackettstown fish hatchery, as pointed out by local officials. In addition, this brook has experienced fish kills in the past caused by industrial pollution.

Among the lakes evaluated, Lake Musconetcong suffers from advanced eutrophication linked to suburban runoff. Lake Shawnee in Morris County is impacted by increasing housing construction. Lake Hopatcong receives a wide range of nonpoint source pollution; known sources include runoff from housing and road construction, and runoff from road and suburban surfaces. A severe problem with septic system leachate has been singled out by local authorities. Well maintained retention basins is a suggested solution made by local authorities. Lake Hopatcong is also reported to receive local fuel spills and leaks which have been suspected in fish kills.

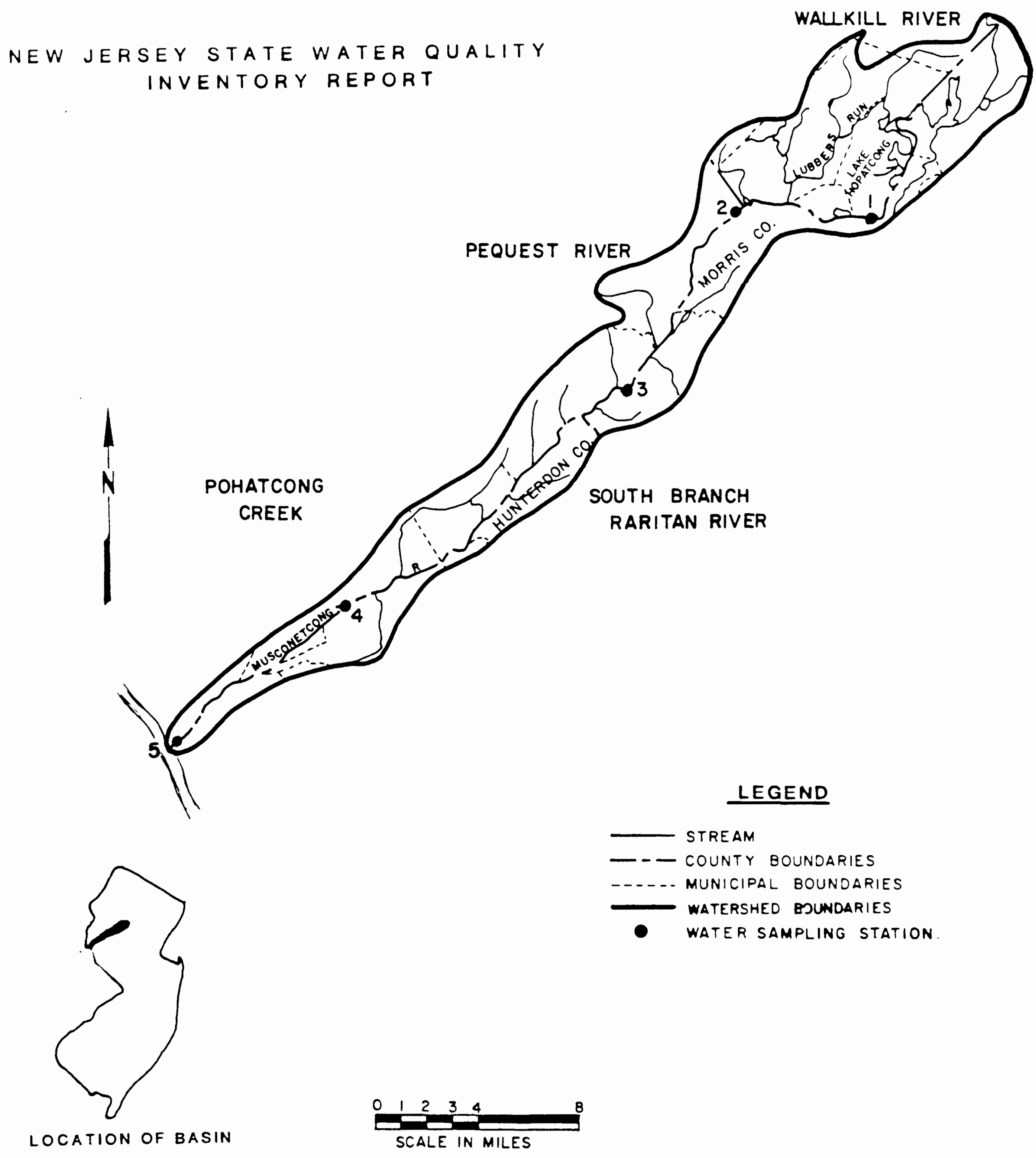
Designated Use and Goal Assessment

Approximately 30 of the 35 monitored miles of the Musconetcong River is considered not swimmable, only the section immediately below Lake Hopatcong will meet this designated use. The Musconetcong River contains generally healthy trout and smallmouth bass fisheries and is heavy stocked and utilized by fishermen. As such, the river will meet the fish maintenance and propagation use and goal. A section of the river in the Bloomsbury area, however, is threatened by industrial pollution. Wills Brook contains a moderately degraded fisheries resource because of wastewater discharges. Hances and Trout Brooks have healthy fisheries, but they are threatened. Lakes in the watershed generally support both the swimmable and fish propagation/maintenance designated uses.

Monitoring Station List

Map Number	Station Name and Classification
1	Musconetcong River at the outlet of Lake Hopatcong, FW-2 Trout Maintenance
2	Musconetcong River at Lockwood, FW-2 Trout Maintenance
3	Musconetcong River at Beattystown, FW-2 Trout Maintenance
4	Musconetcong River near Bloomsbury, FW-2 Trout Maintenance
5	Musconetcong River at Riegelsville, FW-2 Trout Maintenance

MUSCONETCONG RIVER



WATER QUALITY INDEX PROFILE

Musconetcong River

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Musconetcong River at outlet of Lake Hopatcong	AVG WQI	17	4	6	9	13	6	3	14	14 Good
	WORST3 MONTHS	June-August	July-Sept	June-August	Sept-Nov	July-Sept	Jan-March	Jan-March	March May	30 Fair June August
Musconetcong River at Lockwood	AVG WQI	15	7	6	17	17	8	11	17	19 Good
	WORST3 MONTHS	June-August	Sept-Nov	June-August	June-August	July-Sept	Nov-Jan	July-Sept	Aug-Oct	38 Fair July-Sept
Musconetcong River at Beattystown	AVG WQI	14	5	11	18	23	8	10	ID	21 Good
	WORST3 MONTHS	June-August	May-July	Feb-April	July-Sept	July-Sept	July-Sept	July-Sept		40 Fair June August
Musconetcong River near Bloomsbury	AVG WQI	11	17	16	31	17	8	9	ID	30 Fair
	WORST3 MONTHS	June-August	Feb-April	Jan-March	August-Oct	Nov-Jan	Nov-Jan	June-August		43 Fair July Sept
Musconetcong River at Riegelsville	AVG WQI	11	6	12	30	18	8	8	29	34 Fair
	WORST3 MONTHS	June-August	March-May	March-May	July-Sept	May-July	Dec-Feb	July-Sept	April June	56 Fair June-August

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met.
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: MUSCONETCONG RIVER**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Byram Twp. Bd. of Ed.	0022632	East Brook	Byram/Sussex	Municipal
US Mineral Products	0004600	Musconetcong River	Stanhope/Sussex	Ind./Comm.
Our Lady of the LK Rectory	0026239	Musconetcong River	Mt. Arlington/Morris	Municipal
Reichold Chem-Cooke Div	0028657	Musconetcong River	Mansfield/Warren	Ind./Comm.
Hackettstown MUA	0021369	Musconetcong River	Hackettstown/Warren	Municipal
Amerace-ESNA Corp.	0004812	Schooleys MTN. Brook	Washington/Morris	Ind./Comm.
Diamond Hill Estates SP	0028592	Hansen Creek	Mansfield/Warren	Municipal
Garden St. Truck Plaza	0023094	Musconetcong River	Bloomsbury/Hunterdon	Ind./Comm.
Bloomsbury WD	0025569	Musconetcong River	Bloomsbury/Hunterdon	Municipal
Asbury Graphite Mills	0031208	Musconetcong River	Franklin/Warren	Ind./Comm.
Reigel Paper Corp-Hughesville	0004421	Musconetcong River	Lopatcong/Warren	Ind./Comm.
Musconetcong SA		Wills Brook	Byram/Sussex	Municipal
Regional West	0035033	Hatchery Brook	Hackettstown/Warren	Ind/Oil-H20 sept/SW
Musconetcong SA	0027821	Musconetcong River	Mount Olive/Morris	Municipal
Jefferson TWP	0021105	Lake Hopatcong	Jefferson/Morris	Municipal
Jefferson TWP Rock	0026867	Mitts Pond	Jefferson/Morris	Municipal
Consolidated School	0021156	Lake Hopatcong	Lake Hopatcong/Morris	Municipal
Advanced Environmental Tech	0034975	Willis Brook	Mount Olive/Morris	Ind./Storm
Warren Glen Mill	0004448	Musconetcong River	Holland/Hunterdon	Thermal
USR of Tonix	0032247	Musconetcong River	Washington/Morris	Ind.

7. DELAWARE RIVER TRIBUTARIES - HUNTERDON COUNTY

Watershed Description

The tributaries to this 45 mile length of the Delaware River include Hakihokake, Harihokake, Nishisakawick, Lockatong, Wickecheoke, Alexauken, and Swan Creeks in Hunterdon County; and Moores, Fiddlers, and Jacobs Creeks in Mercer County. They are jointly divided into three sub-watersheds: Harihohake Creek to Warford Creek, Lopcatong Creek to Wickechecheoke Creek, and Alexauken Creek to Gold Run. This is a total drainage area of 200 square miles, with approximately 75 total stream miles. The Delaware and Raritan Canal originates in this area. There are no large population centers here, but towns evident are Milford Borough, Frenchtown, Sergeantsville, Lambertville, and Stockton. Two impoundments are the Swan Creek Reservoirs, East and West.

The land use in this area is primarily agricultural and forested with residential and commercial development scattered throughout. Residential development is increasing in these small watersheds. There are 11 NJPDES permitted discharges to these Delaware tributaries. Six are municipal and five are commercial/industrial. The waterways in this section have been classified FW-1 at Washington's Crossing State Park, FW-2 Trout Production, FW-2 Trout Maintenance, and FW-2 Nontrout.

Water Quality Assessment

Wickecheoke Creek at Stockton is the only ambient monitoring station on the Delaware River tributaries between the Musconetcong River and Assunpink Creek. The streams in this section are small with summer flows generally below 20 cfs. Wickecheoke Creek has overall fair water quality, with conditions degrading in late summer to early fall. Water quality problems in this creek include elevated stream temperatures in warm weather periods, periodic high fecal coliform counts, and excessive nutrients with regard to total nitrogen. Un-ionized ammonia exceeded the state water quality criterion for trout maintenance waters in 13 percent of all samples, usually in the period from July through September. pH values indicate highly alkaline conditions due to the nature of the region's bedrock material. One cadmium value was above the recommended level during the period 1983 to 1987.

Ambient monitoring has been discontinued on a number of streams in this area. Streams with sampling data to 1982 include Lockatong Creek, Hakihokake Creek, Harihokake Creek, Alexauken

Creek and Swan Creek. Lockatong, Alexauken and Swan Creeks had generally good water quality, while Hakihokake and Harihokake Creeks were of fair quality. All the streams had excessive fecal coliform, and experienced elevated stream temperatures during the summer months.

Among the Delaware River tributaries evaluated by the Division of Fish, Game and Wildlife, Locatong Creek (13 miles) and Alexauken Creek (6 miles) have both been assessed as supporting healthy cold water fisheries. Wickechoeke Creek (approx. 14 miles), also a cold water fishery, is evaluated as moderately degraded. An intensive survey on this latter stream's macroinvertebrate community has found a shift from forms normally present in cold water streams to species tolerant of extremely saline conditions.

Problem and Goal Assessment

Point Source Assessment

Any introduction of pollutants into these streams can have a deleterious impact, especially during low flow periods. No permitted facilities however are reported to be out of compliance within this watershed as of the end of 1989. The Texas Eastern facility in West Amwell, Hunterdon Co., is a hazardous waste site and is suspected to be polluting Alexauken Creek with PCBs, PHC and dioxin.

Nonpoint Assessment

Locatcong and Wicheckeoke Creeks are assessed to be impacted by runoff from crop land and from pasture land. These agricultural sources are believed to be on the decline and are being replaced by increasing quantities of runoff from road construction/maintenance. These streams also receive occasional septic tank leachate which is suspected to have contributed to nutrient enrichment and fecal coliform contamination.

Alexauken Creek is known to be impacted by a wide range of nonpoint pollution sources. Agriculture, specifically crop and pasture land, contributes fertilizers, soil, and manure runoff. Suburban runoff from storm sewers contribute oils, salts, and fecal coliform contamination. Alexauken Creek receives nutrients and fecal bacteria from local septic systems.

Designated Use and Goal Assessment

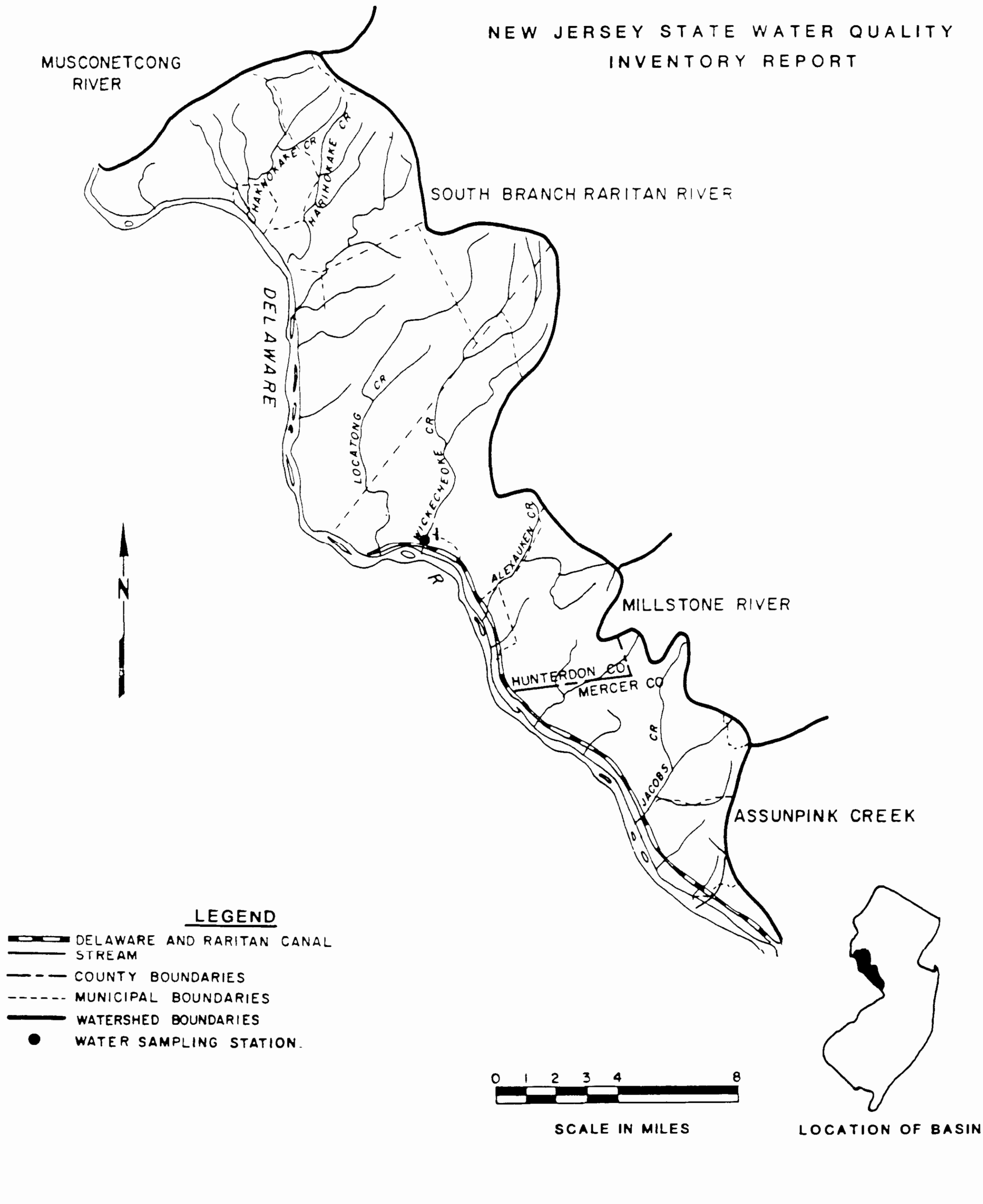
The Delaware River tributaries discussed in this segment are generally not considered suitable for primary contact recreation because of excessive fecal coliform concentrations. Lockatong and Alexauken Creeks meet the fish propagation and maintenance use/goal (approximately 20 miles), while Wickecheoke Creek (14 stream miles) is considered to have a moderately degraded fisheries, (i.e. partially meeting this designated use), because of wastewater discharges.

Monitoring Station List

Map Number	Station Name and Classification
1	Wickecheoke Creek at Stockton, FW-2 Trout Maintenance

DELAWARE RIVER TRIBUTARIES
(HUNTERDON/MERCER COUNTIES)

NEW JERSEY STATE WATER QUALITY INVENTORY REPORT



WATER_QUALITY_INDEX_PROFILE_

Delaware River Tributaries
Hunterdon County

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION_
Wickecheoke Creek at Stockton	AVG WQI	16	8	12	19	22	9	8	21	29 Fair
	WORST3 MONTHS	June-August	July-Sept	August-Oct	Sept-Nov	Sept-Nov	Jan-March	July-Sept	Sept Nov	51 Fair Aug- Oct

LEGEND - Water_Quality_Index_Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels, severe stress to stream life; water uses not met
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY	WATERSHED: DELAWARE TRIBUTARIES

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Salvation Army-Camp Techmuseh	0023001	Nishisakawick Creek	Alexandria Twp./Hunt.	Ind./Comm.
Alexandria Bd. of Ed.	0027553	Trib to Nick-kawick creek	Alexandria Twp./Hunt	Municipal
Kingwood Twp. Bd. of Ed.	0023311	Krial Pond	Kingwood Twp./Hunter	Municipal
Delaware Twp. MUA	0027561	Tributary to Wick-echeoke Creek	Delaware Twp./Hunter	Municipal
Magnesium Elecktron Inc.	0027537	Wickecheoke Creek	Kingwood Twp./Hunter	Ind./Comm.
Lehigh Fluid Power, Inc.	0036005	Alexauken Creek	Lambertville/Hunter	Industrial
Glen Gardner Station	0070645	Spruce Run	Lebanon Twp./Hunter	Ind./Comm.
Homasote Company	0004031	Gold Run	Ewing Township	Industrial
Mercer County Airport STP	0023779	Jacob Creek	Ewing Township	Municipal
General Sullivan Group Inc.	0034321	Gold Run	Ewing Township	Industrial
Hopewell Valley Reg. Bd.of Ed	0021776	Trib of Delaware R.	Titusville/Mercer	Municipal
County of Mercer Co. Pine	0027715	Fidler Creek	Hopewell/Mercer	Municipal

8. ASSUNPINK CREEK

Watershed Description

The Assunpink Creek drains an area of 91 square miles. It is about 25 miles long, flowing from Millstone Township in Monmouth County through central Mercer County to the Delaware River at Trenton. The Upper and Lower Assunpink sub-watersheds comprise the entire Assunpink watershed. Shabacunk Creek and Miry Run are the major tributaries to the Assunpink. A number of impoundments exist along Assunpink Creek and its tributaries for flood control and other purposes.

Land uses in this watershed are both agricultural/undeveloped and urban/suburban. Population is centered in Trenton and surrounding areas. There are 17 NJPDES permitted discharges here, 2 municipal and 15 commercial/industrial. The waters of the Assunpink Creek watershed are classified primarily FW-2 Nontrout with a two mile stretch determined to be FW-2 Trout Maintenance.

Water Quality Assessment

Assunpink Creek experiences severe degradation in water quality when it flows into the Trenton area, based on monitoring near Clarksville and at Trenton. The creek is of overall good quality at Clarksville, upstream of Trenton. However, below Clarksville Assunpink Creek is impounded, channelized, and subject to significant municipal and industrial discharges. As a result, water quality is fair to poor in this area.

The Assunpink near Clarksville drains suburban development, and crop and vacant lands. Water quality problems are limited to excessive phosphorus and periodic high fecal coliform concentrations. Fecal coliform levels averaged 52 MPN/100ml during the 1983 to 1987 period with 13 percent exceeding the 200 MPN/100ml criterion. Total phosphorus was above its criterion in 63 percent of all samples collected. Stream quality shows little change throughout the year.

Assunpink Creek at Trenton contains water quality conditions that are typical of highly developed urban areas of the state. Fecal and total coliform averaged 622 and 2770 MPN/100ml, respectively. Total phosphorus was above the .1 mg/l recommended limit in all samples collected (average levels were seven times the .1 mg/l criterion). Total inorganic nitrogen levels also indicate high nutrient enrichment of the creek. During 1983 to 1987, the late spring and early summer months found poor water quality conditions in the Assunpink.

Overall conditions have not changed significantly since a major regional municipal wastewater facility, which discharges to the creek, initiated advanced treatment. Biomonitoring of Assunpink Creek at Trenton continues to indicate excessive nutrient enrichment and some toxic influence from an unknown source. Only 1 - 2% of the macroinvertebrate population sampled were regarded as intolerant of organic enrichment or low dissolved oxygen conditions. In contrast, the remaining 98% were all forms tolerant of varying degrees of pollution. Previous biological data reveal polluted conditions existing at this station since the biological monitoring began in 1977. In 1984 the impact of toxic substances (or substance) began to make an observable influence upon the biota by depressing the numbers of individuals and taxa in the region. This condition has since been observed to the present time.

The upper 16 miles of Assunpink Creek were evaluated as supporting a healthy warm water fish community. The lower 6 miles begins to degrade becoming moderately degraded due to low species diversity and a lack of game species. This lower portion of the Assunpink supports both warm and cold water fish forms. New Sharon Branch, a small tributary also assessed by the Division of Fish, Game and Wildlife, contains a healthy warm water fishery.

Problem and Goal Assessment

Point Source Assessment

Point source discharges influence water quality conditions in the lower sections of Assunpink Creek, especially from Whitehead Mill Pond downstream. Impacts from point sources above the pond are localized. Two dischargers are reported to be out of compliance in this watershed. The Borough of Roosevelt STP discharges improperly treated wastewater into Assunpink Creek. The Consumers Oil Corp., a distribution facility in Hamilton Twp., exceeds its permit limitations for: COD, suspended solids, pH, and petroleum hydrocarbons.

Nonpoint Source Assessment

In the Upper Assunpink watershed an increase in suburban and commercial development is currently underway, but water quality does not appear to have been adversely impacted. Pollution problems may be masked by the retention effects of a number of impoundments on the creek which are used for flood control purposes. What problems are conveyed in the monitoring data for the Upper Assunpink are likely nonpoint source related. Crop production in the upstream sections of the Assunpink is known to have led to soil erosion and increasing stream siltation. Further downstream, agriculture gives way to urban runoff as the principal source of nonpoint source contamination, specifically land development and urban runoff. In Trenton, however, water quality degradation is evident from the large municipal and industrial wastewater contributions to the creek. These wastewaters, combined with the effects of stream channelization and nonpoint sources, result in a water body that cannot assimilate organic and nutrient loads. The high bacterial levels are due to urban runoff.

Evaluated lakes in the Assunpink watershed; Lake Assunpink, Stone Tavern Lake, Rising Sun Lake, and Mercer Lake are all believed to receive some nutrient loading from agricultural and residential runoff.

Designated Use and Goal Assessment

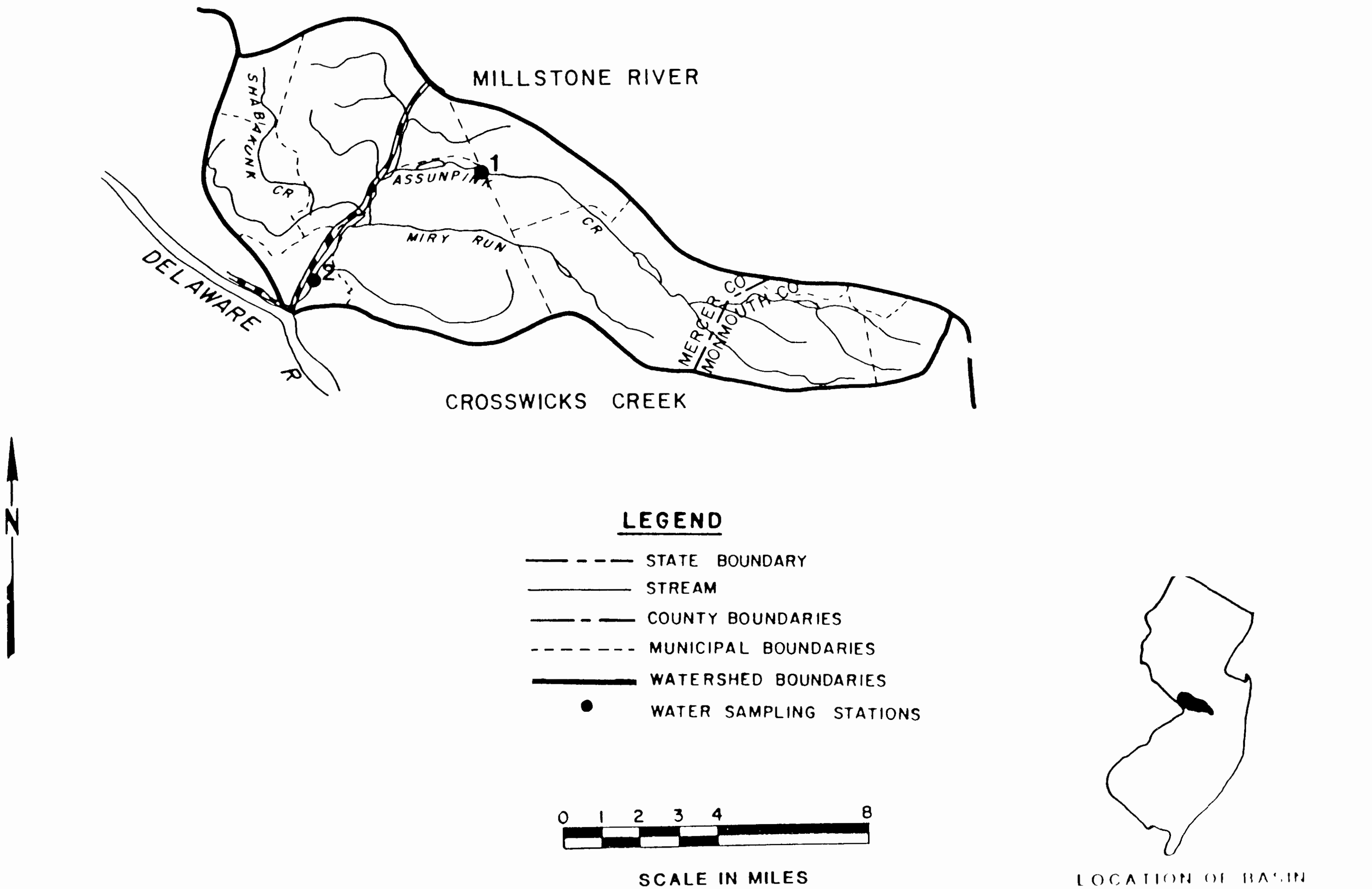
The fishable goal will be met in the Upper Assunpink Creek watershed, and partially met in the Trenton area, (the lower 5 miles). The highly enriched conditions in the Lower Assunpink and degraded biological community indicates that stress occurs to the warm water fisheries present. The swimmable goal is partially met at the Clarksville monitoring location, and not achieved in the lower reaches.

Monitoring Station List

Map Number	Station Name and Classification
1	Assunpink Creek near Clarksville, FW-2 Nontrout
2	Assunpink Creek at Trenton, FW-2 Nontrout

ASSUNPINK CREEK

NEW JERSEY STATE WATER QUALITY
INVENTORY REPORT



WATER QUALITY INDEX PROFILE

Assunpink Creek

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Assunpink Creek near Clarksville	AVG WQI	4	7	8	11	30	3	0	5	16 Good
	WORST3 MONTHS	July-Sept	July-Sept	Sept-Nov	July-Sept	Dec-Feb	Nov-Jan	Aug-Oct	April-June	20 Good Dec-Feb
Assunpink Creek at Trenton	AVG WQI	5	12	11	44	53	10	3	16	54 Fair
	WORST3 MONTHS	June-August	May-July	May-July	March-May	August-Oct	March-May	May-July	Nov-Jan	72 Poor April-June

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts, water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: ASSUNPINK CREEK**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Carter-Wallace Inc.	0031429	Assunpink Creek	Trenton City/Mercer	Ind./Comm.
Fermenta Animal Heat	0004502	Sand Run Creek	Lawrence Twp./Mercer	Ind./Comm.
Hydrocarbon Research: R+D Ctr	0032913	Asspunpink Creek	Lawrence Twp./Mercer	Ind./Comm.
Trane, DPG	0032832	Assunpink Creek	Hamilton Twp./Mercer	Ind./Comm.
Goodall Rubber Co.	0004626	Assunpink Creek	Hamilton Twp./Mercer	Ind./Comm.
National Sponge Cushion Co.	0032999	Assunpink Creek	Trenton City/Mercer	Ind./Comm.
Transamerica De Laval-Turbine	0004677	Assunpink Creek	Hamilton Twp./Mercer	Ind./Comm.
Boro of Roosevelt	0022918	Assunpink Creek	Roosevelt Boro/Momth	Municipal
Ewing-Lawrence SA	0024759	Assunpink Creek	Lawrence Twp./Mercer	Municipal
American Biltrite Inc.	0031895	Assunpink Creek	Hamilton Sq./Mercer	Thermal
Wenkzel Tile Corp.	0033278	Assunpink Creek	Trenton/Mercer	Ind./Comm.
NJ Transit Corp	0061077	Assunpink Creek	Trenton/Mercer	Ind.
Delorenzo Transfer Station	0064106	Assunpink Creek	Trenton/Mercer	Ind.
Polychrome Corp	0099066	Assunpink Creek	Hamilton Squ./Mercer	Ind.
Exxon Station 0139	0064297	Pond Run	Hamilton Twp./Mercer	Comm.
Er Squibb & Sons	0027618	Shiptauken Creek	Princeton/Mercer	Ind.
Sterling Drug	0032255	Wallkill River	Trenton/Mercer	Ind.

9. CROSSWICKS CREEK

Watershed Description

Crosswicks Creek is 25 miles long and drains an area of 146 square miles to the Delaware River at Bordentown. It drains sections of Ocean, Burlington, Monmouth, and Mercer Counties. The two main population centers here are Yardville in Mercer County and Bordentown in Burlington County. Major tributaries include Jumping Brook, Lahaway Creek, North Run, and Doctors Creek (17 miles long). Sub-watersheds includes Upper and Lower Crosswicks Creeks and Doctors Creek. Tides affect this stream up to the Crosswicks Mill Dam. Allentown Lake, Oxford Lake, Prospertown Lake, and Imlaystown Lake are the major impoundments in the Crosswicks Creek watershed.

Important land uses in this watershed include agricultural, forested, residential/commercial and military installations. There are 14 NJPDES permitted discharges, of which 9 are municipal, 3 are commercial/industrial, and 2 are from the military installations of McGuire Air Force Base and Fort Dix. Crosswicks Creek and tributaries have been classified as FW-1 from the headwaters of Lahaway Creek in the Colliers Mill Wildlife Management Area and FW-2 Nontrout for the rest of the Crosswicks Creek system.

Water Quality Assessment

Routine ambient monitoring of Crosswicks Creek and tributaries, representing approximately 15 stream miles, is performed at the following locations: Crosswicks Creek at Extonville and Doctors Creek at Allentown. The Ocean County Health Department samples Crosswicks Creek and selected tributaries once yearly. The results of an ambient monitoring station, Crosswicks Creek at Groveville, which was discontinued in 1983, are also briefly presented.

The Upper Crosswicks Creek watershed appears to be moderately to severely degraded. Intensive survey results from 1984 show nutrient enrichment, with generally high bacteria counts and low dissolved oxygen saturation. Nutrient concentrations were usually higher during low flow periods. In addition, elevated total residual chlorine levels, noticeable chlorine odors and chloroform were found in Upper Crosswicks Creek. Macroinvertebrate sampling of the Upper Crosswicks Creek watershed also indicate generally poor water quality, with pollution tolerant organisms prevalent throughout.

Downstream at Extonville water quality improves so that good (overall) to fair (summer period) conditions are present. Crosswicks Creek, as measured at Extonville, contains elevated fecal coliform and phosphorus levels, and reduced dissolved oxygen recorded as percent saturation. Although biochemical oxygen demand is periodically high (over 5.0 mg/l), dissolved oxygen concentrations were within State criterion. The low dissolved oxygen saturation levels may be due to the ground water contribution to base stream flows. The fecal coliform geometric average at Extonville from 1983 to 1987 was 223 MPN/100ml; total phosphorus averaged .25 mg/l with 95 percent of the values greater than the State criterion. Inorganic nitrogen is also occasionally high. pH readings in the creek fluctuated around the neutral level. The results of the discontinued monitoring at Groveville found conditions similar to those at Extonville.

Doctors Creek, a major tributary to the Lower Crosswicks Creek, contains fair water quality as monitored at Allentown. Like Crosswicks Creek, Doctors Creek has water quality problems due to high fecal coliform, inorganic nitrogen and total phosphorus concentrations. Total phosphorus exceeded the .1 mg/l State criterion in all of samples taken, while fecal coliform was excessive in 75 percent of all samples. Doctors Creek experiences reduced water quality conditions during the May to July period.

Direct assessments of the fish populations of Crosswicks and Doctors Creeks are not available. Neighboring and tributary streams in the watershed, however, have been evaluated by the New Jersey Division of Fish, Game, and Wildlife. Of these, two adjacent streams Black Creek (13 miles), and Crafts Creek (15 miles) were assessed as supporting healthy warm water fish communities. Black Creek (4 miles), a tributary to Crosswicks Creek, was likewise assessed to be in the same condition. Duck Creek's warm water fishery was evaluated to be moderately degraded, as was North Run (9 miles), a tributary to Crosswicks, because of poor bass reproduction. An unnamed tributary to Doctors Creek was described as supporting a healthy warm water fish population.

Problem and Goal Assessment

Point Source Assessment

Sewage treatment plant effluent, together with runoff and other nonpoint sources, is suspected of causing nutrient enrichment and poor water quality in the headwaters of Crosswicks Creek. The Wrightstown MUA discharge to Crosswicks Creek is under enforcement action for not meeting permit limitations on solids, BOD, and chlorine. The Hamilton Township STP is also currently under NJDEP enforcement action because of excessive ammonia in its discharge. The Hamilton facility discharges to Crosswicks Creek just above its confluence with the Delaware River. Additional dischargers to Crosswicks Creek undergoing enforcement include the Spartan Village Mobile Home Park STP for excessive flow violations, and the Hanover Mobile Village STP for excessive BOD and suspended solids. Doctors Creek is reported to be receiving inadequately treated wastewater from the Borough of Allentown STP. Bacon's Run receives excessive BOD, suspended solids, and chlorine from the sewage treatment plant servicing the Northern Burlington County High School.

A number of hazardous waste sites are present in the upper watershed that may be contaminating local surface waters. They include: McGuire Air Force Base (aromatic hydrocarbons to South Run), Hopkins Farm site (volatile organics and unknown substances to unnamed tributary), Wilson Farm site (volatile organics and unknown substances to Bordens Run), and Goose Farm (volatile organics to unnamed tributary).

Nonpoint Source Assessment

The upper 15 miles of Crosswicks Creek receives pollution from both agriculture and suburban development. The Soil Conservation Service has found agricultural sheet and rill erosion to be high in the Crosswicks Creek basin. Severe runoff from cropland and housing construction is known to be responsible for turbidity, high total dissolved solids, and excessive phosphorus levels in the creek. Rising rates of suburban development in New Egypt has brought about severe problems with septic tank leachate and surface runoff. These have resulted in reports of elevated ammonia and coliform bacteria, as well as depressed dissolved oxygen levels. The lower reaches of Crosswicks Creek, some 7 miles, are known to receive fertilizer, herbicides, pesticides, and silt loads from ever increasing amounts of crop land runoff. In addition, stream bank erosion is suspected in Crosswicks Creek along stretches of pasture land. Severe runoff from suburban construction sites, storm sewers, as well as road maintenance are noted to be increasing problems. Local septic systems are suspected to be causing rising levels of coliform contamination. The only declining source of nonpoint source pollution here was reported to be that produced by road and bridge construction.

The 17 mile long Doctors Creek is believed to receive severe levels of crop land runoff carrying fertilizer, herbicides, pesticides, and silt. Housing and road construction in the upstream reaches are suspected to be contributing additional silt loads to this stream. North Run is evaluated as receiving agricultural and road runoff which are believed to be causing water quality degradation from the effects of nutrient enrichment and oil and grease. Duck Creek is believed to receive increasing amounts of storm sewer effluent. Back Creek is assessed as possibly receiving large quantities of runoff from road and housing construction in addition to runoff from suburban surfaces.

Imlaystown and Allentown Lakes were also evaluated and noted to be receiving high levels of siltation from local plant nursery stock operations.

Designated Use and Goal Assessment

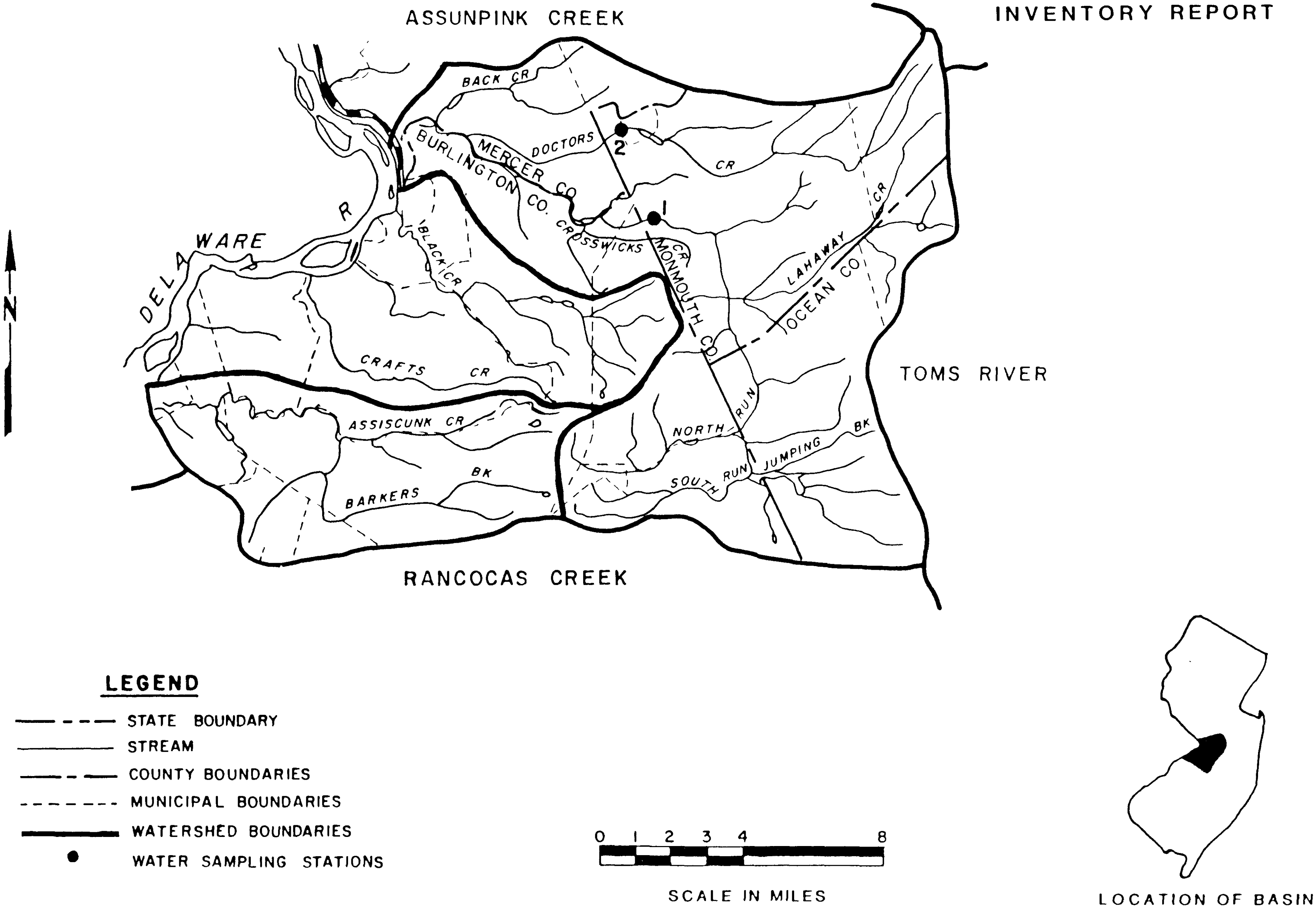
Portions of Crosswicks Creek and tributaries will meet the fish propagation/maintenance goal, but swimmable status can not be assigned to the watershed. The macroinvertebrate survey of 1984 indicates that fishlife may be stressed in the upper watershed, as such this section is considered to be partially meeting the fish propagation/maintenance use. In the Lower Crosswicks Creek this use is met. Fecal coliform counts in streams frequently exceed the standard for swimming.

Monitoring Station List

Map Number	Station Name and Classification
1	Crosswicks Creek at Extonville, FW-2 Nontrout
2	Doctors Creek at Allentown, FW-2 Nontrout

CROSSWICKS CREEK

NEW JERSEY STATE WATER QUALITY INVENTORY REPORT



WATER QUALITY INDEX PROFILE

Crosswicks Creek

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Crosswicks Creek at Extonville	AVG WQI	2	21	10	20	27	5	2	10	24 Good
	WORST3 MONTHS	June-August	May-July	April-June	June-August	Dec-Feb	July-Sept	May-July	April-June	37 Fair June-August
Doctors Creek at Allentown	AVG WQI	3	16	13	34	28	4	4	6	32 Fair
	WORST3 MONTHS	June-August	July-Sept	March-May	Sept-Nov	May-July	Nov-Jan	July-Sept	Oct-Dec	45 Fair May-July

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met.
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: CROSSWICKS & ASSISCUNK CREEK**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Bordentown Cty Disposal Plant	0024678	Blacks Creek	Bordentown City/Bur.	Municipal
Yates Indust., Inc.	0004332	Mile Hollow Brook	Bordentown City/Bur.	Ind./Comm.
Hamilton Twp/Independence Ave	0026301	Crosswicks Creek	Hamilton Twp./Mercer	Municipal
Ocean Spray Cranberries, Inc.	0004294	Thornton Creek	Bordentown City/Bur.	Ind./Comm.
Garden St. Water Co.	0001198	Culvert Pond Run	Hamilton Twp./Mercer	Municipal
N.J. Tpk. Auth.-Area 6N + 6S	0020737	Crosswicks Creek	Hamilton Twp./Mercer	Municipal
Bordentwn Twp Mile Hollow STP	0024121	Crosswicks Creek	Bordentown Twp./Bur.	Municipal
Yth. Correct. Inst.-Bordentwn	0026719	Crosswicks Creek	Bordentown Twp./Bur	Municipal
Allentown Borough Water Plant	0030848	Doctors Creek	Allentown Boro Monm	Municipal
Allentown Borough STP	0020206	Doctors Creek	Allentown Boro Monm	Municipal
Burlington Twp.-Gorce SQ. SA	0021695	Assiscunk Creek	Burlington Twp./Bur.	Municipal
Burlington Twp.- Central Ave STP	0021709	Tawners Run	Burlington Twp./Bur.	Municipal
N. Burlington C. Reg. School District	0022381	Bacon Run	Mansfield Twp./Bur.	Municipal
Springfield Twp. School STP	0021571	Barkers Creek	Springfield Twp./Bur.	Municipal
Calif. Villa Mobile Home Pk.	0027511	Crosswicks Creek	N. Hanover Twp./Bur.	Ind./Comm.
Wrightstown MUA	0022985	Crosswicks Creek	Wrightstown Boro/Bur.	Municipal
McGuire A.F.B.	0022578	South Run	Wrightstown Boro/Bur.	Municipal
US Army-Ft. Dix+Training Ctr.	0004855	Crosswicks Creek	New Hanover Twp/Bur.	Municipal
Hanover Mobile Home Pk.	0027464	Crosswicks Creek	N. Hanover Twp./Bur.	Ind./Comm.
Plumstead Twp. School Dist.	0021407	Crosswicks Creek	New Egypt/Ocean	Municipal
Hub Servall Record Mfg. Corp.	0031950	Highland Brook	Cranbury/Middlesex	Thermal
Linpro Company	0059838	Assiscunk	Plainsboro/Middlesex	Ind./Comm.
IBM Corp. - Card Mfg. Plant	0000426	Assiscunk	Dayton/Middlesex	Industrial
McCleon Eng. Labs Inc.	0003794	Little Bear Creek	Princeton Jct./Mercr	Industrial
Bordentown Water Department	0028649	Crosswicks Creek	Bordentown/Burlington	Industrial
Interstate Storage & Pipeline	0033677	Ditch to Assiscunk	Burlington/Burlington	Industrial
Kauffman & Minteer Inc.	0032310	Assiscunk Creek	Jobstown/Burlington	Industrial

10. RANCOCAS CREEK

Watershed Description

The Rancocas Creek watershed is 360 square miles and the largest in south-central New Jersey. Of this area, 167 square miles is drained by the North Branch and 144 square miles is drained by the South Branch. The North Branch is 31 miles long and is fed by the Greenwood Branch, McDonalds Branch, and Mount Misery Brook. The major tributaries to the South Branch (27 miles long) include the Southwest Branch Rancocas Creek, Stop the Jade Run, Haynes Creek, and Friendship Creek. The mainstem flows about eight miles and drains an area of approximately 49 square miles before emptying into the Delaware River at Delanco and Riverside. Tidal influence occurs for about 15 stream miles, extending the entire length of the mainstream to the dam at Mt. Holly on the North Branch, Vincentown on the South Branch, and Kirby Mills on the Southwest Branch. The Rancocas Creek watershed has been divided into six sub-watersheds: Upper North Branch, Cranberry Branch, Lower North Branch, Upper South Branch, Southwest Branch, Lower South Branch and Rancocas Creek mainstem. Population centers are Pemberton Township, Medford Township, Medford Lakes Borough, Evesham Township, Mount Holly, and Willingboro. Major impoundments include Medford Lake, Pine Lake, Browns Mills Lake, and Crystal Lake.

About half this drainage basin is forested, with the remaining area divided between agricultural use and urban/suburban. Significant development is taking place in many former agricultural areas. The eastern part of this watershed drains the Pinelands Protection Area. There are 24 NJPDES permitted discharges here, of which 20 are municipal and four are industrial/commercial. This watershed has been classified FW-Central Pine Barrens, FW-1 for the waters within the state parks, state forests, and wildlife management areas, and FW-2 Nontrout.

Water Quality Assessment

Ambient water quality monitoring of the North and South Branches of Rancocas Creek indicates good to fair conditions, with water quality degradation occurring in the downstream direction. No ambient monitoring is performed on the tidal mainstem Rancocas Creek. The North and South Branches have background water quality which is indicative of the Pinelands area - low pH in the range of 3.5-5.5 *SU*, and reduced dissolved oxygen saturation and nutrient levels. McDonalds Branch, a tributary of the North Branch, is sampled as part of the National Hydrologic Benchmark

Program for determining natural or background conditions. This location is in the heart of the Pinelands area, and has dissolved oxygen saturation averaging 41 percent and a pH of 4.07 SU from 1983 to 1987.

The North Branch of Rancocas Creek is routinely sampled (in downstream order) at Browns Mills, Pemberton, and Mt. Holly. Overall water quality at these three locations can be characterized as good, with fair conditions during warm weather months at Browns Mills. Conditions improve at Pemberton before some degradation at Mt. Holly. Dissolved oxygen concentrations are adequate for warm-water fisheries in the North Branch, but percent saturation often falls below 80 percent. Moderate nutrient enrichment is found at both Browns Mills and Mt. Holly, as evident in the total phosphorus levels and above normal pH values. Total phosphorus exceeded State criterion in 30 and 83 percent, respectively, at Browns Mills and Mt. Holly. Fecal coliform counts are comparatively low at Browns Mills and Pemberton with geometric means under 30 MPN/100ml, but amounts significantly increase at Mt. Holly (averages 123 MPN/100ml with 50 percent greater than State criterion). One elevated value of each lead and copper was found at Pemberton between 1983 and 1987.

The South Branch of Rancocas Creek is of good to fair quality as sampled at Vincentown and Hainesport. During the late spring period water quality at Hainesport degrades to near poor conditions. Both stations show the effects of man's pollution: generally high nutrient and fecal bacteria concentrations. As in the North Branch, water quality worsens in a downstream direction. Total phosphorus averages .16 mg/l at Vincentown and .28 mg/l at Hainesport. Fecal coliform increased from a geometric mean of 73 MPN/100ml at Hainesport to 618 MPN/100ml at Vincentown during the period of review. The low dissolved oxygen saturation values during the summer may indicate ground water discharges to base stream flows. Biological monitoring of the South Branch Rancocas at Lumberton reveal a fauna adapted to heavy silt deposition and to moderate levels of nutrient enrichment. Data from 1986 suggest similar conditions.

The upper and lower sub-watersheds of the North Branch of the Rancocas, as well as Cranberry Branch, an 8 mile long tributary to this creek, have been evaluated by the New Jersey Division of Fish, Game, and Wildlife as supporting a healthy warm water fish community. Assessments for the South Branch of the Rancocas were unavailable. However, numerous tributaries to this stream were evaluated. Of these, Friendship Creek (4 miles), Mason Creek (9 miles), and Haynes Creek (5 miles) were all assessed to be containing healthy warm water fisheries. Mill Creek, 8 miles long, was judged to be supporting a moderately degraded warm water fish community.

Problem and Goal Assessment

Point Source Assessment

The North and South Branches of Rancocas Creek suffer from low to moderate amounts of water pollution. Pollution inputs come from both point and nonpoint sources. Surface water quality problems in the Rancocas Creek occur because of the following dischargers which are now under Department enforcement action: Delran STP (mainstem), the Riverside STP (mainstem), Mobile Estates of Southhampton (North Branch Rancocas), Medford Twp. Water Pollution Control Plant (South Branch Rancocas), the Elmwood Road STP in Evesham Twp. (South West Branch Rancocas), and the Willingboro MUA treatment plant (mainstem). The BEMS Landfill is a hazardous waste site suspected of contaminating Centribury Lake in Southampton Township.

In the tidal Rancocas Creek mainstem a water quality modeling study found excessive nutrients, elevated algae production and highly fluctuating diurnal dissolved oxygen concentrations. The study also concluded that Delaware River boundary affects were limited to the western end of the mainstem, and that stream sources (sediments) of oxygen demand were greater than those from point source inputs.

Nonpoint Source Assessment

Agricultural and suburban runoff is responsible for the pH, bacteria, and nutrient concentrations that are higher than natural background levels. It is expected that the significant development pressures will further stress the streams in the Rancocas watershed. The Upper North Branch of the Rancocas receives nonpoint runoff from a wide assortment of sources; among these are dairy farms, croplands, road and housing construction, road salting, urban surfaces, and storm sewers. Most of these are believed to be increasing over time. Local fish kills are suspected to be the result of pollution coming from the spreading of sludge on local farms lands, the L&D Landfill, and a hazardous waste site (Syron Chemical Co.). The fisheries resource in the lower reaches of the North Branch are evaluated as being threatened by runoff from housing construction, road maintenance, croplands, and the subsurface infiltration of septic wastes. The landfill in Pemberton has been described by local authorities as an extreme and increasing threat to local water quality.

The fish population of Cranberry Branch, a tributary to the North Branch is threatened by subsurface infiltration of septic wastes.

In addition, this stream is also believed to receive nonpoint source pollution from cropland runoff and from local housing construction activities. The fishery in Powell Run is suspected to be impaired by local land disposal of sludge. The Upper South Branch Rancocas is suspected to suffer water quality degradation from sod farm runoff, road and housing construction, urban surface runoff, and septic tank leachate. Furthermore, a landfill in Lumberton is suspected of being a growing problem, affecting water quality there.

The Lower South Branch receives much of the same nonpoint source pollution as the upper reaches including increasing levels of runoff from housing construction, urban surfaces, croplands, septic systems, and surface mining activities. These are all believed to be associated with past fish kills which have occurred in this waterway.

Friendship Creek, Mason Creek, Mill Creek, all tributaries to the Rancocas, are suspected to be impacted by road and highway runoff. Friendship Creek is believed to be further impacted by a local sanitary landfill, while Mill Creek is suspected of being affected by urban runoff.

Designated Use and Goal Assessment

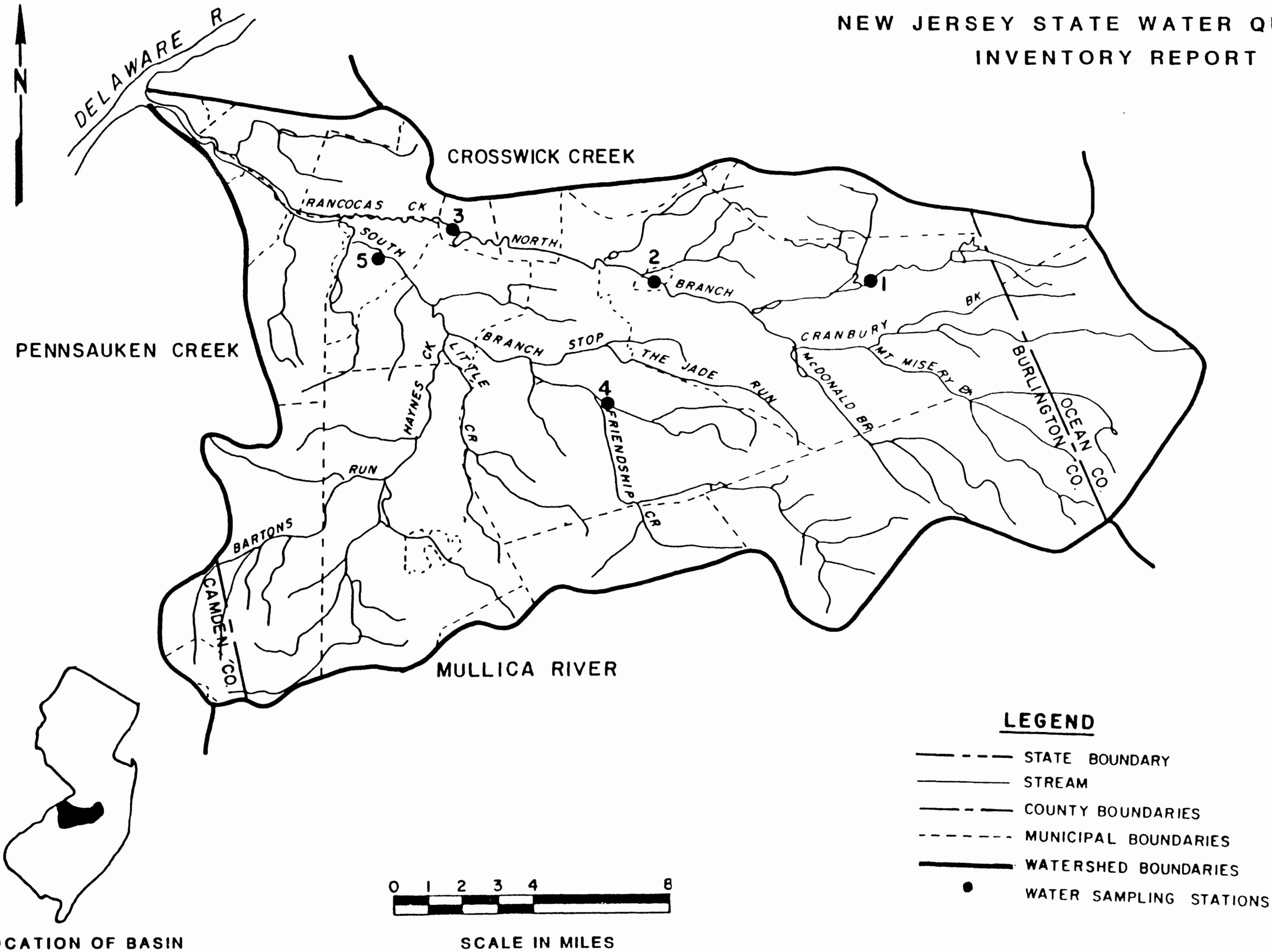
Monitoring indicates that of the 25 miles assessed, 15 are marginally swimmable. This is because of periodic high fecal coliform counts in the upper portions of both North and South Branches. The remaining section appear to be not swimmable. Most of the evaluated fisheries (55 stream miles) are healthy and therefore, the streams are meeting the fish propagation/maintenance designated use. However, of these 55 miles, over 30 are considered threatened because of various pollution problems. Mill Creek contains a moderately degraded fisheries and is thought to be partially meeting the designated use.

Monitoring Station List

Map Number	Station Name and Classification
1	North Branch Rancocas Creek at Browns Mills, FW-2 Nontrout
2	North Branch Rancocas Creek at Pemberton, FW-2 Nontrout
3	North Branch Rancocas Creek at Mt. Holly, FW-2 Nontrout
4	South Branch Rancocas Creek at Vincentown, FW-2 Nontrout
5	South Branch Rancocas Creek at Hainesport, FW-2 Nontrout

RANCOCAS CREEK

NEW JERSEY STATE WATER QUALITY INVENTORY REPORT



WATER QUALITY INDEX PROFILE

Rancocas Creek

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
NB Rancocas Creek at Browns Mills	AVG WQI	3	8	20	6	17	1	0	8	14 Good
	WORST3 MONTHS	July-Sept	June-August	July-Sept	July-Sept	July-Sept	Dec-Feb		July-Sept	31 Fair July-Sept
NB Rancocas Creek at Pemberton	AVG WQI	2	15	5	10	11	2	0	19	11 Good
	WORST3 MONTHS	June-August	June-August	July-Sept	May-July	June-August	Oct-Dec		Oct-Dec	16 Good Aug-Oct
NB Rancocas Creek at Mt. Holly	AVG WQI	3	10	5	23	25	3	0	14	20 Good
	WORST3 MONTHS	July-Sept	Sept-Nov	Feb-April	Dec-Feb	June-August	Sept-Nov		July-Sept	25 Good July-Sept
SB Rancocas Creek at Vincentown	AVG WQI	3	20	7	14	21	2	0	16	20 Good
	WORST3 MONTHS	June-August	June-August	Oct-Dec	Aug-Oct	June-August	June-August		Oct-Dec	29 Fair June-August
SB Rancocas Creek at Hainesport	AVG WQI	3	31	4	38	29	4	0	19	44 Fair
	WORST3 MONTHS	July-Sept	June-August	Feb-April	March-May	July-Sept	Sept-Nov		Jan-March	58 Fair April-June

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts, water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY	**WATERSHED: RANCOCAS CREEK**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Riverside Sewage Plant	0022519	Rancocas Creek	Riverside Twp./Bur.	Municipal
Delran Sewage Treat. Auth.	0023507	Rancocas Creek	Delran Twp./Bur.	Municipal
Willingboro Filtration Plant	0030741	Mill Creek	Willingboro Twp./Bur	Municipal
Willingboro M.U.A.	0023361	Rancocas Creek	Willingboro Twp./Bur	Municipal
Mt. Laurel-Interim STP	0025178	Rancocas Creek	Mt. Laurel Twp./Bur.	Municipal
Moorestown Twp.	0029548	Kendalls Run-Ranc.	Moorestown Twp./Bur	Municipal
NJ Tpk. Auth.-4N Serv. Area	0020745	Parkers Creek	Mt. Laurel Twp./Bur	Municipal
Evesham MUA	0024031	Rancocas Creek	Evesham Twp./Bur	Municipal
Mt. Holly S.A.	0024015	Rancocas Creek	Mt. Holly Twp./Bur	Municipal
Mt. Laurel Twp.-Rancocas STP	0023990	Rancocas Creek	Mt. Laurel Twp./Bur	Municipal
Elizabethtown Water Co.	0004731	Rancocas Creek	Mt. Holly Twp/Bur.	Ind./Comm.
Landfill + Development Co.	0033502	Rancocas Creek	Mt. Holly Twp./Bur	Ind./Comm.
Exxon Service Station	0069400	N. Br. Rancocas Cr.	Mt. Holly Twp./Bur	Ind./Comm
Southhampton Sew. Treat.Plant	0023736	S. BR. Rancocas Crk.	Southampton Twp./Bur	Municipal
Medford WPC Plant	0026832	S.W. Br. Rancocas Cr	Medford Twp./Burling	Municipal
Sybron Chem. Div. WWTP	0005509	Rancocas Creek	Pemberton Twp./Bur	Ind./Comm.
Pemberton Twp. MUA	0024821	Rancocas Creek	Pemberton Twp./Bur	Municipal
Pemberton Twp. H.S. #1 STP	0022438	N. Br. Rancocas Cr.	Pemberton Twp./Bur	Municipal
Sunbury Village S. Co.	0027383	N. Br. Rancocas Crk.	Pemberton Twp./Bur	Municipal
New Lisbon St. School	0021768	Rancocas Creek	Woodland Twp./Bur	Municipal
Medford Lks. Boro. STP	0021326	Atna Run	Mdfrd. Lks. Boro/Bur	Municipal
Pemberton Twp. Bd. of Ed.	0031011	N. Br. Rancocas Crk.	Pemberton/Burlington	Municipal
Moble Homes of Southhampton	0028665	Rancocas Creek	Southhampton/Bur.	Municipal
Stokes of Vincetown Inc.	0033367	Rancocas Creek	Vincetown/Burlington	Industrial
Flanangan Auto Maintenance Facility	0063380	Mason's Creek (Trib to Rancocas)	Lumberton/Burlington	Oil/Wtr Sep

11. PENNSAUKEN CREEK

Watershed Description

The Pennsauken Creek drains 33 square miles of southwestern Burlington County and northern Camden County. This creek flows into the Delaware River near Palmyra, New Jersey. The North Branch of the Pennsauken Creek, 10 miles long, is in Burlington County; while the South Branch, 11 miles long, is the boundary between Burlington and Camden Counties. The tide affects the three mile mainstem and the first few miles up the branches. Population is centered around Mt. Laurel, Maple Shade, Cherry Hill and downstream of Maple Shade. Industry is concentrated at the mouth of the Pennsauken Creek. Much of this watershed is developed urban/suburban area with the remainder divided between farmland and forested land. There are 15 NJPDES permitted discharges here, 13 of which are municipal and two are industrial. Waters have been classified FW-2 Nontrout.

Water Quality Assessment

Pennsauken Creek water quality is representative of a small urban stream receiving significant amounts of point and nonpoint source pollution. Routine monitoring performed on the North Branch Pennsauken Creek near Moorestown and on the South Branch Pennsauken Creek at Cherry Hill supports this conclusion. Streams in the Pennsauken Creek watershed contain extremely high levels of fecal bacteria, nutrients, and biochemical oxygen demand. In addition, elevated concentrations of PCBs and pesticides have been found in the Creek's sediment and fishlife.

The North Branch Pennsauken Creek has fair overall water quality with poor conditions during low-flow periods (September through November). Ninety-five percent of the samples collected from 1983 to 1987 contained total phosphorus in excess of the State criterion. Forty-two percent of the samples had fecal coliform counts greater than the 200 MPN/100ml criterion for freshwater streams. The South Branch Pennsauken Creek has among the worst water quality in the State. Poor water quality conditions are found in the stream throughout the year, with very poor stream quality during the summer months. The South Branch experiences total phosphorus concentrations that average eleven times the State criterion, and fecal coliform counts with geometric means over 5100 MPN/100ml. Un-ionized ammonia levels exceed State criterion for protection of warm-water fisheries during summer months. Total inorganic and Kjeldahl nitrogen was also elevated in almost all samples collected. Five-day biochemical oxygen demand is periodically greater than 10 mg/l indicating significant organic loadings in the stream. Despite this, dissolved oxygen concentrations appear to be adequate, but extreme diurnal fluctuations can be expected in this enriched water system. Dissolved oxygen saturation was usually less than 80 percent, and averaged 69 percent during the period of review.

High levels of chlordane and PCBs in fish taken from the Pennsauken Creek mainstem and the South Branch from Strawbridge Lake downstream pose a potential health hazard. As a result, recreational fishing has been banned in these waterways. The North Branch Pennsauken Creek was assessed by the N.J. Division of Fish, Game and Wildlife as supporting a healthy warm water fish community.

Problem and Goal Assessment

Point Source Assessment

The severe water quality problems found in Pennsauken Creek are due to the large amount of treated wastewaters and storm-waters discharged to the stream, combined with a limited assimilative capacity of the creek to decompose wastes. Plans for the elimination of a number of the municipal treatment discharges and construction of a regional facility discharging to the Delaware River, should result in better water quality. The three Cherry Hill STPs discharging to the South Branch watershed (Kingston, Pennsauken Cr., and Colwick Cr.) are currently under enforcement action and are suspected of having water quality impacts upon their receiving waters.

Nonpoint Source Assessment

The North Branch of the Pennsauken (10 stream miles) is evaluated as receiving pollution from several nonpoint sources including runoff from urban surfaces, roadways, bridge and highway construction sites; and leachate from landfills. These sources were assessed as being severe and are presently believed to be increasing. Additional suspected sources, but of less severity, include construction activities (declining), storm sewers, an industrial tract in Palmyra (oil runoff), septic systems, mining and agricultural sources. Many of these sources are evaluated by the New Jersey Division of Fish, Game, and Wildlife as threatening the health of the fishery resources of the North Branch. Fish kills have occurred in Pennsauken Creek over the years.

Two lakes were assessed within the Pennsauken watershed. Strawbridge Lake receives urban runoff from a dense development of homes, offices, and light industry. This pollution is suspected as having contributed to fish and duck kills. The other lake, Memorial, also receives urban surface runoff causing siltation.

Designated Use and Goal Assessment

Limited attainment of clean water goals will occur in this watershed. Primary contact recreation is precluded in the waterways, and the maintenance and propagation of aquatic life goal is occurring in the North Branch, but it is threatened. The South Branch is considered to have a degraded fish community because of pollution sources and habitat destruction. Chlordane contamination of fish tissue also threatens the viability of the fisheries.

Monitoring Station List

Map Number	Station Name and Classification
1	South Branch Pennsauken Creek at Cherry Hill, FW-2 Nontrout
2	North Branch Pennsauken Creek near Moorestown, FW-2 Nontrout

See page III-144 for a map of the Pennsauken Creek watershed.

WATER QUALITY INDEX PROFILE

Pennsauken Creek

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
NB Pennsauken Creek at Moorestown	AVG WQI	4	25	6	30	50	9	4	18	50 Fair
	WORST3 MONTHS	June-August	Sept-Nov	April-June	Oct-Dec	May-July	Dec-Feb	July-Sept	Sept-Nov	72 Poor Sept- Nov
SB Pennsauken Creek at Cherry Hill	AVG WQI	2	31	13	66	66	11	13	4	80 Poor\ Very Poor
	WORST3 MONTHS	June-August	July-Sept	July-Sept	Sept-Nov	June-August	Dec-Feb	July-Sept	Aug-Oct	100VeryPoor July-Sept

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met.
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: PENNSAUKEN CREEK**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Mt Ephraim STP	0023817	Little Timber Creek	Mt. Ephraim/Camden	Municipal
Cadillac Pet Foods Inc.	0031216	Pennsauken Creek	Pennsauken/Camden	Ind./Comm.
Camden City:Morris-Delair WTP	0031984	Pennsauken Creek	Pennsauken/Camden	Municipal
Merchantville-Pennsauken Park	0032093	Pennsauken Creek	Pennsauken/Camden	Municipal
Maple Shade-Linwood Ave STP	0028738	Pennsauken Creek	Maple Shade/Bur	Municipal
Cherry Hill-Colwick Crk	0025127	Pennsauken Creek	Cherry Hill/Camden	Municipal
Cherry Hill-Pennsauken Crk	0025089	Pennsauken Creek	Cherry Hill/Camden	Municipal
Moorestown STP	0024996	Pennsauken Creek	Moorestown/Bur	Municipal
Armack	0004588	Pennsauken Creek	Maple Shade/Bur	Ind./Comm.
Maple Shade WD	0025577	Pennsauken Creek	Maple Shade/Bur	Municipal
Maple Shade-Main St STP	0028746	S Br Pennsauken Ck	Maple Shade/Bur	Municipal
Maple Shade-WP#2	0031879	Pennsauken Creek	Maple Shade/Bur	Municipal
West Roland Ave.Playground LF	0063657	Pennsauken Creek	Maple Shade/Bur	Ind./Comm.
Maple Shade Twp. STP	0069167	Pennsauken Creek	Maple Shade/Bur	Municipal
Mt Laurel-Ramblewood STP	0023981	Pennsauken Creek	Mt Laurel/Bur	Municipal
Cherry Hill- Kingston STP	0025071	Pennsauken Creek	Cherry Hill/Camden	Municipal
Evesham-Woodstream STP	0024040	Landing Creek	Evesham/Bur	Municipal

12. COOPER RIVER

Watershed Description

The Cooper River is 16 miles long and its watershed encompasses an area of 40 square miles. The river flows from northwest Camden County to the Delaware River at Camden. The most significant tributary is Tindale Run, on the South Branch of the Cooper River. There is intense development along the mainstem and the areas adjacent to the North and South Branches, with the population centers being Camden, Cherry Hill, Haddonfield, and Haddon. Major impoundments include Cooper River Lake, Linden Lake, Hopkins Lake, and Square Circle Lake.

Land use in this watershed is primarily urban/suburban. There are 8 NJPDES permitted discharges here, of which 6 are municipal and two are industrial. The streams in the watershed have been classified FW-2 Nontrout.

Water Quality Assessment

Cooper River, like Pennsauken Creek, is a highly degraded urban stream receiving significant amounts of sewage treatment effluent and stormwater runoff. Monitoring performed on the Cooper River at Lindenwold, Lawnside and Haddonfield shows that water quality is generally good in the upper stretches of the stream, but rapidly worsens to some of the poorest quality surface waters in the State as it flows through Camden and adjoining towns. In addition, pesticide contamination in stream sediments and fishlife has resulted in a recreational fishing ban on the Lower Cooper River.

The Cooper River is sampled at Lindenwold directly below Linden Lake. Partially because of settling and detention in the lake, the Cooper River emerges as a generally good quality stream with moderate amounts of nutrients and reduced summertime dissolved oxygen concentrations. Fecal coliform counts are low, with a geometric mean of 21 MPN/100 ml from 1983 to 1987. However, in just a few miles where the Cooper River reaches Lawnside it has received wastewaters from a number of municipal treatment facilities. Water quality is now very poor with extremely high amounts of nutrients and fecal coliform, and severely depressed dissolved oxygen. Total phosphorus exceeded State criterion in all samples collected between 1983 and 1987, and averaged 1.7 mg/l. Total Kjeldahl nitrogen and inorganic nitrogen averaged 8.8 mg/l and 8.4 mg/l, respectively; two to three times the recommended limits. Fecal coliform was above the 200 MPN/100ml criterion in 61 percent of all samples. Because of high biochemical oxygen demand in the stream, dissolved oxygen is frequently below 4.0 mg/l during low-flow and warm weather periods. Un-ionized ammonia concentrations are, for the most part, above the criterion (.05 mg/l) for protection of warm-water fisheries during summer months.

Downstream at Haddonfield the Cooper River is still grossly polluted and in very poor condition. Phosphorus averages 1.1 mg/l and nitrogen-containing compounds continue to be excessive, with levels similar to those found at Lawnside. Fecal coliform had a geometric mean of 1162 MPN/100ml between 1983 and 1987. Dissolved oxygen concentrations were adequate, all above the criterion for nontrout waters. This may be due, however, to high primary productivity in the stream. DEP enforcement is reporting improvements in water quality brought about by the extensive regionalization of the wastewater treatment plant system in the Cherry Hill/Camden area (see Point Source Assessment). Substantial improvements to water quality are however expected to be hampered by runoff and benthic oxygen demand for some time into the future.

Biomonitoring at Haddonfield in 1988 confirms the presence of a very unhealthy stream environment. The dominant organism was the pollution tolerant bryozoan Plumatella repens, a filter feeder which comprised almost 80% of the community sampled. Organisms tolerant of nutrient enrichment made up 83% of the sampled population. A review of earlier biomonitoring data suggest that water quality at this location may have improved somewhat from 1979 through 1986. The 1988 data however more closely reflect the fauna observed in 1979.

The Cooper River from Cooper River Lake downstream to the confluence with the Delaware River is closed to recreational fishing because of chlordane contamination of fish tissues. Elevated chlordane and PCB concentrations have also been identified in stream sediments.

Fishery evaluations as performed by the New Jersey Division of Fish, Game, and Wildlife in the Cooper River watershed was limited to Tindale Run, a 5 mile long tributary to the Cooper River, which was found to be supporting a healthy warm water fish population.

Problem and Goal Assessment

Point Source Assessment

The water quality problems of the Cooper River have been the result of excessive municipal and industrial wastewater discharges, combined with the effects of urban stormwater runoff and the limited assimilative ability of the stream. The Camden County U.A. regional sewage system is acting to eliminate most of the discharges to the Cooper River. Under terms of a 1986 Consent Order, construction of the Camden County Municipal Utilities Authority's regional wastewater treatment system is continuing. Seventeen individual sewage treatment plants that were discharging inadequately treated wastewater into the Cooper River and it's tributaries have now been taken off-line and all flows conveyed to the upgraded and expanded Camden Co. MUA facility located in Camden City. An additional twenty one plants are scheduled to be abandoned over the upcoming year. DEP enforcement reports that their surface water sampling has shown a decrease in fecal coliform levels and improvements in overall water quality as a result of this regionalization.

Of the treatment plants still in operation, three are under enforcement action for excessive BOD and suspended solids: Cherry Hill - Barclay Farms, the Cherry Hill - Old Orchard STP, and the N.J. Turnpike Authority's (Area 3S) discharge to Tindale Run.

Nonpoint Source Assessment

The 16 mile long Cooper River is known to receive nonpoint source pollution from roadways and housing construction as well as from croplands, storm sewers, suburban surfaces, highway maintenance activities, various spills, mining activities, and landfills. These, combined with point sources, are cited as contributing to declining water quality and occasional fish kills in this river. The fisheries of Tindale Run are believed to be threatened by urban surface and road runoff and by local sewage treatment plant effluent.

Designated Use and Goal Assessment

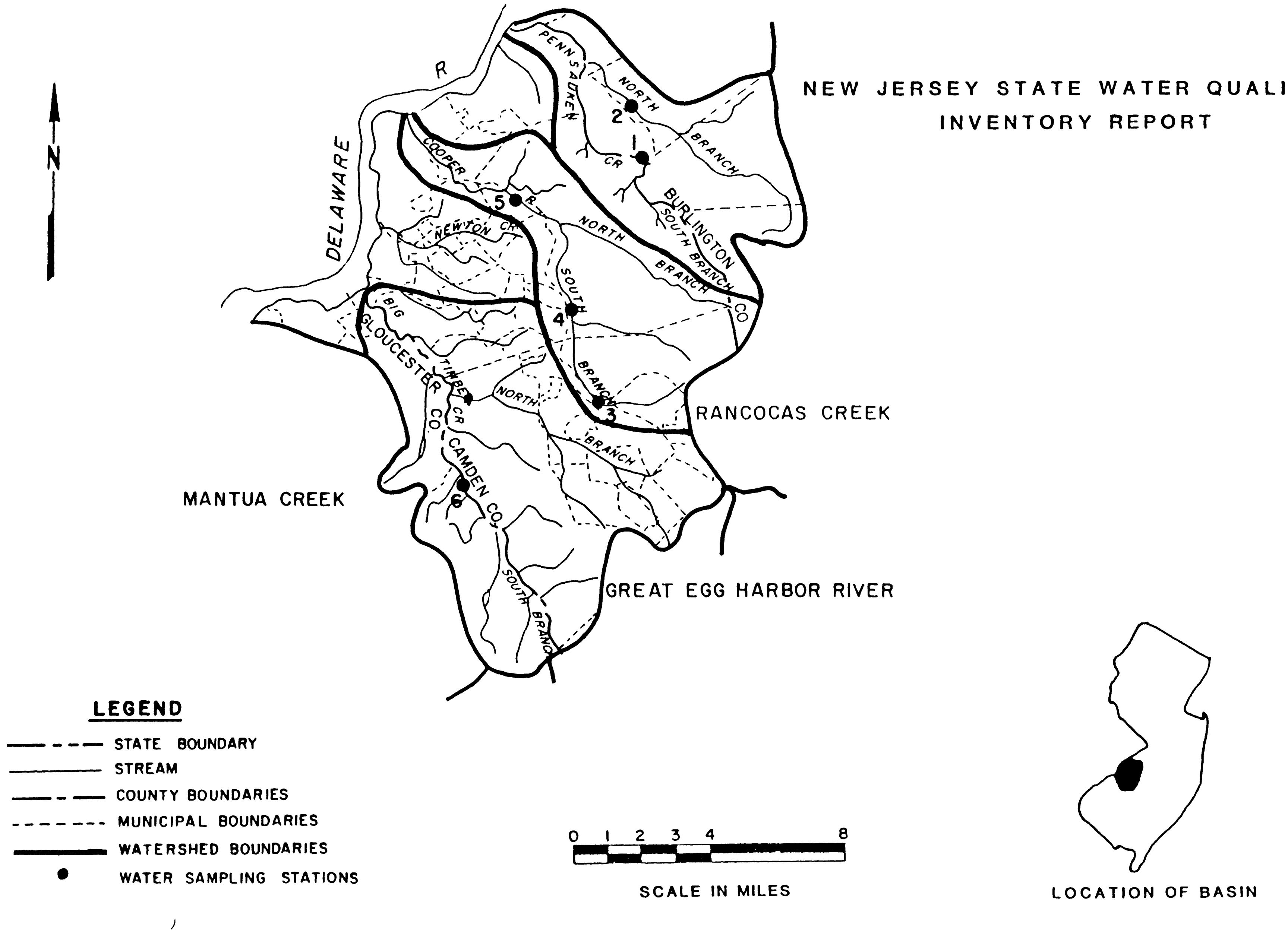
The Cooper River and tributaries partially meet the swimmable and fish propagation/maintenance designated uses only in the headwater reaches. At Lindenwold the Cooper River is considered marginally swimmable, but downstream of this location it is not. In addition, below Lindenwold, excessive pollution prohibits the maintenance and propagation of natural biota. Tindale Run is currently meeting the fish propagation/maintenance goal, but it is threatened from the various pollution sources.

Monitoring Station List

Map Number	Station Name and Classification
3	Cooper River at Lindenwold, FW-2 Nontrout
4	Cooper River at Lawnside, FW-2 Nontrout
5	Cooper River at Haddonfield, FW-2 Nontrout

PENNSAUKEN CREEK, BIG TIMBER CREEK AND COOPER RIVER

NEW JERSEY STATE WATER QUALITY INVENTORY REPORT



WATER QUALITY INDEX PROFILE 1983 1987

Cooper River

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Cooper River at Lindenwold	AVG WQI	3	26	5	12	22	2	0	5	20 Good
	WORST3 MONTHS	June-August	Oct-Dec	April-June	Oct-Dec	June-August	Dec-Feb		April-June	28 Fair August-Oct
Cooper River at Lawnside	AVG WQI	3	56	13	48	98	9	21	9	95Very Poor
	WORST3 MONTHS	July-Sept	June-August	July-Sept	July-Sept	Oct-Dec	Nov-Jan	Sept-Nov	Sept-Nov	100VeryPoor June-August
Cooper River at Haddonfield	AVG WQI	4	23	10	46	98	11	15	16	90 VeryPoor
	WORST3 MONTHS	July-Sept	Oct-Dec	July-Sept	June-August	July-Sept	Feb-April	July-Sept	July-Sept	100VeryPoor July-Sept

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met.
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: COOPER RIVER**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Campbell Soup Co	0005053	Cooper River	Camden/Camden	Ind/Comm
Merchantville-Pennsauken-Brow	0032085	Chandlers Run	Pennsauken/Camden	Municipal
Collingswood Boro WP	0029564	Cooper River	Collingswood/Camden	Municipal
NJ Tpk Auth Area 3S	0020753	Tindale's Run	Cherry Hill/Camden	Municipal
Hussman Refrigerator Co	0003999	Cooper River	Cherry Hill/Camden	Municipal
Cherry Hill-Barclay STP	0025046	Cooper River	Cherry Hill/Camden	Municipal
Cherry Hill-Old Orchard	0025054	Cooper River	Cherry Hill/Camden	Municipal

13. BIG TIMBER CREEK

Watershed Description

Big Timber Creek drains an area of 63 square miles. The mainstem and most of the South Branch divide Gloucester and Camden Counties before flowing into the Delaware River near Brooklawn, south of Camden. Aside from the North and South Branches, (which are 10 and 11 miles long, respectively), major tributaries include Otter Creek, Beaver Brook, and Almohesson Creek. The mainstem is less than four miles long. The major impoundments are Blackwood Lake, Grenlock Lake, Hirsch Pond, and Nashs Lake.

This watershed is primarily urban/suburban with forests at the headwaters and cities at the mouth of Big Timber Creek. There are 18 NJPDES permitted discharges here, 15 of which are municipal and 3 are industrial. The waters in the watershed are FW-2 Nontrout, with the exception of a small area in a headwater stream (Mason Run) classified as FW-2 Trout Production.

Water Quality Assessment

The South Branch of Big Timber Creek is currently monitored at Blackwood Terrace, (this location is thought to represent around 5 stream miles). The North Branch at Glendora monitoring station was discontinued in 1983. The South Branch is of fair water quality throughout the year, while past monitoring shows the North Branch to contain poor water quality. The North Branch Big Timber Creek experienced depressed summer dissolved oxygen levels and excessive concentrations of nutrients and fecal bacteria. Both total inorganic nitrogen and total phosphorus averaged above recommended criteria. Eighty percent of the fecal coliform samples from 1981 to 1983 exceeded the 200 MPN/100ml criterion. Water quality was found to decline to very poor conditions during late spring and early summer. Current conditions are thought to be similar to what was identified earlier in the decade.

Water quality is appreciably better in the South Branch Big Timber Creek at Blackwood Terrace. However, total phosphorus and fecal coliform still generally exceed the State criteria. The concentrations of total phosphorus average .15 mg/l during the current period of review, with 73 percent of the values greater than the State criterion. Fecal coliform exceeded 200 MPN/100ml in 52 percent of the samples collected. The South Branch has adequate dissolved oxygen readings, despite the presence of occasionally high biochemical oxygen demand.

The South Branch of Big Timber Creek (11 miles long) was evaluated by the New Jersey Division of Fish, Game, and Wildlife as supporting a healthy warm water fish community.

Problem and Goal Assessment

Point Source Assessment

Big Timber Creek is subject to a variety of pollution sources. Numerous municipal wastewater discharges contribute to the poor conditions in the North Branch, and to the fair quality of the South Branch. Fourteen municipal treatment plants in this watershed are under DEP enforcement action for discharging wastewaters in violation of permit limitations. A major regionalization has occurred in this watershed with the elimination of five treatment plants: three discharges into Newton Creek, one into Woodbury Creek, and one into Kings Run. The regions formally serviced by these plants are now tied into the Camden County MUA.

The regionalization of municipal treatment systems in Camden County will, in the long-run, eliminate these plants that will result in improved water quality conditions. Gems Landfill, a national Superfund hazardous waste site, is thought to be contaminating Holly Run and Briar Lake with a variety of organic substances. Clean-up activities are currently underway at this site. Fazzio Landfill is also suspected of contaminating Big Timber Creek with organic chemicals.

Nonpoint Source Assessment

Urban/suburban runoff are suspected of being important contributors to the elevated nutrients and bacteria in these streams. Big Timber Creek (25 total stream miles) and Woodbury Creek were evaluated by local authorities as receiving a wide range of pollutants from nonpoint sources including runoff from cropland and feed lots, road and housing construction, urban surfaces, surface mining, road maintenance, eight landfills, septic systems, waste storage tank leaks, and local spills.

Designated Use and Goal Assessment

Attainment of clean water goals is limited in the Big Timber Creek watershed. The South Branch Big Timber Creek generally contains healthy warm-water fisheries, but they are threatened from a variety of pollution sources. Although the fish propagation/maintenance goal is assigned to the remaining streams in the watershed, stressful conditions likely occur in the urbanized and tidal areas during warm weather. High fecal coliform levels preclude the use of these waters for swimming.

Monitoring Station List

Map Number	Station Name and Classification
6	South Branch Big Timber Creek at Blackwood Terrace, FW-2 Nontrout

See page III-144 for a map of the Big Timber Creek watershed.

WATER_QUALITY_INDEX_PROFILE

Big Timber Creek

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
SB Big Timber Creek at Blackwood Terrace	AVG WQI	3	13	12	33	22	4	0	7	27 Fair
	WORST3 MONTHS	June-August	June-August	April-June	Sept-Nov	Sept-Nov	Dec-Feb	April-June	Oct-Dec	43 Fair Sept-Nov

LEGEND - Water_Quality_Index_Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met.
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY	WATERSHED : NEWTON CREEK & BIG TIMBER CREEK

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Gloucester City STP	0026620	Big Timber Creek	Gloucester/Camden	Municipal
Sohio Pipeline Co.	0028801	Unnamed Ditch	West Deptford/Glou	Ind./Comm.
Bellmawr SA	0026743	Big Timber Creek	Bellmawr/Camden	Municipal
Runnemede SA	0026859	Beaver Brook	Runnemede/Camden	Municipal
Gloucester Twp. Chws Lndg	0026468	Big Timber Creek	Gloucester/Camden	Municipal
Gloucester Blackwood STP	0026476	Big Timber Creek	Gloucester/Camden	Municipal
Owens-Corning Fiberglass	0004316	Otter Br. Creek	Barrington/Camden	Ind/.Comm.
Barrington SU	0026875	Beaver Brook	Barrington/Camden	Municipal
Gloucester Mardale Manor	0026484	Signey Run	Gloucester/Camden	Municipal
Stratford Sa	0022624	N Br of Big Timber C	Stratford/Camden	Municipal
Camden City Hosp Lakeland	0029840	S Br of Big Timber C	Gloucester/Camden	Municipal
Clementon STP	0020320	Big Timber Creek	Clementon/Camden	Municipal
Alhyde Co	0032336	Big Timber Creek	Trenton/Mercer	Thermal
Booklawn STP	0022748	Big Timber Creek	Brooklawn/Camden	Municipal
Gloucester MUA	0026492	N Br Big Timber	Gloucester/Camden	Municipal
Gloucester MUA	0028959	S Br Big Timber	Gloucester/Camden	Municipal
Magnolia SA	0021431	Otter Br Cr	Magnolia/Camden	Municipal
Mt. Ephraim	0023817	Little Timber Cr	Mt Ephriam/Camden	Municipal
National Park	0025844	Woodbury Cr	National Park/Glous	Ind
Dun-rite Sand & Gravel	0035891	Slab Bridge Bran	Turnersville/Glous	Ind
Durkee Food Dive of SCM	0033260	Wilkens Ditch	West Depford/Glous	Ind
Gulf Oil/Cumberland Farm	0026026	Woodbury R	Woodbury/Gloust	Ind
Polyrez Comp Inc	0004871	Matthews	Woodbury/Gloust	Thermal

14. RACCOON CREEK

Watershed Description

The Raccoon Creek watershed contains approximately 40 square miles and drains central Gloucester County. The creek itself is 19 miles long and flows from Elk Township to the Delaware River, across from Marcus Hook, Pennsylvania. While there are several minor tributaries, the only significant one is the South Branch Raccoon Creek. Population centers of this rural area are Swedesboro and Mullica Hill. At the mouth of Raccoon Creek are tidal marshes and much of the lower half of the creek is tidal. Ewan Lake, Mullica Hill Pond, and Swedesboro Lake are among the many small lakes and ponds of this area.

The land use in this watershed is primarily agricultural/rural with industries located along the creek's tidal section. However, there has been recent suburban residential and commercial development in much of the watershed. There are 5 NJPDES permitted discharges in the Raccoon Creek watershed: 2 municipal and 3 industrial. Waters are classified as FW-2 Nontrout and SE-2.

Water Quality Assessment

Raccoon Creek is routinely sampled east of Swedesboro for ambient water quality. This monitoring represents approximately five stream miles. Results indicate that the creek is of good quality with conditions declining to fair quality in the summer. (The 1986 305(b) report identified fair conditions in the stream throughout the year.) Elevated total phosphorous concentrations along with moderately excessive fecal coliform counts and inorganic nitrogen levels are the water quality problems found in the creek. Dissolved oxygen appears to be adequate in Raccoon Creek for the maintenance of warm water fisheries, although dissolved oxygen saturation periodically drops below 80 percent. Biochemical oxygen demand is usually below 2.5 mg/l and, as a result, should not have a significant effect on dissolved oxygen levels. pH of the stream is slightly to moderately acidic.

Fecal coliform counts exceeded State criterion in 33 percent of the samples collected since 1983. The geometric mean for this period was 161 MPN/100 ml, with the highest counts occurring during the warm weather months. Total phosphorus was above the State criterion of .1 mg/l in 71 percent of all samples since 1983 and averaged .24 mg/l. Total inorganic nitrogen was highest during the winter season with levels periodically over 2.0 mg/l.

The approximate 8 miles of the South Branch Raccoon Creek maintains a fish community evaluated as moderately degraded. This is the only stream in the watershed evaluated. The approximately 4 mile long Repaupo Creek, a nearby Delaware River tributary, was assessed as supporting a healthy warm water fish community.

Problem and Goal Assessment

Point Source Assessment

Raccoon Creek is a moderately enriched waterway, based on the nutrient levels present. Agricultural runoff and a municipal point source are the likely sources of the nutrients. Five municipal dischargers and one industrial facility are reported to be in violation of their discharge permits: Greenwich Sewer Corp. (Nehonsey Creek), Swedesboro STP (Raccoon Creek), Greenwich Twp. STP and East Greenwich Sewer Corp. (both to Wiggins Pond), and Pennwalt Corp. (Little Mantua Creek).

A regional Gloucester County UA sewerage system is also planned for the western sections of the watershed that will eliminate the Swedesboro STP. Chemical Leaman Tank Lines (Logan Township) waste site is contaminating tidal waters in the western portion of the watershed with pesticides and organics.

Nonpoint Source Assessment

Raccoon Creek is evaluated as receiving nonpoint source pollution from agricultural sources as well as that created by suburban development. The agricultural sources include runoff from crop production, pasture lands, feed lots, and animal holding areas. Suburban, urban, and industrial development has led to impacts from housing construction, urban surface runoff, mining, septic systems, runoff from road maintenance, and occasional chemical spills. All these impacts as well as the impact of various point sources within the watershed are judged to be gradually increasing and acting to degrade local water quality.

Designated Use and Goal Assessment

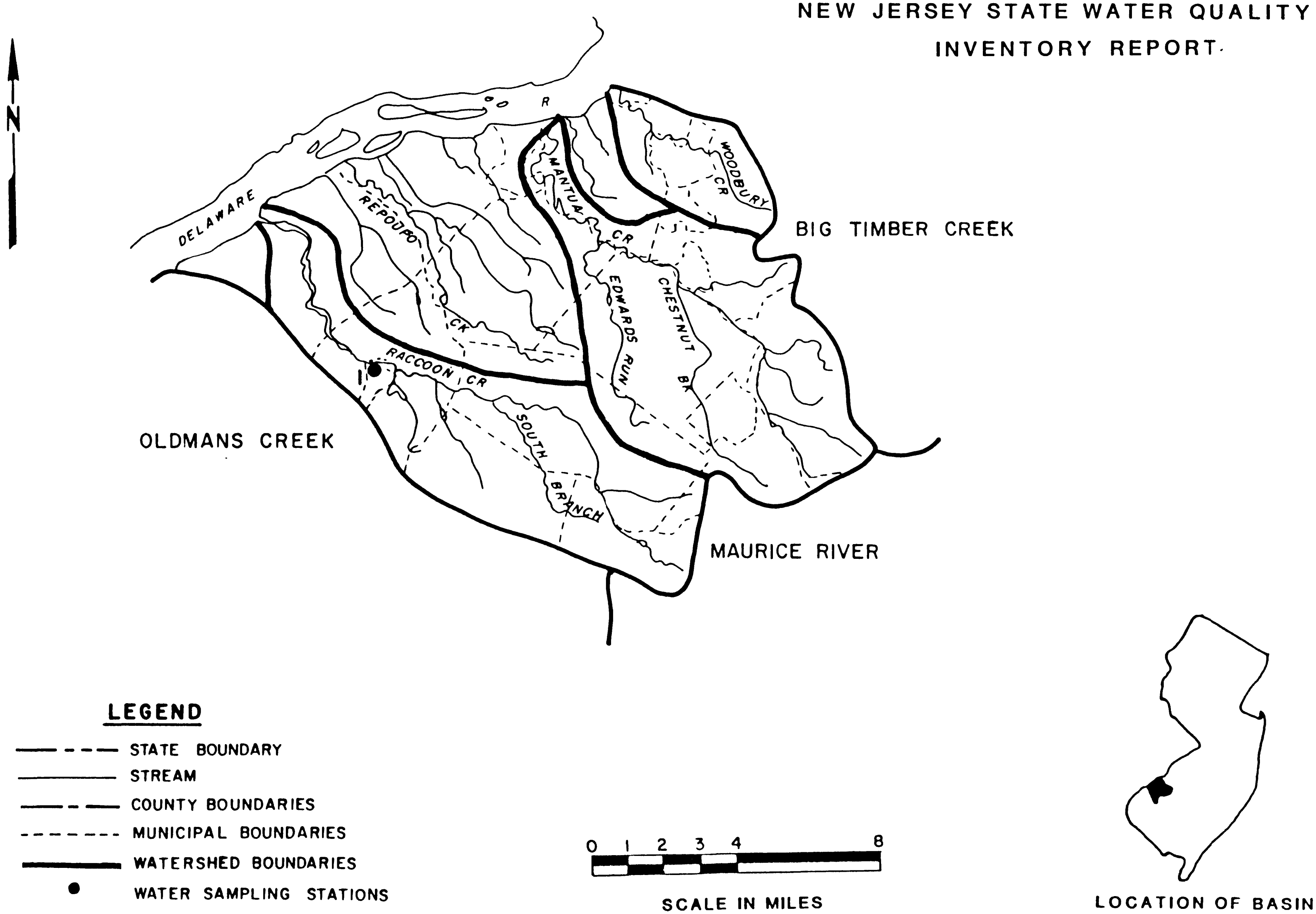
Raccoon Creek will generally meet the fish propagation/maintenance goal of the Clean Water Act, but the South Branch is classified as partially meeting this goal because of some fisheries degradation. The creek is not achieving swimmable status. Elevated fecal coliform concentrations occur primarily during warm weather months rendering the waters unfit for primary contact recreation.

Monitoring Station List

Map Number	Station Name and Classification
1	Raccoon Creek near Swedesboro, FW-2 Nontrout

MANTUA AND RACCOON CREEKS

NEW JERSEY STATE WATER QUALITY INVENTORY REPORT.



WATER QUALITY INDEX PROFILE

Raccoon Creek

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Raccoon Creek near Swedesboro	AVG WQI	2	8	9	20	24	4	0	6	16 Good
	WORST3 MONTHS	June-August	Nov-Jan	August-Oct	May-July	July-Sept	August-Oct	April-June	July-Sept	30 Fair July-Sept

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met.
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: RACCOON CREEK**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Rollins Env Ser	0005240	Raccoon Creek	Logans/Gloucester	Ind./Comm
Air Prod & Chem Inc	0004278	Clonmell Creek	Paulsboro/Gloucester	Ind./Comm.
Paulsboro WTP Well #4	0026191	Clonmell Creek	Paulsboro/Gloucester	Ind.
First Brands Corp.	0052213	Mantua Creek	Paulsboro/Gloucester	Thermal
BP Oil Comp.	0005584	Mantua Creek	Paulsboro/Gloucester	Thermal
Swedesboro Borough STP	0022021	Raccoon Creek	Swedesboro/Glouc	Municipal
Atlantic Richfield Co	0023230	Little Mantua Creek	West Deptford/Glouc	Ind./Comm.
Paulsboro Borough	0026191	Mantua Creek	Paulsboro/Glouc	Municipal
ICI Americas Inc	0033588	Mantua Creek	Woodbury/Glouc	Ind/Comm
East Greenwich Sew Corp	0030368	Nehonsey Creek	East Greenwich/Glouc	Municipal
Harrison- Mullica Hill STP	0020532	Raccoon Creek	Harrison/Glouc	Municipal
CBS Records	0004413	Chestnut Br Trib	Pitman/Glouc	Ind/Comm
Owens- Illinois Divis Glass C	0005312	Still Run	Glassboro/Glouc	Ind/Comm/Th
Ron & Son Mushroom Prod.,Inc	0032361	Still Run	Glassboro/Glouc	Ind/Comm
Delaware River Port Authority	0026379	Raccoon Creek	Camden/Camden	Ind
Shell Chemical Corp	0035831	Mantua Creek	Woodbury/Glouc	Ind/SW
Nalco Chem Co	0036153	Little Mantua Creek	Paulsboro/Glouc	Ind
Pureland Water Comp	0023299	Trib to Raccoon Cr	Logan/Glouc	Ind

15. OLDMANS CREEK

Watershed Description

Oldmans Creek drains an area of 44 square miles and flows on the Coastal Plain to the Delaware River. This creek, 20 miles long, marks the boundary between Gloucester and Salem Counties. Tidal marshes exist at the mouth of this creek, while the western third of the creek is tidal. Major tributaries include Kettle Run and Beaver Creek.

For the most part, this watershed is agricultural and forested, with some residential and industrial development. The two NJDPES permitted discharges are industrial. Oldmans Creek and tributaries have been classified FW-2 Nontrout, except the tidal portions, which are rated SE-1.

Water Quality Assessment

Oldmans Creek is routinely monitored at Porches Mill, it is thought to represent about one-half of the stream's length. Although overall quality is considered good, during late spring and early summer conditions degrade to fair quality. Principal water quality problems are high fecal coliform and nutrient concentrations. Fecal coliform exceeded State criteria in 52 percent of the samples collected between 1983 and 1987, with a geometric mean of 235 MPN/100ml. Bacteria counts are highest in the months May through July.

Nutrient levels are generally elevated throughout the year. Total phosphorus and total inorganic nitrogen averaged .18 and 2.1 mg/l, respectively. Sixty-five percent of the phosphorus values exceeded the .1 mg/l criteria. Dissolved oxygen concentrations are adequate in Oldmans Creek with all values above 4.0 mg/l. Biochemical oxygen demand was usually less than 3.0 mg/l. Oldmans Creek is moderately acidic.

Oldmans Creek has been evaluated by the New Jersey Division of Fish, Game and Wildlife as supporting a healthy warm water fish community.

Problem and Goal Assessment

Point Source Assessment

Point source effects in this watershed are thought to be limited to the tidal portions of Oldmans Creek. No enforcement activities or hazardous waste sites were identified as impacting the watershed.

Nonpoint Source Assessment

Nonpoint sources are the sole contributors to the water quality problems identified in Oldmans Creek. Agricultural sheet and rill erosion is considered a high priority in this region by the Soil Conservation Service. Oldmans Creek is believed to be receiving nonpoint source pollution from agricultural runoff and suburban development activities. Sources of agricultural runoff include crop production, pasture land, and animal holdings. Suburban sources of pollution include runoff from road and housing construction, urban surfaces, mining activities and leachate from septic systems. All these sources are believed by local officials to be responsible for a decline in water quality, some minor habitat destruction, and are suspected to be threatening the health of the instream fishery.

Designated Use and Goal Assessment

Monitored waters of Oldmans Creek will not meet the swimmable designated use/goal because of excessive bacteria levels. The creek will achieve the fish propagation goal, although the warm-water fisheries present is considered threatened from nonpoint sources.

Monitoring Station List

Map Number	Station Name and Classification
1	Oldmans Creek at Porches Mill, FW-2 Nontrout

See page III-166 for a map of the Oldmans Creek watershed.

WATER QUALITY INDEX PROFILE

Oldmans Creek

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Oldsman Creek at Porches Mill	AVG WQI	2	10	10	27	21	5	0	7	20 Good
	WORST3 MONTHS	June-August	Nov-Jan	April-June	May-July	June-August	August-Oct	Feb-April	August-Oct	28 Fair May-July

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met.
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: OLDMANS CREEK**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
B.F. Goodrich-Chem. Grp.	0004286	Ditch to Oldmans Trb	Oldmans Twp./Salem	Ind./Comm.
Airco Ind. Gases	0004553		Oldmans Twp./Salem	Ind./Comm.

16. SALEM RIVER

Watershed Descriptions

The Salem River drains an area of 114 square miles and flows 32 miles from Upper Pittsgrove Township west to Deepwater, then south to the Delaware River. This area lies within Salem County. Much of the lower section of the river is tidal. The Upper and Lower Salem River sub-watersheds comprise the entire watershed. The major population center of this area is Salem City. Major tributaries to the Salem River include Mannington Creek, Game Creek, Majors Run, and Fenwick Creek. There are some ponds on this creek, with a major impoundment being East Lake.

Land use in this watershed is about 40 percent cropland, with the rest being woodland, tidal/freshwater marshes, urban, and pasture. Of the 11 NJPDES permitted discharges here, 5 are municipal and 6 are industrial. Surface water has been classified FW-2 Nontrout, except for the tidal portions, which are SE-1.

Water Quality Assessment

Ambient water quality monitoring occurs at two locations in the Salem River watershed; on the Salem River at Woodstown and at Courses Landing. This monitoring represents less than 10 stream miles. Based on sampling from these two locations overall water quality conditions are assessed as good to fair at Woodstown and fair at Courses Landing. In the short distance between the two stations (approximately 4 miles) conditions degrade from Woodstown to Courses Landing. Both locations contain elevated fecal coliform and nutrient concentrations.

The Salem River at Woodstown is monitored at the outlet of Memorial Lake; as such conditions are not indicative of true stream quality. Even with the effects of retention in the lake, nutrients and fecal coliform bacteria are excessive at the outlet. Total phosphorus averaged .27 mg/l during 1983 to 1987, over three times the State criterion for flowing waterways. Total inorganic nitrogen was also elevated with 54 percent of the samples collected greater than 2.0 mg/l. Fecal coliform counts appear to be highest during spring. Overall, the geometric mean of fecal coliform was 202 MPN/100ml between 1983 and 1987. Fifty percent were above the 200 MPN/100ml level. Dissolved oxygen, measured as concentration and percent saturation, is adequate throughout the year. Stream temperature appears to periodically exceed 28 degrees Celsius during the summer months indicating that some stress to warm-water fisheries may occur.

At Courses Landing the Salem River contains the same problems as at Woodstown, but levels of pollutants are higher. In spring the quality of the river approaches poor conditions. Total phosphorus averaged .42 mg/l with all values above the State criterion of .1 mg/l. Total inorganic nitrogen concentrations are similar to those identified at Woodstown. The geometric mean of fecal coliform was 207 MPN/100ml. Although dissolved oxygen concentrations were always above 4.0 mg/l, percent saturation averaged only 78 percent between 1983 and 1987. Biochemical demand is generally high in the river with numerous levels over 4.0 mg/l. One elevated concentration of lead was found in the river at this location during the period of review.

Biomonitoring was conducted at Woodstown for periphyton and macroinvertebrates in 1988. Filter feeders dominated the macroinvertebrate population sampled, making up 96%, suggesting the presence of significant amounts of suspended organic material (most likely algae) at this station. Only one percent of the individuals observed were forms intolerant of low dissolved oxygen levels. Previous sampling was performed at Courses Landing in 1986 where similar conditions were observed.

Fishery evaluations for the Salem River were not available; rather, assessments were performed on two Salem River tributaries. Game Creek, a 5 mile long tributary to the Upper Salem was categorized as supporting a healthy community of warm-water fish species. Swedes Run (4 miles) a tributary to the lower Salem River was evaluated as containing a moderately degraded warm water fish community. Among the neighboring streams adjacent to the Salem River watershed, Alloway Creek and Horse Run were both evaluated as supporting healthy warm water fisheries. In contrast, Harby Creek (3 mile) and Black Ditch (4 miles) are both assessed as containing severely degraded warm water fish communities.

Problem and Goal Assessment

Point Source Assessment

The upper watershed of the Salem River contains water quality problems resulting from the combined effects of both point and nonpoint sources. An advanced treatment upgrade of the regions municipal dischargers is believed necessary in order to improve overall water quality conditions here. In tidal sections of the Salem River conditions are thought to be generally poor. A limited assimilative capacity together with numerous point sources in the lower watershed are considered to be reasons for these conditions.

Two municipal and three industrial/commercial dischargers are reported to be releasing effluent of poor quality in the watershed and are under enforcement action: Woodstown SA (rock Brook), N.J. Turnpike Authority - Area 1S in Oldmans Twp. (Game Creek), Anchor Glass in Salem City (Fenwick Creek), Games Chemical in Pennsville (tributary to Miles Creek), and Pilot Oil Co. in Carney's Point (Salem River).

Nonpoint Source Assessment

The Upper Salem River is believed to be receiving occasional, yet increasing, amounts of nonpoint runoff from agricultural and urban sources. Agricultural sources include cropland, feedlots, and animal holdings. Urban contributors include surface and road runoff, septic tank leachate, building construction runoff, and mining runoff. The agricultural runoff is believed to be threatening the fishery of Game Creek, a tributary to the Salem River. The Lower Salem watershed receives nonpoint source pollution from croplands, pastures, feedlots, animal holdings, road and housing construction sites, septic systems, suburban surfaces, and road runoff. These sources are estimated to be at moderate to severe levels but have shown little increase over time. The fishery resource of Swedes Run, a tributary to the Lower Salem is believed to be degraded by the combined inputs of industrial point sources and nonpoint road runoff. In addition, local authorities have noted that housing developments, storm sewers, and pasturelands all present moderate to severe problems to water quality in Swedes Run.

Local officials have pointed out that the Salem River Watershed contains some 13 landfills, which although at present do not produce any "known" impact, do represent a potential problem and hence should be monitored.

Designated Use and Goal Assessment

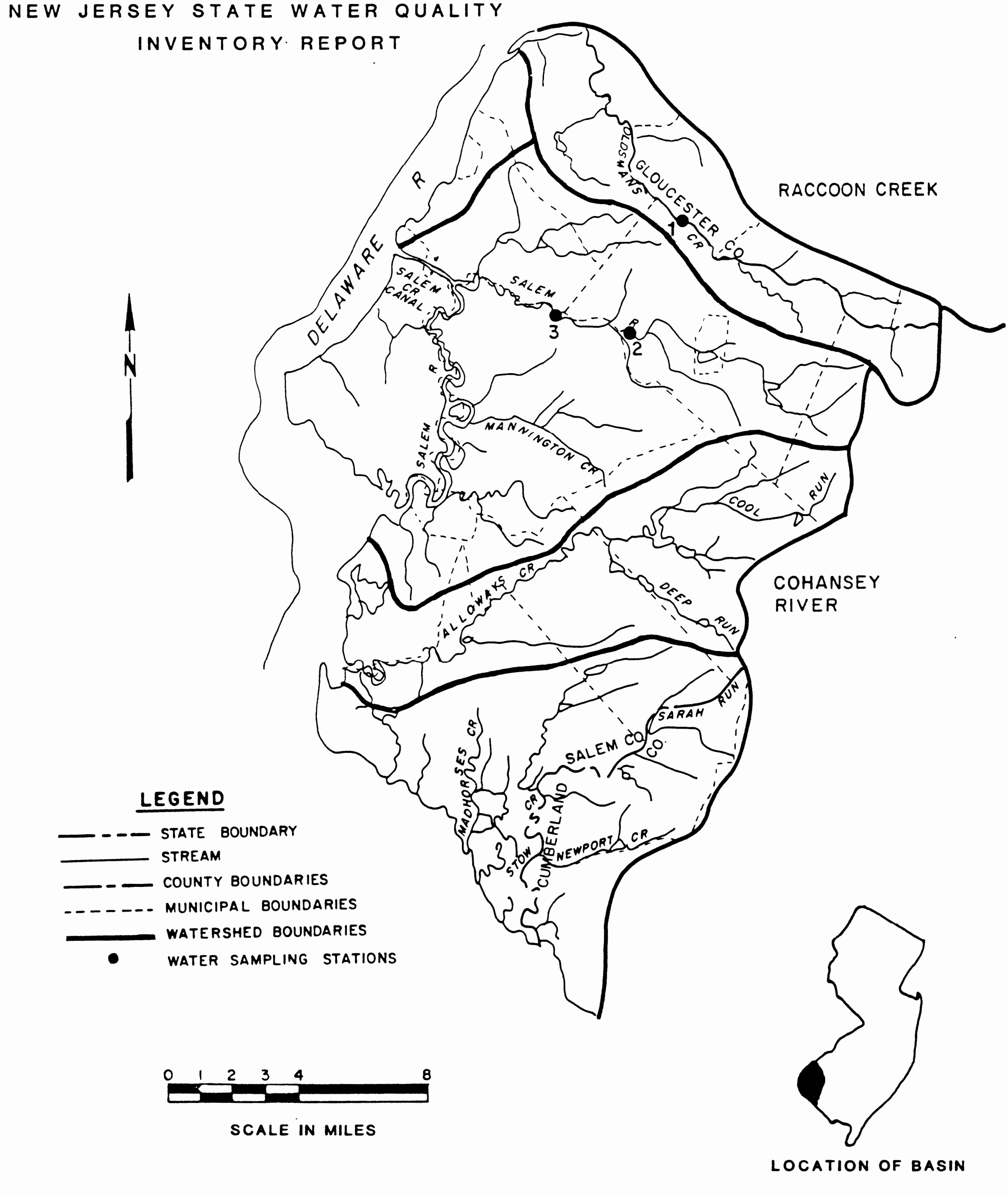
The Salem River, despite its water quality problems, will meet the fish propagation/maintenance use, but the fisheries may be threatened. This is also the case for Game Run; Swedes Run is considered to be partially meeting this use. The swimmable goal is not met at Woodstown and Courses Landing because of excessive fecal coliform counts in the river.

Monitoring Station List

Map Number	Station Name and Classification
2	Salem River at Woodstown, FW-2 Nontrout
3	Salem River at Courses Landing, FW-2 Nontrout

OLDSMANS CREEK AND SALEM RIVER

NEW JERSEY STATE WATER QUALITY INVENTORY REPORT



Salem River

WATER QUALITY INDEX PROFILE

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Salem River at Woodstown	AVG WQI	5	5	14	27	27	5	2	6	25Good/Fair
	WORST3 MONTHS	June-August	May-July	July-Sept	May-July	Feb-April	Sept-Nov	May-July	March-May	35 Fair May-July
Salem River at Courses Landing	AVG WQI	3	33	8	31	36	7	1	18	45 Fair
	WORST3 MONTHS	June-August	April-June	August-Oct	Jan-March	Feb-April	Oct-Dec	August-Oct	July-Sept	56 Fair Feb-April

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met.
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: SALEM RIVER**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Budd Chem Co	0033570	Delaware R. Trib	Carney's Pt/Salem	Ind/Comm
N.J. Tph Auth Area 1s and 1n	0020761	Playton Lake	Oldmans/Salem	Municipal
Richman Ice Cream	0004308	Salem River	Wooktown/Salem	Ind/Comm
Woodstown SA	0022250	Rock Brook	Woodstown/Salem	Municipal
Salem Co Vo Tech Sch	0028797	Mavor Run Creek	Mannington/Salem	Ind/Comm
Mannington Mills, Inc	0005614	Pledger Creek	Mannington/Salem	Ind/Comm
Salem STP	0024856	Salem River	Salem/Salem	Municipal
Anchor Glass Containers Corp	0005151	Salem River	Salem/Salem	Therm
ALU Chem Inc	0052400	Lower Salem River	Salem/Salem	Thermal
Salem WTP, City of	0035742	Keasby Creek	Salem	Municipal
Lower Alloways Tep Hancock	0050423	Alloways Creek	Lower Alloway/Salem	Ind

17. COHANSEY RIVER

Watershed Description

The Cohansey River is nearly 30 miles long, draining 105 square miles of eastern Salem County to the Delaware Bay. This is an area of very low relief which results in numerous small tributaries. Sunset Lake and Mary Elmer Lake are among 10 major impoundments in this drainage basin. The largest population center is Bridgeton. The river is tidal from Bridgeton. The Cohansey contains two sub-watersheds: the Upper and Lower sections of the watershed.

The main land use of this watershed is agriculture, but much of this area is forested. There are four NJPDES permitted discharges here, two are industrial and two are municipal. Waterways are classified FW-2 Nontrout, except those portions that are SE-1 (downstream of Sunset Lake) and FW-1 (within State parks and wildlife management areas).

Water Quality Assessment

Ambient monitoring is conducted on the Cohansey River at Seeley as part of the USGS/DEP Primary Network. Results from this monitoring shows that about 5 miles of the Upper Cohansey River is of fair quality with conditions worsening somewhat during the early summer months. The reasons for the moderate water quality are generally high fecal coliform and nutrient levels. Inorganic nitrogen and phosphorus occur in elevated concentrations. Total phosphorus has averaged 0.1 mg/l since 1983 with 77 percent above the 0.05 mg/l criterion for waters flowing into lakes and impoundments. Total inorganic nitrogen averaged 4.2 mg/l during this period, with all readings greater than 2.0 mg/l.

Fifty-nine percent of the fecal coliform samples between 1983 and 1987 were greater than the 200 MPN/100ml level. Dissolved oxygen concentrations are above the 4.0 mg/l warm-water criterion throughout the year, but percent saturation periodically drops below 80 percent. Biochemical oxygen demand is low to moderate in this watershed. Within the two sub-watersheds of the Cohansey River, fishery evaluations were available on Clarks Run, a four mile tributary to the Upper Cohansey, and Mill Creek, a five mile long tributary to the Lower Cohansey. Both streams are assessed by the New Jersey Division of Fish, Game and Wildlife as supporting healthy warm water fish communities.

Problem and Goal Assessment

Point Source Assessment

The Cohansey River watershed has some impacts from point sources, but they are not clearly defined. The presence of municipal and industrial point sources likely influences local water quality conditions.

Only one enforcement action is reported in this watershed at present: the Cumberland County UA in Bridgeton City for discharging excess suspended solids, bacteria, and oxygen consuming materials into the Cohansey River. There are no hazardous waste sites in the watershed suspected of impacting surface water quality.

Nonpoint Source Assessment

Nonpoint source pollution, most likely from agriculture, is the probable cause of the moderately degraded water quality in the Cohansey River at Seeley. Numerous nonpoint pollution sources are known to impact the Upper Cohansey River and have resulted in siltation and the impairment of the local fisheries. Pollution sources include both agricultural and suburban development activities; specific sources include runoff from croplands (increasing), pasture lands, feedlots, housing developments, roads and urban surfaces. In addition, septic systems have been described by local authorities in this region as creating a severe water quality problem. Landfills too are noted as a potential problem, yet their actual impact on local waterways at the present time is not known.

Impacts in the Lower Cohansey watershed are much the same. Suspected sources, both agricultural and urban, include runoff from crop production, pasture lands, feedlots, animal holdings, tree harvesting, urban surfaces, expanding housing construction, road maintenance runoff, surface mining, as well as leachate from septic systems. Of these sources: cropland runoff, an increasing problem in the sub-watershed, is known to have brought about the degradation of local fishing and shellfish harvesting waters. Here as in the Upper Cohansey, landfills are noted as an increasing potential problem.

Designated Use and Goal Assessment

The Cohansey River will not meet the swimmable goal of the Clean Water Act based on monitoring at Seeley. The river and tributaries will meet the fish propagation and maintenance goal. In the tidal sections it will not achieve the shellfish harvesting designated use because of excessive bacteria levels.

Monitoring Station List

Map Number	Station Name and Classification
3	Cohansey River at Seeley, FW-2 Nontrout

See page III-178 for a map of the Cohansey watershed.

WATER QUALITY INDEX PROFILE

Cohansey River

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Cohansey River at Seeley	AVG WQI	2	9	4	29	48	5	0	7	38 Fair
	WCRST3 MONTHS	June-August	July-Sept	Nov-Jan	May-July	Nov-Jan	Nov-Jan		March-May	54 Fair May-July

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met.
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: COHANSEY RIVER**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
CCUA: Cohansey R. Basin Plant	0024651	Cohansey River	Bridgeton Cty/Cumlnd	Municipal
Petrunis Realty Co.	0025992	Cohansey River	Bridgeton Cty/Cumlnd	Mun/Strmwtr
Seabrook Brothers & Sons	0033066	South Branch Fos	Seabrook/Cumlnd	Thermal
Seabrook Plant	0062731		Upper Deerfield Twp.	Industrial

18. MAURICE RIVER

Watershed Description

The Maurice River has a drainage area of 386 square miles and meanders south for 50 miles through Cumberland County to the Delaware Bay. The population centers are Vineland and Millville. The major tributaries of this river are Scotland Run, Manantico Creek, Muskee Creek, Muddy Run, and the Manumuskin River. There are about 20 major lakes in this area, with Union Lake being the largest. The river is tidal below Union Lake. The Maurice River drainage area has been segmented into nine sub-watersheds: Still Run, Scotland Run, Upper Maurice River, Muddy Run, Union Lake, Maurice River below Union Lake, Menantico Creek, Manumuskin Creek and Lower Maurice River.

Principal land use in this watershed is agriculture, with much of the area forested. Of the 17 NJPDES permitted discharges in the watershed 1 is municipal while 16 are industrial/commercial. The Maurice watershed is primarily classified FW-2 Nontrout, with some SE-1 and FW-1.

Water Quality Assessment

The Maurice River is monitored at Norma and near Millville for ambient water quality, representing approximately 10 stream miles. Both locations have good to excellent water quality, although at Millville conditions degrade to fair quality during late winter. However, stream degradation is thought to occur in the Maurice River below Union Lake, but no monitoring is performed to substantiate this conclusion. In the lower tidal sections of the Maurice River, bacterial contamination of shellfish growing areas has resulted in the condemned status of these waters.

The Upper Maurice River, as monitored at Norma and near Millville, contains very low fecal coliform levels and moderate amounts of nutrients. Total phosphorus was above appropriate State criteria in 19 and 36 percent of the samples at Norma and Millville, respectively. While at Norma contains occasionally high inorganic nitrogen, this indicator was elevated in nearly three-quarters of the samples collected between 1983 and 1987. The only other water quality problem measured at these stations is occasional dissolved oxygen saturation measurements below 80 percent. Biochemical oxygen demand is usually under 2.0 mg/l.

declining water quality and causing local fish kills. Additionally, a municipal treatment plant is suspected of being the cause of bathing beach closures in the Upper Maurice. In the Lower Maurice River point source effluents are believed to have led to the impairments of shellfish harvesting waters.

Hazardous waste sites contaminating surface waters include the Vineland Chemical Corporation site and Shield Alloy. The Vineland Chemical Corporation has caused widespread arsenic contamination of sediments in Union Lake, while Shield Alloy is contaminating Hudsons Branch with chromium.

Nonpoint Source Assessment

In the northern most assessed areas of the Maurice River watershed are the sub-watersheds of Still Run and Scotland Run. Tributaries to Still Run, Little Ease Run, and Reeds Branch are believed to be receiving storm water runoff. Still Run is suspected of suffering fish kills and overall water quality degradation from moderate to large quantities of both agricultural and urban nonpoint source pollution. Suspected sources impacting this waterway, as well as to Scotland Run, are septic tank leachate, runoff from crop and pasture lands, urban surfaces, road and home construction, and road maintenance. The Upper Maurice River itself receives both agricultural and suburban nonpoint source pollution; sources include runoff from crop production, tree harvesting, road and home construction, road maintenance and runoff. Additional pollution sources include sludge disposal activities and local landfills. This runoff is suspected to be contributing to a general decline in water quality and to fish kills in the Upper Maurice River.

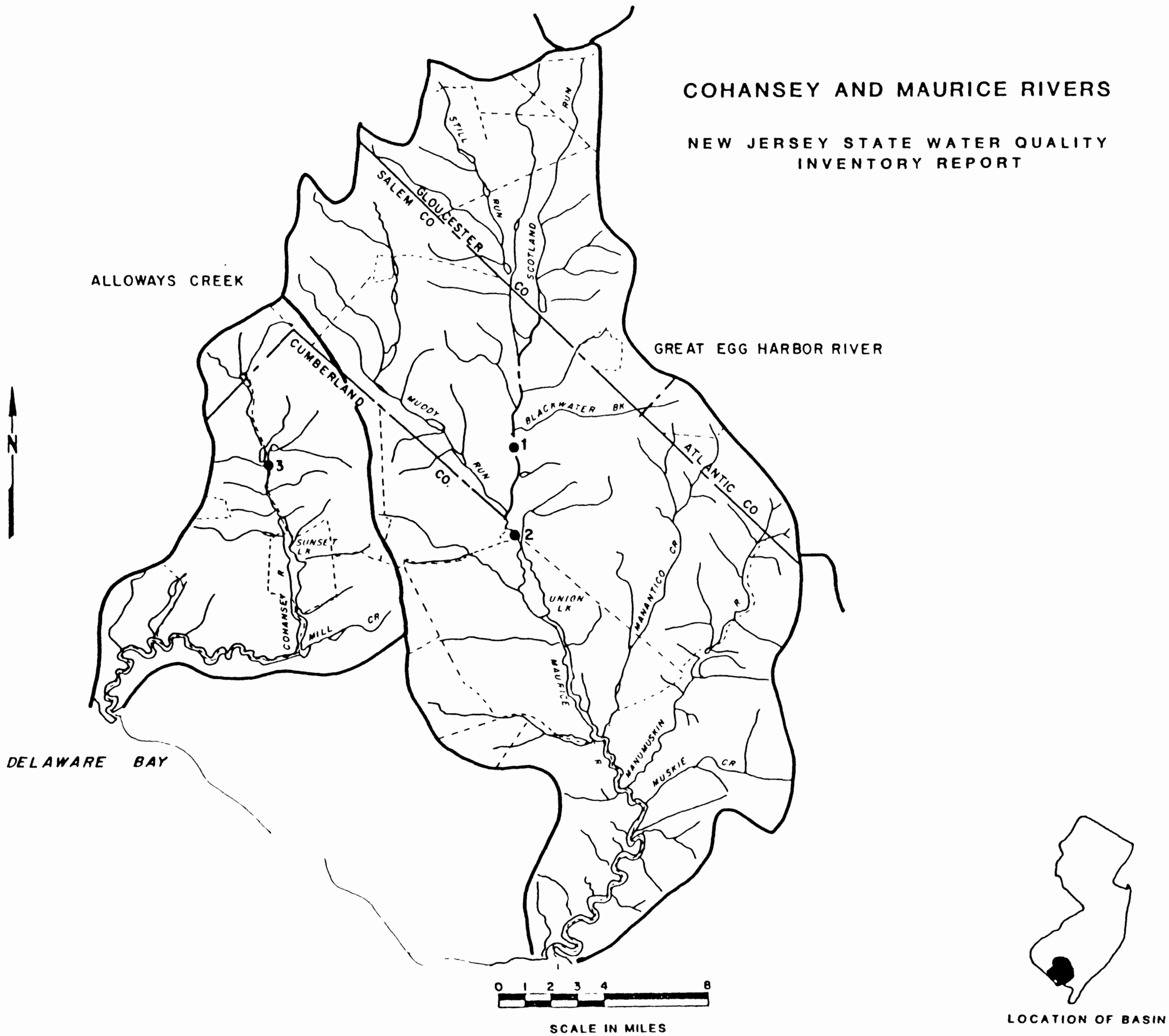
Farther downstream in the area surrounding Union Lake, runoff is believed to be coming from urban storm sewers, urban surfaces, sludge disposal sites, landfills, hazardous waste sites, and dam construction activities, all of which are estimated to be on the rise. Additional sources reported are surface mining, road maintenance, and housing construction. Below Union Lake, pollution from storm sewers and urban surfaces, while estimated to be on the decline, is believed to have contributed to the impairment of shellfish harvesting areas further downstream. In this region also, landfills are viewed as a possible source of pollution whose actual impact upon local waters is not yet known. Other suspected sources of nonpoint pollution are tree harvesting activities, home construction, urban and road surfaces, dredging, and septic systems. Of the two large tributaries to the Lower Maurice, Manantico Creek receives occasional runoff from croplands, construction sites, urban surfaces, storm sewers, tree harvesting, as well as from what is estimated to be increasing levels of road construction and maintenance. Manamuskin River is believed to receive pollution in its headwaters from croplands (estimated to be in decline), and is impacted in its mainstem by road construction, road runoff, suburban surface runoff, landfills, and dredging. To the west a third tributary, Muddy Run, is suspected of experiencing water quality degradation from what is believed to be moderate to severe levels of cropland and pastureland runoff, as well as pollution from road and housing construction sites, surface mining, and sludge disposal.

Designated Use and Goal Assessment

The Maurice River at Norma and near Millville is considered to be meeting the swimmable designated use, based on monitoring information. The river is also considered to be achieving the fish propagation/maintenance use, but some sections may be threatened from various pollution sources. The tributaries are classified as either fully meeting this use (30 miles), fully meeting but threatened (30 miles) or partially meeting the use (15 miles). The tidal sections of the Maurice River are condemned for shellfish harvesting.

Monitoring Station List

Map Number	Station Name and Classification
1	Maurice River at Norma, FW-2 Nontrout
2	Maurice River near Millville, FW-2 Nontrout


COHANSEY AND MAURICE RIVERS
NEW JERSEY STATE WATER QUALITY INVENTORY REPORT
ALLOWAYS CREEK
GREAT EGG HARBOR RIVER
DELAWARE BAY
GLOUCESTER CO
SALEM CO
CUMBERLAND CO.
ATLANTIC CO
STILL RUN
SCOTLAND RUN
BLACKWATER BK
MUDDY RUN
SUNSET LK
COHANSEY R
MILL CR
UNION LK
MAURICE R
MANANTICO CR
MANUMUSKIN
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1
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SCALE IN MILES
LOCATION OF BASIN

WATER QUALITY INDEX PROFILE

Maurice River

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Maurice River at Norma	AVG WQI	2	14	3	7	14	2	0	7	7 Excellent
	WORST3 MONTHS	June-August	May-July	Feb-April	July-Sept	Nov-Jan	Sept-Nov		April-June	11Good/Exc May-July
Maurice River near Millville	AVG WQI	2	20	3	11	24	3	0	11	18 Good
	WORST3 MONTHS	June-August	March-May	June-August	Oct-Dec	Dec-Feb	August-Oct	June-August	Oct-Dec	34 Fair Jan-March

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: MAURICE RIVER**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Pioneer Metal Finishing, Inc.	0025658	Scotland Run	Franklin Twp/Glcstr.	Ind./Comm.
Shield Alloy Corp.	0004103	Maurice River	Newfield Boro/Glcstr	Ind./Comm.
Owens-Illinois Inc.	0004499	Ditch to Maurice R.	Vineland City/Cumlnd	Ind./Comm.
Vineland Cty.Elec-Howard Down	0032182	Maurice River	Vineland Cty./Cumlnd	Ind./Comm.
Owens-Ill.-Schott Process Sys Inc.	0005304	Parvins Brook	Vineland Cty./Cumlnd	Ind./Comm.
Progresso Quality Foods	0004880	Trib to Maurice R.	Millville Cty/Cumlnd	Ind./Comm.
West Co.	0023744	Wheaton Prop. Pond	Millville Cty/Cumlnd	Ind./Comm.
Wheaton Glass Co.	0004171	Petticoat Stream	Millville Cty/Cumlnd	Ind./Comm.
Kerr Glass Mfg. Corp.	0005398	Maurice River	Millville Cty/Cumlnd	Ind./Comm.
Unimin Corp.	0004405	Dividing Creek	Millville Cty/Cumlnd	Ind./Comm.
NJ Silica Sand Co.	0004618	Manamuskin River	Maurice R Twp/Cumlnd	Ind./Comm.
Owens-Ill. Corp.-Millville	0005339	Muskie River	Comm. Twp./Cumlnd.	Ind./Comm.
Port Norris Oyster Co., Inc.	0026051	Maurice River	Comm. Twp./Cumlnd.	Ind./Comm.
Geo. O. McConnell Co.	0029581	Maurice River	Comm. Twp./Cumlnd.	Ind./Comm.
Delaware Bay Oyster Co.	0029530		Comm./ Twp./Cumlnd	Ind./Comm.
Kings Crab Ranch	0069001	Maurice River	Comm. Twp./Cumlnd	Ind./Comm.
Leesburg St. Prison	0021989	Riggins Ditch	Maurice Twp./Cumb.	Municipal
Millville SA, City of	0029467	Maurice River	Millville/Cumberland	Municipal
Capt. Sig's Seafood Inc.	0004766	Maurice River	Port Norris/Cumblnd	Ind.
Marshall Service Inc.	0036129	Maurice River	Newfield/Glcstr.	Ind.

19. GREAT EGG HARBOR RIVER

Watershed Description

The Great Egg Harbor River is 49 miles long and drains an area of 304 square miles. It originates in eastern Gloucester and Camden Counties, an agricultural and suburban area, before flowing through the Pinelands region. The river drains into Great Egg Harbor Bay before emptying into the Atlantic Ocean. The river is tidal downstream of the dam at Mays Landing. Upper, Mid and Lower Great Egg Harbor River sub-watersheds have been delineated.

The watershed's dominate land use is forests with the remainder agricultural and developed. Population centers include Berlin, Winslow, Monroe, Mays Landing, and Egg Harbor City. The major tributaries are Hospitality Branch, Watering Race, Babcock Creek, Deep Run, South River, and Stephens Creek. There are many lakes and ponds in this area, but the largest is Lake Lenape, near Mays Landing. Of the 12 NJPDES permitted discharges here, 6 are municipal and 6 are industrial/commercial. Waters in the Great Egg Harbor watershed are classified FW-2 Nontrout, Pineland Waters, FW-1, and SE-1.

Water Quality Assessment

Four ambient water quality monitoring stations are present on the Great Egg Harbor River: near Sicklerville and Blue Anchor, at Folsom and at Weymouth. This monitoring represents most of the freshwater reaches of the river and shows that water quality is severely degraded in the headwaters near Sicklerville, but that conditions improve to fair quality as one travels downstream. Although the Great Egg Harbor is a Pinelands stream, pH in the river has been significantly altered because of water pollution.

Near Sicklerville the Great Egg Harbor River has poor to very poor water quality because of high nutrient concentrations, reduced dissolved oxygen, and pH readings which are frequently near neutral levels. Stream conditions are most severe during summer months. Total phosphorus averaged 0.57 mg/l during the 1983 to 1987 period with all of the values greater than appropriate State criterion. Total inorganic nitrogen also appeared excessive in nearly 50 percent of the samples collected. Dissolved oxygen concentrations drop below 4.0 mg/l during summer months and percent saturation averaged only

60 percent during the period of review. Biochemical oxygen demand frequently exceeds 3.0 mg/l. Stream pH averages 6.3 SU, significantly greater than the recommended 3.5 to 5.5 range for Pineland surface waters.

Downstream near Blue Anchor and at Folsom the Great Egg Harbor River recovers somewhat from the problems at Sicklerville. Total phosphorus is still high with 94 and 100 percent above State criterion near Blue Anchor and at Folsom, respectively. But total inorganic nitrogen is lower and dissolved oxygen concentrations appear to be adequate (dissolved oxygen saturation is still commonly below 80 percent). In addition, pH values show reductions, although they continue to average above what is considered natural background for Pineland streams. Fecal coliform counts are low with only 26 and 0 percent above recommended levels near Blue Anchor and at Folsom, respectively. Two elevated copper values occurred in samples collected at Folsom. The source of this copper should be investigated further since this problem was identified in the 1986 305(b) report.

Water quality in the river at Weymouth shows continued improvement. Total phosphorus remains elevated but concentrations are lower. The average pH value is just above the 5.5 level, showing a return to more natural conditions. Dissolved oxygen concentrations are sufficient for the protection and maintenance of warm-water fisheries.

The Tuckahoe River is reported to have continuously failed to meet public health fecal coliform standards for primary contact recreation during the spring and summer periods. Intensive sampling has revealed that the primary source of this fecal contamination is from animals, with additional contributions coming from local septic tank overflows which occur along the mainstem of the river.

Biomonitoring has been performed at Folsom. Pollution intolerant macroinvertebrates comprised 30 % of the substrate sample in 1988 indicating favorable dissolved oxygen levels. Biomonitoring over the past ten years has suggested that there has been a gradual improvement in water quality through time at this station. No fisheries evaluations were made by the NJ Division of Fish, Game and Wildlife of streams in the Great Egg Harbor River watershed.

Problem and Goal Assessment

Point Source Assessment

The water quality problems present in the Great Egg Harbor River appear to be related to point source discharges in the upper watershed. The Berlin Borough STP, which will be eliminated in the near future, continues to be under enforcement action for inadequate treatment of wastewaters. A number of other enforcement cases concerning ground water discharges are underway in the watershed. In the Lower Great Egg Harbor River watershed the Hamilton Twp. STP discharge to Babcock Creek, the NJ EA discharge to Makepeace Stream in Hammonton, the Buena Borough STP discharge to the Batsto River, and the Federal Aviation Administration discharge to Gravelly Run are all inadequately treated. These facilities are currently undergoing DEP enforcement action. Local officials have noted that various nonpermitted discharges have been entering Hospitality Branch, a tributary to the Lower Great Egg Harbor.

Nonpoint Source Assessment

Runoff from croplands is suspected to be impacting the entire length of the Great Egg Harbor River above Mays Landing. Additional pollution sources in this sub-watershed are believed to be from surface mining, which impact the uppermost reaches of the river, and sediment loads which result from ditch bank erosion occurring in the small tributary streams which flow into the Great Egg in the region around Lake Lenape. Below Mays Landing, nonpoint source pollution is believed to shift from agricultural sources to suburban development: storm sewers, road surfaces, and septic systems.

In the assessed tributaries feeding into the Upper Great Egg Harbor River, stormwater runoff and suburban development appear to be the major contributors to nonpoint source pollution. Squankum Branch (7 miles long) and Four Mile Branch both are suspected of being impacted by stormwater runoff. Water quality in the 13 mile long Hospitality Branch is believed to be affected by stormwater/road runoff; in addition, surface mining is reported to be a known yet declining source of sedimentation in the Hospitality Branch. Babcock Creek (10 miles long) is undergoing excessive sedimentation; the suspected sources are runoff from animal holding areas, construction sites, surface mines, and outfalls from combined sewers. Local authorities have reported however, that these problems in Babcock Creek are presently on the decline. Gravelly Run and Miry Run, 6 miles and 5 miles long respectively, are receiving what are believed to be diminishing quantities of sedimentation. Mill Branch is believed to be impacted by housing construction and combined sewers. Maple Run is reported to be affected by rising amounts of siltation, known sources of which are the rising levels of construction and stream channelization occurring in the sub-watershed. Patcong River receives ever increasing quantities of sediment, which is suspected to be coming from local storm sewers.

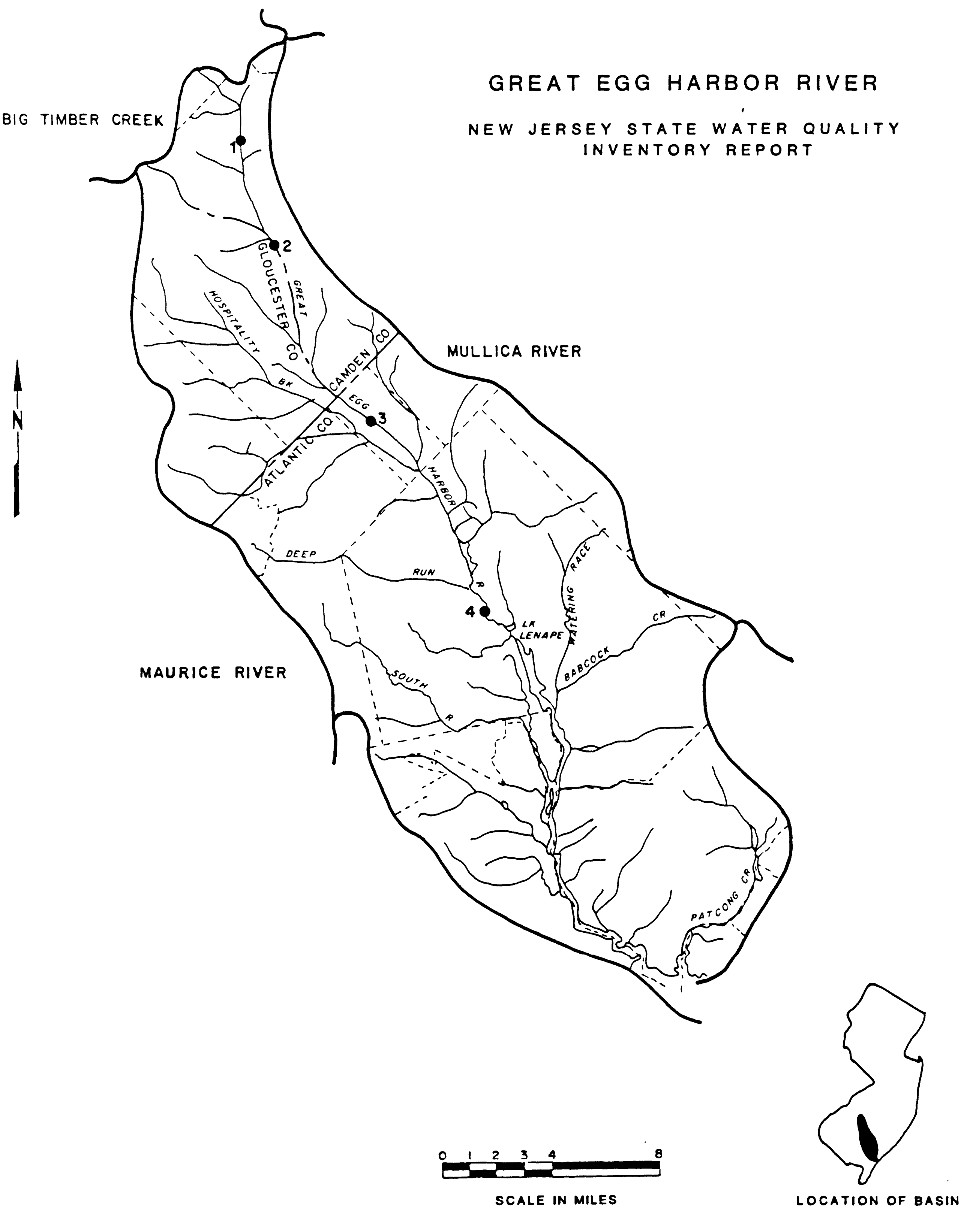
Of the lakes assessed in the Great Egg Harbor River Watershed, Colling Lake is reported to be receiving septic system leachate and road runoff. Lake Lenape is believed to be impacted by road and cropland runoff, and Patcong Lake is said to be becoming a shallow "silted in" lake from what is suspected to be runoff from housing construction sites and suburban surfaces.

Designated Use and Goal Assessment

Fecal coliform counts are low enough to classify the Great Egg Harbor River as meeting the swimmable use/goal in the region around Folsom and Weymouth (approximately 10 miles); however the remaining freshwater sections of the river are considered either not swimmable (5 miles) or marginally swimmable (5 miles). The river can also be considered as meeting the fish propagation/maintenance use with the exception of the river's headwaters in Camden County which are classified as partially degraded. Elevated pH levels have seriously affected the acid tolerant aquatic community in this area. The majority of the tidal sections of the river are classified as condemned for the direct harvesting of shellfish.

Monitoring Station List

Map Number	Station Name and Classification
1	Great Egg Harbor River near Sicklerville, FW-2 Nontrout
2	Great Egg Harbor River near Blue Anchor, Pineland Waters
3	Great Egg Harbor River at Folsom, Pineland Waters
4	Great Egg Harbor River at Weymouth, Pineland Waters


GREAT EGG HARBOR RIVER
NEW JERSEY STATE WATER QUALITY INVENTORY REPORT
BIG TIMBER CREEK
MULLICA RIVER
MAURICE RIVER
N
1
2
3
4
GLOUCESTER CO
CAMDEN CO
ATLANTIC CO
GREAT
EGG
HARBOR
R
HOSPITALITY
BK
DEEP
RUN
LK LENAPE
WATERING RACE
BABCOCK
CR
SOUTH
R
PATCONG CR
0 1 2 3 4 8
SCALE IN MILES
LOCATION OF BASIN

Great Egg Harbor River

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Great Egg Harbor River near Sicklerville	AVG WQI	1	42	45	17	72	3	0	7	78 Poor
	WORST3 MONTHS	June-August	June-August	June-August	Oct-Dec	June-August	June-August		June-August	100 Very Poor June-August
Great Egg Harbor River near Blue Anchor	AVG WQI	1	29	37	18	27	3	0	6	43 Fair
	WORST3 MONTHS	June-August	Oct-Dec	June-August	May-July	May-July	Oct-Dec		Sept-Nov	62 Poor June-August
Great Egg Harbor River at Weymouth	AVG WQI	1	12	28	6	32	2	0	13	27 Fair
	WORST3 MONTHS	June-August	March-May	July Sept	August-Oct	May-July	Dec-Feb		March-May	47 Fair June-August
Great Egg Harbor River at Folsom	AVG WQI	1	16	43	8	39	2	0	23	49 Fair
	WORST3 MONTHS	June-August	April-June	July Sept	June-August	Jan-March	Oct-Dec		Oct-Dec	54 Fair August-Oct

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met.
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: GREAT EGG HARBOR RIVER**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Berlin Boro STP	0026972	Great Egg Harbor R	Berlin Twp./Camden	Municipal
Scott Paper Co.	0004324	Deep Run	Buena Boro/Atlantic	Ind./Comm.
Buena Boro MUA	0021717	Trib. to Deep Run	Buena Boro/Atlantic	Municipal
NJ Expressway Auth.	0026522	Makepeace Stream	Hammonton Town/Atl.	Municipal
Scholler Bros. Inc.	0021393	Babcock Stream	Hamilton Twp./Atl.	Ind./Comm.
Hamilton Twp. MUA	0002193	Babcock Stream	Hamilton Twp./Atl.	Municipal
Lenox China Inc.	0005177	Jack Pudding Brook	Galloway Twp./Atl.	Ind./Comm.
NJ Hwy. Auth.-Atlantic City	0027189	Mattily Run	Galloway Twp./Atl.	Municipal
Stockton State College	0027588	Bonita Tideway	Brigantine Cty./Atl.	Industrial
FAA Technical Center	0020800	Gravelly Run Branch	Egg Harbor City/Atl.	Municipal
Pleasantville Facility	0069205	Lakes Bay	Atlantic City/Atl.	Ind./Comm.
Atlantic Electric	0005444	Great Egg Harbor	Marmora/Cape May	Ind/Thermal
Lower, Township of, MUA	0023809	Cox Hall Creek	Lower Twp./Cape May	Ind./Comm

20. MULLICA RIVER

Watershed Description

The total drainage basin for the Mullica River and tributaries is 561 square miles. The Mullica River itself is about 45 miles long. This watershed is considered the primary drainage system for the Pinelands . Major tributaries include the Wading River (30 miles long), Nochescatauxin Brook, Atsion Creek, the Bass River (8 miles long), Batsto River (18 miles), Nescochaque Creek, Landing Creek, Hammonton Creek (9 miles) and the Oswego River (21 miles). The Mullica River empties into Great Bay, a large estuarine system. The population centers are Winslow, Galloway, and Hammonton. Subwatersheds include the Batsto River, Upper Mullica River, Mid-Mullica River, Oswego River, West Branch Wading River, Lower Mullica River and Great Bay.

About 80 percent of this watershed is undeveloped state parks and forests, with the remainder being agricultural and developed areas. Of the 7 NJPDES permitted discharges here, 4 are municipal/institutional and 3 are industrial/commercial. The streams are classified FW-Pineland Waters, FW-1, FW-2 Nontrout, and SE-1. Much of these waterways are incorporated in the New Jersey Wild and Scenic River System.

Water Quality Assessment

The Mullica River watershed is the largest in southern New Jersey. As such, seven ambient monitoring stations are present on the Mullica and tributaries. The Mullica is sampled at the outlet of Atsion Lake and at Green Bank. Hammonton Creek, Batsto River, West Branch of the Wading River, Oswego River and the East Branch of the Bass River are all sampled. The Mullica watershed is for the most part undeveloped forests within State parks. Water quality is among the best in the State, especially on the tributaries mentioned above (with the exception of Hammonton Creek). Surface waters of the Pinelands are naturally highly acidic with low nutrient content.

The Mullica River contains excellent water quality at Atsion, but degrades to generally good quality downstream at Green Bank. No pollution indicators contravened State criteria in samples collected at Atsion. The Mullica River at Green Bank, however, contains moderately excessive bacteria and nutrient concentrations, as well as pH which often is greater than natural background. Dissolved oxygen levels are adequate when measured as milligrams per liter. The geometric mean of fecal coliform counts between 1983 and 1987 was 41 MPN/100ml with 16 percent greater than 200 MPN/100ml. Total phosphorus was considered high in 66 percent of the samples from this period. High conductivity values, especially during summer months, indicates that some brackish tidal water occurs at Green Bank.

The Batsto River at Batsto, West Branch Wading River at Maxwell, Oswego River at Harrisville and East Branch Bass River at New Gretna all contain excellent water quality. In all streams fecal coliform and nutrient concentrations are low and conditions are generally indicative of natural background. One elevated mercury and cadmium concentration were detected in the Batsto and West Branch Wading Rivers, respectively.

Hammonton Creek is the only waterway with significant pollution problems. The creek is subjected to a significant municipal point source discharge which has severely degraded water quality. The creek at Westcoatville is in very poor condition with severely reduced dissolved oxygen, elevated nutrients and pH not reflective of Pineland's water. During summer months water quality worsens to very poor conditions. Dissolved oxygen is often recorded less than 2.0 mg/l in summer months with biochemical oxygen demand frequently above 4.0 mg/l. Dissolved oxygen saturation averaged only 47 percent from 1983 to 1987 and forty-five percent of the dissolved oxygen values were less than 4.0 mg/l. Total phosphorus averaged .82 mg/l with all values contravening State criterion. Total inorganic nitrogen was excessive in the majority of the samples collected.

Biomonitoring has been performed on the Mullica River at Green Bank. Macroinvertebrate sampling found the site to be favorable, but there has recently been a decrease in clean water organisms along with an increase in pollution tolerant forms. Periphyton sampling suggests some organic enrichment although species representative of acidic conditions were abundant.

All rivers and streams in the Mullica River watershed which were evaluated by the New Jersey Division of Fish, Game and Wildlife were found to be supporting healthy warm water fish populations. The assessed waters were the Muskingun Brook, a 5 mile long tributary to the Batsto River; Sleeper Branch, a tributary to the Nochescatauxin Brook; Hammonton Creek, a 9 mile long tributary to the Mullica; the 21 mile long Oswego River; the 20 mile long West Branch of the Wading River; and lastly, the lower 16 miles of the Mullica itself.

Problem and Goal Assessment

Point Source Assessment

The Mullica watershed contains surface waters that are generally of natural quality. With the exception of Hammonton Creek, all monitored waters are of either excellent or good water quality. These waters are extremely sensitive to the effects of man's activities. Both point and nonpoint sources can seriously alter the acid-tolerant stream environments of the watershed. Hammonton Creek is reported to have been severely impacted by the Hammonton MUA wastewater discharge which releases excess nutrients and oxygen demanding substances. The Egg Harbor City STP is reported to be having deleterious impacts on Union Creek. Both facilities continue to be under enforcement action by DEP. Also named for permit violates is NJEA-Weymouth in Hamilton Twp. (Atlantic Co.) for releasing poorly treated wastewater into Makepeace Steam.

Hammonton Creek is severely impacted by the Hammonton MUA wastewater discharge which contains large amounts of nutrients and oxygen-demanding substances. The Egg Harbor City STP is having deleterious impacts on Union Creek. Both facilities are currently under enforcement action by the DEP.

One hazardous waste site has been identified in the Mullica watershed to be contaminating local surface waters. This is Woodland Chemical Dumps 1 and 2 near Chatsworth. The dumps are suspecting of releasing volatile organics, pesticides and metals to nearby cranberry bogs.

Nonpoint Source Assessment

Agricultural and suburban runoff can have significant impacts on water quality by adding nutrients and raising stream pH. This appears to be occurring throughout the Pinelands region in various waterways including those within the Mullica River watershed.

The Upper Mullica sub-watershed is known to suffer water quality problems caused by what are reported to be moderate amounts of nonpoint source contamination from construction activities, surface mining and landfills. Also reported is a problem with ditch bank erosion in drainage ditches associated with cropland areas. The Upper Mullica, Sleeper Branch, Gum Branch, and Albertsons Branch are all believed to be impacted by increasing amounts of road and highway runoff.

In the Mid-Mullica sub-watershed, runoff from croplands is suspected to be an occasional water quality problem, although it is assessed to be on the decline. As in the Upper Mullica, there are problems with ditch bank erosion. Hammonton Creek is suspected of being impacted on occasion by leachate from land disposal sites, urban runoff, as well as runoff from construction sites. Landing Creek, Indian Cabin Creek, and Union Creek are all believed to be impacted by moderate yet increasing amounts of urban stormwater runoff. Landing Creek is also suspected to be impacted by occasional leachate from local landfills.

In the Lower Mullica/Great Bay sub-watersheds, the Wading River is suspected to be severely impacted by hazardous waste sites. The problem is assessed as increasing and impairing the local fisheries. Surface mining, although evaluated as being in decline, is known to be causing occasional turbidity in Morses Mill Creek, a tributary to Great Bay. Matix Run, also a Great Bay tributary, is suspected of being impacted by rising levels of runoff from housing construction sites and stormwater. To the northeast, the Oswego River is assessed by local authorities to have no reportable nonpoint source pollution problems.

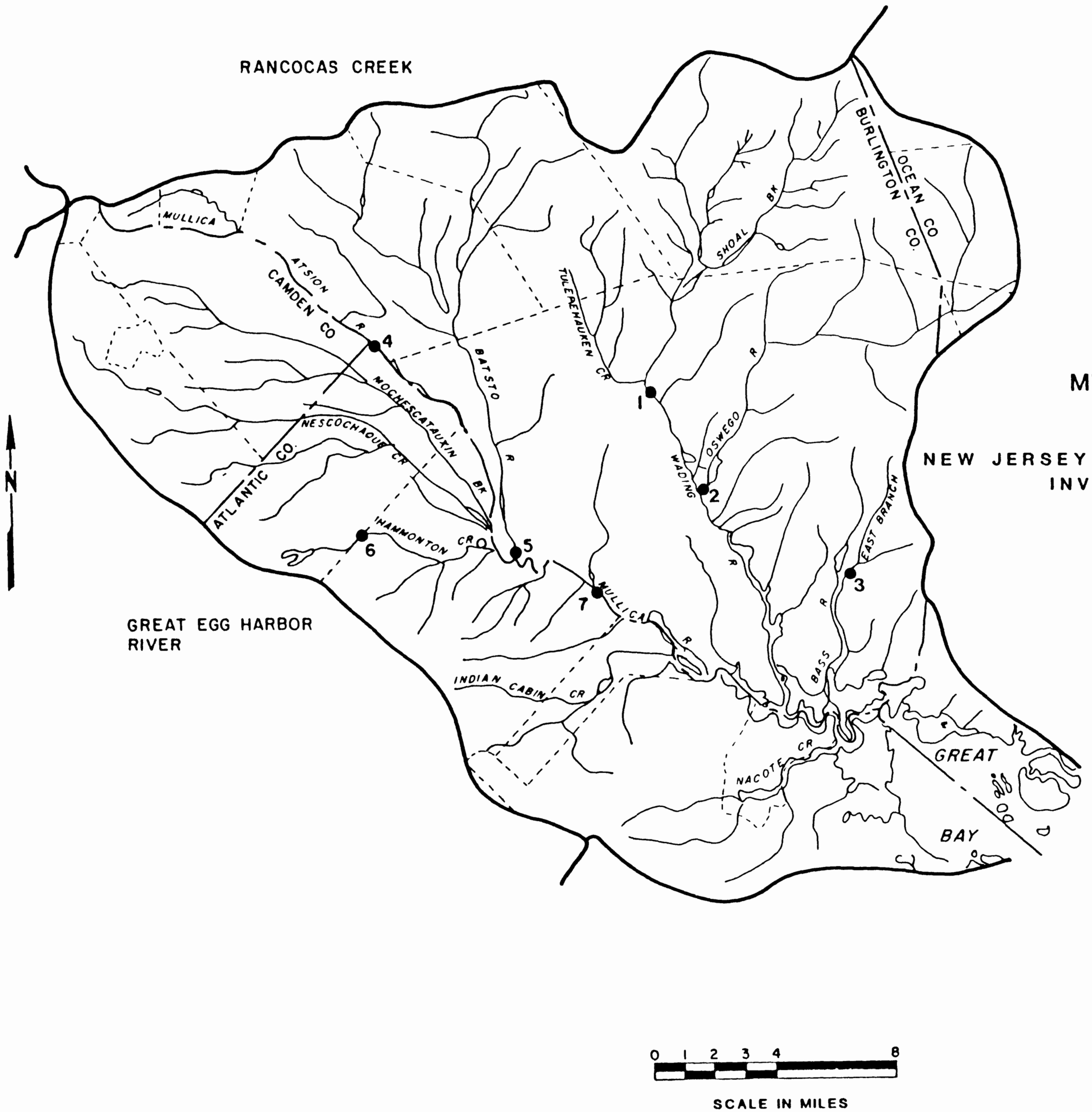
The only lake evaluated in the Mullica watershed was Hammonton Lake. Here increasing amount of runoff from urban surfaces, roads, and storm sewers were believed to be impacting the lake's water quality.

Designated Use and Goal Assessment

All waters in the Mullica River system, with the exception of Hammonton Creek, will meet the swimmable and fish propagation/maintenance goals of the Clean Water Act. The Lower Mullica around Green Bank can be considered to be marginally swimmable while Hammonton Creek is not swimmable. While all streams are thought to contain generally healthy fish communities, Hammonton Creek is considered to be partially meeting the fish propagation and maintenance goal because of very poor water quality conditions. Tidal sections of the Mullica River and tributaries are classified as seasonal, or open with regard to shellfish harvesting, depending on location.

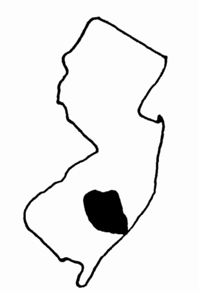
Monitoring Station List

Map Number	Station Name and Classification
1	West Branch Wading River at Maxwell, Pinelands Waters
2	Oswego River at Harrisville, Pinelands Waters
3	East Branch Bass River at New Gretna, Pinelands Waters
4	Mullica River at outlet of Atsion Lake, Pinelands Waters
5	Batsto River at Batsto, Pinelands Waters
6	Hammonton Creek at Westcoatville, Pinelands Waters
7	Mullica River at Green Bank, Pinelands Waters



MULLICA RIVER

NEW JERSEY STATE WATER QUALITY INVENTORY REPORT



LOCATION OF BASIN

WATER QUALITY INDEX PROFILE

Mullica River

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
West Branch Wading River at Maxwell	AVG WQI	1	13	3	3	6	1	0	6	4 Excellent
	WORST3 MONTHS	June-August	May-July	Oct-Dec	April-June	Dec-Feb	Nov-Jan		Aug-Oct	5 Excellent July-Sept
Oswego River at Harrisville	AVG WQI	3	5	4	9	7	1	0	9	5 Excellent
	WORST3 MONTHS	July-Sept	March-May	August-Oct	March-May	June-August	May-July		April-June	9 Excellent May-July
East Branch Bass River New Gretna	AVG WQI	1	21	5	8	7	1	0	ID	10Excellent
	WORST3 MONTHS	July-Sept	August-Oct	March-May	May-July	June-August	May-July			5 Good August-Oct
Mullica River at Atsion	AVG WQI	3	4	7	8	7	1	0	5	5 Excellent
	WORST3 MONTHS	July-Sept	May-July	Sept-Nov	May-July	July-Sept	Dec-Feb		April-June	5 Ecellent Aug-Oct
Hammonton Creek at Westcoat-ville	AVG WQI	2	62	47	13	59	3	1	11	84Very Poor
	WORST3 MONTHS	July-Sept	August-Oct	Jan-March	May-July	August-Oct	August-Oct	Jan-March	March-May	100verypoor July-Sept

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met.
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

River from this action. No facilities are currently under enforcement action by the Department in the watershed.

Nonpoint Source Assessment

The Manasquan River watershed receives a wide range of nonpoint source pollutants. Sources include agriculture, waste disposal, and suburban development. Here as in other eastern coastal watersheds, bacterial contaminations of waterways is a widespread and significant problem.

In the Manasquan River itself, agricultural nonpoint source pollution impacts are reported to be largely centered in the region just east of Route 9. Here croplands, pastureland, feed lots and animal holding areas have combined to cause nutrient loading, siltation, and high bacterial levels in the river. Bacterial levels after rain events are known to be on the decline from pastureland but are believed to be on the rise from local sheep and horse farms. Non-agricultural problems include dam and reservoir construction (Manasquan Reservoir) which has led to local stream bank modification and the loss of riparian vegetation. This has caused severe and increasing degrees of erosion, siltation, and turbidity in the stream; posing a threat to the local freshwater fishery. Increasing amounts of housing construction are also contributing to siltation and turbidity problems, while moderate to severe levels of runoff from urban surfaces and road salting have led to increases in salinity and nutrient loading.

Tributaries to the Manasquan received much the same types of nonpoint pollution as does the Manasquan itself. Squankum Brook is suspected of receiving increasing amounts of runoff from cropland, pastures, and animal holding areas, (and from the Bog Creek Farm site mentioned above). Marsh Bog Brook is suspected of being impacted by agricultural runoff from cropland and animal holding areas, a problem which is believed to be on the rise. Local landfills and septic systems are also suspected and known sources of pollution respectively. DeBois Creek is known to be impacted by siltation from both road and home construction. Here tree cutting during road construction has led to the destablization of streambanks. DeBois Creek is also degraded by increasing amounts of urban runoff.

Lakes assessed in the watershed are experiencing high bacterial levels and eutrophication as a result of inputs from waterfowl and road runoff.

WATER QUALITY INDEX PROFILE

Mullicia River Continued

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Batsto River	AVG WQI	3	8	6	8	8	1	0	13	6 Excellent
	WORST3 MONTHS	June-August	Oct-Dec	June-August	May-July	Dec-Feb	Oct-Dec		April-June	8 Excellent Dec-Feb
Mullica River at Batsto	AVG WQI	5	11	23	17	18	17	0	ID	18 Good
	WORST3 MONTHS	June-August	May-July	Sept-Nov	March-May	June-August	August-Oct			25Good/Fair March-May

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met.
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: MULLICA RIVER**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Eastern Brewing Corp.	0028223	Cedar Branch Stream	Hammonton Twn/Atlantic	Ind./Comm
Hammonton Waste Trmt. Plant	0025160	Hammonton Creek	Hammonton Twn/Atlantic	Municipal
NJ Exp. Auth. Elwood-Weymouth	0026531	Makepeace Stream	Hamilton Twp/Atlantic	Municipal
Whitehall Laboratories	0024210	Pond Lk. to Mullica River	Hammonton Twn/Atlantic	Ind./Comm.
Egg Harbor City WTP	0024589	Union Creek	Egg Harbor/Atlantic	Municipal
Carpenter Realty Inc.	0005428	Mullica River	Washington/Burlington	Mun/Ind/Thr
Presswell Records Mfg. Co.	0031275	Neschoaque Creek	Camden County SA	Thermal

21. TOMS RIVER

Watershed Description

Toms River is 31 miles long and drains an area of 124 square miles. It flows from western Ocean and Monmouth Counties southeast to Barnegat Bay at Toms River, 11 miles north of Barnegat Inlet. This is an area of low relief containing many small tributaries to the Toms River. The larger tributaries include Davenports Branch, Union Branch, and Wrangle Brook. Sub-watersheds include Upper Toms River, Union Branch and Lower Toms River. The watershed also drains a large area of the Pinelands. Major impoundments include Success Lake and Horicon Lake. Population centers include Toms River, Lakehurst, Dover, and Manchester.

This watershed lies in the Coastal Plain and is about one-half forested, with the remainder being residential developments, a military installation and agricultural. There has been a substantial amount of new residential and commercial development throughout the watershed in the past five years. Of the 9 NJPDES permitted discharges within the watershed, 5 are industrial/commercial, and 4 are municipal/institutional. Waters have been classified as Pinelands (some of the Pinelands water are also designated trout maintenance), FW-1, FW-2, Nontrout and SE-1.

Water Quality Assessment

An evaluation of water quality data collected from the Toms River near the City of Toms River was utilized in this assessment. This station is part of the NASQUAN national monitoring network operated by the US Geological Survey. Additional monitoring is also performed by the Ocean County Health Department on the Toms River and other streams in the county. However, sample collection is limited to once or twice yearly.

The Toms River near Toms River Boro contains generally good water quality with conditions reduced somewhat during the summer months. There appears to be some degradation since the previous report, as the river was considered to have excellent water quality in the first half of this decade. Indicators which appear at problematic levels are fecal coliform and pH. Fecal coliform exceeded the State criterion of 200 MPN/100 ml in 38 percent of the samples collected. Surface and ground waters are naturally acidic in this region. While pH averaged 5.07 SU between 1983 and 1987, 28 percent of the values were greater than the 5.5 SU upper criterion for Pinelands waters. Nutrients were within respective criteria for over 90 percent of the values. Dissolved oxygen concentrations are sufficient throughout the year and biochemical oxygen demand is usually less than 2.5 mg/l.

Ocean County Health Department monitoring of the Upper Toms River in the first half of this decade found good to fair quality waters. Low dissolved oxygen saturation is found in the upper watershed, probably due to ground water inflow to the river.

The fish communities of five streams which drain portions of the central coastal area other than the Toms River were assessed by the New Jersey Division of Fish, Game and Wildlife. These were the Metedeconk River (the North Branch and mainstem), Cedar Creek, Union Branch of the Toms River, Oyster Creek, and Westecunk Creek. All were judged to support healthy warm water fish communities. Some cold water fish species are also successfully supported in the upper stretches of the Toms River.

Problem and Goal Assessment

Point Source Assessment

The Toms River does not suffer from any severe pollution problems based on the ambient monitoring conducted. A few minor point sources are present in the watershed, but they do not appear to have significant effects on stream quality. The Ocean County UA regional sewerage system has eliminated a number of municipal facilities in the lower watershed.

Two hazardous waste sites are suspected of impacting surface waters in the Toms River watershed. They are the Lakehurst Naval Air Engineering Center adjacent to the Ridgeway Branch (aromatics, volatile organics, and metals), and Ciba-Geigy which is potentially affecting the Toms River with volatile organics and metals.

Nonpoint Source Assessment

Nonpoint source runoff from man's activities in the watershed have affected water quality from the standpoint of increases in nutrients and stream pH. The streams of the Pinelands region are very susceptible to increases in pH because of the low buffering capacity of the waters. Man's activities tend to cause increases in stream pH. The predominant nonpoint sources in the Toms River and surrounding watersheds are those associated with suburban development. It is the urban surface runoff and septic systems which are suspected to be primarily responsible for the loss of shellfish harvesting areas in Barnegat Bay. Agricultural inputs appear to be limited largely to the Upper Toms River sub-watershed. Another prominent source of nonpoint pollution in this central New Jersey region is the acid-producing mineral deposits located in the soil. When these soils are exposed to air and water as during construction, they produce sulfuric acid, which when carried away in runoff, acts to depress the pH of the receiving waters.

The upper reaches of the Toms River watershed receives agricultural runoff largely from croplands. It appears that the irrigated fields produce larger runoff problems in contrast to nonirrigated fields. Here the principal complaint is that runoff is acting to silt in private ponds. Suburban development is known to create a wide range of severely deleterious impacts to the Toms River including elevations in fecal coliform levels, turbidity, phosphorus, and dissolved solids; as well as declining dissolved oxygen levels, and a decline in the river's suitability for recreational use. These problems are reported to be brought about as a result of the combined impacts of rising levels of septic tank leachate and urban surface runoff. Housing construction in this watershed has caused increased turbidity and siltation as well as the release of increasing amounts of sulfuric acid from acid producing soils.

In the Lower Toms River sub-watershed, suburban development is the primary reported source of nonpoint pollution. Increasing amounts of urban surface runoff, storm sewer drainage, and natural pollution are known to have brought about high levels of phosphorus and coliform bacteria, increases in dissolved solids, and a decrease in dissolved oxygen levels. A decline in the recreational use of the waterway has resulted from periodic beach closures which have occurred in the downstream stretches. The lower Toms River, as well as the Union Branch, have received impacts from stream encroachment and housing construction. Wrangle Brook, a tributary to Toms River in Berkeley Township, is reported to be undergoing a decline in urban surface runoff and septic tank leachate; excessive levels of which have caused high ammonia levels in the stream and have correspondingly threatened the stream's recreational use.

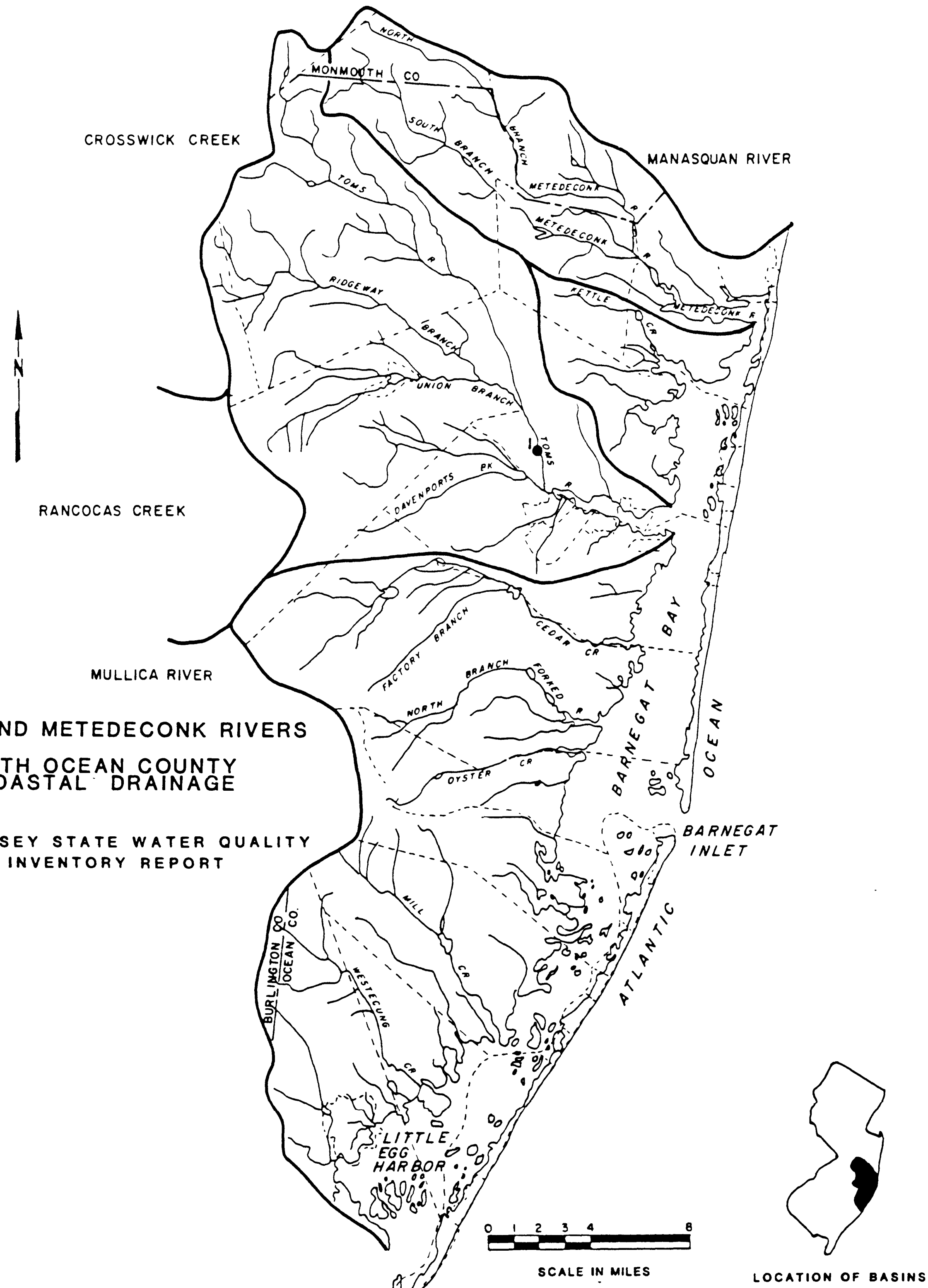
Pine Lake in Manchester Township is reported to have had beach closures because of pollution brought about by urban surface runoff combined with municipal sewage treatment plant effluent.

Designated Use and Goal Assessment

The Toms River will meet the fish propagation/maintenance goal of the Clean Water Act. In the future, however, increasing amounts of runoff may threaten some of the acid tolerant fish populations. Because of high summertime fecal coliform concentrations the river is considered not swimmable in the freshwater sections. In the tidal reaches the Toms River is classified marginally swimmable due to occasionally elevated bacterial levels. The tidal Toms River is also classified as condemned for the harvesting of shellfish.

Monitoring Station List

Map Number	Station Name and Classification
1	Toms River near Toms River, FW-2 Nontrout



TOMS AND METEDECONK RIVERS

WITH OCEAN COUNTY COASTAL DRAINAGE

NEW JERSEY STATE WATER QUALITY INVENTORY REPORT

WATER QUALITY INDEX PROFILE

Toms River

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Toms River near Toms River	AVG WQI	2	10	14	19	9	2	0	8	14 Good
	WORST3 MONTHS	July-Sept	June-August	Sept-Nov	Sept-Nov	June-August	Nov-Jan		May-July	28 Fair June-August

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met.
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: TOMS RIVER**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Naval Air Eng Ctr STP	0004642	Toms River Branch	Manchester/Ocean	Ind/Comm.
Jackson Twp MUA Jr and Sr HS	0029513	North Branch Toms R	Jackson/Ocean	Municipal
Toms River Water Co	0005649	Toms River	Dover/Ocean	Municipal
Toms River Water Co	0005657	Bay Leaf Brook	Dover/Ocean	Municipal
Ciba-Giegy Corp Toms River	0004120	Atlantic Oc.,Toms R	Dover/Ocean	Ind/Comm
Oak Tree Mobile Home Park	0031267	Toms River	Jackson/Ocean	Ind

22. MANASQUAN RIVER

Watershed Description

The Manasquan River drains an area of 81 square miles and flows for 23 miles southeasterly from Freehold Township in Central Monmouth County to the Manasquan Inlet on the Ocean/Monmouth County line. Here, it empties into the Atlantic Ocean at Manasquan Inlet. The headwaters flow from a rural/agricultural area to the densely populated shore. The Manasquan River is connected in its lower reach to Barnegat Bay through the Point Pleasant Canal. The Manasquan River is fed by the major tributaries of Debois Creek, Mingamahone Creek, and Marsh Bog Brook (7 miles long). Population centers include Point Pleasant, Howell Township, Freehold Township, Freehold Borough, and Wall Township. The tides affect the Manasquan River up to a point two miles east of the Garden State Parkway.

About half of the land use in this watershed is crop/pastureland, although, like other watersheds in this region large-scale development is taking place in many areas. There are a number of small lakes and ponds, most of which are used for local recreational purposes. Of the 9 NJPDES permitted discharges in the watershed, one is municipal and 8 are industrial/commercial. The waters are classified FW-1, FW-2 Trout Maintenance, FW-2 Non-trout, and SE-1.

Water Quality Assessment

The Manasquan River has been assessed on the basis of sampling at Squankum. A tributary, Marsh Bog Brook is also routinely monitored and assessed at Squankum. Results indicate that both the Manasquan River and Marsh Bog Brook are of fair water quality. Water quality appears to have improved in the Manasquan during the past few years, while declining in Marsh Bog Brook. This is based on comparing present water quality indices with those from 1986. Sampling of the Upper Manasquan River near Georgia was performed until 1983. This monitoring also found fair conditions.

At Squankum the Manasquan contains excessive levels of nutrients and fecal coliform. Dissolved oxygen is periodically below criterion for trout maintenance waters and stream temperature is at times higher than that recommended for cold-water fisheries. Fecal coliform averaged 625 MPN/100ml between 1983 and 1987, with all of the values greater than 200 MPN/100ml. Dissolved oxygen is lower in summer months and DO saturation frequently falls below 80 percent. Stream temperatures during warm weather months also indicate some stress to cold-water fisheries may occur. Overall water quality conditions are reduced during the summer months.

Fair water quality is present in Marsh Bog Brook, a major tributary to the Manasquan. As with the Manasquan, high nutrients and bacteria are present in this stream. Fecal coliform was excessive in 65 percent of samples since 1983, and averaged 536 MPN/100ml during this period. Total phosphorus was also high in 75 percent of the samples taken, while total inorganic nitrogen was above 2.0 mg/l in 30 percent of the samples. Levels of organic nitrogen were periodically excessive. Dissolved oxygen concentrations were sufficient throughout the period of review, although DO saturation averaged only 81 percent.

Biomonitoring conducted on the Manasquan River at Squankum found less than favorable community structures in 1984 and in 1988. Organisms intolerant of low dissolved oxygen comprised only 14% of the individuals observed in 1988. Since 1978, forms tolerant to low dissolved oxygen have gradually increased over time, replacing more intolerant species at this location.

The Manasquan River is assessed by the New Jersey Division of Fish, Game and Wildlife as supporting a healthy fish community of both warm and cold water species.

Problem and Goal Assessment

Point Source Assessment

The Manasquan River and Marsh Bog Brook experience significant point source loadings. These have contributed to excessive nutrients and as a result, low levels of dissolved oxygen in some sections of the stream. In the Freehold Boro area, a number of industrial facilities discharge to tributaries of the Upper Manasquan. In the headwaters of the river, Lone Pine landfill, a Superfund hazardous waste site exists and contributes pollutants (volatile organics and metals) to the river. In addition, the Bog Creek Farm site is contaminating the North Branch Squankum Brook with volatile organics. A number of municipal wastewater facilities within the Manasquan watershed have been eliminated and their wastewater flows transferred to the Ocean County UA Northern facility for treatment and discharge to the Atlantic Ocean. Long-term improvements are expected in the Manasquan

River from this action. No facilities are currently under enforcement action by the Department in the watershed.

Nonpoint Source Assessment

The Manasquan River watershed receives a wide range of nonpoint source pollutants. Sources include agriculture, waste disposal, and suburban development. Here as in other eastern coastal watersheds, bacterial contaminations of waterways is a widespread and significant problem.

In the Manasquan River itself, agricultural nonpoint source pollution impacts are reported to be largely centered in the region just east of Route 9. Here croplands, pastureland, feed lots and animal holding areas have combined to cause nutrient loading, siltation, and high bacterial levels in the river. Bacterial levels after rain events are known to be on the decline from pastureland but are believed to be on the rise from local sheep and horse farms. Non-agricultural problems include dam and reservoir construction (Manasquan Reservoir) which has led to local stream bank modification and the loss of riparian vegetation. This has caused severe and increasing degrees of erosion, siltation, and turbidity in the stream; posing a threat to the local freshwater fishery. Increasing amounts of housing construction are also contributing to siltation and turbidity problems, while moderate to severe levels of runoff from urban surfaces and road salting have led to increases in salinity and nutrient loading.

Tributaries to the Manasquan received much the same types of nonpoint pollution as does the Manasquan itself. Squankum Brook is suspected of receiving increasing amounts of runoff from cropland, pastures, and animal holding areas, (and from the Bog Creek Farm site mentioned above). Marsh Bog Brook is suspected of being impacted by agricultural runoff from cropland and animal holding areas, a problem which is believed to be on the rise. Local landfills and septic systems are also suspected and known sources of pollution respectively. DeBois Creek is known to be impacted by siltation from both road and home construction. Here tree cutting during road construction has led to the destablization of streambanks. DeBois Creek is also degraded by increasing amounts of urban runoff.

Lakes assessed in the watershed are experiencing high bacterial levels and eutrophication as a result of inputs from waterfowl and road runoff.

Designated Use and Goal Assessment

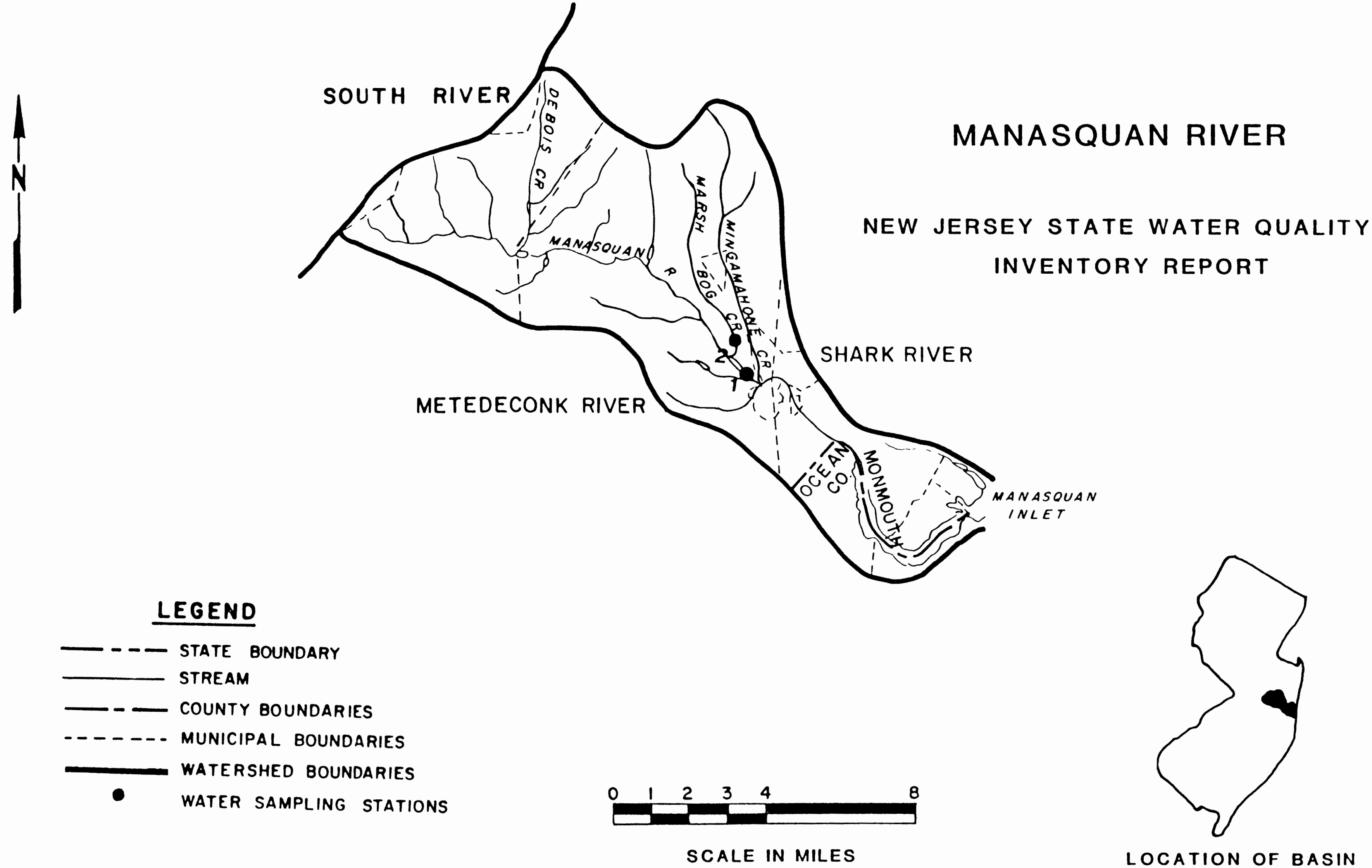
The Manasquan River and Marsh Bog Brook will not meet the swimmable goal of the Clean Water Act and New Jersey's designated use because of elevated fecal coliform levels. The tidal Manasquan River is also condemned for the harvesting of shellfish. These streams will meet the fish propagation and maintenance use and goal, but the fish communities are threatened in sections due to the water's highly enriched condition and occasional reduced dissolved oxygen.

Monitoring Station List

Map Number	Station Name and Classification
1	Manasquan River at Squankum, FW-2 Trout Maintenance
2	Marsh Bog Brook at Squankum, FW-2 Nontrout

MANASQUAN RIVER

NEW JERSEY STATE WATER QUALITY INVENTORY REPORT



WATER QUALITY INDEX PROFILE 1983-1987

Manasquan River

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Marsh Bog Brook at Squankum	AVG WQI	1	19	6	34	23	4	2	7	28 Fair
	WORST3 MONTHS	June-August	June-August	March-May	May-July	April-June	August-Oct	June-August	Oct-Dec	52 Fair June-August
Manasquan River at Squankum	AVG WQI	9	16	15	36	23	6	2	20	33 Fair
	WORST3 MONTHS	June-August	July-Sept	Oct-Dec	July-Sept	May-July	July-Sept	July-Sept	July-Sept	48 Fair July-Sept

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met.
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: MANASQUAN RIVER**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Peerless Tube Co	0004910	Manasquan River	Freehold/Monmouth	Ind/Comm.
Harwood Co.	0032956	Manasquan River	Farmingdale/Monmouth	Ind/Comm.
Frequency Eng. Labs	0028622	Mingamahone Creek	Farmingdale/Monmouth	Ind/Comm.
Arthur Brisbane Trmnt Ctr	0022977	Branch of Manasquan	Wall/Monmouth	Municipal
Brockway Glass Co	0002933	Debois Creek	Freehold/Monmouth	Ind/Comm.
Nestles Co, Inc	0005606	Debois Creek	Freehold/Monmouth	Ind/Comm.
Capscan Cable Co	0031917	Manasquan River	Freehold/Monmouth	Thermal
Howell-Freehold Car Wash	0050270	Long Brook	Howell/Monmouth	Ind
Minnesota Mining & Mtg. Co	0004359	Passaquanaqu Creek	Fairton/Cumberland	Ind/Thm/Sto
First Brands Corp	0029661	Burke's Creek	Freehold/Monmouth	Ind/Comm.
O-I Brockway Glass, Inc.	0002933	Debois Creek	Freehold/Monmouth	Thermal

23. COASTAL MONMOUTH COUNTY DRAINAGE - NAVESINK AND SHARK RIVERS

Watershed Description

The Navesink River is the largest watershed in this segment, draining an area of 95 square miles, while the Shrewsbury River drains an area of 27 square miles, and the Shark River an area of 23 square miles. Tributaries to these rivers include: the Swimming River - Yellow Brook, Big Brook, Mine Brook, and Willow Brook; Parkers Creek, Oceanport Creek, and Little Silver Creek to the Shrewsbury River; and Jumping Brook (7 miles long) to the Shark River (10 miles). Small tidal streams drain northern Monmouth County to Raritan Bay and Sandy Hook Bay. These creeks include: Cheesequake Creek, Matawan Creek, and Waackaack Creek. Sub-watersheds include the Navesink, Shrewsbury and Shark Rivers, and tributaries to Raritan Bay. Population centers in this area include Asbury Park, Long Branch, Red Bank, Keyport, and Eatontown. There are many small ponds in this area, but major impoundments used for potable water are the Swimming River Reservoir and the Glendola Reservoir.

Land use in this watershed is about one third forested, with a smaller percentage agricultural. An appreciable amount of land is used for residential/commercial/industrial uses with about 15 percent being wetlands and water. Of the 36 NJPDES permitted discharges, 9 are municipal and 27 are industrial/commercial. The waters in this region have been classified FW-2 Trout Maintenance, FW-2 Nontrout, and SE-1.

Water Quality Assessment

Jumping Brook and the Shark River near Neptune City are the only ambient water quality monitoring locations in these watersheds. Monitoring was discontinued on both Willow and Yellow Brooks in 1983, and the results of this monitoring is briefly described.

Yellow and Willow Brooks are tributaries to the Swimming River Reservoir, a potable water supply. Water quality was considered fair in these streams between 1981 and 1983 with fecal coliform and total phosphorus occurring in excessive levels.

Water quality is considered excellent and good based on sampling in Jumping Brook and the Shark River, respectively. The only water quality indicator found in problematic levels in Jumping Brook are occasional fecal coliform counts greater than 200 MPN/100ml (less than 20 percent). Nutrient and fecal coliform levels are higher in the Shark River, but still less than statewide averages. Fecal coliform had a geometric mean of 125 MPN/100ml in the Shark River with 30 percent greater than the State criterion. Total phosphorus was above the .1 mg/l criterion in 26 percent of the samples collected between 1983 and 1987. Dissolved oxygen is sufficient throughout the year in the two streams. Both streams are moderately acidic.

The warm-water fishery of the Navesink River was evaluated by the New Jersey Division of Fish, Game and Wildlife as healthy. The Shark River which supports both warm and cold water fish species was also assessed to support healthy communities. The Shrewsbury River in contrast, which supports warm water forms, was judged to be moderately degraded.

Problem and Goal Assessment

Point Source Assessment

Point sources contribute to water quality problems in many of the coastal streams of Monmouth County. Willow Brook suffers from the contribution of both point and nonpoint sources. A number of industrial point sources combined with suburban and agricultural runoff and septic systems are the likely causes of the elevated nutrients and bacteria in the brook. As of the beginning of 1990, there are no reported violations of discharge permits in these watersheds.

Imperial Oil Co. contains a hazardous waste site that is affecting Lake Lefferts and Birch Swamp Brook with organics, metals and PCBs. The Seaview Square Mall is built on an old dump site and is suspected of contaminating Deal Lake with metals and polyaromatic hydrocarbons.

Nonpoint Source Assessment

Horse farms, construction activities, and urban runoff are believed to be the principal nonpoint sources of pollution in this region. These have brought about siltation, nutrient loading, and excess bacterial contamination in the local rivers. Bacteria from horse farms and urban runoff has contaminated many of the shellfish harvesting beds in the downstream reaches of these rivers. In the tidal Navesink River a NJDEP nonpoint source control project is underway to alleviate the bacterial contamination of shellfish growing waters by suburban and agricultural runoff. The US Soil Conservation Service is also sponsoring a soil erosion and animal waste control project in the watershed.

In the Navesink watershed both agricultural and suburban construction activities have created severe pollution problems. Crop production and horse farming, especially the stockpiling of manure, are described by local authorities as a severe problem which has resulted in excessive nutrients and bacterial loadings. In addition, depressed dissolved oxygen levels now threaten the local fresh water fishery in the Navesink. Urban development impacts the Navesink largely by contributing stormwater runoff and septic tank leachate, both of which are believed to contribute to siltation, nutrient loading, and oil and grease contamination.

The Shark River watershed appears to be impacted more by suburban pollution sources and less by agricultural sources than the Navesink River watershed. Agricultural activity is suspected of contributing some runoff from pasturelands resulting in nutrient and silt loads entering the waterway. In this watershed road and housing construction, as well as urban runoff and landfills predominate as the suspected principal nonpoint pollution sources. Local construction on roadways and housing are suspected of contributing to severe siltation and turbidity, especially in the headwaters. In addition, construction activities expose acid-producing soils which in turn can cause a pH depression in local streams. Wide spread suburban runoff from both suburban surfaces have sent excess silt, road salts, and bacteria into the Shark River, its tributaries and lakes. Landfills and other forms of waste storage are also suspected sources of pollution in the Shark River. In the head waters in Tinton Falls, volatile organics are reported to be leaking into the local waters during rain. In Neptune City, underground waste storage tanks are known to be leaking petroleum products.

The Shrewsbury River is impacted by much of the same problems that impact the other local waters. Severe agricultural runoff from croplands, pastures, and animal holding areas are believed to be contributing excess nutrients, silt, and bacteria to surface water. Horse manure at Monmouth Race Track is known to contribute high levels of bacteria to the river. Increases in suburban and commercial construction in the watershed have combined with runoff from storm sewers and suburban surfaces to send what are believed to be excess amounts of silt, salts, nutrients, and oil and grease into the waterway. This has caused high water temperatures, low dissolved oxygen levels, and restrictions in shellfish harvesting. Some nonpoint pollution in the Shrewsbury watershed is also suspected from septic systems, and from waste disposal sites.

Designated Use and Goal Assessment

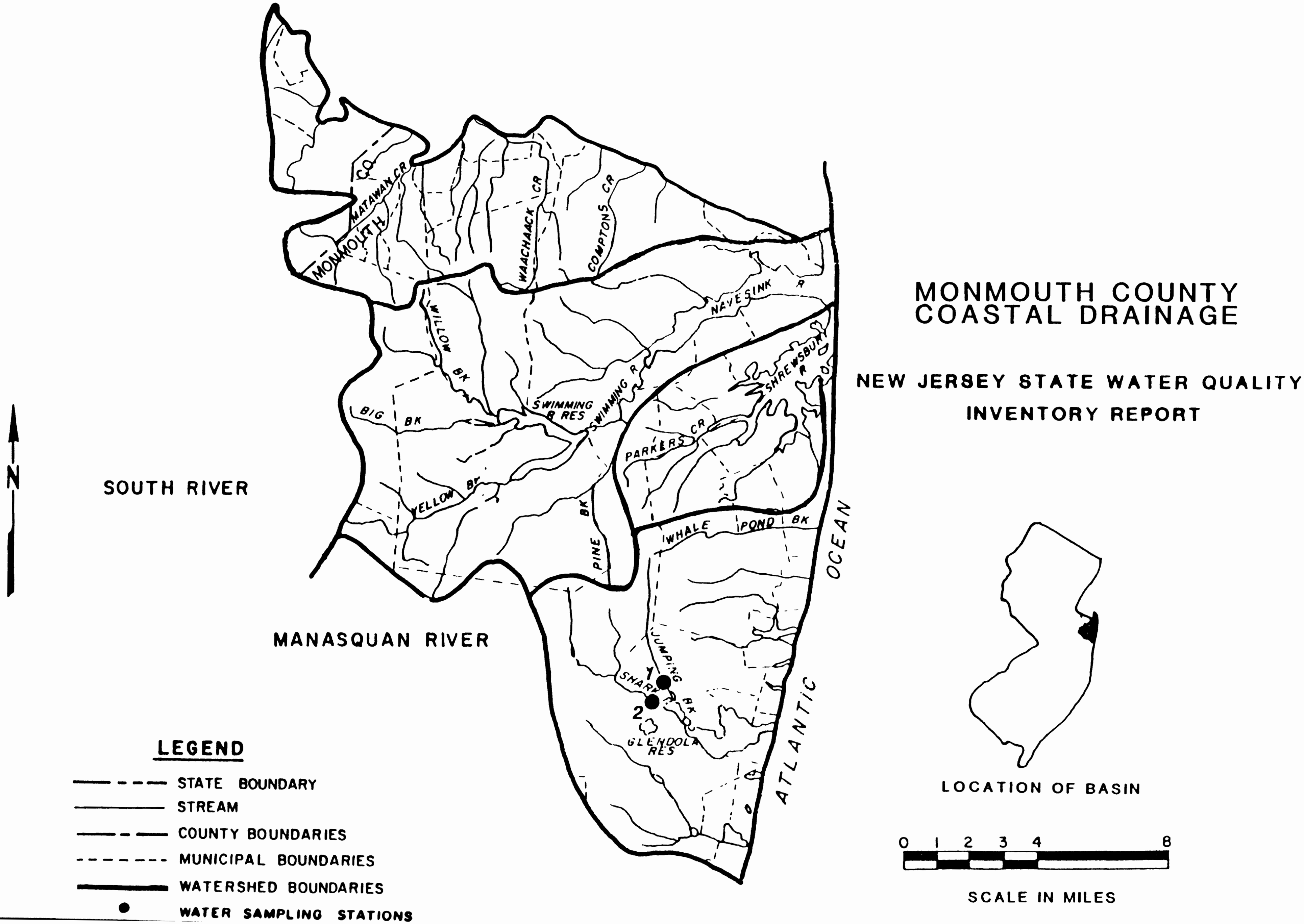
The fish propagation/maintenance designated use will be met in the Shark and Navesink watersheds, but the fisheries of portions of the Navesink River and tributaries are considered threatened from poor water quality. The fisheries of the Shrewsbury River are partially degraded, and therefore, the river is considered to be partially meeting the fish propagation/maintenance use. Shellfish growing waters in this region are classified both condemned and restricted (further treatment required) for harvesting. Jumping Brook will partially meet the swimmable use, while the Shark River is not swimmable.

Monitoring Station List

Map Number	Station Name and Classification
1	Jumping Brook near Neptune City, FW-2 Nontrout
2	Shark River near Neptune, FW-2 Nontrout

MONMOUTH COUNTY COASTAL DRAINAGE

NEW JERSEY STATE WATER QUALITY INVENTORY REPORT



WATER QUALITY INDEX PROFILE

Coastal Monmouth County

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Jumping Brook near Neptune City	AVG WQI	2	6	10	12	9	4	0	7	7 Excellent
	WORST3 MONTHS	June-August	Nov-Jan	Jan-March	July-Sept	July-Sept	Jan-March		August-Oct	11Excellent July-Sept
Shark River near Neptune	AVG WQI	1	8	2	20	15	4	0	7	11 Good
	WORST3 MONTHS	June-August	May-July	July-Sept	July-Sept	July-Sept	Dec-Feb		March-May	20 Good July-Sept

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met.
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: NAVESINK RIVER SANDY HOOK BAY**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
South Amboy STP	0020541	Raritan Bay	South Amboy City/Mds	Municipal
South Amboy WTP	0003913	Raritan Bay	South Amboy City/Mds	Municipal
Sayreville Boro-Morgan STP	0023825	Raritan Bay	Sayreville Boro/Mds	Municipal
Old Bridge- Lawrence Hrbr.	0022471	Raritan Bay	East Brunswick/Mds	Municipal
Aberdeen Twp. MUA Strathmore	0022543	Mohingson Creek	Aberdeen/Monmouth	Municipal
Aberdeen Twp. MUA River Gard.	0022829	Matawan Creek	Aberdeen/Monmouth	Municipal
Biddle Sawyer Inc.	0030872	Lupatacong Creek	Keyport/Monmouth	Ind/Comm.
Union Bch. Boro W.D.	0025437	Little Creek	Union Bch./Monmouth	Municipal
Shorelands Water Plant 1	0025453	East Creek	Hazlet Twp./Monmouth	Industrial
Comdata Systems Incorporated	0001775	Ditch to Mahora	Holmdel Twp/Monmouth	Ind/Comm.
Bell Labs - Crawford Hill	0000485	Ramanessin Brook	Holmdel Twp/Monmouth	Ind/Comm.
USEPA Office R&M	0005762	Sandy Hook Bay	Middletown/Monmouth	Ind/Comm.
Seacoast Products	0000779	Sandy Hook Bay	Middletown/Monmouth	Ind/Comm.
Middletown TWP SA	0025356	Atlantic Oc	Middletown/Monmouth	Municipal
McConnell Fuel Oil Co	0000868	Sandy Hook Bay	Atlantic Highlands/Mon	Ind/Comm.
Holmdel Nursing + Conval	0027529	Branch Willow Brook	Holmdel/Monmouth	Ind/Comm.
Pleasant Valley Pub Inc.	0031674	Navesink River	Holmdel/Monmouth	Ind/Comm.
Marlboro St Psych. Hosp.	0022586	Big Brook	Matawan Boro/Monmouth	Municipal
Bell Laboratories	0000477	Ramanenssin Brook	Holmdel/Monmouth	Ind/Comm.

N.J.P.D.E.S. DISCHARGE INVENTORY WATERSHED: NAVESINK RIVER SANDY HOOK BAY,Continued

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Holmdell Twp. B. of Ed.	0027031	Ramanenssin Brook	Holmdel/Monmouth	Municipal
Pennwalt - SS White Div. Holm	0001481	Willow Brook	Holmdel Twp/Monmouth	Ind/Comm.
Colts Neck Inn	0031771	Mine Brook	Colts Neck/Monmouth	Ind/Comm.
US Naval Weapons Sta Earle	0023540	Trib to Yellow Brook	Colts Neck/Monmouth	Mun/Comm/In
Bendix Corp. Electric Power	0002623	Husky Brook	Eatontown Boro/Monm	Ind/Comm.
Electronic Ass Inc	0002135	Turtle Mill Brook	West Long Branch/Mon	Ind/Comm.
Shore Gas Oil Co.	0021849	Takannassee Lake	Ocean/Monmouth	Ind/Comm.
NJ Highway Auth. G.S.Pkwy.	0021148	Trib to Shark River	Wall/Monmouth	Municipal
Molecular Wire Corp	0034258	Shark River	Wall/Monmouth	Thermal
Farmingdale WTP	0055581	Shark River	Farmingdale/Mon	Ind
Electronic Concepts Inc	0067075	Shrewsbury River	Eatontown/Monmouth	Ind
Allanhurst Water Dept T	0098647	Shark River	Allenhurst Boro/Mon	Ind
Prudential Propetry and Casua	0035718	Willow Brook	Holmdel/Monmouth	Municipal
Water Treatment P1#2	0067156	Big Brook	Marlboro/Monm	Ind
Water Treatment P1#3	0067164	Big Brook	Marlboro/Monm	Ind
Four Ponds Center Assoc.	0035441	Jumping Brook	Middlet	

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: NAVESINK RIVER SANDY HOOK BAY**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
East Coast Ice	0063134	Shark River	Neptune/Monmouth	Ind
Laird and Company	0035823	Yellow Brook	Scobeyville/Mon	Municipal
New Jersey Gravel and Sand Co	0032239	Wreck Pond Brook	Wall/Monmouth	Ind
Bel Ray Company Inc	0034177	Shark River	Wall Twp/Mon	Ind
Atlantic Highlands Borough	0034924	Many Mind Creek	Atlantic High/Mon	Municipal
Shorelands Water	0025461	East Creek	Holmdel Twp/Mon	Municipal
Takanassee Beach Club	0069477	Lake Takanassee	Long Branch/Mon	Ind

24. SOUTH BRANCH RARITAN RIVER

Watershed Description

The South Branch of the Raritan River drains an area of 279 square miles and flows from western Morris County through central Hunterdon County and into western Somerset County before joining the North Branch. The South Branch is 51 miles long. Population centers include Flemington, Washington Township, Mt. Olive, Clinton, and High Bridge. Major tributaries to the South Branch are the Neshanic River (11 miles long), Spruce Run Creek (6 miles) Mulhockaway Creek (8 miles), and Cakepoulin Creek. The major impoundments located in the watershed are Spruce Run Reservoir and Round Valley Reservoir. The watershed has been divided into the following sub-watersheds: Upper and Lower South Branches, Neshanic River and Pleasant Run.

The land use in this watershed is mostly agricultural, but suburban/industrial development is increasing at a rapid rate. Of the 23 NJPDES permitted discharges here, 12 are municipal, and 11 are industrial/commercial. The streams in this watershed are classified as FW-2 Trout Production, FW-2 Trout Maintenance, and FW-2 Nontrout.

Water Quality Assessment

The South Raritan River and tributaries are monitored at eight locations: the South Branch at Middle Valley, High Bridge, Stanton Station, and Three Bridges; Spruce Run near Glen Gardner and at Clinton; Mulhockaway Creek at Van Syckel; and the Neshanic River at Reaville. Bushkill Brook at Rockefellows Mill was sampled until mid-1983 when it was discontinued. Results from monitoring indicate that the South Branch watershed contains generally good quality waters.

The Upper South Branch Raritan River has good water quality as measured at Middle Valley and High Bridge. Both stations degrade during summer months to fair quality because of elevated stream temperature, nutrients and fecal coliform. The river, trout maintenance at these two locations, frequently has summer stream temperatures above recommended criterion for the protection of cold-water fisheries. Fecal coliform exceeded the State criterion in 42 and 20 percent of the samples collected from 1983-1987 at Middle Valley and High Bridge, respectively. Total phosphorus was excessive in about one-half of the samples at both stations.

In the Lower South Branch, as measured at Stanton Station and Three Bridges, water quality degrades somewhat to fair conditions. At Stanton Station stream temperatures are often high during warm-weather months for trout maintenance waters, while fecal coliform and total phosphorus were elevated in 38 percent of their samples. Unionized ammonia was periodically elevated in the early 1980s, but now appears to be at acceptable levels. Downstream at Three Bridges the South Branch is classified as nontrout waters. Water quality indicators found at problematic levels are fecal coliform and total phosphorus. The geometric mean of fecal coliform counts during the period of review (1983-1987) was 659 MPN/100ml with 66 percent above 200 MPN/100ml. Total phosphorus was elevated in 77 percent of the samples and averaged .15 mg/l. At both locations all dissolved oxygen readings were above respective criterion throughout the period. Biochemical oxygen demand is usually under 3.0 mg/l in the Lower South Branch as measured at Three Bridges and Stanton Station.

Monitoring of tributaries has found good water quality in Spruce Run and Mulhockaway Creek, and fair quality in the Neshanic River and Bushkill Brook. Spruce Run above Spruce Run Reservoir and Mulhockaway Creek are trout production waters with high summertime stream temperatures and moderately excessive fecal coliform and total phosphorus concentrations. Below the reservoir Spruce Run at Clinton is of excellent quality.

Bushkill Brook is a small tributary draining the Flemington area and adjacent developed lands. The brook has a history of water pollution problems due to point sources. Sampling from 1981 to mid-1983 found the brook to be of fair quality with conditions becoming poor during the summer. Most severe are nutrients (total phosphorus and inorganic nitrogen), total dissolved solids and reduced dissolved oxygen saturation.

The remaining tributary monitored is the Neshanic River. The Neshanic River is of fair quality, but worsens to very poor quality in the summer. The river appears to be enriched and experiences supersaturated dissolved oxygen during this critical period as a result of elevated primary productivity. Both total phosphorus and total inorganic nitrogen appear in generally high amounts. Fecal coliform was above the 200 MPN/100ml criterion in 75 percent of samples collected, with a geometric mean of 511 MPN/100ml. Also occurring as a periodic problem are excessive total dissolved solids and un-ionized ammonia concentrations.

Biological monitoring of the South Branch at Stanton Station in 1988 has found generally healthy conditions; macroinvertebrate sampling revealed 47% of the sample to be forms intolerant of low dissolved oxygen levels. The sampling however, did indicate some nutrient enrichment. Macroinvertebrate sampling over the past ten years has suggested continuing good conditions at this station.

The South Branch of the Raritan River was evaluated by the New Jersey Division of Fish, Game, and Wildlife as supporting a healthy fish community. The Neshanic River and Pleasant Run, tributaries to the South Branch, are both judged to contain healthy warm water fisheries.

Problem and Goal Assessment

Point Source Assessment

The South Branch Raritan River watershed contains a variety of pollution problems. Point and nonpoint sources both contribute to the water quality conditions found in the river. NJDEP enforcement actions continue against the Clinton Township STP discharge to the South Branch, the Clover Hill STP (Mt. Olive) discharge to Drakes Brook and the Schooley Mountain STP (in Washington Twp.) discharge to the South Branch. These facilities are releasing excessive pollutants commonly associated with municipal treatment systems. As of the end of 1989, the Skyview STP discharge to Drakes Brook, and the United States Bronze Powders, Inc. discharge to Mill Creek have been added to the list of discharge violators in this watershed.

Nonpoint Source Assessment

The South Branch Raritan River exhibits a pattern which appears common throughout the State: a gradual decline in agricultural nonpoint source pollution paralleled by a rapid increase in suburban nonpoint sources. Both housing and road construction are reported to be in the rise in the Upper South Branch watershed and these are known to be sources of excessive sediment loading to the South Branch. Coupled with these activities are the increasing problems with runoff from suburban sources and storm drains which are known to be contributing additional nutrients and sediments to the river. Septic tanks are reported to be a severe problem in this watershed, especially the increasing number of older systems which are failing in the High Bridge and Califon areas. Agriculture also is suspected in contributing nutrient and sediment loads to the South Branch. Local authorities suggest that while runoff from pasture lands maybe on the rise, the gradual loss of farmland in this watershed has caused a decline in the severity of cropland runoff. Agricultural sheet and rill erosion is considered severe in the South Branch watershed by the Soil Conservation Service. Local timber harvesting is noted to have contributed to siltation but this problem is also believed to be on the decline. Other pollution sources suspected of impacting the South Branch are surface mining activities and general road runoff.

Five large tributary streams were evaluated for NPS impacts in this watershed: Bushkill Creek, Spruce Run Creek, Mulhockaway Creek, the Neshanic River, and Pleasant Run. Bushkill Creek is believed to have been impacted by chemical spills and by urban runoff from combined sewers. Spruce Run Creek is known to be impacted by runoff from road maintenance, construction activities, feedlots, surface mines, and leaks from waste storage facilities. These in turn have sent excess silt as well as oil and grease into the stream, and are reported to have contributed to a general decline in the creek's fishery habitat. The Mulhockaway Creek subwatershed is said to be experiencing significant amounts of housing development, which is causing severe silt problems. The Neshanic River receives what are believed to be excess levels of nutrient and sediment loads from agricultural sources. Of these suspected sources, runoff from local croplands is judged to be on the rise while feedlot and pasture land runoff is believed to be on the decline. Suburban development in the Neshanic watershed has brought about a rise in pollution problems. These problems arise from construction activities, septic systems, suburban surface runoff, and road runoff. Additional problems in this sub-watershed have been reported from the improper land disposal of sludge. Pleasant Run is suspected of receiving excessive amounts of nutrient and sediment from croplands, suburban construction sites, storm sewers, and roads.

Designated Use and Goal Assessment

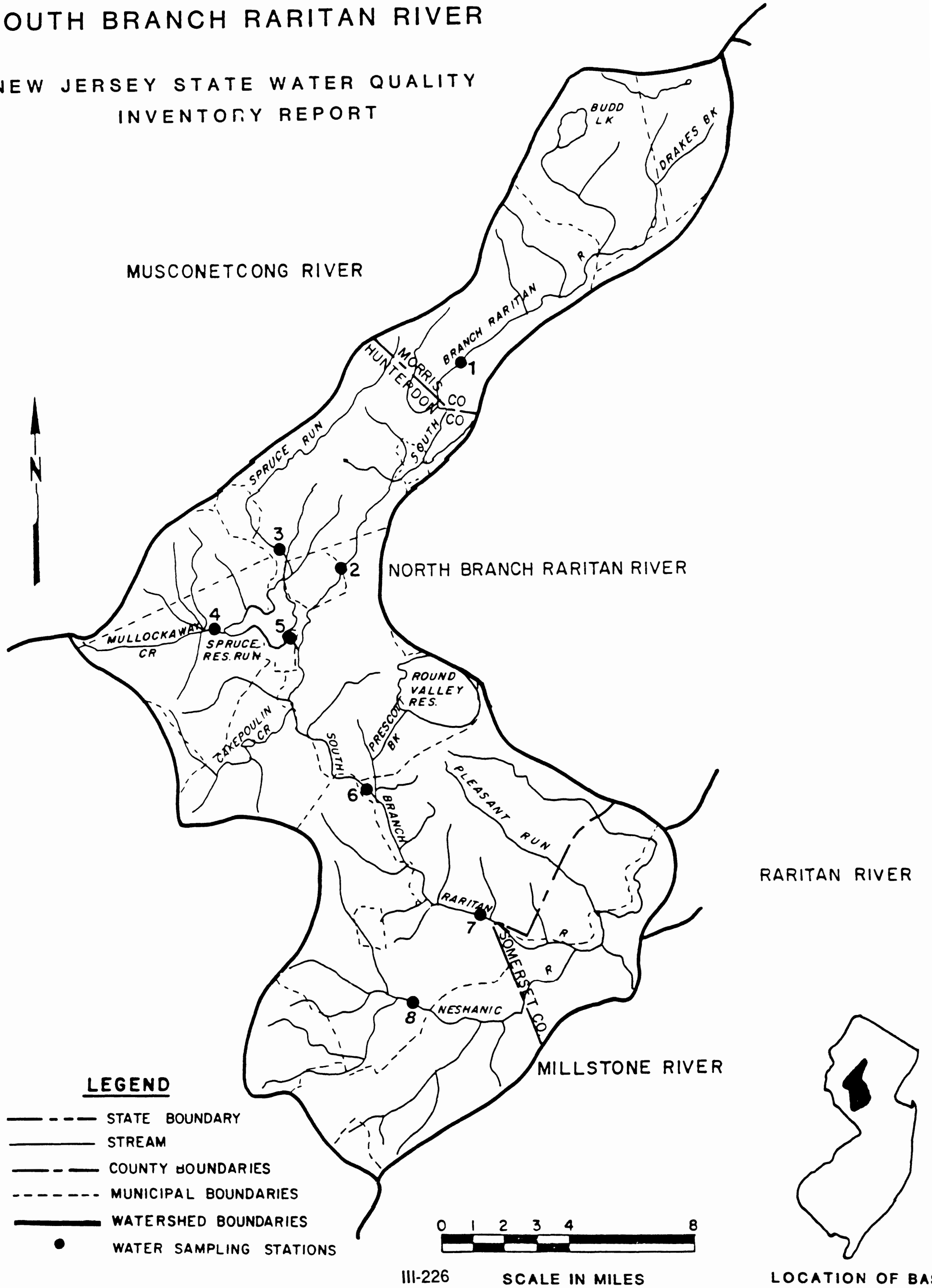
The Neshanic River, Mulhockaway Creek, most of the South Branch and the upper portions of Spruce Run will all not meet the swimmable use. Below Spruce Run Reservoir, Spruce Run appears to have sufficiently low fecal coliform counts to meet the swimmable designated use, while the South Branch in the High Bridge area is considered marginally swimmable. All waters will achieve the fish propagation and maintenance use and are recognized as having healthy cold and warm-water fisheries. The healthiness of the fisheries of most streams, however, are threatened in sections because of increasing pollution loads.

Monitoring Station List

Map Number	Station Name and Classification
1	South Branch Raritan River at Middle Valley, FW-2 Trout Maintenance
2	South Branch Raritan River at High Bridge, FW-2 Trout Maintenance
3	Spruce Run near Glen Gardner, FW-2 Trout Production
4	Mulhockaway Creek at Van Syckel, FW-2 Trout Production
5	Spruce Run at Clinton, FW-2 Trout Maintenance
6	South Branch Raritan River at Stanton Station, FW-2 Trout Maintenance
7	South Branch Raritan River at Three Bridges, FW-2 Nontrout
8	Neshanic River at Reaville, FW-2 Nontrout

SOUTH BRANCH RARITAN RIVER

NEW JERSEY STATE WATER QUALITY INVENTORY REPORT



WATER QUALITY INDEX PROFILE

South Branch Raritan River

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
SB Raritan River at Middle Valley	AVG WQI	9	7	7	23	20	6	6	17	19 Good
	WOPST3 MONTHS	July-Sept	May-July	August-OCt	July-Sept	July-Sept	Dec-Feb	July-Sept	Sept-Nov	35 Fair July-Sept
SB Raritan River at High Bridge	AVG WQI	13	5	10	20	18	6	6	20	20 Good
	WORST3 MONTHS	June-August	May-July	August-Oct	May-July	July-Sept	Nov-Jan	July-Sept	April-June	35 Fair June-August
Spruce Run near Glen Gardner	AVG WQI	9	7	9	18	23	4	1	17	17 Good
	WORST3 MONTHS	June-August	August-Oct	August-Oct	May-July	July-Sept	Sept-Nov	June-August	March-May	31 Fair July-Sept
Mulhockaway Creek at Van Syckel	AVG WQI	8	5	7	19	19	5	1	17	14 Good
	WORST3 MONTHS	June-August	June-August	Sept-Nov	June-August	Feb-April	Sept-Nov	May-July	March-May	33 Fair June-August
Spruce Run at Clinton	AVG WQI	16	6	6	9	10	4	1	17	12 Good
	WOR3T3 MONTHS	June-August	Sept-Nov	March-May	Oct-Dec	July-Sept	Dec-Feb	June-August	August-Oct	24 Good June-August

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met.
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

WATER QUALITY INDEX PROFILE

South Branch Raritan River Continued

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
SB Raritan River at Stanton Station	AVG WQI	15	6	10	27	20	5	6	20	26Good/Fair
	WORST3 MONTHS	June-August	Jan-March	Feb-April	Oct-Dec	April-June	Oct-Dec	June-August	July-Sept	41 Fair June-August
SB Raritan River at Three Bridges	AVG WQI	3	7	7	40	22	7	6	6	28 Fair
	WORST3 MONTHS	June-August	Nov-Jan	August-Oct	Sept-Nov	Oct-Dec	Dec-Feb	July-Sept	Sept-Nov	42 Fair Sept-Nov
Neshanic River at Reaville	AVG WQI	5	45	23	37	20	11	8	5	54 Fair
	WORST3 MONTHS	July-Sept	July-Sept	July-Sept	Sept-Nov	Dec-Feb	Sept-Nov	July-Sept	Oct-Dec	85 VeryPoor July-Sept

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met.
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: S. BRANCH RARITAN RIVER**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Washington Twp. Schooleys Mtn	0023493	S. Branch Raritan R	Washington Twp/Morris	Municipal
Welsh Farms Inc.	0001236	Electric Brook	Washington Twp/Morris	Ind./Comm.
Roxbury Twp. Skyview STP	0022683	Trib. to Jakes Brook	Roxbury Twp./Morris	Municipal
Clinton Twp. Bd. of Ed.	0023175	S. Br. Raritan River	Clinton Twp./Hunter	Municipal
Town of Clinton	0020389	S. Br. Raritan River	Clinton Twp./Hunter	Municipal
N. Hunterdon H.S.	0028363	Cramer Creek	Clinton Twp./Hunter	Municipal
Flemington Boro STP	0028436	Bushkill Creek	Flemington Boro/Hunt	Municipal
Ethyl Corp.	0003298	S. Br. Raritan River	Raritan Twp./Hunter.	Ind./Comm.
Branchburg Twp. Neshanic Sta.	0020354	S. Br. Raritan River	Branchburg Twp./Somer	Municipal
Wilson Fiberfil International	0003051	Raritan River	Branchburh Twp/Somer	Ind./Comm.
Merck + Co. - 3 Bridges Farm	0003905	Erie Basin	Hillsborough Twp/Som	Ind./Comm.
Exxon Co. USA Flemington Term	0000892	Second Neshanic R.	Raritan Twp./Hunter	Ind./Comm.
Raritan Twp. MUA	0022047	S. Br. Raritan R.	Flemington Boro/Hunt	Municipal
Wayne's Amoco	0071897	Bushkill Creek	Flemington Boro/Hunt	Ind./Comm.
Youth Corr. Inst. Annandale	0028487	S. Br. Raritan River	Annandale/Hunterdon	Municipal
Youth Correc. Inst.	0029874	S. Br. Raritan River	Sussex	Municipal
Dart Ind.	0032662	S. Br. Raritan River	Neshanic St./Somer	Thermal
U.S. Bronze Powders Corp.	0003336	Bushkill Creek	Raritan Twp./Hunter	Thermal
Meenam Oil Co. Inc.	0028754	Raritan River	Clinton Twp./Hunter	Industrial
Tenneco Polymers, Inc.	0001660	Bushkill Creek	Raritan Twp./Hunter	Ind./Comm.
Lentine Aggregates	0026450	Spruce Run Creek	Glen Gardner/Hunter	Industrial
Roxbury Motel Assoc.	0028304	Drakes Brook	Roxbury Twp/Morris	Municipal
Hercules Inc.	0000876	Black River	Roxbury Twp/Morris	Ind/Comm.
Mt. Olive Twp.	0021954	Drakes Brook	Flanders/Morris	Municipal

25. NORTH BRANCH RARITAN RIVER

Watershed Description

The North Branch of the Raritan River, 23 miles long, drains an area of 190 square miles and flows from northwestern Morris County through Somerset County to the confluence with the South Branch between the towns of Branchburg and Raritan. Population centers include Bernardsville, Peapack-Gladstone, Chester, Bedminister, Mendham, and Far Hills. Major tributaries to the North Branch are Peapack Brook, Rockaway Creek (16 miles), and the Lamington River (27 miles). The only major impoundment in this drainage area is Ravine Lake. Subwatersheds include the Upper and Lower North Branches and the Lamington River.

The land use in this watershed is primarily rural, woodland, agricultural and scattered commercial/residential, but there is intense development along the major road corridors (Rts. 24, 206, and highways 22, 287, and 78). Of the 22 NJPDES permitted discharges here, 10 are municipal, and 12 are industrial/commercial. The streams in this watershed have been classified, along various stretches, FW-2 Trout Production, FW-2 Trout Maintenance, and FW-2 Nontrout.

Water Quality Assessment

The North Branch Raritan River and tributaries contains generally good water quality, although conditions are marginal or fair in the headwaters and during warm weather. Ambient monitoring is performed on the North Branch near Chester, at Burnt Mills, and at North Branch. Sampling of tributaries includes the Lamington River near Ironia, near Pottersville, at Burnt Mills, and on the Rockaway Creek at Whitehorse.

The Lamington River, the major tributary of the North Branch, contains good water quality with the exception of the headwaters. The Upper Lamington River, as sampled near Ironia, is generally of fair quality, but conditions approach poor quality in the early summer period. The river at this location contains elevated nutrients and fecal coliform, and during low flow, reduced dissolved oxygen that may pose a threat to in-stream fisheries. Both total phosphorus and total inorganic nitrogen appeared at high concentrations. Downstream near Pottersville and at Burnt Mills water quality improves as dissolved oxygen is for the most part above respective criteria in samples collected since 1983. Total phosphorus and inorganic nitrogen is significantly lower, although it still exceeds recommended levels in 60 percent of all samples at the Pottersville station. Fecal coliform counts, lower at Pottersville, increase again at Burnt Mills. Geometric means of fecal coliform measurements near Pottersville and at Burnt Mills were 82 and 220 MPN/100ml, respectively. The Lamington River near Pottersville is a trout production stream. Summertime stream temperature frequently exceeds recommended temperature for these waters.

Rockaway Creek, a tributary to the Lower Lamington River is sampled at Whitehorse. Results indicate the stream is of good quality, but that during the early summer conditions degrade to fair quality. The creek has generally low nutrients, *(approximately one-third of the total phosphorus values were* greater than State criterion), but experiences high fecal coliform counts. Fecal coliform exceeded 200 MPN/100ml in 60 percent of the samples collected between 1983 and 1987, and had a geometric mean of 232 MPN/100ml. Dissolved oxygen is sufficient for this warm-water stream. The Lamington River and Rockaway Creek are both mildly alkaline.

The North Branch Raritan River measured near Chester has fair quality waters containing elevated nutrients and fecal coliform concentrations. In addition, stream temperatures are periodically above recommended levels during the summer for trout production waters. Total phosphorus was greater than the State criterion in all of samples collected and averaged .44 mg/l. Total inorganic nitrogen concentration were also high averaging 2.6 mg/l between 1983 and 1987. The geometric mean of fecal coliform during this period was 119 MPN/100ml with 26 percent above 200 MPN/100ml. Dissolved oxygen appears to drop below the 7.0 mg/l criterion for trout waters at times during warm-weather months. One elevated cadmium level was recorded on the North Branch at this location during the period of review.

In the Lower North Branch water quality is generally good although fecal coliform is frequently high. Geometric means were 178 and 138 MPN/100 ml at Burnt Mills and North Branch, respectively. Total phosphorus is moderately high at Burnt Mills, averaging .13 mg/l, but concentrations lower at North Branch, averaging only .08 mg/l. Dissolved oxygen levels are adequate with no measured concentrations below 4.0 mg/l.

Biomonitoring of the North Branch at North Branch in 1984 found generally healthy conditions with balanced populations. In contrast, macroinvertebrate sampling farther downstream at Raritan in 1988 suggest excessive nutrient enrichment at this location.

The Lamington River, Trout Brook and the North Branch Raritan River are all assessed to be supporting healthy fish communities. The Lamington and the upper reaches of the North Branch Raritan both support cold water fish species, while in the lower portion of the North Branch the fish community shifts to one of warm water forms.

Problem and Goal Assessment

Point Source Assessment

The North Branch Raritan River and tributaries experience water quality degradation in the vicinity of a number of point sources. The Upper Lamington River, while naturally having large diurnal dissolved oxygen fluctuations, contains elevated total phosphorus primarily from the Roxbury Township-Ajax Terrace STP. Although this facility is to be upgraded for phosphorus removal, it presently remains a source of poor quality effluent and is under DEP enforcement action. Other enforcement actions involving facilities impacting stream quality include: Oldwick Materials, Inc. in Tewksbury Twp. discharge to a Lammington River tributary (excess suspended solids), Stavola Construction Materials, Inc. in Bridgewater Twp. discharge to Middle Brook (suspended solids), and John Delorean Wastewater Treatment Plant in Bedminster Twp. (excess chlorine) to Middle Brook, and the Mendham Boro STP (excessive ammonia) discharge to India Brook.

The Combe Fill South waste site is contaminating tributaries of the Lamington with volatile organics.

Nonpoint Source Assessment

Active suburban development appears to be the primary nonpoint pollution source in the North Branch Raritan River watershed. The Lamington River is impacted by increasing amounts of housing construction along its entire length, many of these developments being on former farmlands. These developments are suspected of contributing nutrients and sediments to the river. Other reported problems arising from suburban development are increasing urban runoff from storm sewers, leachate from septic tanks, and runoff from land clearing. Agriculture is a suspected nonpoint source problem largely from crop production, and from one poorly managed pasture. Rockaway Creek, a tributary to the lower Lamington is reported to have a severe pollution problem from surface mines. The Rockaway is also suspected to be impacted by horse pasture and septic systems in its north branch, and road runoff in its south branch.

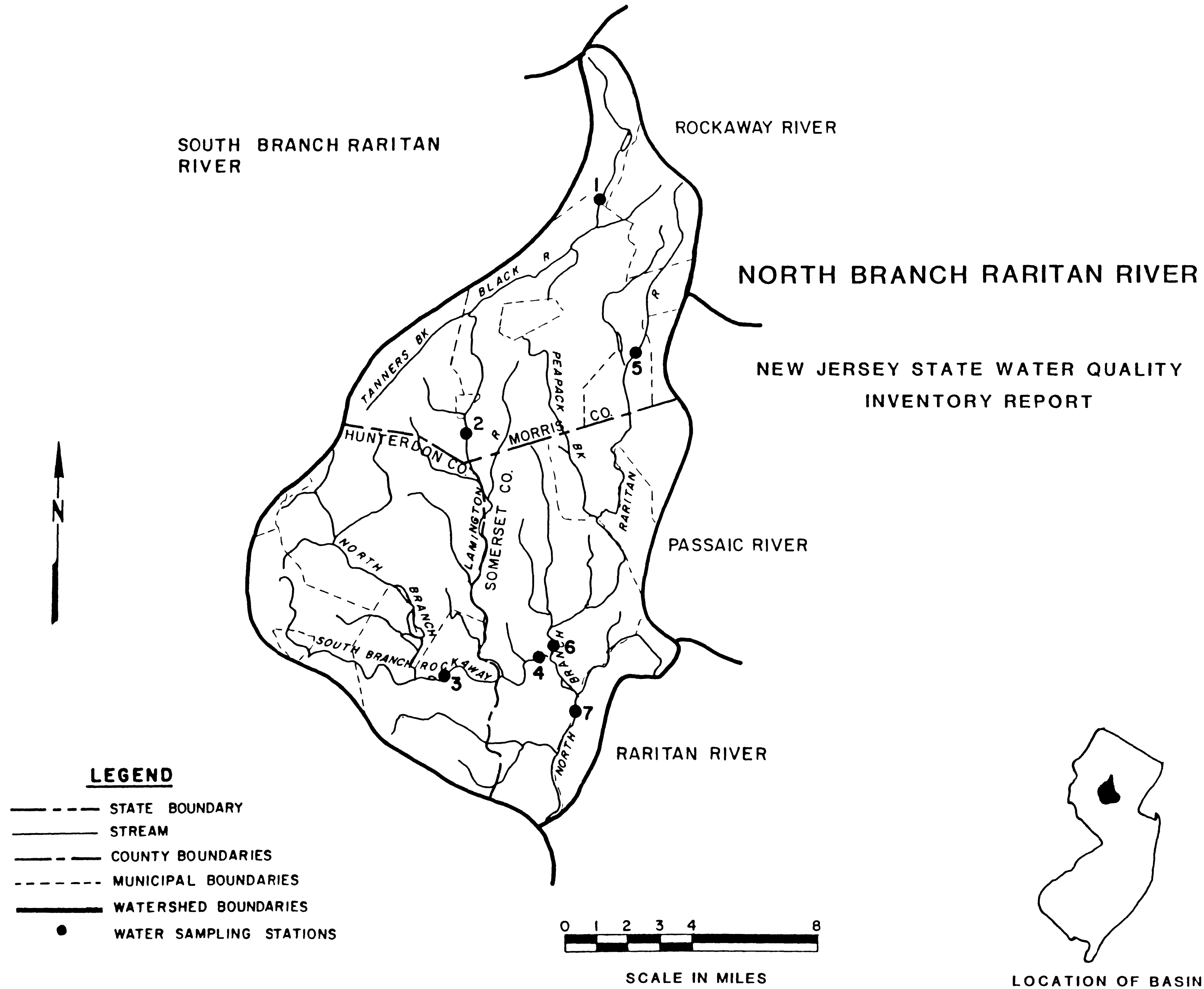
The North Branch Raritan River is impacted much the same way as is the Lamington. Active suburban development along much of its length, especially in the Pluckemin and Mendham areas, is known to contribute to the excessive loading of nutrients and sediments. Another suspected suburban pollution source is urban surface runoff, which appears to be a declining problem now due to better stormwater control. Agricultural activities also have an impact in this river, primarily through poorly managed pasture lands and feedlots. Pasture lands are estimated by local authorities to be an increasing nonpoint problem while the feedlots are assessed to be in decline due to an overall decrease in farm activity in the area.

Designated Use and Goal Assessment

Monitored waters of the North Branch and tributaries are not of swimmable quality due to fecal coliform concentrations. However, they do contain generally healthy fish communities. Recreational fishing for trout and smallmouth bass is heavy in many streams of the watershed. Water quality problems threaten the fisheries in sections of the Lamington and North Branch.

Monitoring Station List

Map Number	Station Name and Classification
1	Lamington River near Ironia, FW-2 Nontrout
2	Lamington River near Pottersville, FW-2 Trout Production
3	Rockaway Creek at Whitehorse, FW-2 Nontrout
4	Lamington River at Burnt Mills, FW-2 Nontrout
5	North Branch Raritan near Chester, FW-2 Trout Production
6	North Branch Raritan River at Burnt Mills, FW-2 Nontrout
7	North Branch Raritan River at North Branch, FW-2 Nontrout



NORTH BRANCH RARITAN RIVER
NEW JERSEY STATE WATER QUALITY INVENTORY REPORT
SOUTH BRANCH RARITAN RIVER
ROCKAWAY RIVER
PASSAIC RIVER
RARITAN RIVER
BLACK R
TANNERS BK
PEAPACK BK
LAMINGTON R
RARITAN
NORTH BRANCH
SOUTH BRANCH ROCKAWAY
HUNTERDON CO.
MORRIS CO.
SOMERSET CO.
1
2
3
4
5
6
7
N
LEGEND
STATE BOUNDARY
STREAM
COUNTY BOUNDARIES
MUNICIPAL BOUNDARIES
WATERSHED BOUNDARIES
WATER SAMPLING STATIONS
0 1 2 3 4 8
SCALE IN MILES
LOCATION OF BASIN

WATER QUALITY INDEX PROFILE

North Branch Raritan River

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Lamington R near Ironia	AVG WQI	2	38	7	18	38	10	2	7	41 Fair
	WORST3 MONTHS	June-August	May-July	Jan-March	July-Sept	May-July	Dec-Feb	March-May	April-June	58 Fair May-July
Lamington R near Pottersville	AVG WQI	15	6	5	18	18	6	2	18	18 Good
	WORST3 MONTHS	June-August	June-August	Jan-March	Nov-Jan	June-August	Nov-Jan	March-May	Sept-Nov	30 Fair June-August
Lamington R at Burnt Mills Brook	AVG WQI	2	7	8	25	16	6	2	8	15 Good
	WORST3 MONTHS	July-Sept	August-Oct	August-Oct	Nov-Jan	May-July	Aug-Oct	August-Oct	April-June	22 Good July-Sept
Rockaway Creek at Whitehouse	AVG WQI	2	6	10	25	18	5	4	6	16 Good
	WORST3 MONTHS	July-Sept	March-May	March-May	May-July	June-August	August-Oct	July-Sept	June-August	30 Fair May-July
NB Raritan River near Chester	AVG WQI	10	8	7	17	37	6	5	ID	27 Fair
	WORST3 MONTHS	June-August	June-August	Dec-Feb	June-August	July-Sept	Sept-Nov	March-May		48 Fair July-Sept

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met.
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

WATER QUALITY INDEX PROFILE

North Branch Raritan River

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
NB Raritan River AT Burnt Mills	AVG WQI	1	11	15	21	19	6	4	8	16 Good
	WORST3 MONTHS	June-August	Sept-Nov	August-Oct	July-Sept	June-August	Sept-Nov	August-Oct	April-June	32 Fair July-Sept
NB Raritan River at NB	AVG WQI	2	8	8	20	15	6	2	11	15 Good
	WORST3 MONTHS	June-August	June-August	Aug-Oct	May-July	Dec-Feb	August-Oct	August-Oct	August-Oct	31 Fair June-August

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
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81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met.
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Branchburg Twp Fox Hollow STP	0020338	Trib to N. Branch Raritan River	Somerville Boro/Som	Municipal
Vianini Pipe Inc.	0032328	Chambers Brook	Somerville Boro/Som	Ind./Comm.
Readington Twp. Bd. of Ed.	0026677	Holland Brook	Readington Twp./Hunt	Municipal
Taylor Forge Stainless	0003638	N. Branch Raritan R.	Branchburg Twp./Somer	Ind./Comm.
Print Products Division	0003158	Trib to Chambers Brk	Branchburg Twp/Somer	Ind./Comm.
RCA Corp. Solid State Plant	0002569	Raritan River	Bridgewtr. Twp/Somer	Ind./Comm.
Chester Shopping Mall	0026824	N. Branch Raritan R.	Chester Boro/Morris	Ind./Comm.
County Concrete Corp.	0002861	Black River	Roxbury Twp./Morris	Ind./Comm.
Oldwick Materials Inc.	0002197	Rockaway Creek	Tewskbury Twp/Hunter	Ind./Comm.
A.M. Best Co.	0028452	N. Br. Rockaway Crk	Tewskbury Twp/Hunter	Ind./Comm.
John Z. Delorean	0027227	Lamington River	Bedminster Twp/Somer	Ind./Comm.
Bedminster Twp. STP	0028495	N. Br. Raritan River	Bedminster Twp/Somer	Municipal
Environmental Disposal Corp.	0033995	Raritan River	Bedminster Twp/Somer	Ind./Comm.
Peapack-Gladstone STP	0021881	Peapack Brook	Peapack-Gladstone/ Somerset	Municipal
Bernardsville Boro STP	0026387	Mine Brook	Bernardsville Boro/ Somerville	Municipal
Bernardsville Quarry Inc.	0029637	Mine Brook	Bernardsville Boro/Som	Ind./Comm.
Branchburg Township of	0020362	Tri to Chambers Brk	Branchburg Twp/Somer	Municipal
During Farms Inc.	0031488	Rockaway Creek	Whitehouse Station/ Hunterdon	Thermal/Ind
Readington-Lebanon S.A.	0098922	Rockaway Creek	Readington Twp./Hunt	Municipal
Valley Road Sewerage Co.	0022781	Lamington R.	Tewksbury/Hunterdon	Municipal
Roxbury Twp - Ajax STP	0022675	Lamington R.	Roxbury/Morris	Municipal
Mendham Boro STP	0021334	India Brook	Mendham/Somerset	Municipal

26. MILLSTONE RIVER

Watershed Description

The Millstone River drains an area of 271 square miles that includes parts of Hunterdon, Somerset, Middlesex, Mercer, and Monmouth Counties. This river is 38 miles long and flows from Millstone Township in Monmouth County to the Raritan River near Manville and Bound Brook. Most of the lower half of the river flows adjacent to the Delaware and Raritan Canal. The population centers in this drainage basin are Princeton Township and Borough, Manville, South Brunswick Twp., East and West Windsor Township, Hightstown, and Pennington Boro. Major tributaries include Stony Brook (21 miles), Cranbury Brook, Bear Brook, Ten Mile River, Six Mile River, and Bedens Brook (10 miles). The largest impoundment in this area is Carnegie Lake in Princeton Twp., but there are a large number of smaller lakes in the watershed. Sub-watersheds include Stony Brook and the Upper and Lower Millstone.

The land use in the Millstone watershed is primarily suburban development with scattered agricultural areas. Extensive and recent development is present in the Upper Millstone watershed. Of the 43 NJPDES permitted discharges here, 23 are municipal and 20 are industrial/commercial. All surface waters in the Millstone basin are classified FW-2 Nontrout.

Water Quality Assessment

Seven ambient monitoring stations currently exist in the Millstone watershed. They are: the Millstone River near Manalapan, Grovers Mill, Kingston, Blackwells Mills and Weston; Stony Brook is monitored at Princeton; and Bedens Brook is monitored near Rocky Hill. Results of this monitoring from 1983 through 1987 show generally good to fair quality waters exist in the watershed.

The Upper Millstone River (above Carnegie Lake) is sampled near Manalapan and Grovers Mill. The Manalapan location has good overall water quality, but contains fair conditions during summer months. Both fecal coliform and total phosphorus are moderately excessive, averaging 130 MPN/100ml and .19 mg/l, respectively. Dissolved oxygen concentrations were above 4.0 mg/l at all times, but percent saturation periodically falls below 80 percent. At Grovers Mill the Millstone River attains its worst water quality. Here the river contains fair to poor water quality with conditions degrading further during late spring/early summer.

Both total phosphorus and total inorganic nitrogen are highly elevated, averaging .32 mg/l and 3.4 mg/l, respectively. Fecal coliform exceeded State criterion in 57 percent of all samples collected and had a geometric mean 226 MPN/100 ml. Although dissolved oxygen concentrations were only occasionally measured below 4.0 mg/l, when analyzed as percent saturation, it was below 80 percent in 65 percent of the values and averaged only 70 percent. Biochemical oxygen demand often is greater than 4.0 mg/l. One elevated concentration of lead and copper was also found in the period reviewed.

Stony Brook, a tributary of Carnegie Lake, is sampled at Princeton. Water quality here is fair with conditions slightly worse during winter months. Nutrients (primarily phosphorus) and fecal coliform appear to be the main problem indicators in the brook. Total phosphorus averaged .08 mg/l with 83 percent of the values greater than the .05 mg/l State criterion. Fecal coliform exceeded its recommended level in 41 percent of the samples analyzed and had a geometric mean of 248 MPN/100ml. Dissolved oxygen saturation is frequently above 120 percent indicating supersaturated conditions.

At the outlet of Carnegie Lake the Millstone River emerges with good quality waters except during summer months when good-fair conditions are present. Total phosphorus and total inorganic nitrogen were above recommended levels in 72 and 22 percent of the samples collected, respectively. The geometric mean of fecal coliform was 132 MPN/100ml with 29 percent greater than 200 MPN/100ml. Downstream at Blackwells Mills water quality degrades to fair quality. Nutrients and bacterial levels are higher, and dissolved oxygen saturation is lower. The Millstone at Blackwells Mills seems to be highly enriched. Total phosphorus averaged .34 mg/l, while inorganic nitrogen had a mean value of 2.5 mg/l. Fecal coliform exceeded recommended criterion in 66 percent of the samples and had a geometric mean of 268 MPN/100ml. Dissolved oxygen saturation averaged only 85 percent from 1983 through 1987 with nearly one-quarter of the values below the 80 percent level.

The final monitoring station on the Millstone River before it joins the Raritan River is located at Weston. Water quality is similar to what is found at Blackwells Mills, with fair conditions existing. Total phosphorus and total inorganic nitrogen concentrations remain elevated, but fecal coliform and dissolved oxygen saturation readings are somewhat better. Late spring and early summer months bring reduced water quality at this location.

Bedens Brook, a tributary to the Lower Millstone, has generally fair water quality. This stream, however, also experiences elevated fecal coliform and total phosphorus concentrations.

Total inorganic nitrogen is also periodically elevated. High dissolved oxygen saturation levels indicate supersaturated conditions in the brook during summer months.

In 1987 a modeling study of the Upper Millstone (Rocky Brook to Carnegie Lake) was completed by the Department for determining appropriate point source wasteload allocations. This study found nitrogenous biochemical oxygen demand was the major dissolved oxygen sink in the river, and that the lower sections of the study area are enriched with ammonia from treatment plant discharges. Phosphorus appears to be the limiting nutrient.

Biomonitoring of the Millstone River at Blackwells Mills suggest an enriched stream environment. Macroinvertebrates intolerant of low dissolved oxygen levels were limited to a mere eight percent of the samples obtained. The remaining forms exhibited varying degrees of low oxygen tolerance. Filterfeeders comprised 78% of the community suggesting a rich available food supply of suspended organic material.

The Millstone River is assessed by the New Jersey Division of Fish, Game and Wildlife as supporting a moderately degraded warm water fish community along its entire length.

Problem and Goal Assessment

Point Source Assessment

The Millstone River's most severe problem is elevated nutrient concentrations. Sources of the nutrients are suspected to be primarily from point sources. The wasteload allocation study identified treatment plant effluent from Hightstown and East Windsor as the major cause for dissolved oxygen and nutrient problems in the river. Because of the need for additional sewage flows in the upper watershed, level 4+ treatment will be required for discharge during critical low flow periods. In the Lower Millstone River, the Stony Brook Regional SA up-graded their discharge to include nitrification, but the facility will have to enlarge in the near future to accommodate new development in the region.

Department enforcement actions involving facilities having an impact on surface water quality in the Millstone watershed include: the Hightstown STP discharge to Rocky Brook, the Twp. of Hopewell/Princeton Farms discharge to Stoney Brook, and the East Windsor MUA discharge to the Millstone River.

Nonpoint Source Assessment

The predominant nonpoint pollution sources in the Millstone watershed are those associated with suburban development which is on the increase throughout the watershed. Runoff from construction sites, suburban surfaces, storm sewers and roads are contributing to excessive sediment loading. Septic systems are also believed to be a potential pollution problem throughout the watershed. In the upper reaches of the Millstone River, this source may also be a threat to the ground water.

Nonpoint pollution associated with agriculture is limited in this watershed to the regions drained by Etra and Peddie lakes, Cranbury Brook, and the lower reaches of the Millstone near its confluence with the Raritan River. Sediments, nutrients, and pesticides are suspected of coming from croplands, and are believed to be severe in the East Windsor area where chronic fish kills have occurred. It is a combination of agricultural and urban runoff, along with local sewage treatment plant effluent, which is suspected of degrading the fish communities in the upper Millstone River.

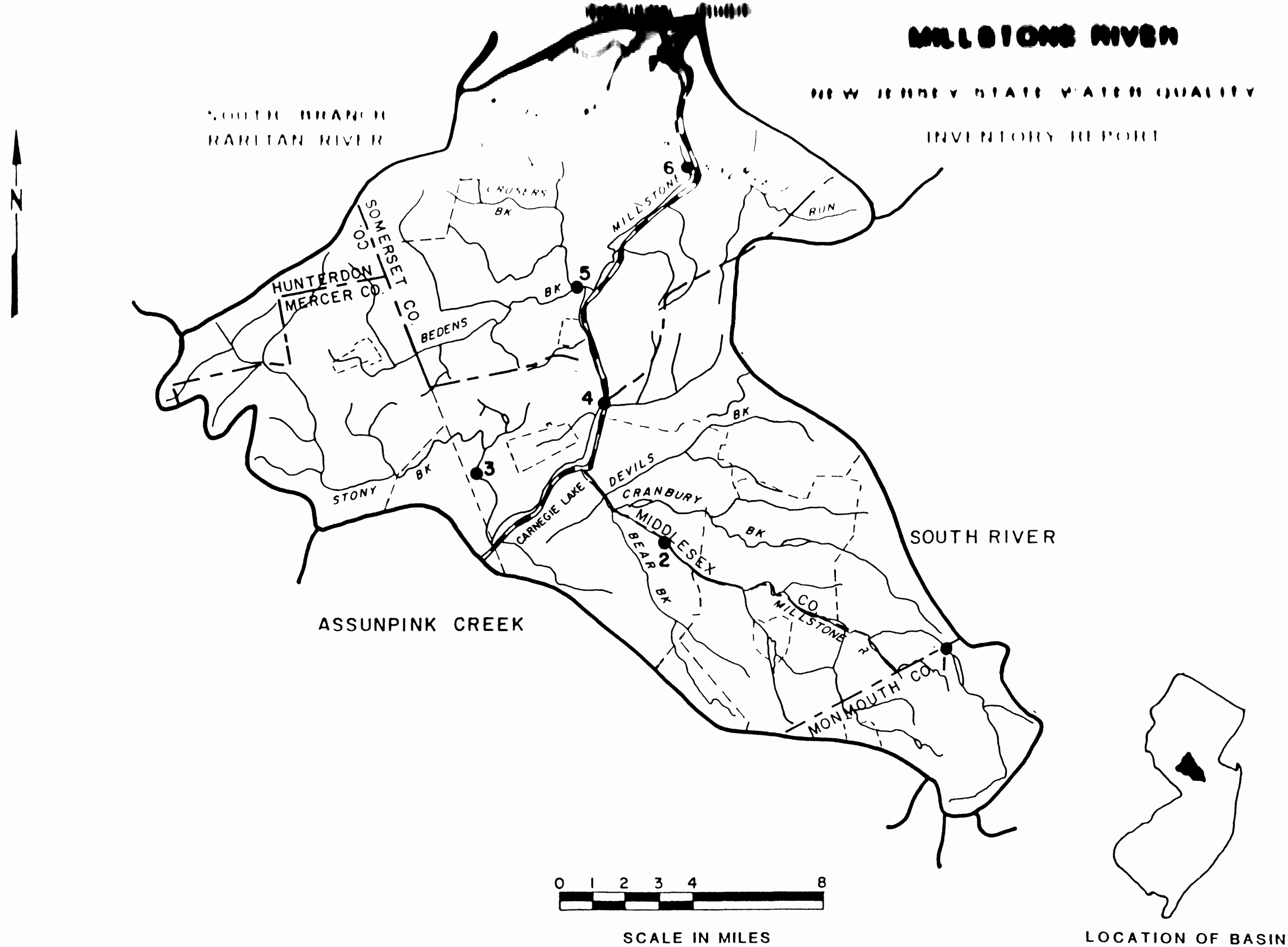
Other nonpoint pollution sources have been reported in the Millstone watershed. Fuel oil spills have occurred in the Upper Millstone, causing fish kills. Landfills are assessed as problems, both in the upper watershed where recreational usage and ground water are impacted, and in South Brunswick where leachate from a municipal landfill has been noted by local authorities as a problem.

Designated Use and Goal Assessment

The Millstone River and tributaries contain moderately degraded fisheries, and as such, it is considered to be partially meeting the fish propagation/maintenance use. The monitored waters of the Millstone River and tributaries are classified as not swimmable because of excessive fecal bacteria concentrations.

Monitoring Station List

Map Number	Station name and Classification
1	Millstone River near Manalapan, FW-2 Nontrout
2	Millstone River at Grovers Mill, FW-2 Nontrout
3	Stony Brook at Princeton, FW-2 Nontrout
4	Millstone River at Kingston, FW-2 Nontrout
5	Bedens Brook near Rocky Hill, FW-2 Nontrout
6	Millstone River at Blackwells Mills, FW-2 Nontrout
7	Millstone River at Weston, FW-2 Nontrout



N
HUNTERDON CO.
MERCER CO.
SOMERSET CO.
BEDENS BK
STONY BK
MILLSTONE
RUN
DEVILS BK
CRANBURY BK
CARNEGIE LAKE
BEAR BK
MIDDLESEX CO
MILLSTONE R
MONMOUTH CO.
SOUTH RIVER
ASSUNPINK CREEK
2
3
4
5
6
0 1 2 3 4 8
SCALE IN MILES
LOCATION OF BASIN

WATER QUALITY INDEX PROFILE

Millstone River

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Millstone R near Manalapan	AVG WQI	2	12	4	27	23	3	0	8	22 Good
	WORST3 MONTHS	June-August	May-July	June-August	July-Sept	May-July	Sept-Nov		Sept-Nov	32 Fair July-Sept
Millsone R at Grovers Mill	AVG WQI	4	36	5	29	61	5	2	14	60Fair/Poor
	WORST3 MONTHS	June-August	August-Oct	March-May	May-July	Nov-Jan	Dec-Feb	April-June	Sept-Nov	73 Poor May-July
Stony Brook at Princeton	AVG WQI	2	15	8	28	32	6	5	6	31 Fair
	WORST3 MONTHS	June-August	July-Sept	March-May	Dec-Feb	Oct-Dec	July-Sept	March-May	August-Oct	40 Fair Jan-March
Bedens Brook near Rocky Hill	AVG WQI	3	13	7	33	22	6	4	5	27 Fair
	WORST3 MONTHS	June-August	June-August	June-August	Sept-Nov	July-Sept	July-Sept	June-August	March-May	42 Fair Sept-Nov
Millstone River at Kingston	AVG WQI	6	5	18	22	21	5	8	9	22 Good
	WORST3 MONTHS	July-Sept	August-Oct	Sept-Nov	April-June	April-June	Dec-Feb	July-Sept	June-August	25 Good Sept-Nov

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from [illegible]rate to high levels [illegible]
61-80	Poor	Pollution in high amounts, water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met.

ID Insufficient Data

WATER_QUALITY_INDEX_PROFILE

Millstone River Continued

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Millstone River at Blackwells Mills	AVG WQI	3	14	8	28	34	6	1	13	31 Fair
	WORST3 MONTHS	June-August	April-June	April-June	May-July	May-July	Oct-Dec	Jan-March	July-Sept	43 Fair May-July
Millstone River at Weston	AVG WQI	3	12	4	28	33	5	3	6	28 Fair
	WORST3 MONTHS	July-Sept	April-June	Feb-April	May-July	Nov-Jan	July-Sept	June-August	Oct-Dec	50 Fair May-July

LEGEND - Water_Quality_Index_Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts, water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY — WATERSHED: MILLSTONE RIVER

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Johnson + Johnson Baby Prod.	0026140	Back Brk.	Montgmy.Twp/Somerset	Ind./Comm
Carrier Foundation	0023663	Cruisers Brk.	Montgmy.Twp/Somerset	Municipal
Bedens Brook Club	0032417	Bedens Brook	Montgmy.Twp/Somerset	Ind./Comm
Cherry Valley STP	0069523	Bedens Brook	Montgmy.Twp/Somerset	Municipal
Gen. Serv. Admn.-Public Bldg. Service	0020656	Br. of Cruisers Brk.	Hillsboro Twp./Somer	Municipal
Montgomery Twp. STP #1-Burnt Hill	0026891	Back Brook	Montgmy.Twp./Somerset	Municipal
Montgomery Twp. STP #2	0026905	Millstone R.	Montgmy.Twp/Somerset	Municipal
Montgomery Bd. of Ed.-Burnt Hill	0023124	Kings Crk.	Montgmy.Twp/Somerset	Municipal
Princeton Sewer Operating Comm.	0020796	Millstone R.	Princeton Boro/Mercer	Municipal
Valley Rd. Sewer Co.-River Rd	0022764	Royce Bk.	Hillsboro Twp./Somer	Municipal
Stony Brook Reg. S.A.	0031119	Millstone R.	Princeton Twp./Mercer	Municipal
Ingersoll-Rand Res. Inc.	0032565	Millstone R.	Montgmy. Twp/Somer.	Ind./Comm.
RCA Corp.	0002534	Millstome R.	S. Brunswk. Twp/Mids	Ind./Comm.
Lincoln Prop. Co. Util.	0024104	Cranbury Brook	Plansboro Twp/Midsex	Municipal
East Windsor MUA	0023787	Millstone River	E. Windsor Twp/Mercr	Municipal
Orachard Swimming Pool	0072613	Rocky Brook	E. Windsor Twp/Mercr	Ind./Comm.
Faloona Robert Chemical E.	0033821	Highstown Sewer	Hightstown Boro/Mrcr	Ind./Comm.
Jefferson Pk. Trmt. Plant	0022551	Bridgroom Run	W. Windsor Twp/Mercr	Municipal
Hightstown Boro. Plant	0029475	Rocky Brk.-Millstone	Hightstwn Boro/Mercr	Municipal
Hightstown Boro. STP	0003832	Rocky Brk.	Hightstwn Boro/Mercr	Municipal
Coca-Cola Co. Foods Div.	0004561	Big Bear Brook	Hightstwn Boro/Mercr	Ind./Comm.
Standard Pkg./National Metal	0032611	Shallow Brk.	Cranbury Twp./Midsex	Ind./Comm.
Carter-Wallace: 2 Plants	0002666	Cranbury Brook	Cranbury Twp./Midsex	Ind./Comm.
Minnesota	0003255	Roaring Brook	Belle Mead/Somerset	Industrial
Aethna Gas Products	0036021	Royce's Brook	Belle Mead/Somerset	Thermal
Riverside Farms Sewage	0050130	Millstone River	Montgomery	Municipal
North Princeton Dev SLF	0022390	Rocky Brook	Skillman	Municipal
Princeton Plasma Physics Lab	0023922	Millstone River	Plainsboro	Industrial

N.J.P.D.E.S. DISCHARGE INVENTORY	WATERSHED: MILLSTONE RIVER

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Columbian Chemical Com.	0000191	Heathcote Brook	Monmouth Junct/Midd	Ind
Pennington Quarry	0032263	Baldwins Creek	Kingston/Midd	Ind
NL Chemicals	0004243	Millstone River	Hightstown/Mercer	Ind/Thermal
David Sarnoff Research Center	0000272	Millstone River	Ocean Gate Boro/Mer	Ind/Thermal
FMC Corp	0027731	Millstone River	Princeton/Mercer	Ind/Thermal
Stony Brook Reg. SA	0035301	Stony Brook	Princeton/Mercer	Municipal
Mobil Research & Dev Co	0000795	Stony Brook	Hopewell/Mercer	Industrial
Hopewell Township MUA	0022560	Honey Brook Trib	Hopewell/Mercer	Municipal
Stony Brook Reg SA	0035319	Stony Brook	Princeton/Mercer	Municipal
Princeton SOC	0020770	Stony Brook	Princeton/Mercer	Municipal
Ed. Testing Service	0022110	Stony Brook	Princeton/Mercer	Municipal
Princeton Theological Sem.	0023205	Stony Brook	Princeton/Mercer	Municipal
Benton Fibre Drum Co	0060992	Millstone River	Lower Millstone/Mon	Industrial
NJE Corp	0057339	Lower Millstone	South Brunswick/Midd	Industrial
AT&T	0000809	Stony Brook	Mercer	Industrial
Hopewell Regional School	0032905	Stony Brook	Pennington/Mercer	Municipal

27. SOUTH RIVER

Watershed Description

The South River drains an area of 133 square miles. It begins at Duhernal Lake in Spotswood, Middlesex County and flows through the County to the Raritan River at Sayreville. Tides affect this 10 mile waterway from Duhernal Lake to the outfall into the Raritan River. The South River is formed by the confluence of Manalapan (20 miles long) and Matchaponix (15 miles) Brooks. Other tributaries include Deep River and Tennants Brook. The major impoundments are Duhernal Lake and Lake Manalapan. The population of this drainage area is concentrated in Spotswood, Old Bridge, East Brunswick, and Sayreville. Sub-watersheds include Manalapan Brook, Matchaponix Brook, and South River.

Agriculture and forests probably still account for the major portion of land uses in the upper watershed (Manalapan and Matchaponix Brooks), but there is much new industrial and residential development in these watersheds with older existing development along the South River. There are 17 NJPDES permitted discharges in the watershed, 8 are municipal and 9 are industrial/ commercial. Waters have been classified FW-2 Nontrout and SE-1.

Water Quality Assessment

Three ambient monitoring stations exist in the South River watershed. They are Manalapan Brook near Manalapan and at Spotswood, and Matchaponix Brook at Spotswood. A fourth station, the South River at Old Bridge, was discontinued in 1983. The three existing stations are analyzed below. Manalapan Brook has good quality surface waters, while Matchaponix Brook is of fair quality. The South River had good water quality based upon past monitoring which had occurred earlier in the decade.

Manalapan Brook experiences a moderate improvement in water quality as one travels downstream. Both monitoring stations have good overall water quality, but the Manalapan location experiences only fair conditions during the summer months. Both total phosphorus and fecal coliform are higher at Manalapan, exceeding State criteria in 90 and 31 percent, respectively, of the samples collected between 1983 and 1987. At Spotswood, Manalapan Brook contained total phosphorus and fecal coliform concentrations above criteria in 55 and 31 percent of the samples, respectively. Dissolved oxygen measured as concentration and percent saturation appears adequate for the protection of warm-water fisheries. Manalapan and Matchaponix Brooks are both moderately acidic waterways, but pH in Manalapan Brook at Spotswood often falls below 4.5 SU. This may be due to highly acidic soils being disturbed from development activities.

Matchaponix Brook contains much higher nutrient concentrations than Manalapan Brook. Total phosphorus has averaged .16 mg/l with 85 percent above the criterion of .05 mg/l for waters flowing into an impoundment. Total inorganic nitrogen is also elevated, exceeding 2.0 mg/l in 75 percent of the samples and averaging 3.0 mg/l. Total Kjeldahl nitrogen is also periodically excessive. Dissolved oxygen concentrations occasionally drop below 4.0 mg/l during summer months, and saturation averages only 77 percent. Fecal coliform concentrations are similar to those found in Manalapan Brook, having a geometric mean from 1983 to 1987 of 116 MPN/100ml. Conditions in Matchaponix Brook degrade significantly during low-flow months.

Below Duhernal Lake monitoring of the South River between 1981 and 1983 found generally good conditions. In summer months, the river has marginal water quality. During summer months reduced flows over Duhernal Lake dam allow brackish tidal waters to reach this station.

Manalapan Brook, Matchaponix Brook, South River, and Deep Run were all assessed by the New Jersey Division of Fish, Game and Wildlife as supporting healthy warm water fish communities.

Problem and Goal Assessment

Point Source Assessment

Water quality in Manalapan and Matchaponix Brooks is influenced by both point and nonpoint sources. Manalapan Brook contains a few small wastewater discharges that may have localized impacts on water quality. Matchaponix Brook, however, receives wastewaters from a regional sewage treatment system in the headwaters area. This facility may be responsible for the high nutrient concentrations found in the brook. The treatment system has been upgraded to perform advanced nitrogen removal.

A number of hazardous waste sites are found in the South River watershed, many of which are on the National Priority (Superfund) List. Two sites are suspected of contaminating local surface waters: the Sayreville Landfill which is adjacent to the South River (releasing pesticides and volatile organics) and the Viking Terminal also adjacent to the South River (containing mirex).

Nonpoint Source Assessment

Land uses in this watershed are primarily agricultural and suburban/commerical, with significant amounts of residential and commercial development continuing to take place. Agricultural soil erosion in the watershed is considered to be moderate by the Soil Conservation Service. Manalapan and Matchaponix Brooks appear to receive nonpoint source pollution primarily from areas of suburban development. A major threat to the fisheries of both streams is the runoff coming from acid-producing soils of the region. When exposed to air and water, as during construction, these soils produce sulfuric acid which when washed in to rivers in runoff, can cause a sudden and sometimes long lasting pH depression. This in turn can have a deleterious effect on the aquatic biota of the receiving stream. In addition, increasing amounts of construction activity coupled with urban surface and road runoff have all contributed to silt loadings, flooding, and a reduction in the quality of fish habitat. This is especially severe in the Manalapan Township region of Monmouth County. Runoff from construction sites is reported to be a severe and increasing problem along Matchaponix Brook. Also judged to be impacting these two brooks is septic tank leachate, and stream bank destabilization. Agricultural impacts to both brooks are evaluated to be largely sediment loads coming from increasing local cropland runoff.

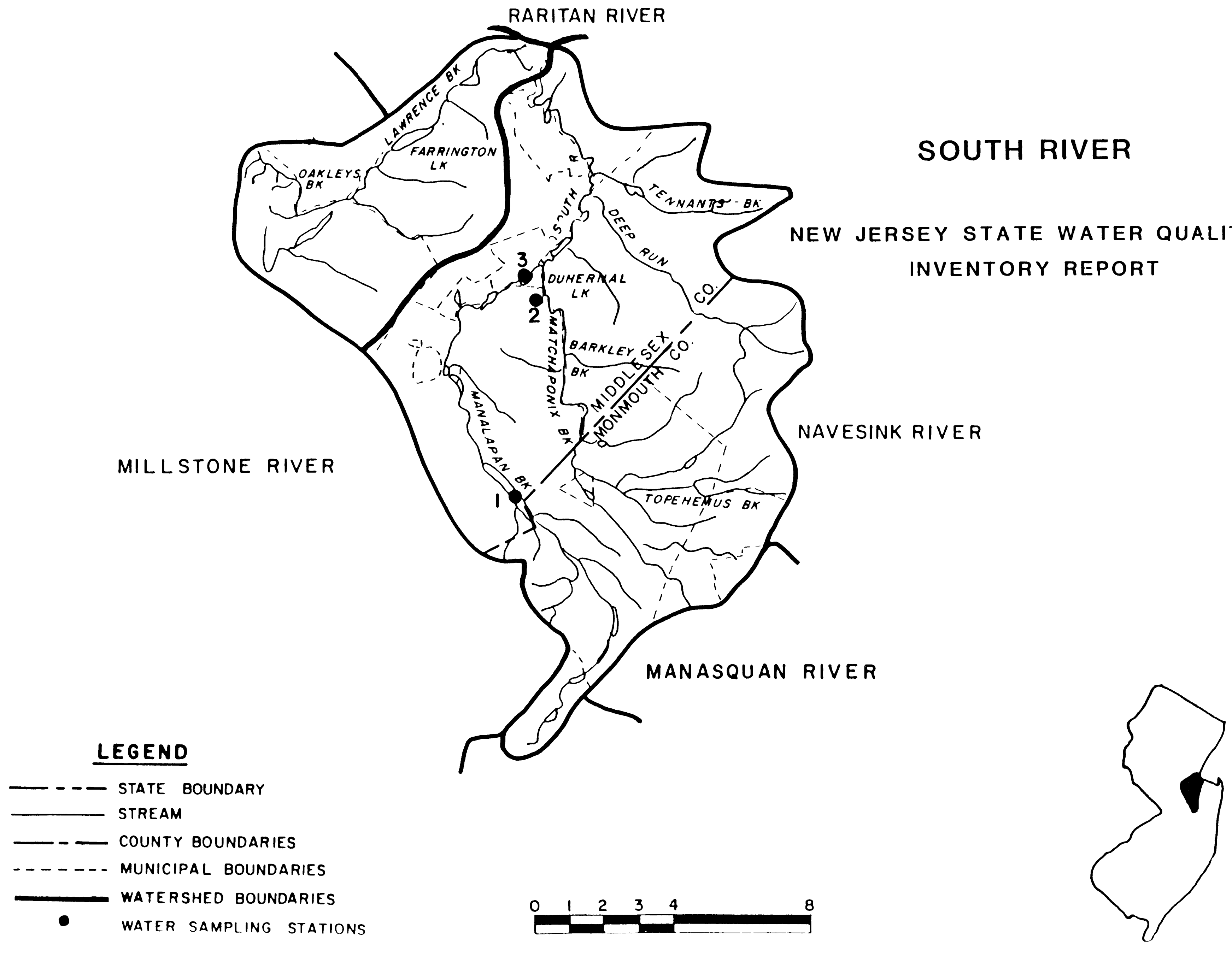
The South River receives nonpoint source pollution largely from developed lands. Construction activities and severe stream bank modification are known to have contributed to silt loads and local flooding. Increasing amounts of runoff from urban surfaces, roads and storm sewers are suspected of contributing to nutrient and sediment loading. In addition, this stream is believed to be threatened with toxic contamination from the Burnt Fly Bog waste disposal site located near Deep Run, a tributary to the South River.

Designated Use and Goal Assessment

Waters of the South River and tributaries will meet the fish propagation/maintenance designated use and goal, but state fisheries biologists feel that these fish communities are threatened with various point and nonpoint sources. The monitored sections of Manalapan and Matchaponix Brooks are not considered swimmable because of high fecal coliform levels.

Monitoring Station List

Map Number	Station Name and Classification
1	Manalapan Brook near Manalapan, FW-2 Nontrout
2	Matchaponix Brook at Spotswood, FW-2 Nontrout
3	Manalapan Brook at Spotswood, FW-2 Nontrout



SOUTH RIVER
NEW JERSEY STATE WATER QUALI
INVENTORY REPORT
RARITAN RIVER
LAWRENCE BK
FARRINGTON LK
OAKLEYS BK
SOUTH R
TENNANTS BK
DEEP RUN
DUHERNAL LK
MATCHAPONIX BK
BARKLEY BK
MIDDLESEX CO.
MONMOUTH CO.
MANALAPAN BK
TOPEHEMUS BK
NAVESINK RIVER
MILLSTONE RIVER
MANASQUAN RIVER
N
1
2
3
LEGEND
STATE BOUNDARY
STREAM
COUNTY BOUNDARIES
MUNICIPAL BOUNDARIES
WATERSHED BOUNDARIES
WATER SAMPLING STATIONS
0 1 2 3 4 8

Monitoring Station List

Map Number	Station Name and Classification
1	West Branch Rahway River at West Orange, FW-2 Nontrout
2	Rahway River near Springfield, FW-2 Nontrout
3	Rahway River at Rahway, FW-2 Nontrout
4	Elizabeth River at Ursino Lake, FW-2 Nontrout

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: SOUTH RIVER**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Hercules Inc	0001023	South River	Sayreville/Middsex	Ind/Comm
E.I. Dupont-F&F Dept	0000159	Pond Creek	Sayreville/Middsex	Ind/Comm
Quigley Co., Inc	0028771	Deep Run & South R	E. Brunswick/Middsex	Ind/Comm
Busch Ind Pro Corp	0002470	South River	E. Brunswick/Middsex	Ind/Comm
Old Bridge Bd of Ed	0022306	Tennetts Brook	Old Bridge/Middsex	Municipal
Western Monmouth Utilities	0023728	Matchaponix Brook	Manalapan/Monmouth	Municipal
Englishtown Boro WT	0003921	Matchaponix Brook	Englishtown/Monmouth	Municipal
Freehold Boro WTP	0029190	McGallairds Brook	Freehold/Monmouth	Municipal
Wickatunk Village	0026816	Deep Run	Morganville/Monmouth	Ind/Mun
Marlboro MUA	0031887	Deep Run	Wickatunk/Momnouth	Ind/Mun
Edgeboro MUA	0031071	South River	E. Brunswick/Midd	Ind/Mun
Jamesburg School For Boys	0028479	Matchaponix Brook	Monroe/Midd	Municipal
B&J Warren And Sons, Inc	0053473	Manalapan Brook	Monroe/Midd	Industrial
Water Treatment Plant 1	0063851	Millford Br.	Manalapan/Mon	Municipal
Water Treatment Plant 5	0067181	Tepehemus Br.	Manalapan/Mon	Municipal
BFI Monroe Twp SLF	0099988	Matchaponix Br.	Jamesburg/Mon	Municipal

28. RARITAN RIVER

Watershed Description

The Raritan River, its tributaries, and branches drain an area totalling over 1,100 square miles. The Raritan River basin is the largest river basin located entirely within New Jersey. The mainstem, 31 miles long, drains parts of Somerset, Union, Middlesex, and Monmouth Counties before emptying into the Raritan Bay. Tides affect this waterway to the Fieldsville Dam upstream of New Brunswick. The Delaware and Raritan Canal flows alongside the Raritan River from the confluence of the Millstone River to New Brunswick. Major tributaries to the Raritan are the North and South Branches, Millstone River, South River, Green Brook, and Lawrence Brook. The section of the Raritan basin reviewed here is the mainstem of the Raritan River from the confluence of the North and South Branches to Raritan Bay, and small tributaries. For the most part, this drainage area is densely populated, with the centers of population being Plainfield, New Brunswick, Perth Amboy, Edison, South Amboy, Sayreville, Bound Brook, Somerville, Manville, Piscataway, Metuchen, and Bridgewater. There are two low dams in the river, Fieldsville Dam and Calco Dam. Among the many small recreational lakes and ponds in this area are Watchung Lake, Surprise Lake, Spring Lake, and Green Brook Pond (all manmade).

The land use in this watershed is primarily urban/suburban, with industrial and commercial centers throughout. There are 73 NJPDES permitted discharges here, 12 of which are municipal and the remainder industrial/commercial. Fifteen discharges go to Raritan Bay and tributaries. Classifications of waters in the Lower Raritan River watershed are FW-2 Trout Maintenance, FW-2 Nontrout, and SE-1.

Water Quality Assessment

The Raritan River is currently monitored at three locations in the river. These locations are at Raritan, Manville, and from the Queens Bridge at South Bound Bridge.

The Raritan River at Raritan and Manville contains generally good water quality. At Manville conditions worsen to fair quality during the late spring-early summer period. The similar conditions at the two locations is exemplified in the water quality data collected between 1983 and 1987. Total phosphorus and fecal coliform often appear in elevated levels. Total phosphorus averaged .1 mg/l at both Raritan and Manville.

Approximately 50 percent of all phosphorus values from the two stations were in excess of the recommended State criterion. Total inorganic nitrogen was greater than 2.0 mg/l in 15 percent of the samples from Raritan and 10 percent from Manville. Fecal coliform had geometric means of 132 and 158 MPN/100ml at Raritan and Manville, respectively. Fecal coliform violated State criterion in less than one-half of all samples collected at the two stations. Dissolved oxygen was above 4.0 mg/l in all samples from 1983 to 1987, while biochemical oxygen demand was generally under 3.0 mg/l.

Downstream at South Bound Brook, ambient monitoring has detected fair water quality with conditions worsening in the summer period. The river here has experienced major changes in water quality within the past decade. In 1981 the Raritan River experienced very poor conditions during low flow periods. Extremely high nutrient concentrations and low dissolved oxygen saturation indicated a severely stressed stream. However, between 1981 to 1985 conditions improved in the river. While nutrients (phosphorus and nitrogen containing compounds) are still elevated, concentrations are one-third to one-half of those recorded in 1981. Total phosphorus values averaged .22 mg/l from 1983 to 1987, compared to .64 mg/l in 1981. Fecal coliform continues to be found at problematic levels, having a geometric mean of 752 MPN/100ml from 1983 to 1987. Dissolved oxygen appears to be adequate in this section of the river, but large diurnal fluctuations during warm weather are still expected. The significant improvements in the Raritan River at South Bound Brook can be attributed to the gradual reduction in discharge flows from the American Cyanamid facility. In 1985 the company's discharge was eliminated with flows transferred to the Somerset Raritan Valley SA treatment plant.

The NJDEP's Division of Science and Research has performed extensive work in the Raritan River to study the fate and transport of toxic substances in 1982 and 1983. The results of this study was thoroughly described in the 1982 and 1986 305(b) reports, but are summarized here. Water samples were analyzed for priority pollutants. Sediments were analyzed for priority pollutants as well as grain size. The water analyses showed that the volatile organics were the most frequently occurring organic compounds. Chloroform, toluene, ethylbenzene, and 1, 1, 2, 2-tetrachloroethylene were found at levels up to 50 ug/l in almost every sample. Copper, zinc, arsenic, and silver were the most frequently occurring metals.

The sediment analyses detected organic compounds rather infrequently. Metals were detected in every sample. Copper and zinc were detected at the highest levels, most likely due to their geologic abundance. Lead was also detected at elevated levels. Fine grain sediments were positively correlated to the metal concentrations; metals were also strongly intercorrelated meaning that when one was high others were also elevated.

The Raritan River, from the confluence of the North and South Branches downstream to the confluence with the Millstone River, is assessed as supporting a healthy warm water fish community. Below the confluence with the Millstone down to the Landing Lane Bridge in New Brunswick, the river's fishery is judged to be moderately degraded.

Problem and Goal Assessment

Point Source Assessment

The Raritan River appears to be heavily influenced by both point and nonpoint sources. The elimination of the American Cyanamid discharge, as noted above, has resulted in improvements in river water quality.

The regionalization of four local treatment plants (Old Bridge UA, Sayreville Borough's Morgan and Melrose STPs, and the Keasbey STP of Woodbridge) into the Middlesex Co. UA wastewater treatment plant should also help to reduce the point source loading experienced by the river. This Middlesex Co. facility is however itself presently under enforcement action (discharge to Raritan Bay) and is constructing a supplemental outfall line which should relieve the need it presently has to bypass the STP's main pump station.

Facilities under DWR enforcement action which are having known impacts on surface water quality are limited to discharges to Raritan Bay and its tributaries. These include: The Raritan River Steel Co. (Perth Amboy), the Aberdeen Twp. MUA (Clifford Beach facility) into Whale Creek, the Strathmore STP to Mohingson Brook, the Garden STP into Matawan Creek, the Middlesex Co. UA (discussed above), and the City of South Amboy STP to Raritan Bay. The Old Bridge Municipal Utilities Authority STP (discharge to Raritan Bay) has agreed to an Administrative Consent Order because of a discharge problem, and will be connected to the Middlesex Co. UA at some time in the future.

A number of hazardous waste sites are located in the Raritan River watershed, many of which are on the National Priority List. Sites that are impacting surface waters include: Blue Spruce International (Raritan River), Chemical Insecticide Corporation (Mill Creek), Horseshoe Road Dump (Raritan River), KinBuc Inc. (Edmonds Creek and Raritan River), Renora Inc. (Mill Creek), and Rhone-Poulene/Reagent Chemical (Raritan River).

Nonpoint Source Assessment

The Raritan River is impacted by nonpoint source pollution from urban/suburban development throughout its length. Additional nonpoint source pollution from landfill leachate is suspected in the lower portions of the river. Runoff from urban surfaces, storm sewers and roadways are all believed to be an increasing problem in the watershed. Additional contamination sources are suspected from the land disposal of wastewater and from local chemical spills.

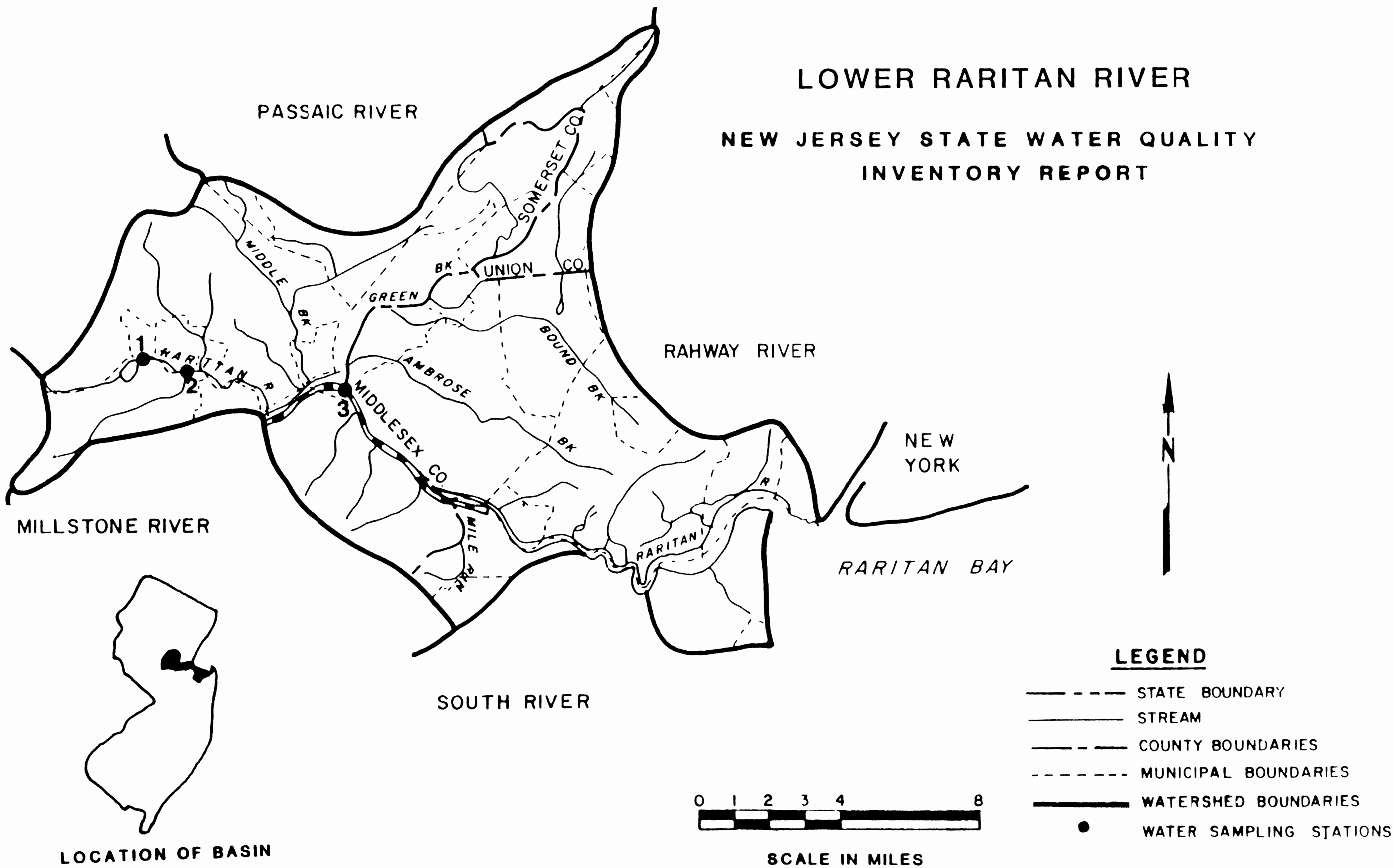
Construction activities are noted to be active in the Peters Brook area of the Upper Raritan sub-watershed, and in Franklin and Warren Townships in the Lower Raritan sub-watershed. The result of this urbanization is an increase in the nutrient and sediment loads which the river must absorb, as well as an increase in local flooding.

Designated Use and Goal Assessment

The Raritan River will only partially meet clean water goals and State designated uses. The entire river is not swimmable, and only the freshwater portions can be considered to be meeting the fish propagation and maintenance use/goal. The fisheries in this part of the river are thought to be threatened by the pollution sources present. In the tidal section of the river a moderately degraded fisheries is present and there is a fishing advisory because of PCBs contamination in certain fishes. The presence of elevated PCBs may indicate possible long-term health effects for fish. As a result the tidal Raritan River is only partially meeting the fish propagation/maintenance use.

Monitoring Station List

Map Number	Station Name and Classification
1	Raritan River at Raritan, FW-2 Nontrout
2	Raritan River at Manville, FW-2 Nontrout
3	Raritan River at Queens Bridge, FW-2. Nontrout


LOWER RARITAN RIVER
NEW JERSEY STATE WATER QUALITY INVENTORY REPORT
PASSAIC RIVER
RAHWAY RIVER
MILLSTONE RIVER
SOUTH RIVER
NEW YORK
RARITAN BAY
SOMERSET CO.
UNION CO.
MIDDLESEX CO.
MIDDLE BK
GREEN BK
BOUND BK
AMBROSE BK
RARITAN R
MILE RUN
RARITAN R
1
2
3
N
LOCATION OF BASIN
0 1 2 3 4 8
SCALE IN MILES
LEGEND
STATE BOUNDARY
STREAM
COUNTY BOUNDARIES
MUNICIPAL BOUNDARIES
WATERSHED BOUNDARIES
WATER SAMPLING STATIONS

WATER QUALITY INDEX PROFILE

Raritan River

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Raritan River at Raritan	AVG WQI	3	6	10	24	18	6	5	ID	16 Good
	WORST3 MONTHS	July-Sept	August-Oct	August-Oct	April-June	July-Sept	Nov-Jan	July-Sept		23 Good April-June
Raritan River at Manville	AVG WQI	4	11	11	22	18	6	6	7	17 Good
	WORST3 MONTHS	July-Sept	March-May	August-Oct	May-July	May-July	Sept-Nov	August-Oct	April-June	30 Fair May July
Raritan River at Queens Bridge	AVG WQI	3	7	4	39	28	7	5	10	31 Fair
	WORST3 MONTHS	June-August	August-Oct	March-May	July-Sept	August-Oct	August-Oct	May-July	Feb-April	50 Fair July-Sept

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY	WATERSHED: RARITAN RIVER

DISCHARGE NAME	NJPDES NO	RECEVING WATERS	MUNICIPALITY/COUNTY	TYPE
Septembers On The Hill	0026727	Raritan River	Watchung/Union	Mun.
Valvoline Oil Comp.	0030503	Raritan River	Edison/Middlesex	Ind.
Nuodex Inc.	0000116	Raritan River	Fords/Midd.	Therm/Ind
Weldon Concrete	0000345	Raritan River	Keasbey/Midd.	Ind.
Sohio-Carborundum	0002950	Raritan River	Keasbey/Midd.	Ind.
Woodbridge. Twp	0020401	Raritan River	Keasbey/Midd.	Mun.
New Brunswick	0033219	Raritan River	N. Brunswick/Midd.	Mun.
Old Bridge, Twp	0022471	Raritan Bay	Old Bridge/Midd.	Mun.
Old Bridge MUA Browntown	0033065	Raritan Bay	Old Bridge/Midd.	Mun.
Reserve Terminal Corp.	0001392	Raritan Bay	Perth Amboy/Midd.	Ind.
Perth Amboy	0023213	Raritan Bay	Perth Amboy/Midd.	Mun.
Raritan River Steel Comp.	0031178	Storm Sewer to Rar	Perth Amboy/Midd.	Ind.
Witco Chemical Corp.	0029483	Spa Spring Creek	Perth Amboy/Midd.	Thermal
Union Carbide	0000256	Raritan River	Piscataway/Midd.	Ind./Comm.
Beecham Laboratories Inc.	0035491	Raritan River	Piscataway/Midd.	Ind.
EH Werner Generating Station	0002755	Raritan River	South Amboy/Midd.	Ind./Comm.
Silvatrim Corp. of American	0030881	Raritan River	South Plainfield/Midd.	Ind.
Butrico Auto Body Shop	0069973	New Market Pond	South Plainfield/Midd.	Ind.
Design & Molding Services	0029629	Bound Brook	Piscataway/Midd.	Ind.
Captive Plastics	0030571	Ambrose Brook	Piscataway/Midd.	Imd.
Parkway Plastics	0032042	Bound Brook	Piscataway/Midd.	Thermal
Evans Partnership	0033723	Ambrose Brook	Piscataway/Midd.	Ind.
Eastern Steel Barrel Corp.	0034797	Bound Brook	Piscataway/Midd.	Ind.
Bound Brook Operation	0061794	Bound Brook	Piscataway/Midd.	Ind.
Exxon Service Station	0063967	Raritan River	Matawan/Mon.	Ind.
North American Phillips Lgt.	0064939	Ambrose Brook	South Plainfield/Midd.	Ind.

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
St. Bernards Sch. STP	0020991	Lochiel Creek	Brdgwtr. Twp/Somerset	Municipal
Ethicon Inc.	0001139	Peters Brook	Brdgwtr. Twp/Somerset	Ind./Comm.
Crestline Div. of N. Am. Prod	0029921	Gaston Ave. Brook	Raritan Boro/Somerset	Ind./Comm.
Indust. Tube Corp.	0023019	Raritan River Trib.	Smrvil. Boro/Somerset	Ind./Comm.
Valley Rd. Sew. Co.- Fieldhedge	0022772	Royce Brook	Hillsboro Twp/Somerset	Municipal
Chemicals Corp.	0021806	Middle Brook	Brdgwtr. Twp/Somerset	Ind./Comm
Somerset-Raritan Valley S.A.	0024864	Cuckel's Brook	Brdgwtr. Twp/Somerset	Municipal
American Cynamid-Bound Brook	0002313	Raritan River	Brdgwtr. Twp/Somerset	Ind./Comm.
Taylor Oil Co.	0029271	Raritan River	Smrvil. Boro/Somerset	Ind./Comm.
Devro Inc.	0001961	Peters Brook	Smrvil. Boro/Somerset	Ind./Comm.
Warren Twp. SA-Stage 3 STP	0023752	Middle Brook	Warren Twp./Somerset	Municipal
Johns-Manville Sales Corp.	0001678	Raritan River	Manville Boro/Somerset	Ind./Comm.
Manville Boro STP	0028762	Confluence of Raritan/Millst.	Manville Boro/Somerset	Municipal
Veterans Admin. Supply Depot	0020036	Roycefield Brook	Smrvil. Boro/Somerset	Municipal
RBH Dispersions	0033545	Ambrose Brook	Midsex Boro/Middlesex	Ind./Comm.
Reagent Chem. + Research In.	0033251	Trib to Raritan Riv.	Midsex Boro/Middlesex	Ind./Comm.
National Starch & Chem. Corp.	0032506	Raritan River	Brdwtr. Twp/Somerset	Thermal
Gibson Tube, Inc.	0064700	Trib. to Cuckles Brk	Brdgwtr. Twp/Somerset	Ind/Thermal

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: RARITAN RIVER, Continued**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Academy Die Casting & Plating	0034495	Ambrose Brook	Edison/Mid	Industrial
Union Steel Corp.	0001015	Trib. to Raritan R.	Piscataway Twp/Midsx	Ind./Comm.
Sun Oil Co. of Pennsylvania	0025798	Raritan River	Piscataway Twp/Midsx	Ind./Comm.
Kentile Floors	0030023	Bound Brook	So Plnfld. Boro/Mid.	Ind./Comm.
LA Dreyfus Co.	0001210	Drainage Ditch to Bound Brook	S. Plnfld. Boro/Mid.	Ind./Comm.
Mobile Chem. Co.	0026255	Bound Brook	Edison Twp./Middlesex	Ind./Comm.
PSE&G - Edison	0003603	Raritan River	Edison Twp./Middlesex	Ind./Comm.
Raritan Arsenal	0028835	Raritan River	Edison Twp./Middlesex	Municipal
Ford Motor Co. - Metuchen	0002691	Mill Brook	Edison Twp./Middlesex	Ind./Comm.
Oxford Div. - Hartford	0032557	Mile Run Brook	New Brnswk/Mdsx	Ind./Comm.
Delco Remy Div. of GMC Plant 12	0003092	Mile Run Brook	New Brnswk/Mdsx	Ind./Comm.
Rhone - Poulenc Corp.	0000060	Mile Run Brook	New Brnswk/Mdsx	Ind./Comm.
Spear Packing Corp.	0070220	Mile Run Brook	New Brnswk/Mdsx	Ind,/Therm
Nuodex Inc.	0001791	Raritan River	Edison Twp./Middlesex	Ind./Comm.
NJP + Light	0002747	Raritan River	Sayreville Boro/Mdsx	Ind./Comm.
Amerada Hess Corp.	0001376	Raritan River	Perth Amboy Cty/Mdsx	Ind./Comm.
Cheese Borough Ponds Corp.	0002381	Raritan River	Perth Amboy Cty/Mdsx	Ind./Comm.
Saytech Inc.	0031470	Trib. to Burt Ditch	New Brnswk. Cty/Mdsx	Ind./Comm.
Middlesex Co. M.U.	0020141	Raritan Bay	Sayreville Boro/Mdsx	Municipal
Sayreville Boro-Melrose STP	0023833	Raritan Bay	Sayreville Boro/Mdsx	Municipal
Sayreville Generating Station	0002747	Raritan River	Sayerville Boro/Mdsx.	Ind./Comm.

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Zappa Res. & Molding Corp.	0030309	Green Brook River	Green Brook/Somerset	Thermal
Colorguard Corp.	0033111	Woodmere Brook	Raritan/Somerset	Thermal
Tingley Rubber Corp	0020672	Dismal Swamp	South Plainfield	Ind/Thermal
Scott Environmental Tech	0033707	Bound Brook	South Plainfield	Industrial
Metz Metallurgical Corp.	0034835	Middlesex County	South Plainfield	Industrial
Ronnie Packing Co.	0034886	Rain Water Ditch	South Plainfield	Thermal
Metz Metallurgical Corp.	0034835	Trib to Bound Brook	South Plainfield	Thermal
United Steel Container Corp.	0032034	Mile Run	N. Brunswick	Thermal
Clayton Block Corp.	0026069	Mill Brook	Metuchen/Midd.	Ind/Strmwtr
Troy Chen-Corp.	0031453	Pierson's Creek	Middlesex Boro/Midd.	Thermal
Webcraft	0052655	Dismal Swamp	Metuchen/Midd.	Thermal
Gulton Industries, Inc.	0028720	Bound Brook	Metuchen/Midd.	Industrial
Sayeville Borough of	0050245	Cheesequake Creek		Industrial

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: RARITAN RIVER, Continued**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Bell Labs-Murray Hill	0000442	Trib. to Green Brook	Brkly Hts. Twp/Union	Ind./Comm.
Anchor Glass Container Corp.	0033651	Long Neck Creek	Cliffwood/Monmouth	Industrial
Buhler and Bitter	0062669	Raritan Bay	Hazlet/Monmouth	Industrial
Comdata Systems Incorp.	0001775	Ditch to Mahora	Holmdel/Mon	Industrial
Biddle Sawyer Corp.	0030872	Lupatcong Creek	Keyport/Mon	Thermal
Aberdeen Township MUA	0022535	Whale Creek	Matawam/Mon.	Municipal
Engineered Precision Castings	0033294	Wrackaack Creek	Middletown Twp./S.A.	Thermal
Aberdeen Township WTP	0034142	Wilkson Creek	Monmouth County	Ind
Imperial Oil Comp Inc	0035874	Lake Lefferts	Morganville/Mon	Ind
Stavola Constructions Mat	0002895	Middle Brook	Red Bank/Mon	Ind/Storm
National Starch & Chemical	0001333	Coreen Brook	Plainfield/Union	Ther/Storm
Olivetti Corp. of America	0032581	Raritan River	Somerville/Union	Ind

29. RAHWAY RIVER (INCLUDING THE ELIZABETH RIVER)

Watershed Description

Measured from the headwaters to the City of Rahway, the Rahway River drains an area of 41 square miles, which includes parts of Middlesex, Union, and Essex Counties. The mainstem, 24 miles long, flows from Union into the Arthur Kill near Linden and is tidal from the Pennsylvania Railroad bridge at Rahway down to the mouth. This is a densely populated area, with the centers of population being Rahway, Woodbridge, Clark, Springfield, Cranford, Westfield, and Kenilworth. Major tributaries to the Rahway River include the East Branch Rahway River, Woodbridge River, and Robinsons Branch. The major impoundments are the Middlesex Reservoir, Orange Reservoir, Lower and Upper Echo Lakes, and Diamond Mill Pond. The Elizabeth River is 11 miles long, much of it being channelized for flood control purposes.

Land uses in these watersheds are residential, commercial, industrial and other uses. There are 53 NJPDES permitted discharges identified in the Rahway and Elizabeth watersheds, all except 5 are industrial/commerical. The waters of the Rahway and Elizabeth Rivers and tributaries have been classified FW-2 Nontrout, SE-2, and SE-3.

Water Quality Assessment

Routine water quality monitoring is performed at three locations on the Rahway River: the West Branch at West Orange, near Springfield and at Rahway. The Elizabeth River is monitored at Ursino Lake in Elizabeth. The Rahway River has fair water quality along its length with generally improving conditions in the downstream direction. The Elizabeth River is severely degraded, especially during the early summer period.

The West Branch Rahway River has fair overall quality with conditions approaching poor quality in late summer. Fecal coliform, total phosphorus, and total dissolved solids are found at problematic levels. Fecal coliform counts had a geometric mean of 1445 MPN/100ml from 1983 to 1987 with 85 percent greater than 200 MPN/100ml. Total phosphorus has averaged .11 mg/l from 1983 to 1987, during which the majority of samples exceeded State criterion. Total dissolved solids have averaged 364 mg/l, among the highest of all monitoring stations in the State. While dissolved oxygen concentrations appear adequate, saturation occasionally falls below 80 percent in the fall.

Near Springfield the Rahway River has its worst monitored water quality. Although overall quality is considered fair, it is poor during late spring/early summer. Excessive fecal coliform and total phosphorus concentrations are found at this location. Periodically, low dissolved oxygen along with high total dissolved solids measurements also occur. Fecal coliform counts had a geometric mean of 1352 MPN/100ml near Springfield, while total phosphorus concentrations averaged around the .1 mg/l criterion for flowing waterways. Occasionally high inorganic nitrogen was also detected. Dissolved oxygen saturation averaged only 74 percent near Springfield, with low dissolved oxygen concentrations often below 4.0 mg/l during early summer. At Rahway conditions are improved over what is found near Springfield. Fecal coliform and total phosphorus are still excessive, but levels are, for the most part, lower. Fecal coliform had a geometric mean of 538 MPN/100ml with 70 percent above State criterion. Solids continue to be present at high concentrations on a periodic basis.

The Elizabeth River drains highly developed urban lands adjacent to the Rahway watershed. Water quality in the Elizabeth River is fair to poor with very poor conditions in May to July. The river, channelized in sections, has fecal coliform concentrations which averaged 13154 MPN/100ml from 1983 to 1987 and excessive phosphorus and nitrogen. Total phosphorus was above State criterion in 61 percent of the samples, while inorganic nitrogen was excessive in one-third of the measurements taken. Dissolved oxygen saturation often exceeds 120 percent during summer months indicating elevated primary productivity. Total dissolved solids have also occurred at elevated levels, averaging 435 mg/l during the period of review.

The warm water fish community of the Rahway River has been evaluated by the New Jersey Division of Fish, Game, and Wildlife as moderately degraded. Morses Creek and the Elizabeth River are judged to be containing degraded fish communities; few fish are reported to be able to survive in either waterway.

Problem and Goal Assessment

Point Source Assessment

Water quality of the Rahway and Elizabeth Rivers are reflective of urbanized streams. The presence of high nutrients, fecal coliform and biochemical oxygen demand is thought to be from nonpoint sources and municipal/industrial point sources. Both the Lower Elizabeth and Rahway Rivers have combined sewer overflows discharging during storm events, however the impacts are most severe in the Elizabeth River. There are 16 Department enforcement actions against discharges that are impacting water quality in these two watersheds. They range from facilities not meeting permit limitations to raw sewage discharges. Hazardous wastes sites are present in these watersheds, but none have been identified to be contaminating surface waters. In the lower tidal sections of the Elizabeth and Rahway Rivers water quality is reduced because of boundary conditions (i.e., Arthur Kill water quality).

Nonpoint Source Assessment

The Rahway River watershed is highly urbanized and its waterways are severely degraded both by nonpoint source pollution and by the physical alterations which extensive urbanization has brought about. In addition to pollution and habitat destruction, flood control has been a major problem in this watershed. Known sources of nonpoint pollution in the Rahway River include construction activities, storm sewers, urban surfaces, roads, and combined sewer overflows; all of which have contributed to high stream temperatures, sediment and nutrient loadings, periodic low dissolved oxygen levels, and fishkills. Another problem in this watershed is landfill leachate which is believed to have contributed to the degradation of the tidal Rahway River, as well as to the adjacent Arthur Kill, Marshes Creek, and Kings Creek.

Morses Creek and the Elizabeth River, draining almost totally developed watersheds, have been extensively channelized. Both are judged to support minimal fish life due to the combined effects of habitat loss and severe water pollution levels coming from numerous nonpoint and point sources. The Elizabeth River has been described as chronically polluted over its entire length.

Designated Use and Goal Assessment

The Rahway and Elizabeth Rivers are not of swimmable quality. Severe pollution of the Elizabeth River along with channelization combine to cause a degraded fish community in the river. Therefore, the freshwater Elizabeth River is classified as not achieving the fish propagation/maintenance use and goal. The freshwater Rahway River is considered to be partially meeting the fish propagation/maintenance use because of a moderately degraded fish community. Designated use attainment (which is generally less than the swimmable/fish propagation goal) in the tidal portions of both rivers is not known because of a lack of water quality information.

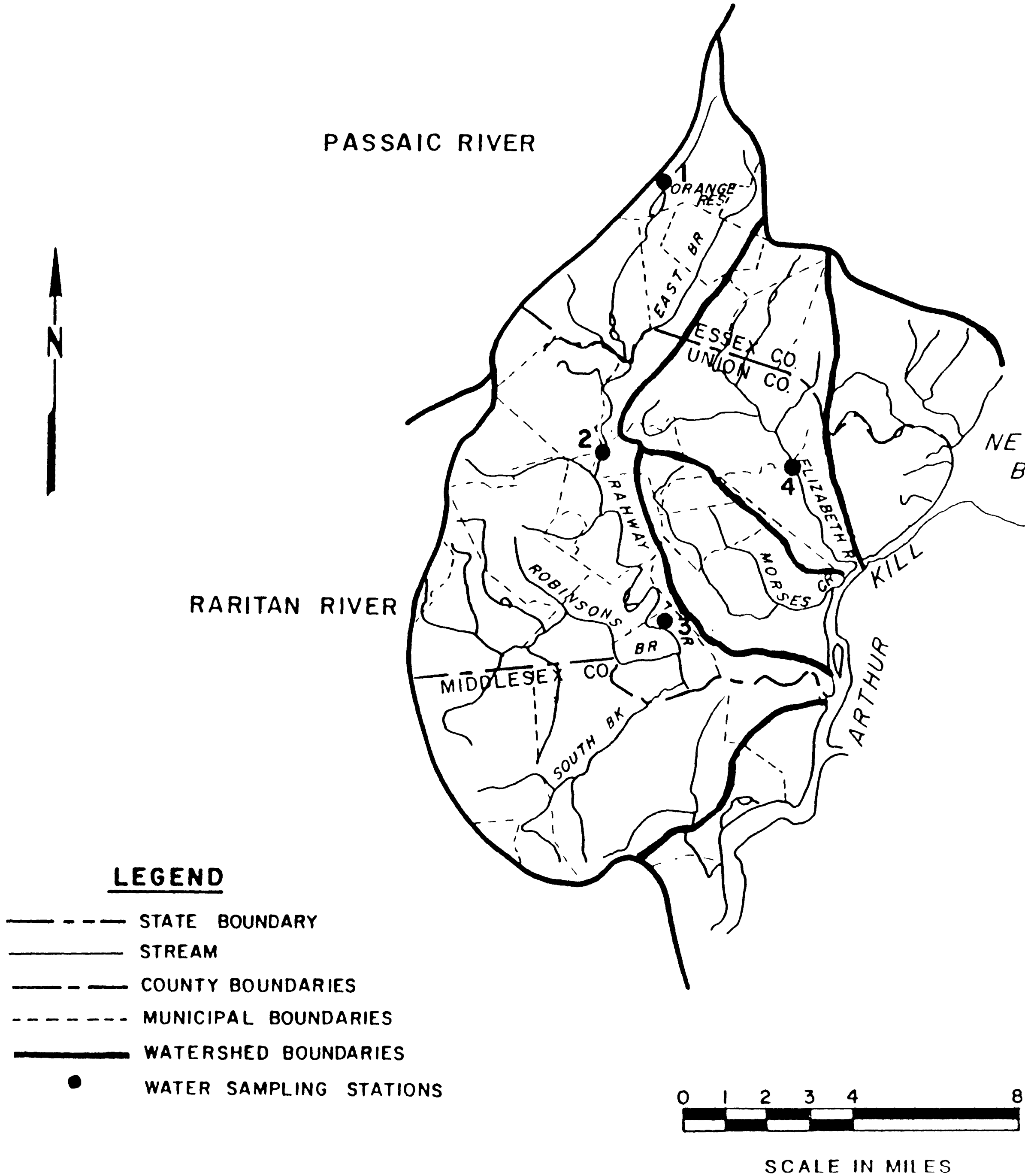
Monitoring Station List

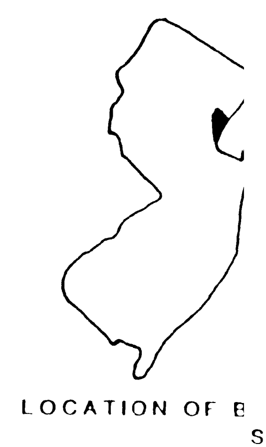
Map Number	Station Name and Classification
1	West Branch Rahway River at West Orange, FW-2 Nontrout
2	Rahway River near Springfield, FW-2 Nontrout
3	Rahway River at Rahway, FW-2 Nontrout
4	Elizabeth River at Ursino Lake, FW-2 Nontrout

RAHWAY RIVER

NEW JERSEY STATE WATER QU

INVENTORY REPORT





STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
West Branch Rahway River at W. Orange	AVG WQI	2	15	2	47	27	20	2	9	41 Fair
	WORST3 MONTHS	June-August	Sept-Nov	Feb-April	August-Oct	June-Aug	Dec-Feb	July-Sept	Sept-Nov	58 Fair Aug-Oct
Rahway River near Springfield	AVG WQI	2	32	3	48	18	14	2	9	43 Fair
	WORST3 MONTHS	June-August	May-July	Feb-April	June-August	May-July	Dec-Feb	April-June	June August	72 Poor May-July
Rahway River at Rahway	AVG WQI	3	15	5	40	18	11	3	15	29 Fair
	WORST3 MONTHS	June-August	July-Sept	Feb-April	Sept-Nov	August-Oct	Feb-April	April-June	Sept-Nov	39 Fair June-August
Elizabeth River at Ursino Lake	AVG WQI	3	17	6	74	24	20	5	14	59Fair/Poor
	WORST3 MONTHS	June-August	June-August	Feb-April	May-July	May-July	Nov-Jan	July-Sept	April June	82FeryPoor May July

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts, water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: RAHWAY RIVER ELIZABETH RIVER**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Carpenter Tech. - Tube Div.	0052931	Rahway River		Ind/Ther/SW
Exxon Bayway Refinery	0026662	Rahway River	Linden/Union	Ind.
AI Manufacturing Corp.	0035203	Kings Creek	Linden/Union	Ind.
Palnut Division of TRW In	0035530	Echo Brook	Mountainside/Union	Ind/Thermal
Rahway DPW, City of	0025585	Rahway River	Rahway/Union	Municipal
Dri-Print Foils, Inc	0062138	Rahway River	Rahway/Union	Thermal/SW
Custom Molders Corporation	0052531	Cedar Brook	Scotch Plains/Union	Industrial
County of Union	0002887	Briant Brook	Springfield Twp/Union	Ind.
Schiable Oil Corp.	0056219	Rahway River	Springfield Twp/Union	Ind.
Engelhard Corp.	0001180	Rahway River	Union Twp/Union	SW
Elastic Stop Nut	0003433	Storm Sewer to L	Union Twp/Union	Ind./Therm
Teledyne Adams	0029416	Rahway River	Union Twp/Union	Thermal
Tuscan Dairy Farm	0034266	Elizabeth River	Union Twp/Union	Thermal
Tuff Lite Corp	0032883	Rahway River	Edison/Middlesex	Ind/Therm
Continental Fibre Drum	0001121	Drainage Ditch T	Carteret/Middlesex	Thermal
AMAX Specialty Coppers Corp.	0069353	Arthur Kill	Carteret/ Middlesex	Ind./Therm
American Alum. Cast Co.	0060194	Elizabeth River	Irvington/Essex	Ind.
Mitchell-Supreme Fuel	0061921	Rahway River	Orange/Essex	Ind.
Mobil Oil - Linden Term	0062103		Linden/Union	Ind.
Polychrome Corp.	0062821	Robinson's Creek	Clark/Union	Ind.
Browning-Ferris Ind.	0062057	Newark Bay	Elizabeth/Union	Ind.
Stephens-Miller Co	0061573	Briant's Pond	Summit/Union	Ind.

32. ROCKAWAY RIVER

Watershed Description

The Rockaway River has a drainage area of 133 square miles that is mostly within Morris County with a small portion in Sussex County. It flows east to a confluence with the Whippany River at Pine Brook. Major tributaries to this 37 mile long river include Stone Brook, Mill Brook, Beaver Brook and Den Brook. There are many lakes and ponds in this area, but the major impoundments are Mountain Lakes Reservoir, Upper Longwood Lake, Boonton Reservoir, Taylortown Reservoir, Splitrock Reservoir, White Meadow Lake, and Lake Denmark. The population centers include Boonton, Randolph, Montville, Kinnelon and Dover.

Much of the land use in this area is wooded, vacant, and park lands. The remaining land is residential, but there is also some industrial and commercial land use. Development is occurring in much of the vacant areas. There are 32 NJPDES permitted dischargers here, of which 25 are industrial/commercial and 7 are municipal. Waters in this drainage basin have been rated FW-2 Trout Production, FW-2 Trout Maintenance, FW-2 Nontrout and FW-1.

Water Quality Assessment

The Rockaway River is routinely monitored at Boonton above the Boonton Reservoir and at Pine Brook. This monitoring indicates that the river is of normally good quality above the reservoir, but has fair quality below it. Conditions in the Lower Rockaway River degrade significantly during summer months to very poor quality.

Above the Boonton Reservoir the Rockaway River contains low to moderate amounts of fecal coliform and total phosphorus. The geometric mean of fecal coliform counts from 1983 to 1987 was 114 MPN/100ml with 41 percent exceeding the State criterion. Total phosphorus was elevated in 25 percent of the samples and averaged .04 mg/l, just below the .05 mg/l criterion for prevention of impoundment/lake eutrophication. Dissolved oxygen concentrations appear to be above the 4.0 mg/l standard for warm-water fisheries in the river, although very high DO levels (over 14 mg/l) may indicate excessive primary productivity in the river.

Below the Boonton Reservoir the Rockaway River is monitored at Pine Brook. Water quality conditions at this location are significantly poorer than those at Boonton. Elevated nutrients, BOD and fecal coliform, along with reduced dissolved oxygen,

N.J.P.D.E.S. DISCHARGE INVENTORY WATERSHED: RAHWAY RIVER ELIZABETH RIVER,Continued

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Gulf Oil Co. -Linden	0000311	Bk. Rahway River	Linden/Union	Ind./Comm.
B.P. Oil Inc.	0000515	Rahway River	Linden/Union	Ind./Comm.
Orange City Water Filtration	0034592	Rahway River	Orange/Essex	Municipal
Coastal Oil Corp.	0027880	Trib.to Clark Res.	Clark/Union	Ind./Storm
Witco Chemical Corp.	0031411	Stream SWR to Robi	Clark/Union	Therm/Storm
Elizabeth, City of	0020648	Elizabeth River	Elizabeth/Union	Municipal
Joint Mtg. Essex & Union	0024741	Elizabeth River	Elizabeth/Union	Municipal
Watchung Die Casting Co.	0055271	Garwood Brook	Garwood/Union	Thermal
ECD Inc.	0031186	Elizabeth River	Hillside Twp./Union	Thermal
Atlas Tod Company	0035980	Elizabeth River	Hillside Twpl/Union	Thermal
EMCO Graphics, Inc.	0061867	Elizabeth River	Hillside Twp./Union	Thermal
Ariston Inc.	0069515	Elizabeth River	Hillside Twp./Union	Thermal
Supermarket Services	0022225	King's Creek	Linden/Union	Municipal
Citgo Petroleum Corp.	0024554	Rahway River	Linden/Union	Industrial
Gulf Oil Co. Linden	0000311	Rahway River	Linden/Union	Ind./Comm.

30. UPPER PASSAIC RIVER

Watershed Description

The Upper Passaic River, from the source to the confluence of the Pompton River, is nearly 50 miles long and drains approximately 200 square miles of eastern Somerset, southern Morris, and western Essex Counties. Major tributaries include the Dead River, Rockaway River, Whippany River, and the Black Brook. There are no large impoundments, but smaller ones include the Canoe Brook Reservoir, Osborn Pond and Van Dorens Mills Pond. The areas adjacent to the Passaic River are subject to frequent flooding. The population centers are Madison-Chatham, Florham Park, Bernards, Berkeley Heights and New Providence. Two sub-watersheds are delineated: the Upper Passaic River from headwaters to the New River, and the Mid-Passaic River from the New River to the Pompton River.

Approximately one-half of the land use in this watershed is undeveloped or vacant with the remainder being primarily residential and commercial. This watershed is facing significant development in the vacant areas. There are 29 NJPDES permitted discharges identified in this watershed, of which 17 are municipal and 12 are industrial/commercial. The streams of the Upper Passaic River watershed have been classified primarily FW-2 Nontrout, but some FW-2 Trout Maintenance waters are present.

Water Quality Assessment

The Upper Passaic River is monitored at three locations - near Millington, at Chatham, and at Two Bridges. Results from this monitoring indicate that the Passaic River has fair water quality near Millington and Chatham, but conditions degrade at Two Bridges to poor quality. As such, water quality worsens in a downstream direction.

Near Millington and Chatham the Passaic River is nutrient enriched as evidenced by total phosphorus and total inorganic nitrogen concentrations. Phosphorus averaged .16 and .38 mg/l near Millington and Chatham, respectively. Seventy-two percent of the values were greater than .1 mg/l near Millington, while 94 percent exceeded this level near Chatham. The Passaic River near Chatham also contains generally high inorganic nitrogen with concentrations averaging 1.8 mg/l from 1983 to 1987. Fecal coliform counts were above the 200 MPN/100ml level in 62 and 77 percent of the samples taken from near Millington and Chatham, respectively. Both locations also experience reduced dissolved oxygen concentrations during summer months when levels are thought to be frequently below 4.0 mg/l (15 percent of the dissolved oxygen values were less than 4.0 mg/l). Saturation averaged only 61 percent near Millington and 78 percent near Chatham. Biochemical oxygen demand is often greater than 4.0 mg/l near Chatham. Water quality conditions degrade somewhat in the Passaic near Millington during the late spring-early summer indicating nonpoint sources may be a contributing factor. Near Chatham conditions worsen to poor quality during summer months, a likely result of the impact of point sources.

At Two Bridges the Passaic River has been subjected to numerous municipal wastewater discharges. These discharges, combined with a limited assimilative capacity of the river as it flows through a swampy area, creates poor overall water quality and very poor conditions during low flow periods. Nutrients and ammonia are excessive and dissolved oxygen is severely depressed during this critical period. Total phosphorus has averaged .62 mg/l at this location from 1983 to 1987, while total inorganic nitrogen concentrations averaged 3.9 mg/l. Un-ionized ammonia is present in problematic amounts during low flow and exceeded the State criterion in 25 percent of all samples collected between 1983 and 1987. Dissolved oxygen concentrations average below the 4.0 mg/l criterion during the months of June to October, while dissolved oxygen saturation was below 80 percent in practically every sample. Total dissolved solids in the Passaic River periodically exceeds 500 mg/l at Two Bridges in the fall months. Fecal coliform is also excessive in the river at this location.
The NJDEP completed a modeling study in 1987 of the Passaic River from Little Falls (Lower Passaic River) upstream. The study examined the possible effects of a Raritan-Passaic interbasin water transfer for low flow augmentation, and to determine appropriate discharge limitations for wastewater discharges. Water quality analyses for this study found severely depressed oxygen throughout the river along with ammonia toxicity problems. The river itself is considered to be eutrophic based on nutrient and algal concentrations. Phosphate is the limiting nutrient in the river.

The Passaic River is evaluated as supporting a healthy fish community from its headwaters downstream to Chatham. From Chatham to Livingston the fishery is judged to be moderately degraded. Downstream of this point to Little Falls the fish community is assessed to be degraded. Species composition in the Passaic is described as cold water types in its headwaters, shifting to both warm and cold water species north of Millington. From Chatham downstream to its mouth the fish community is limited to warm-water forms.

The four mile long Foulertons Brook, a tributary to the Passaic River in Roseland, is evaluated as having a severely degraded fishery, with no aquatic life being evident.

Problem and Goal Assessment

Point Source Assessment

The Passaic River has a very limited capacity to assimilate wastewaters discharged to it and additional pollutants which may enter it as runoff. Modeling performed on the river finds that background conditions alone meet the river's assimilative capacity. In addition, major tributaries such as the Whippany River, Rockaway River and Dead River contribute severely degraded waters to the Upper Passaic. However, protection and restoration of water quality in the river is imperative because it is a significant source of drinking water for a large portion of northeastern New Jersey. Sediment oxygen demand and hydrologic characteristics of the Passaic River may result in municipal discharges having to meet levels 4 or 5 advanced treatment for denitrification. Even such extreme treatment requirements may not significantly improve water quality because of nonpoint impacts.

Department enforcement actions currently underway against facilities that are impacting surface water quality include these Passaic River dischargers: Florham Park STP, Forest Park STP, Automatic Switch Co. in Florham Park, Warren Twp. STP, Chatham Main STP, Madison-Chatham Joint Pollution Control Facility, the Livingston STP, and Sandoz Pharmaceuticals in East Hanover Twp. (discharge to Black Brook). Hazardous waste sites known to be contaminating surface waters in this watershed are the Chevron site in Berkeley Heights releasing PCBs and volatiles to the Passaic River, and the Millington Asbestos site releasing asbestos also to the Passaic River.

Nonpoint Source Assessment

The Passaic River is impacted by the extensive urban/suburban development which has occurred throughout much of its watershed. In the uppermost stretches, the Great Swamp region, local housing construction and the construction of a gas pipeline are suspected of contributing to localized stream habitat destruction. As the river flows from the Great Swamp region to Chatham the degree of development within the watershed becomes greater. Septic seepage, road and building construction, and urban surface and road runoff are all known to impact the Upper Passaic River. Florham Park and Chatham are reported to have a highly developed stormwater infrastructure, suggesting that stormwater outfalls may be a significant source of pollution to the river in this area.

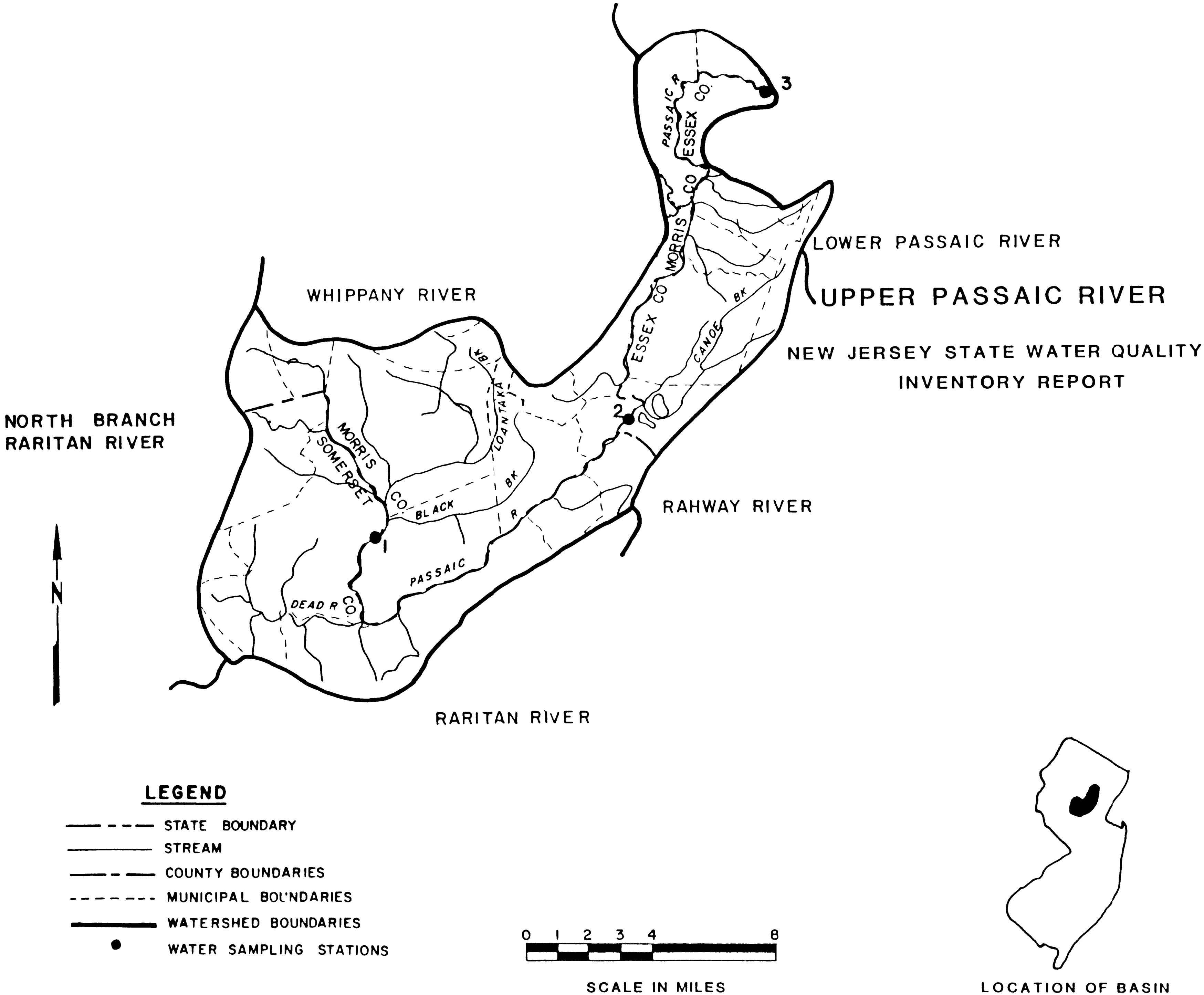
The impacts to the river from urbanization increase in severity along the stretch from Chatham to Livingston. Siltation is suspected of being the principal agent of habitat destruction in this portion of the river. It is here that the fishery begins to noticeably degrade, so that few game species are present. Those species which do survive are largely limited to pollution-tolerant forms such as carp and goldfish. Between Livingston and the Pompton River confluence habitat destruction continues to rise in severity, brought about largely by dredging, channelization, the removal of riparian vegetation, as well as ever increasing silt loads. Stream bank erosion and urban runoff appear to be common problems along the Passaic and many of its tributaries.

Designated Use and Goal Assessment

The Upper Passaic River will meet only the fish propagation and maintenance designated use/goal in portions of the river. This is the section from the river's headwaters to Chatham. From Chatham to Livingston the Passaic is partially meeting this use because of a moderately degraded fishery. From Livingston the river is considered not to be meeting the designated use. Water quality monitoring supports these conclusions. All waters will not meet the swimmable goal.

Monitoring Station List

Map Number	Station Name and Classification
1	Passaic River near Millington, FW-2 Nontrout
2	Passaic River near Chatham, FW-2 Nontrout
3	Passaic River at Two Bridges, FW-2 Nontrout


UPPER PASSAIC RIVER
NEW JERSEY STATE WATER QUALITY
INVENTORY REPORT
LOWER PASSAIC RIVER
WHIPPANY RIVER
NORTH BRANCH
RARITAN RIVER
RAHWAY RIVER
RARITAN RIVER
ESSEX CO.
PASSAIC R
MORRIS CO
ESSEX CO
CANOE BK
LOANTAKA BK
BLACK BK
MORRIS CO.
SOMERSET CO.
PASSAIC R
DEAD R
1
2
3
N
LEGEND
STATE BOUNDARY
STREAM
COUNTY BOUNDARIES
MUNICIPAL BOUNDARIES
WATERSHED BOUNDARIES
WATER SAMPLING STATIONS
0 1 2 3 4 8
SCALE IN MILES
LOCATION OF BASIN

WATER QUALITY INDEX PROFILE

Upper Passaic River

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Passaic River near Millington	AVG WQI	2	45	3	22	22	6	0	6	35 Fair
	WORST3 MONTHS	June-August	May-July	May-July	July-Sept	May-July	Oct-Dec	May-July	April-June	57 Fair May-July
Passaic River near Chatham	AVG WQI	3	28	2	36	36	12	7	7	44 Fair
	WORST3 MONTHS	June-August	August-Oct	April-June	May-July	Sept-Nov	Sept-Nov	August-Oct	April-June	60Fair/Poor July-Sept
Passaic River at Two Bridges	AVG WQI	3	58	2	29	53	12	14	ID	70 Poor
	WORST3 MONTHS	June-August	August-Oct	June-August	Sept-Nov	Sept-Nov	Sept-Nov	July-Sept		100VeryPoor Sept-Nov

LEGEND - Water Quality Index Description

WQI	Condition	Description	WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.	61-80	Poor	Pollution in high amounts; water uses not met.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.	81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.	ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Vet. Admin. Hosp-Lyons	0021083	Passaic River	Bernrdsville Boro/Som.	Municipal
Bernards Twp. SA	0022845	Dead River Trib.	Bernards Twp./Somer.	Municipal
Warren Twp. SA Stage IV STP	0022497	Dead River	Warren Twp./Somerset	Municipal
Warren Twp. SA-Stage 2 STP	0022489	Passaic River	Warren Twp./Somerset	Municipal
Passaic Twp. STP	0024465	Passaic River	Passaic Twp./Morris	Municipal
National Mfg. Co.	0032573	Passaic River	Chatham Twp./Morris	Ind./Comm.
Chatham Twp.-Main Plant	0020290	Black Brook	Chatham Twp./Morris	Municipal
New Providence WW Disp. Plant	0021636	Passaic River	New Providence Boro/ Union	Municipal
Park Central Ass.-Chatham Twp	0020281	Passaic River	Chatham Twp./Morris	Municipal
Reheis Chem. Co.	0002551	Trib to Passaic R.	Brkly. Hts Twp/Union	Ind./Comm.
Madison-Chatham Joint Meeting	0024937	Passaic River	Chatham Boro/Morris	Municipal
Ciba-Giegy Pharmaceutical Div	0000540	Passaic River	Summit City/Union	Ind./Comm.
Celanese Research Co.	0033197	Briant Pond	Summit City/Union	Ind./Comm.
NJDOT Springfield	0002887	Briant Brook	Sprngfld. Twp./Union	Ind./Comm.
Montville Bd of Ed-Cedar Hill	0021181	Passaic River	Montville Twp./Morris	Municipal
Montville MUA-Forest Park	0024431	Passaic River	Montville Twp./Morris	Municipal
Morris Twp. Woodland STP	0024929	Loantaka Brook	Morris Twp./Morris	Municipal
Taylor Rental Center	0064181			Oil/Wtr/Sep.
Warren SA Township of	0022489	Passaic River	Warren	Municipal
Orange Products Inc.	0001490	Passaic River	Chatham/Morris	Thermal
Chatham Twp-Chatham Glen STP	0052256	Passaic River	Chatham/Morris	Municipal
US Army Nike E. Hanover	0021938	Passaic River	E. Hanover Twp/Morris	Municipal
Chem Service Inc.	0035637	Passaic River	E. Hanover Twp/Morris	Thermal
Allied Corp.	0031305	Passaic River	Morristown/Morris	Industrial
Groene Aluminum Kasting	0063461	Upper Passaic River	Chatham/Morris	Industrial
Richards Industries	0063886	Upper Passaic River	West Caldwell/Morris	Industrial
West Caldwell Twp.	0061158	Upper Passaic River	West Caldwell/Morris	Municipal
Welsh Farms	0000850	Passaic River	West Caldwell/Morris	Industrial
Berkeley Heights Twp. STP	0027961	Passaic River	Berkeley Hgt/Union	Municipal

31. WHIPPANY RIVER

Watershed Description

The Whippany River drains 72 square miles of Morris County and flows 18 miles to the New River near East Hanover, directly upstream of the confluence with the Passaic River. Two of the larger tributaries are Black Brook and Troy Brook. Major impoundments include Clyde Potts Reservoir, Speedwell Lake and Pocahantas Lake. The population is centered in Morristown, Parsippany-Troy Hills, Hanover Township, and East Hanover Township.

The land use in this watershed is about one-half agriculture, parkland, and vacant land; with most of the remainder being residential or commercial development. Of the 30 NJPDES permitted discharges, 17 are industrial/commercial and 13 are municipal. Streams in this watershed have been classified FW-2 Trout Production and FW-2 Nontrout.

Water Quality Assessment

The Whippany River is routinely monitored at two locations, Morristown and Pine Brook. These two stations have fair to poor overall water quality. At Morristown the Whippany River was impacted until 1986 by a large raw sewage overflow. This may be why conditions are very poor in the river at certain periods of the year. As a result of the bypass, fecal coliform counts at Morristown have been extremely high. Between 1983 and 1987 the fecal coliform geometric mean was 4798 MPN/100 ml with all of the values above State criterion. Nutrients, most notably total phosphorus, was also elevated to a high level in the Whippany at Morristown. Average values of total phosphorus and inorganic nitrogen were .36 mg/l and 1.9 mg/l, respectively. The State criterion for total phosphorus was exceeded in 100 percent of the samples collected during the period of review. Un-ionized ammonia also appears to be periodically excessive during summer months. While dissolved oxygen concentrations seem to be adequate, wide diurnal fluctuations may be occurring. Dissolved oxygen concentrations of 15 mg/l and over, as well as saturation values over 130 percent, indicate high primary productivity in the river.

Downstream at Pine Brook the Whippany River has significantly lower fecal coliform counts than those found at Morristown, but nutrients are higher and dissolved oxygen is generally lower. Fecal coliform counts were above State criterion in 66 percent of the samples; the geometric mean over the 1983-1987 period being 349 MPN/100ml. On the average, total phosphorus was about 50 percent higher at Pine Brook than at Morristown. In addition, total inorganic nitrogen was elevated in 61 percent of all samples, averaging 2.8 mg/l. Un-ionized ammonia has also been found to be above State criterion in warm weather periods. Dissolved oxygen may routinely drop below 4.0 mg/l during summer months and saturation is also severely reduced during this time.

The upper reaches of the Whippany River from its headwaters to Speedwell Lake were classified by the NJ Division of Fish, Game, and Wildlife as supporting a healthy cold water fish community; the fishery of the river's lower reach, downstream of Speedwell Lake, is judged to be degraded. Troy Brook, a tributary, is evaluated as supporting a healthy warm water fishery.

Problem and Goal Assessment

Point Source Assessment

The Whippany River has a number of municipal and industrial wastewater discharges in its watershed. These point sources combined with urban/suburban runoff create the fair and poor conditions in the river. The Morristown STP remains under NJDEP enforcement action for violating the BOD, suspended solids and ammonia limitations of its permit. Other enforcement cases underway include Sandoz Pharmaceutical in East Hanover, Butterworth STP in Morris Twp., Hanover Sewage Authority STP, and Greystone Park STP in Parsippany-Troy Hills Twp. (discharge to Jacqui Pond). On the positive side, Rowe International, Inc., located in Hanover Twp., has eliminated all of its industrial discharges into the West Brook by tieing directly into the Hanover Sewage Authority STP.

The Sharkey Landfill in Parsippany-Troy Hills is impacting both the Whippany and Rockaway Rivers with metals and volatile organics.

Nonpoint Source Assessment

Urban/suburban development is suspected of degrading the water quality of the Whippany River in its upper reaches and is known to have a severe impact in the river's lower section. Upstream of Speedwell Lake, runoff from construction activity, stormwater discharges, urban surfaces, and the loss of riparian vegetation are all suspected of contributing to increasing levels of siltation in the river. This in turn has led to a reduction in the trout holding capacity of the waterway. In the lower end below Speedwell Lake, urban runoff and chemical spills have resulted in severe siltation and an overall degradation of the river's water quality. The lower Whippany River is reported to have had a long history of fish kills caused by industrial and municipal pollution. Few game fish are said to inhabit this portion of the river, in their stead are pollution-tolerant forms such as carp and pan fish. Speedwell Lake and the wetland areas of the Whippany River watershed, Black and Troy Meadows, are known to be receiving severe and increasing runoff from construction activity and from local storm sewers.

Designated Use and Goal Assessment

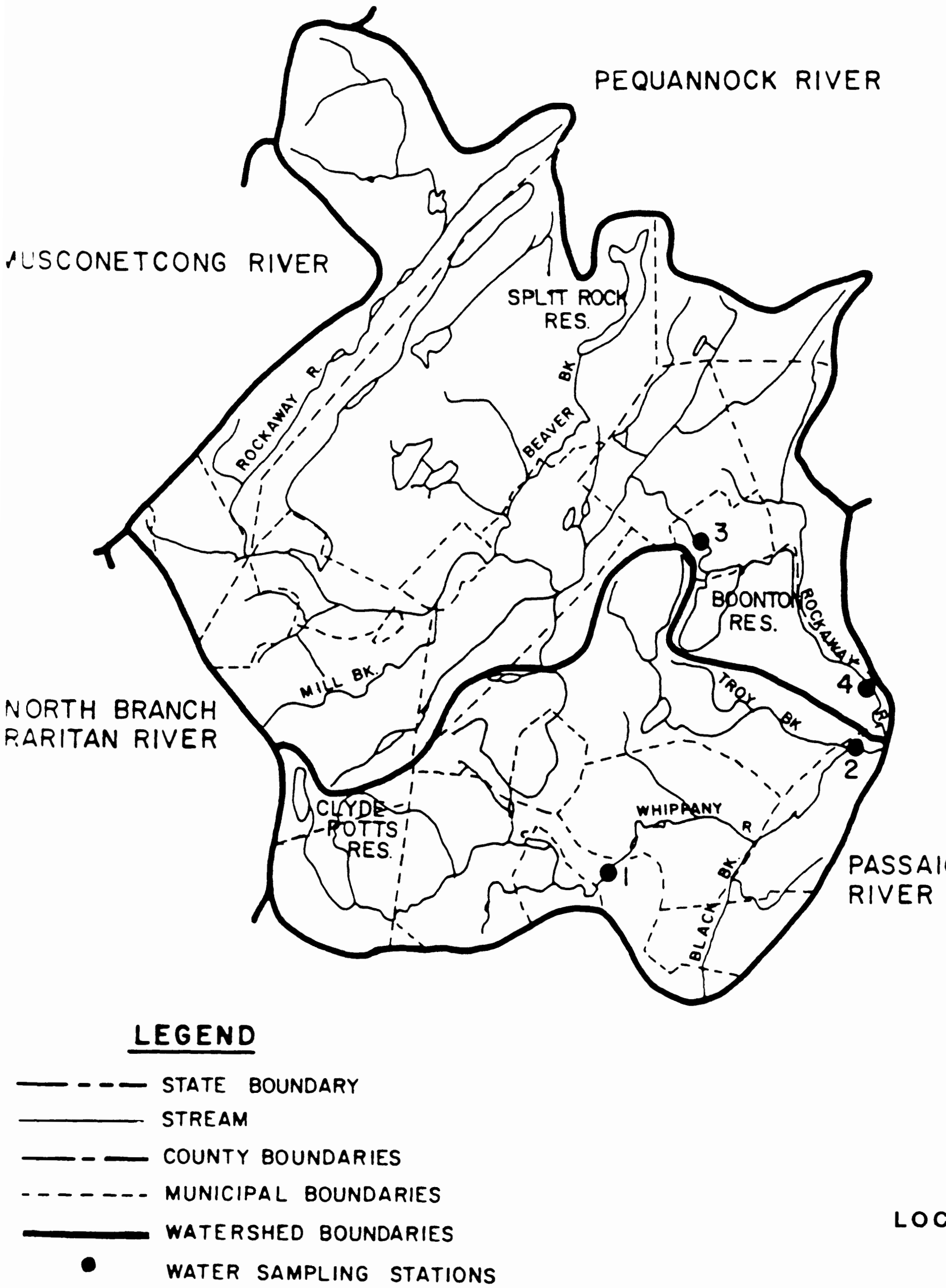
The Whippany River will meet the fish propagation/maintenance designated use in the upper two-thirds of the watershed; but the lower reach of the river is considered as containing degraded fisheries, and as such, is not meeting the fish propagation/maintenance use and clean water goal. The river will not achieve swimmable status because of fecal coliform concentrations.

Monitoring Station List

Map Number	Station Name and Classification
1	Whippany River at Morristown, FW-2 Nontrout
2	Whippany River at Pine Brook, FW-2 Nontrout

WHIPPANY AND ROCKWAY RIVERS

NEW JERSEY STATE WATER QUALITY INVENTORY REPORT



LOCATION OF BASINS

WATER QUALITY INDEX PROFILE 1983-1987

Whippany River

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Whippany R at Morristown	AVG WQI	2	37	8	66	35	8	10	8	69 Poor
	WORST3 MONTHS	June-August	Nov-Jan	August-Oct	May-July	Oct-Dec	Sept-Nov	August-Oct	June-August	94very Poor Nov-Jan
Whippany R at Pine Brook	AVG WQI	2	37	3	30	46	10	10	10	52 Fair
	WORST3 MONTHS	June-August	May-July	Dec-Feb	Feb-April	Sept-Nov	Sept-Nov	July-Sept	April-June	77 Poor June-August

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: WHIPPANY RIVER**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Contract Packaging Corp.	0021334	India Brook	Mendham Boro/Morris	Municipal
St. Marys Abby-Delbarton Sch.	0026751	Whippany River	Morris Twp./Morris	Municipal
DOT I80 Harding Twp. Reststop	0029912	Great Brook	Harding Twp./Morris	Municipal
Parke Davis/Warner Lambert	0002542	Watnong Brook	Morris Plains/Morris	Ind./Comm.
Greystone Pk. Psych. Hospital	0026689	Vaqui Pond to Whipp.	Morris Twp./Morris	Municipal
Airtron Div. Litton Ind.	0025739	Whippany River	Morris Plains/Morris	Ind./Comm.
Colloid Chem. Labs	0003697	Whippany River	Hanover Twp./Morris	Ind./Comm.
Fabricated Plastics	0029734	Whippany River	Morristown Twn./Morr.	Ind./Comm.
Champion-Dairypak Div.	0033685	Whippany River	Morristown Twn./Morr.	Ind./Comm.
Morristown STP	0025496	Whippany River	Morristown Twn./Morr.	Municipal
Morris Twp. Butterworth STP	0024911	Whippany River	Morris Twp./Morris	Municipal
Asco Elec. Prod. Co.	0032166	Eastmans Brook	Parsip.-Troyhills/ Morris	Ind./Comm.
Leeming Pacquin Corp.	0003450	Eastmans Brook	Parsip.-Troyhills/	Ind./Comm.
Rowe International Inc.	0001708	Passaic Basin	Hanover Twp./Morris	Ind./Comm.
Hanover Twp. STP	0024902	Whippany River	Hanover Twp./Morris	Municipal
Campbell-Pratt Oil Co.	0028339	Whippany River	HanoverTwp./Morris	Ind./Comm.
Amax Specialty Metals Inc.	0001881	Black Brook	Florham Pk. Boro/Morr	Ind./Comm.

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: WHIPPANY RIVER, Continued**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Sis. of Charity of St. Eliz.	0026654	Black Brook	Florham Pk. Boro/Morr	Municipal
Exxon Research + Eng.	0003476	Drain to Black Brook	Florham Pk. Boro/Morr	Ind./Comm.
Parsippany-Troyhills	0024970	Whippany River	Parsip. Troyhills/	Municipal
Norda, Inc.	0003514	Whippany River	E. Hanover Twp./Morr	Ind./Comm.
East Hanover Twp. Well No2	0036081	Whippany River	E. Hanover Twp./Morr	Industrial
Township of Morris	0024911	Whippany River	Morris Twp./Morris	Municipal
Mennen Company	0035238	Whippany River	Morristown Twp./Morr	Industrial
Campbell-Pratt Oil Co.	0028339	Whippany River	Whippany R./Morris	Stormwater
Chatham Township Main Sewage	0020290	Black Brook	Chatham/Morris	Municipal
Leslie Co.	0032221	Eastman's Brook	Parsippany/Morris	Industrial
Anchor Swim Club	0050024	Malapardis Brook	Hanover Twp/Morris	Industrial
Magullian Fuel Corp.	0026093	Whippany River	Hanover Twp/Morris	Industrial
Plains Plaza Shopping Ctr.	0026514	Pompton River	Pequannock Twp./Morris	Municipal

32. ROCKAWAY RIVER

Watershed Description

The Rockaway River has a drainage area of 133 square miles that is mostly within Morris County with a small portion in Sussex County. It flows east to a confluence with the Whippany River at Pine Brook. Major tributaries to this 37 mile long river include Stone Brook, Mill Brook, Beaver Brook and Den Brook. There are many lakes and ponds in this area, but the major impoundments are Mountain Lakes Reservoir, Upper Longwood Lake, Boonton Reservoir, Taylortown Reservoir, Splitrock Reservoir, White Meadow Lake, and Lake Denmark. The population centers include Boonton, Randolph, Montville, Kinnelon and Dover.

Much of the land use in this area is wooded, vacant, and park lands. The remaining land is residential, but there is also some industrial and commercial land use. Development is occurring in much of the vacant areas. There are 32 NJPDES permitted dischargers here, of which 25 are industrial/commercial and 7 are municipal. Waters in this drainage basin have been rated FW-2 Trout Production, FW-2 Trout Maintenance, FW-2 Nontrout and FW-1.

Water Quality Assessment

The Rockaway River is routinely monitored at Boonton above the Boonton Reservoir and at Pine Brook. This monitoring indicates that the river is of normally good quality above the reservoir, but has fair quality below it. Conditions in the Lower Rockaway River degrade significantly during summer months to very poor quality.

Above the Boonton Reservoir the Rockaway River contains low to moderate amounts of fecal coliform and total phosphorus. The geometric mean of fecal coliform counts from 1983 to 1987 was 114 MPN/100ml with 41 percent exceeding the State criterion. Total phosphorus was elevated in 25 percent of the samples and averaged .04 mg/l, just below the .05 mg/l criterion for prevention of impoundment/lake eutrophication. Dissolved oxygen concentrations appear to be above the 4.0 mg/l standard for warm-water fisheries in the river, although very high DO levels (over 14 mg/l) may indicate excessive primary productivity in the river.

Below the Boonton Reservoir the Rockaway River is monitored at Pine Brook. Water quality conditions at this location are significantly poorer than those at Boonton. Elevated nutrients, BOD and fecal coliform, along with reduced dissolved oxygen, result in fair overall quality, with very poor conditions during the late summer period. Total phosphorus has averaged above .50 mg/l during the period 1983 to 1987. Seventy-three percent of the samples were greater than the .1 mg/l criterion. Total inorganic nitrogen and total Kjeldahl nitrogen are also high; inorganic nitrogen samples averaged 3.7 mg/l, and Kjeldahl nitrogen averaged 3.1 mg/l. As a result, un-ionized ammonia is frequently above the criterion for protection of aquatic life. Thirty-one percent of all un-ionized ammonia samples were greater than .05 mg/l with the majority of the high values occurring during late summer-early fall. Fecal coliform was above 200 MPN/100ml in 44 percent of all values and had a geometric mean of 169 MPN/100ml during the period of review.

Dissolved oxygen concentrations in the Rockaway River at Pine Brook drop below 4.0 mg/l during the summer, while DO saturation often falls well below 80 percent. DO saturation has averaged only 72 percent from 1983 to 1987.

Biological monitoring of the Rockaway River at Boonton has found the waterway to contain a healthy environment for macroinvertebrates. The percentage of pollutant-tolerant organisms was low, and no single species dominated the community. Excess nutrient enrichment however, is evidenced. Historically, the macroinvertebrate community appears to have improved over the past decade.

The Rockaway River supports cold water fish species in its upstream sections and warm water forms in its downstream reaches. The fish community in the river above Dover is assessed by the New Jersey Division of Fish, Game, and Wildlife to be healthy. Between Dover and the Boonton Reservoir, the fish population is judged to be moderately degraded; below the reservoir the fishery is regarded as degraded.

Four additional streams were assessed in the watershed. Hibernia and Mill Brooks are judged to contain healthy cold water fisheries. The fish community of Beaver Brook is reported to be healthy except in its lower reaches where it is evaluated as moderately degraded. Den Brook is assessed to be degraded.

Problem and Goal Assessment

Point Source Assessment

The Rockaway River appears to be impacted by a combination of point and nonpoint sources. In the Upper Rockaway watershed, a number of small treatment plants discharge to the river. Of these, the Picatinny Arsenal discharges to Green Pond Brook and

35. RAMAPO AND POMPTON RIVERS

Watershed Description

The Ramapo River has a drainage area of about 160 square miles, 110 of which are in New York State. It flows from New York into Bergen County and enters the Pequannock River to form the Pompton River in Wayne Township. The Ramapo River is 15 miles long in New Jersey. The Pompton River is a tributary to the Passaic River and is 7 miles long. Major impoundments include Point View Reservoir #1, Pompton Lake and Pines Lake. The population centers are Mahwah, Pompton Lakes, Pompton Plains, Oakland, and Franklin Lakes.

Over one-half of this watershed is undeveloped, with the remainder being primarily suburban/commericial/industrial. New development is extensive in many areas of the watershed. There are 24 NJPDES permitted discharges present in the two watersheds, 17 of which are municipal and 7 are industrial. Waters have been rated FW-2 Trout Production and FW-2 Nontrout.

Water Quality Assessment

The Ramapo and Pompton Rivers each have one ambient monitoring station . The Ramapo River is sampled at Mahwah, and the Pompton River is monitored at Packanack Lake. Results of this monitoring finds that the Pompton River has good conditions while the Ramapo River contains fair quality waters.

The Ramapo River is afflicted with moderately excessive fecal coliform and nutrient concentrations. Fecal coliform exceeded State criterion in 70 percent of all samples, and had a geometric mean of 586 MPN/100ml. High concentrations of total phosphorus are also found. Total phosphorus averaged .20 mg/l from 1983 to 1987 with 78 percent above the recommended criterion of .1 mg/l. Total inorganic nitrogen was found to be high in 10 percent of the samples collected. Although dissolved oxygen concentrations were above criterion in all measurements, when analyzed as percent saturation it was occasionally below 80 percent. Biochemical oxygen demand appears to periodically be greater than 4.0 mg/l. Conditions in the Ramapo River degrade somewhat during late summer/early fall.

In the Pompton River conditions are better. Good quality waters from the Pequannock and Wanaque Rivers appear to be maintained in the Pompton River. Although lower than the Ramapo River, the Pompton River contains moderate bacterial and nutrient

Many other streams in this watershed are also impacted by urbanization. Construction and urban runoff (sewers, urban surfaces) have degraded Jackson Brook where fish kills have been documented. Beaver Brook is reported to have a severely impaired fishery due to intensive and increasing road and housing construction. Development is so severe around Den Brook that it has led to complete habitat destruction within the stream.

Designated Use and Goal Assessment

The Rockaway River will only meet the fish propagation and maintenance designated uses and Clean Water Act goal in certain areas. This is the river above Dover. From Dover to the Boonton Reservoir the river partially achieves the use, while below the Boonton Reservoir it does not meet the use. Various tributaries meet, meet but are threatened, partially meet, or do not meet the fish propagation/maintenance use. The river will not achieve swimmable status.

Monitoring Station List

Map Number	Station Name and Classification
3	Rockaway River at Boonton FW-2, Nontrout
4	Rockaway River at Pine Brook, FW-2 Nontrout

See page III-285 for a map of the Rockaway watershed.

WATER QUALITY INDEX PROFILE

Rockaway River

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Rockaway R at Boonton	AVG WQI	2	4	7	23	17	6	2	ID	14 Good
	WORST3 MONTHS	June-August	Nov-Jan	June-August	Nov-Jan	Nov-Jan	Feb-April	July-Sept		25Good/Fair Nov-Jan
Rockaway R at Pine Brook	AVG WQI	2	28	2	21	43	9	10	7	41 Fair
	WORST3 MONTHS	June-August	July-Sept	July-Sept	June-August	July-Sept	August-Oct	July-Sept	May-July	86very poor July Sept

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: ROCKAWAY RIVER**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Jefferson Twp. Sr. High and Middle School	0021091	Rockaway River	Jefferson Twp/Morris	Municipal
Roxbury Motel Assoc.	0028304	Drakes Brook	Roxbury Twp./Morris	Municipal
Hercules Inc.	0000876	Black River	Roxbury Twp./Morris	Ind./Comm.
Picatinny Arsenal	0002500	Green Pond Brook	Rockaway Twp./Morris	Ind./Comm.
Air Prod. + Chem. Corp.	0000523	Rockaway River	Wharton Boro/Morris	Ind./Comm.
L>E> Carpenter + Co.	0003611	Rockaway River	Wharton Boro/Morris	Ind./Comm.
GHA Lock Joint	0002593	Rockaway River	Wharton Boro/Morris	Ind./Comm.
Thatcher Glass Mfg. Co.	0034681	Ground Water	Wharton Boro/Morris	Ind./Comm.
Mt. Hope Rock Prod., Inc.	0003409	White Meadow Brook	Rockaway Twp./Morris	Ind./Comm.
Rockaway Townsquare Mall	0032808	Rockaway River	Rockaway Twp./Morris	Ind./Comm.
McWilliams Forge Co., Inc.	0002496	Rockaway River	Rockaway Twp./Morris	Ind./Comm.
Howmet Turbine Co. Corp.	0001635	Rockaway River	Rockaway Twp./Morris	Ind./Comm.
Hewlett-Packard Co. NJ Div.	0003077	Hibernia Brook	Rockaway Twp./Morris	Ind./Comm.
Ivex Corp.	0034720	Rockaway River	Rockaway Twp./Morris	Ind./Comm.
Kueffel + Esser Co. Redon Plt	0001261	Burnt Meadow Brook	Rockaway Twp./Morris	Ind./Comm.
WP Realty Co.	0035050	Beaver Brook	Denville Twp./Morris	Ind./Comm.
Our Lady of the Magnificant School	0024457	Butler Reservoir	Kinnelon Boro/Morris	Municipal
Montville Twp. BP MVA -	0030317	Valhalla Brook	Montville Twp/Morris	Municipal

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: ROCKAWAY RIVER,Continued**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Norland				
Montville Twp. MUA-Brook Valley STP	0030317	Valhalla Brook	Montville Twp/Morris	Municipal
Scerbo Bros., Inc.	0030911	Crooked Brook	Boonton Twp./Morris	Ind./Comm.
Rockaway Valley Reg. S.A.	0022349	Rockaway River	Parsipny.-Tryhls./Morr	Municipal
Jim Salerno Pontiac Inc.	0031755	Rockaway River	Randolph Twp./Morris	Ind./Comm.
Randolph High School	0026603	Mill Brook	Randolph Twp./Morris	Municipal
Advance Pressure Casting Corp	0034649	Rockaway River	Denville Twp./Morris	Thermal
Green Hammer Metal Products Company	0034134	Rockaway River	Dover/Morris	Thermal
Jefferson Middle & High Schl.	0021091	Rockaway River	Jefferson Twp/Morris	Municipal
Mt. Olive Township	0021954	Drakes Br.	Flanders/Morris	Municipal
Howmet Turbine Comporets Corp	0001635	Rockaway River	Rockaway/Morris	Thermal/Ind
White Meadow Lake Prop Onm	0022802	White Meadow Brook	Rockaway Twp./Morris	Municipal
Joseph Klockner	0073466	Rockaway River	Rockaway Twp./Morris	Ind./Comm.

N.J.P.D.E.S. DISCHARGE INVENTORY	WATERSHED: ROCKAWAY RIVER CONT.

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Action Technology Company	0027564	Burnt Meadow Brook	Rockaway/Morris	Industrial
Rockaway Township WTP	0035785	Beaver Brook	Rockaway Twp/Morris	Industrial
Pneu Hydro Products Inc.	0052396	Green Pond Brook	Wharton Boro/Morris	Industrial
Thermal American Fused	0032026	Beaver Brook	Montville/Morris	Thermal
Adron	0003506	Lake Intervale	Parsippany/Morris	Industrial
Berkshire Sand & Stone	0029394	Rockaway River	Jefferson Twp./Morr	Industrial

33. PEQUANNOCK RIVER

Watershed Description

The Pequannock River is 30 miles long and drains an area of 90 square miles. Its headwaters are in Sussex County and it flows east, delineating the Morris/Passaic County line. It continues flowing east and joins the Wanaque River and flows to the Pompton River in Wayne Township. There are many lakes, ponds and reservoirs in this area, but the major impoundments are the Kikeout Reservoir, Lake Kinnelon, Clinton Reservoir, Canistear Reservoir, Charlottsburg Reservoir, Oak Ridge Reservoir, and Echo Lake Reservoir. The major tributary is Stonehouse Brook. Population in this watershed is centered in Butler and Bloomingdale Townships.

The great majority of the land use in this watershed is forested and protected for water supply purposes and parklands. The remaining is residential and industrial/commercial. There are 18 NJPDES permitted discharges; 6 municipal and 12 industrial. Waters are classified FW-1 in the Newark water supply area, FW-2 Trout Production, FW-2 Trout Maintenance, and FW-2 Nontrout.

Water Quality Assessment

The Pequannock River is routinely sampled at the Macopin Intake. Based on this monitoring the Pequannock River has good overall water quality, with conditions approaching fair quality during summer months. The river is classified trout maintenance at this location. The only significant water quality problem identified in ambient monitoring is stream temperature, which is often above recommended trout maintenance criterion from June to August. Dissolved oxygen is sufficient at all times and biochemical oxygen demand is usually less than 3.0 mg/l. Fecal coliform counts did not exceed the 200 MPN/100ml criterion from 1983 to 1987, and had a geometric mean of 25. Nutrients are also low, as total phosphorus averaged .05 mg/l and exceeded the recommended criterion in only one sample during the period of review.

Biological monitoring is also performed at the Macopin Intake. Both macroinvertebrate and periphyton sampling found healthy communities, but some nutrient enrichment or the presence of detritus is indicated. The communities showed no evidence of depressed dissolved oxygen in the environment.

The Pequannock River upstream of Butler is assessed as supporting a healthy cold water fish community. Below Butler, the fishery is judged to be moderately degraded. Two additional streams in the watershed were assessed: Pacack Brook is evaluated to be containing a healthy warm water fishery; Kikeout Brook is believed to carry a degraded cold water fish community.

Problem and Goal Assessment

Point Source Assessment

The Pequannock River watershed is primarily forested and in protected water supply lands. As a result, development and pollution sources are, for the most part, limited. Enforcement activities are underway against three facilities: Highview Acres STP in West Millford Twp. discharge to Macopin River, the Kinnelon High School STP, the latter two discharging to the Pequannock River.

Nonpoint Source Assessment

The principal source of nonpoint pollution in the Pequannock River watershed from Stockholm to the Pompton River is evaluated to be urban/suburban development. In general, water quality declines as one travels downstream, especially as one passes through the Butler-Bloomingdale area. Reported pollution sources include rising levels of runoff from roads, building construction, urban surfaces, storm sewers and surface mines. Additional problems below Bloomingdale include channelization, streambank modification, and the removal of riparian vegetation. All this has contributed to high water temperatures, silt loads, and organic pollution.

Designated Use and Goal Assessment

The Pequannock River will achieve the fish propagation/maintenance designated use in most parts of the river. The lower five miles, evaluated to contain a moderately degraded fisheries, is classified as partially meeting the designated use. Monitoring at the Macopin Intake finds that the river will meet the swimmable use and clean water goal at this location.

Monitoring Station List

Map Number	Station and Classification
1	Pequannock River at Macopin Intake, FW-2 Trout Maintenance

See page III-310 for a map of the Pequannock River watershed.

WATER_QUALITY_INDEX_PROFILE

Pequannock River

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Pequannock River at Macopin Intake	AVG WQI	15	8	8	9	9	4	2	ID	12 Good
	WORST3 MONTHS	June-August	March-May	Nov-Jan	June-August	May-July	Jan March	July-Sept		26 Good June-August

LEGEND - Water_Quality_Index_Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: PEQUANNOCK RIVER**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
W.Milford MUA-Crescent Pk STP	0026174	Belchers Creek	W. Milford Twp/Pass	Municipal
Camp Vacamas Ass. of NJ	0030201	Pequannock R. Trib.	W. Milford Twp/Pass	Mun/Ind/Com
W. Milford MUA-Olde Milford	0027677	Belchers Creek Trib.	W. Milford Twp/Pass	Municipal
W. Milford High View	0027685	Vreeland Pond	W. Milford Twp/Pass	Municipal
Milford Manr Nursing Home-STP	0026981	Trib. to Nosengo	W. Milford Twp/Pass	Ind./Comm.
B+D Automotive	0068845	Belchers Creek	W. Milford Twp/Pass	Ind./Comm.
Kinnelon H.S.	0022284	Trib to Pequannock R	Kinnelon Boro/Morris	Municipal
Kinnelon Twp.-Stony Brk. Sch.	0022276	Pequannock River	Kinnelon Boro/Morris	Municipal
Pass. Crushed Stone Co., Inc.	0025500	Pequannock River	Pompton Lks.Boro/Pass.	Ind./Comm.
Riverdale Quarry	0001601	Pequannock River	Riverdale Boro/Mooris	Ind./Comm.
W. Milford Shopping Ctr.	0024414	Belcher's Creek	W. Milford/Passaic	Industrial
Passaic Rubber Co.	0030457	Pequannock River	Wayne Twp/Passaic	Ind/Thermal
Mack-Wayne Plastics Com	0030775	Pequannock River	Wayne Twp/Passaic	Ind/Thermal
Pilot Metal Fabricators Inc.	0033642	Pequannock River	Wayne Twp/Passaic	Thermal
NJ Department of Defense	0050717	Pequannock River	Riverdale Boro/Morris	Industrial
Raia Industries	0062243	Pequannock River	Riverdale Boro/Morris	Ind./Storm
Vibration Mounting & Control	0025712	Pequannock River	Butler/Morris	Industrial
Butler Water Department	0025721	Kakeout Brook	Butler/Morris	Industrial
Franks Sanitation Service	0065862	Pequannock River	Riverdale/Burl.	Ind.

34. WANAQUE RIVER

Watershed Description

The Wanaque River, with its headwaters in New York State, has a total drainage area of 108 square miles. That part which is in New Jersey is in Passaic County. Its headwaters begin as minor tributaries to Greenwood Lake (which is half in New York and half in New Jersey) before flowing southwesterly to the Wanaque Reservoir, then south to Lake Inez. It flows from Lake Inez to its confluence with the Pequannock River at Riverdale. The river's total length is 27 miles. Major tributaries include West Brook and Jennings Creek. There are many lakes, reservoirs, and ponds with the larger ones being the Wanaque Reservoir, Greenwood Lake, Arcadia Lake and Lake Inez. There are no large population centers, but most of the people can be found living in Ringwood and Wanaque Townships.

Most of the land in this watershed is undeveloped, consisting of vacant lands, reservoirs, parks, and farms. For the most part, the remainder is residential with some land being used for industry and commerce. Of the 11 NJPDES permitted discharges here, 4 are commercial/industrial, and 7 are municipal. The waters of this drainage area have been classified FW-1, FW-2 Trout Production, FW-2 Trout Maintenance, and FW-2 Nontrout.

Water Quality Assessment

The Wanaque River has one ambient water quality monitoring station which is located at Wanaque. This is just downstream of the dam at Wanaque Reservoir, a major water supply source. As such, water quality conditions in the Wanaque River at Wanaque are highly influenced by the impoundment. Routine monitoring finds the Wanaque River to be of excellent quality with very little pollution. During 1983 to 1987 there was very little seasonal change in water quality

Few water quality problems have been documented by ambient monitoring of the Wanaque River at Wanaque. Fecal coliform counts had a geometric mean of 9 MPN/100 ml from 1983 to 1987, with all counts less than 200 MPN/100 ml. Total phosphorus was similarly low, averaging .03 mg/l. Dissolved oxygen, as measured as concentration and percent saturation, is adequate for warm water fisheries throughout the year.

The Wanaque River upstream of the Wanaque Reservoir is assessed by the New Jersey Division of Fish, Game and Wildlife as containing a healthy cold water fish community. Below the reservoir the fishery shifts to warm water species and is judged to be moderately degraded. Belcher Creek is evaluated as supporting a moderately degraded warm water fish community.

Problem and Goal Assessment

Point Source Assessment

The water quality of the Wanaque River at Wanaque, although excellent, is probably not indicative of the entire river. Conditions are thought to degrade somewhat in a downstream direction. Below this monitoring station point sources and increased development likely influence the river's quality.

A total of ten facilities were reported to be discharging inadequately treated effluent. Of these the two largest are the Wanaque Valley Regional STP discharging to the Wanaque River, and Olde Milford Estates STP discharging into Belcher Creek. Both facilities are discharging excess BOD, ammonia, and phosphorus into their receiving waters. An industrial discharge to Belcher Creek is suspected of degrading the fishery of the creek.

The Lakeland High School hazardous waste site in Wanaque Township is contaminating High Mountain Brook with chemicals.

Nonpoint Source Assessment

Nonpoint source assessments on the Wanaque River were restricted to the river reaches below the Wanaque Reservoir. In this region the primary nonpoint pollution sources are those associated with urban/suburban development; they have degraded the fishery habitat by contributing to excessive siltation and elevated stream temperatures. West Brook for example, a unique trout production waterway characterized as one of the few streams in our state with a naturally reproducing rainbow trout population and is threatened by such development.

Other nonpoint pollution sources known to be a problem here include runoff from urban surfaces and roads. In addition, the removal of riparian vegetation along the river is reported to have further contributed to stream degradation.

Designated Use and Goal Assessment

The Wanaque River is swimmable as it emerges from the Wanaque Reservoir. It is not known if the river maintains good bacterial quality downstream. The Wanaque River will meet the fish propagation and maintenance use above the reservoir, but is thought to partially meet it below the impoundment.

Monitoring Station List

Map Number	Station Name and Classification
2	Wanaque River at Wanaque, FW-2 Nontrout

See page V-310 for a map of the Wanaque Watershed.

WATER_QUALITY_INDEX_PROFILE_

Wanaque River

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Wanaque River at Wanaque	AVG WQI	1	3	4	4	6	3	0	6	3 Excellent
	WORST3 MONTHS	July-Sept	May-July	Jan-March	Sept-Nov	April-June	Feb-April	July-Sept	Sept-Nov	4 Excellent Sept-Nov

LEGEND - Water_Quality_Index_Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts, water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: WANAQUE RIVER**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
American Candle Co. Inc.	0029769	Passaic Trib.	Wanaque Boro/Passaic	Ind./Comm.
Arrow Group Ind., Inc.	0001317	Post Brook	Wanaque Boro/Passaic	Ind./Comm.
Solar Prod.	0029947	Wanaque River	Pomton Lks Boro/Pass.	Ind./Comm.
National Beryllia Precision	0025470	Post Brook	Wanaque Boro/Passaic	Thermal
West Milford Twp. MUA	0027669	Wanaque River	West Milford/Passaic	Municipal
Wanaque Valley RSA/WTP	0053759	Wanaque River	Ringwood Boro/Pass.	Municipal
Ringwood Plaza STP	0032395	Wanaque River	Ringwood Boro/Pass.	Municipal
Ringwood Acres Treatment	0027006	High Mt.Brook	Ringwood Boro/Pass.	Municipal
Robert Erskine School	0029432	Erskine Brook	Ringwood Boro/Pass.	Municipal
Peter Cooper School	0034169	High Mt. Brook	Ringwood Boro/Pass.	Municipal
Marshall Hill School	0033308	Greenwood Lake	West Milford/Passaic	Municipal

35. RAMAPO AND POMPTON RIVERS

Watershed Description

The Ramapo River has a drainage area of about 160 square miles, 110 of which are in New York State. It flows from New York into Bergen County and enters the Pequannock River to form the Pompton River in Wayne Township. The Ramapo River is 15 miles long in New Jersey. The Pompton River is a tributary to the Passaic River and is 7 miles long. Major impoundments include Point View Reservoir #1, Pompton Lake and Pines Lake. The population centers are Mahwah, Pompton Lakes, Pompton Plains, Oakland, and Franklin Lakes.

Over one-half of this watershed is undeveloped, with the remainder being primarily suburban/commericial/industrial. New development is extensive in many areas of the watershed. There are 24 NJPDES permitted discharges present in the two watersheds, 17 of which are municipal and 7 are industrial. Waters have been rated FW-2 Trout Production and FW-2 Nontrout.

Water Quality Assessment

The Ramapo and Pompton Rivers each have one ambient monitoring station . The Ramapo River is sampled at Mahwah, and the Pompton River is monitored at Packanack Lake. Results of this monitoring finds that the Pompton River has good conditions while the Ramapo River contains fair quality waters.

The Ramapo River is afflicted with moderately excessive fecal coliform and nutrient concentrations. Fecal coliform exceeded State criterion in 70 percent of all samples, and had a geometric mean of 586 MPN/100ml. High concentrations of total phosphorus are also found. Total phosphorus averaged .20 mg/l from 1983 to 1987 with 78 percent above the recommended criterion of .1 mg/l. Total inorganic nitrogen was found to be high in 10 percent of the samples collected. Although dissolved oxygen concentrations were above criterion in all measurements, when analyzed as percent saturation it was occasionally below 80 percent. Biochemical oxygen demand appears to periodically be greater than 4.0 mg/l. Conditions in the Ramapo River degrade somewhat during late summer/early fall.

In the Pompton River conditions are better. Good quality waters from the Pequannock and Wanaque Rivers appear to be maintained in the Pompton River. Although lower than the Ramapo River, the Pompton River contains moderate bacterial and nutrient concentrations. Total phosphorus was elevated in 66 percent of the samples, and averaged .19 mg/l. Total inorganic nitrogen is occasionally high, averaging 1.3 mg/l. Fecal coliform had a geometric mean of 143 MPN/100ml during the period of review, with 44 percent greater than the 200 MPN/100ml criterion. The Pompton River also suffers from low dissolved oxygen saturation during summer months. During this period saturation is usually less than 80 percent. BOD concentrations are somewhat elevated in low flow periods. One elevated cadmium concentration was found in the Pompton River during the period of review. Pompton Lake is reported to be receiving contaminants from Acid Brook.

The Ramapo River is evaluated by the New Jersey Division of Fish, Game and Wildlife as supporting a healthy warm water fish community. The Masonicus Brook, a Ramapo River tributary, is judged to be containing a moderately degraded warm water fishery. The Pompton River supports both cold and warm water fish forms, yet these populations are believed to be moderately degraded.

Problem and Goal Assessment

Point Source Assessment

The Ramapo and Pompton Rivers have water quality problems that are due to both point and nonpoint sources. The Ramapo has a significant discharge to it in New York State before it flows into New Jersey. Fish kills are thought to have resulted at times because of the discharge. Downstream, Oakland Boro continues to be a problem, requiring centralized treatment to correct on-site system problems. Pompton Lakes Borough MUA STP is under Department enforcement action for discharging inadequately treated wastewater into the Ramapo. Along the Pompton River a number of municipal dischargers have been either upgraded or eliminated. Most recently reported are improvements to the Ringwood Shopping Plaza STP located in Ringwood Boro which have allowed this plant to meet effluent limitations and thus improve the quality of Skyline Lake into which it discharges. Three facilities were reported to be under Department enforcement action for violating discharge permits: Sheffield Hills STP in Wayne Twp., Laurel Homes STP in Pequannock Twp., and Plains Plaza Shopping Center STP, also in Pequannock Twp.

Nonpoint Source Assessment

Moderate, yet increasing levels of suburban/urban development along the length of the Ramapo River have resulted in both a loss of habitat for biota and an apparent decline in water quality from siltation and elevated stream temperatures. Runoff from housing and road construction sites, especially the construction of Interstate 287, combined with runoff from urban surfaces and storm sewers, have contributed significantly to pollution in the waterways. Habitat loss in this river has been expanded and intensified by local dredging and channelization. The fisheries in the Ramapo are also considered threatened by agricultural activity in the watershed.

Urban development has resulted in water quality degradation in the Pompton River. Increasing levels of runoff from construction activity, urban surfaces, storm sewers, and surface mining, together with dredging and the removal of riparian vegetation have contributed to silt and nutrient loading, elevated stream temperatures, and flooding. The fish community in the Pompton has been reduced to species tolerant of degraded conditions; few game fish are present and species diversity is low in many areas of the river.

Designated Use and Goal Assessment

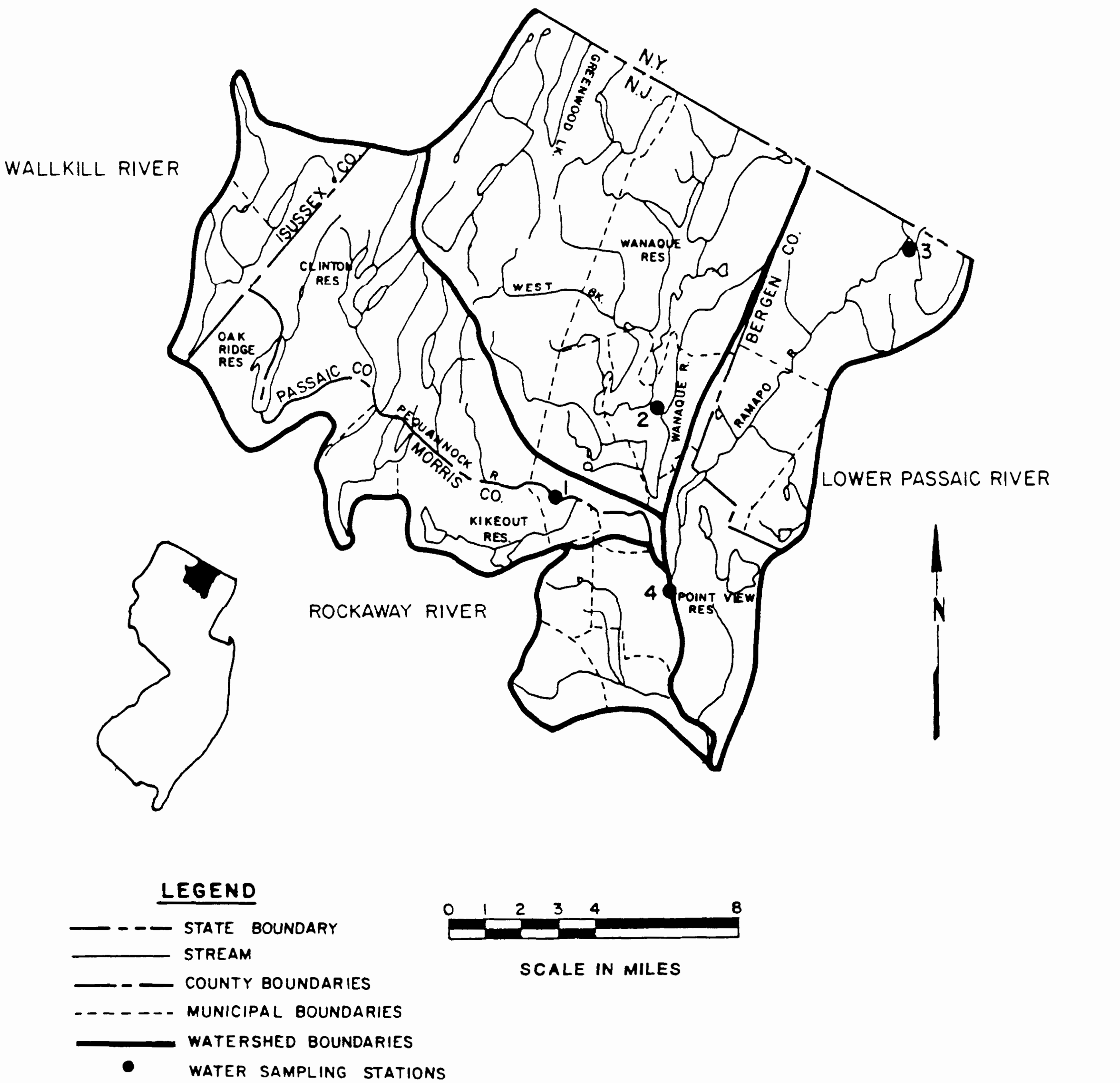
The Ramapo River will meet the fish propagation and maintenance designated use, but the waterway's fisheries are threatened by agricultural pollution. The Pompton River will partially meet this designated use because of moderately degraded fisheries. Both rivers are not of swimmable quality due to elevated fecal coliform levels.

Monitoring Station List

Map Number	Station Name and Classification
3	Ramapo River near Mahwah, FW-2 Nontrout
4	Pompton River at Packanack Lake, FW-2 Nontrout

POMPTON, PEQUANNOCK, RAMAPO AND WANAQUE RIVERS

NEW JERSEY STATE WATER QUALITY INVENTORY REPORT



WATER_QUALITY_INDEX_PROFILE

Ramapo And Pompton Rivers

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Ramapo R Near Mahwah	AVG WQI	2	10	5	42	24	9	8	6	32 Fair
	WORST3 MONTHS	July-Sept	August-Oct	Jan-March	July-Sept	August-Oct	Dec-Feb	Jan-March	May-July	42 Fair Aug-Oct
Pompton R Packanack Lake	AVG WQI	2	12	2	24	22	7	6	9	20 Good
	WORST3 MONTHS	June-August	July-Sept	Sept-Nov	Sept-Nov	August-Oct	August-Oct	August-Oct	Sept-Nov	32 Fair Aug-Oct

LEGEND - Water_Quality_Index_Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts; water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY — WATERSHED: POMPTON AND RAMAPO RIVERS

DISCHARGER NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Oak Knolls-Oakland Boro	0027774	Unnamed Trib. to Ramapo River	Oakland Boro/Bergen	Municipal
E.I. DuPont De Nemours	0001350	Pompton Lake	Pmptn. Lk. Boro/Pass	Ind./Comm.
Franklin Lakes STP	0021946	Ramapo River	Mahwah Twp./Bergen	Municipal
Mahwah Twp.-Blue Hills Dev.	0023906	Ramapo River	Mahwah Twp./Bergen	Municipal
Gem Car Wash	0030139	Ramapo River	Wayne Twp./Passaic	Ind./Comm.
Manito Sch. Bd. of Ed.	0030384	Ramapo River	Oakland Boro/Bergen	Municipal
Ramapo-Indian Hills Reg. H.S.	0021253	Crystal Brook	Franklin Lks. Boro/ Bergen	Municipal
Ramapo St. College STP	0024082	Ramapo River	Mahwah Twp./Bergen	Municipal
Riverdale Plastics Inc.	0030074	Passaic River Trib.	Riverdale Boro/Morris	Ind./Comm.
Pompton Lakes Borough MUA	0023698	Pompton River	Pompton Lks Boro/Pass.	Municipal
Sheffield Hills Plt.	0026841	Pompton River	Wayne Twp./Passaic	Municipal
Pequannock Twp.-Plains Plaza	0026514	Pompton River	Pequannock Twp/Morris	Ind./Comm.
Pequannock Twp.-Laurel Homes	0022926	Pompton River	Pequannock Twp/Morris	Municipal
Tri Corner Realty Corp.	0021245	Ramapo River	Franklin Lakes/Bergen	Municipal
Urban Farms Shopping CTR	0026441	Pond Brook	Franklin Lakes/Bergen	Municipal
Ramapo Hills Bd. of Ed.	0021253	Crystal Creek	Oakland/Bergen	Municipal
Oakland Care Center	0029858	Ramapo River	Oakland/Bergen	Municipal
Oakland, Borough of	0021342	Ramapo River	Oakland/Bergen	Municipal
Dewey Electronic Corp.	0052299	Ramapo River	Oakland/Bergen	Thermal
Oakland Boro-Chapel Hill Est.	0053112	Trib of Ramapo	Oakland/Bergen	Municipal
Oakland Town Houses	0061981	Trib of Ramapo	Oakland/Bergen	Municipal
Wayne, Township of	0026841	Pompton River	Wayne/Passaic	Municipal
MBA Printed Circuits Inc.	0029653	Pompton River	Wayne/Passaic	Municipal
Clifton Adhesive Inc.	0029971	Burgess Place	Wayne/Passaic	Ind
American Cyanamid Co.	0032778	Point View Res	Wayne/Passaic	Ind
Pequannock LP & Fair FLDS		Pompton River	Lincoln Park/Morris	Mun/Ind

36. LOWER PASSAIC RIVER

Watershed Description

The Lower Passaic River is considered in this report to be that section from the Pompton River confluence downstream to Newark Bay. This 33 mile section includes parts of Bergen, Hudson, Passaic and Essex Counties. Major tributaries include the Saddle River, Preakness Brook, Second River, and the Third River. The Lower Passaic River contains a number of falls, culminating with the Great Falls at Paterson. There is one small dam on the river near Newark named Dundee Dam. This is a densely populated area including the major cities of Newark, Paterson, Clifton, and East Orange. Sub-watersheds include the Mid-Passaic River from the confluence of the Pompton River to the confluence of the Saddle River, Saddle River, and the Lower Passaic River.

The predominate land use in this watershed is extensive development with many older cities and industries present. There is little open space except in the Upper Saddle River Watershed. Of the 119 NJPDES permitted discharges identified, 100 are industrial/commercial and 19 are municipal. The waters of the Lower Passaic River and its tributaries are classified FW-2 Trout Production, FW-2 Trout Maintenance (in the Saddle River watershed), FW-2 Nontrout, SE-2 and SE-3.

Water Quality Assessment

The Lower Passaic River, including the Saddle River, flows through a densely populated, urbanized and industrialized region. As a result, water quality conditions in the region's surface waters are reflective of numerous point sources, significant non-point source contributions and high sediment oxygen demands. Ambient monitoring of the Lower Passaic is performed at Little Falls, Singac and Elmwood Park. The Saddle River is monitored at Fair Lawn and Lodi.

Water quality in the Lower Passaic River from 1983 to 1987 varied from fair quality at Singac to good quality at Little Falls and poor quality at Elmwood Park. The improvements in river quality at Little Falls is likely due to instream reaeration caused by a number of small falls in the river. Problems in the river include excessive fecal coliform, in-stream oxygen demand and nutrient concentrations. All three Passaic River monitoring stations had total phosphorus averaging from .36 to .44 mg/l, with nearly all samples containing excessive amounts. Total inorganic nitrogen was also high; averaging around 2.5 mg/l at the three locations. At Singac the Passaic also contained occasionally high total Kjeldahl nitrogen, as 26 percent of the values were greater than 2.5 mg/l. Un-ionized ammonia is elevated in the Passaic River at Little Falls during low-flow periods. This nutrient enrichment is reflected in the macroinvertebrate and periphyton communities. Biological monitoring at Singac revealed a invertebrate community dominated by pollution tolerant organisms, while intolerant forms comprised a minute percentage of the overall community.

Fecal coliform concentrations varied widely at the Lower Passaic stations. Geometric means ranged from 40 MPN/100ml at Little Falls to 2710 MPN/100 ml at Elmwood Park. Exceedence of the 200 MPN/100ml criterion occurred in 61, 40 and 92 percent of the samples collected at Singac, Little Falls, and Elmwood Park, respectively. Dissolved oxygen concentrations were above the 4.0 mg/l standard in all measurements from the Lower Passaic. Dissolved oxygen saturation periodically falls below 80 percent at all three locations. Biochemical oxygen demand occasionally approaches 10 mg/l in the Lower Passaic. Conditions are poorest in the river during low-flow periods.

Water quality of the Saddle River is degraded because of extremely high nutrients, and moderately elevated fecal coliform and biochemical oxygen demand. Total phosphorus averaged 1.3 and .87 mg/l at Fair Lawn and Lodi, respectively, from 1983 to 1987. Practically all samples contained total phosphorus in excess of State criterion. Total inorganic nitrogen and total Kjeldahl nitrogen are found at very high concentrations. Total inorganic nitrogen averaged 6.6 mg/l at Fair Lawn and 5.4 mg/l at Lodi. Total Kjeldahl nitrogen had a mean of 4.6 mg/l at Fair Lawn and 3.4 mg/l at Lodi. Un-ionized ammonia appears high in the Saddle River during late spring, often exceeding State criterion for the protection of a warm-water fishery.

Fecal coliform are found in moderate amounts in the Saddle River, although concentrations are higher at Lodi. Geometric means of 640 and 955 MPN/100 ml have been recorded at Fair Lawn and Lodi, respectively. These counts are significantly higher than those recorded earlier this decade. Dissolved oxygen occasionally falls below 4.0 mg/l at Lodi, but appears sufficient at Fair Lawn. Conditions in the Saddle River are poor at Fair Lawn overall and very poor during late spring-early summer. At Lodi conditions are similar, but poorest quality occurs from August to October during the low flow period.

The warm water fish community of the Passaic River between Little Falls and Garfield has been evaluated by the New Jersey Division of Fish, Game and Wildlife as being moderately degraded, an improvement compared to the more degraded conditions upstream between Livingston and Little Falls. The Passaic River below

Garfield is judged to be in a degraded condition, supporting a fish community dominated by carp and goldfish. Occasional fish kills are also reported here. Second River and Deepvaal Brook, tributaries to the Passaic River, and Verona Lake in Verona are all evaluated as supporting a degraded warm water fishery. Notch Brook in Little Falls is assessed as severely degraded with no aquatic life evident.

Problem and Goal Assessment

Point Source Assessment

The Lower Passaic River from the Pompton River to the Dundee Dam is severely affected by point sources which overload the assimilative capacity of the river. The Passaic River is highly enriched and suffers from excessive nutrients and oxygen demand. Below Dundee Dam the Passaic River is tidal and impacted by point and nonpoint sources, and by boundary conditions. The large number of point sources discharging to the river reflects the complexity of water quality management for the Passaic River. A number of enforcement actions are directed by the Department at discharges in the Lower Passaic. As of 1988, 21 are having impacts on surface water quality (15 to the Passaic River and tributaries, and 6 to the Saddle River and tributaries). A number of municipal treatment facilities have been eliminated or upgraded recently. Included are the upgraded and enlarged Wayne Township STP, and a number of North Haledon Boro plants that were discontinued. Combined sewer overflows are present in the Newark and Bayonne areas, affecting both the Passaic River and Newark Bay.

The Saddle River is suspected of being primarily impacted by urban/suburban runoff, although point sources do exist in the watershed. Six enforcement actions are underway against discharges to the Saddle River that are affecting surface water quality. The very high nutrients levels, especially nitrogen-compounds, are cause for concern and should be studied further.

A number of hazardous waste sites and contamination problems are found in the Lower Passaic and Saddle River watersheds, including Newark Bay. Those sites that are affecting water quality are chromium disposal sites in Jersey City (to Newark Bay), the Wayne Township Landfill (volatile organics and metals to a small pond), the Ottilio Landfill in Newark (base neutrals, volatile organics and metals) and the Diamond Alkali/Shamrock Corporation site along the Passaic River in Newark. This site is suspected of contributing dioxin and other chemicals to the waterway, sediments and aquatic life.

Nonpoint Source Assessment

The Lower Passaic River suffers water quality degradation and habitat destruction from the consequences of extensive urban/suburban runoff, road and building construction activities, waste storage leaks, riparian vegetation removal, and stream channel modifications. It is suspected by local authorities that a proposed flood control project planned for the Lower Passaic will have additional adverse impacts on the already stressed aquatic life in the river.

In the Passaic River, downstream of Garfield, the degrading impacts of urbanization increase to severe levels. In addition to those urban sources listed in the preceding paragraph, the lower reaches also receive chemical spills and leachate from contaminated soils. Severe degradation from urban runoff, construction, and streambank modification is also evident in many of the tributaries to the Passaic in the lower watershed. Many of these streams are so severely degraded that they are reported to be unable to support any form of aquatic life.

Designated Use and Goal Assessment

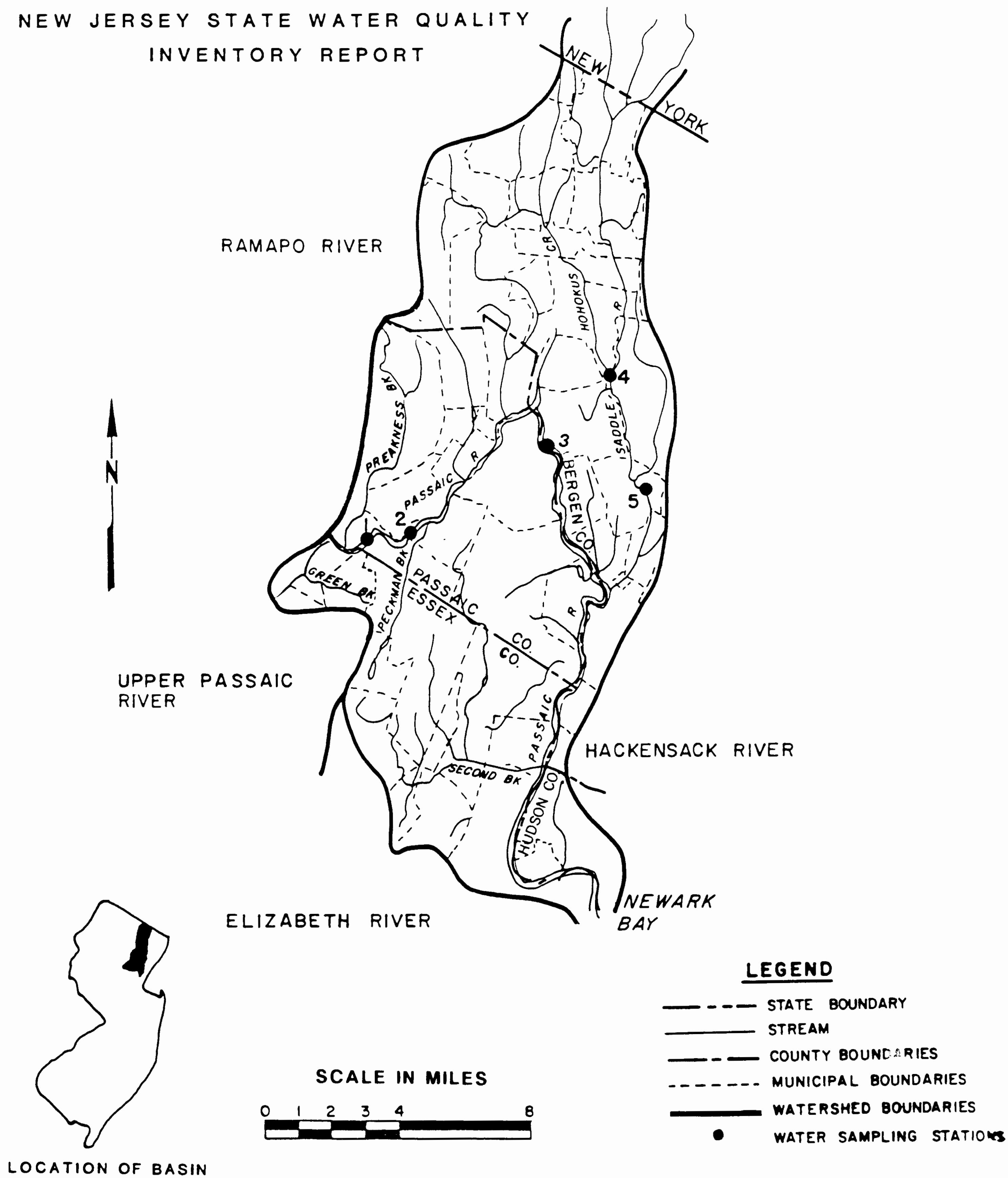
The waters of the Lower Passaic River and Saddle River will not achieve the swimmable designated use and goal. The Passaic River from the Pompton River to Little Falls will not meet the fish propagation/maintenance use and goal because of degraded fisheries. The river from Little Falls to Garfield will partially meet this use and goal. The tidal Passaic River will not meet water quality criteria for the designated uses assigned to SE-2 and 3 waters. This tidal reach of the Passaic River as well as Newark Bay are closed to commercial and recreational fishing and shellfishing (crabbing) because of aquatic life contamination with chlordane, PCBs and dioxin. As such, the tidal Passaic River will not meet the fish propagation and maintenance goal. Lack of water quality data in the tidal Passaic River prevents determination of designated use attainment for fish maintenance in SE-3 waters. The Saddle River is partially meeting the fish propagation/ maintenance use because of the presence of elevated un-ionized ammonia. Other, smaller tributaries to the Passaic River (Deepvaal Brook, Second River and Notch Brook) have been assessed as not achieving this use because of degraded fisheries.

Monitoring Station List

Map Number	Station Name and Classification
1	Passaic River at Singac, FW-2 Nontrout
2	Passaic River at Little Falls, FW-2 Nontrout
3	Passaic River at Elmwood Park, FW-2 Nontrout
4	Saddle River at Fair Lawn, FW-2 Nontrout
5	Saddle River at Lodi, FW-2 Nontrout

LOWER PASSAIC RIVER

NEW JERSEY STATE WATER QUALITY INVENTORY REPORT



WATER QUALITY INDEX PROFILE

Lower Passaic River

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Passaic R at Singac	AVG WQI	3	8	5	29	35	9	8	14	31 Fair
	WORST3 MONTHS	June-August	Oct-Dec	Nov-Jan	Oct-Dec	May-July	May-July	May-July	August-Oct	44 Fair Oct Dec
Passaic R Little Falls	AVG WQI	3	10	4	12	34	9	13	9	23 Good
	WORST3 MONTHS	June-August	Nov-Jan	July-Sept	April-June	June-August	August-October	July-Sept	August-Oct	38 Fair July Sept
Passaic R at Elmwood Park	AVG WQI	4	15	8	61	39	9	5	21	59 Fair
	WORST3 MONTHS	June-August	May-July	May-July	Sept-Nov	Oct-Dec	Nov-Jan	Nov-Jan	Nov-Jan	72 Poor Oct-Dec
Saddle River At Fair Lawn	AVG WQI	3	18	3	39	76	15	21	8	68 Poor
	WORST3 MONTHS	June-August	May-July	Nov-Jan	May-July	Nov-Jan	Dec-Feb	May-July	August-Oct	83Very Poor May-July
Saddle River at Lodi	AVG WQI	3	36	2	44	64	15	17	10	70 Poor
	WORST3 MONTHS	June-August	May-July	Nov-Jan	August-Oct	July-Sept	Dec-Feb	May-July	April-June	98Very Poor Aug-Oct

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts, water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria

N.J.P.D.E.S. DISCHARGE INVENTORY

WATERSHED: LOWER PASSAIC RIVER

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Patterson, City of	0021971	Passaic River	Newark/Essex	Municipal
Macarthur Petrol. & Solvent	0027898	Passaic River	Newark/Essex	Municipal
Kuzmik Mfg Co	0030121	Peckman River	Newark/Essex	Ind/Thm/SW
Essex Industrial Chemical Inc	0002283	Passaic River	Newark/Essex	Ind/Comm
Peerless Tube Co Inc	0029327	Wigwam Brook	Bloomfield/Essex	Thermal
Peerless Tube Co Inc	0029335	Wigwam Brook	Bloomfield/Essex	Thm/SW
The Lummus Co Eng Develop	0052078	Third River	Bloomfield/Essex	Ind
Dresser Pump Division	0036048	Second River	Essex County	Thermal
Orange DPW, City of	0025925	Wigwam Brook	Orange/Essex	Municipal
ITT	0020435	Passaic River	Nutley/Essex	Ind/Comm
Eastern Molding Co Inc	0029319	Passaic River	Belleville/Essex	Ind/Comm
General Plastics Corp	0029173	Passaic River	Bloomfield/Essex	Ind/Comm
Q Petroleum, Inc	0028185	Passaic River	Newark/Essex	Ind/Comm
Franklin Plastics Corp	0002194	Passaic River	Kearny/Hudson	Ind/Comm
Pantasote Co of NY	0020478	Weasel Brook	Passaic/Passaic	Ind/Comm
Garden St. Paper Corp	0000370	Passaic River	Garfield/Bergen	Ind/Comm
Kalama Cem Inc	0000124	Saddle Brook	Wallington/Bergen	Ind/Comm
Farmland Dairies	0033511	Saddle Brook	Wallington/Bergen	Ind/Comm
Hearthstone at Mahwah	0023931	Saddle Brook	Mahwah/Bergen	Municipal
Apple Ridge C.C.	0028827	Saddle Brook	Mahwah/Bergen	Ind/Comm
CM & Son Trucking Inc	0029726	Smokisvoll Brook	Allendale/Bergen	Ind/Comm
Ridgewood Village STP	0024791	Hohokus Brook	Ridgewood/Bergen	Municipal
IBM Corp	0033987	Sprout Brook	Paramus/Bergen	Ind/Comm
Thermo Electric	0029441	Passaic River	Saddle Bk/Bergen	Ind/Comm
PSE&G Essex Station	0000639	Passaic River	Newark/Essex	Ind/Comm
Haledon Borough WD	0003964	Molly Ann Brook	North Haledon/Pass	Municipal
JL Prescott Co	0002232	Passaic River	Passaic/Passaic	Ind/Comm

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: LOWER PASSAIC RIVER**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
PSE&G Harrison Gas	0005066	Passaic River	Harrison/Hudson	Ind/Comm
Passaic Valley Water Comm	0025607	Passaic River	Totowa/Passaic	Municipal
Inmount Corp	0002453	Passaic River	Hawthorne/Passaic	Ind/Comm
Pan Chem Co	0030031	Passaic River	Hawthorne/Passaic	Ind/Comm
Pope Chem Co	0027219	Passaic River	Paterson/Passaic	Ind/Comm
Singer Co Kearfott Div	0030902	Passaic River	Fairfield/Essex	Ind/Comm
Fairmount Chem Co Inc	0033430	Passaic River	Newark/Essex	Ind/Comm
Sandoz, Inc	0001147	Passaic River	Fairlawn/Bergen	Ind/Comm
Curtis-Wright Corp	0002976	Deepavaal Brook	Fairfield/Essex	Ind/Comm
Rexon Corp-Air Spec Div	0030112	Passaic River	Fairfield/Essex	Ind/Comm
Unimatic Mfg Corp	0031003	Trib to Passaic	Fairfield/Essex	Ind/Comm
No W Bergen Co SA	0024813	Hohocus Brook	Waldwick/Bergen	Municipal
GAF Corp- Adm. & Res. Ctr	0028291	Passaic River	Wayne/Passaic	Ind/Comm
IBM OPD Trmt Plt Fac	0020109	W. Br. Hohocus Brk.	Franklin Lks/Bergen	Ind/Comm
Getty Term Corp	0026034	Passaic River	Newark/Essex	Ind/Comm
Sun Oil Co Newark	0002771	Passaic River	Newark/Essex	Ind/Comm
Essex Chem	0002283	Passaic River	Newark/Essex	Ind/Comm
Shulton Inc	0001287	Weasel Brook	Clifton/Passaic	Thermal
Miles Lab Inc	0022608	Passaic River	Clifton/Passaic	Thermal
Heller Heat Treating Comp	0027430	Passaic River	Clifton/Passaic	Thermal
Hawthorne, Borough of	0024767	Passaic River	Hawthorne/Passaic	Municipal
PF Laboratories Inc	0035572	Passaic River	Passaic/Passaic	Thermalt
Tilcon Quarry	0020486	Passaic River	Paterson/Passaic	Thm/Ind

N.J.P.D.E.S. DISCHARGE INVENTORY — WATERSHED: LOWER PASSAIC RIVER

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Stepan Chemical Co	0003182	Lodi Brook	Maywood/Passaic	Thermal
Ramsey Auto Imports	0033634	Ramsey Brook	Ramsey/Passaic	Industrial
Millbrook Farms Inc	0025682	Saddle River	Upper Saddle River	Municipal
International Wire	0098469	Hohokus Brook	Wyckoff/Passaic	Industrial
H & N Chemical Co	0031623	Passaic River	Totowa/Passaic	Thermal
Ungerer & Co	0034444	Passaic River	Totowa/Passaic	Thermal
GAF Corp	0028291	Passaic River	Wayne/Passaic	Industrial
Rexon Techn	0030104	Passaic River	Wayne/Passaic	Thermal
Carsow Corp	0034053	Passaic River	Wayne/Passaic	Thermal
Okonite Comp	0002615	Weasal Brook	Passaic/Passaic	Industrial
Hoffman-LaRoche	0052337	Singac Brook		Thermal
Little Falls, Township of	0024732	Peckman River	Little Falls/Passaic	Municipal
Schmid Products Co	0034941	Peckman River	Passaic/Passaic	Industrial
Hercules Inc	0033600	Passaic River	Passaic/Passaic	Ind/Storm
North Jersey Dev Center	0021261	Natchunk	Totowa/Passaic	Municipal
Wayne, Township of	0028002	Singac Brook	Wayne/Passaic	Municipal
Jersey Specialty Co Inc	0031739	Storm Sewer To Pass	Wayne/Passaic	Industrial
Sandoz Pharmaceuticals Corp	0001155	Black Brook	Glen Gardner/Hunt	Ind/Thm/Sw
Interstate Route 280	0034959	Franks Creek	Kearny/Hudson	Ind/Thm/SW
Mobay Chemical Corp	0003174	Mollyann Brook	Haledon/Passaic	Industrial
Charlotteburg Water Trmt	0069582	Pequannock River	Newflnd/Passaic	Industrial

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: LOWER PASSAIC RIVER**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Union Camp Corp	0031801	Passaic River	Wayne Twp/Passaic	Ind/Comm
Caldwell Borough	0020427	Passaic River	Caldwell/Essex	Municipal
Fritzsche Dodge & Olcott	0001651	Passaic River	East Hanover/Morris	Ind/Comm
T-Fal	0030694	Deepavaal Brook	Fairfield/Essex	Ind/Comm
Precise Rubber Mfg	0030210	Trib to Passaic R	Fairfield/Essex	Ind/Comm
Pollution Ctrl Ind Inc	0028096	Trib to Passaic R	W. Caldwell/Essex	Ind/Comm
Resistoflex Corp	0029955	Passaic River	Roseland/Essex	Ind/Comm
M. Polander & Son, Inc	0003743	Fullertons Brook	Roseland/Essex	Ind/Comm
Servometer Corp	0027847	Peckman River	Cedar Grove/Essex	Ind/Comm
Cedar Grove Twp STP	0025330	Peckman River	Cedar Grove/Essex	Municipal
Essex Co Hosp Center	0021687	Peckman River	Cedar Grove/Essex	Municipal
Verona Boro STP	0024490	Peckman River	Verona/Essex	Municipal
National Starch & Chemical	0003760	Yantacaw River	Bloomfield/Essex	Ind/Comm
National Standard Corp	0000035	Weasel Brook	Clifton/Passaic	Ind/Comm
Clifton Ent. WC	0034932	Weasel Brook	Clifton/Passaic	Ind/Comm
Stone Ind	0001589	Molly Ann Brook	Haledon/Passaic	Ind/Comm
Mycalex	0029114	Passaic River	Passaic/Passaic	Ind/Comm

N.J.P.D.E.S. DISCHARGE INVENTORY — WATERSHED: LOWER PASSAIC RIVER,Continued

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Mona Industries	0035009	Passaic River	Paterson/Passaic	Industrial
US Tempering Glass Comp Inc	0052949	Saddle River		Thermal
Marcel Paper Mills Inc	0002674	Passaic River	East Paterson/Passa	Industrial
Ken Manufacturing Co Inc	0000906	Passaic River	Fairlawn/Passaic	Thermal
Nabisco Inc	0002577	Henderson Brook	Fairlawn/Passaic	Ind/Therm
Unified Data Products	0034738	Passaic River	Fairlawn/Passaic	Ther/Ind/SW
Powertech, Inc.	0071803	Passaic River	Fairlawn/Passaic	Ind./Comm.
FCM Inc	0035459	Passaic River	Garfield/Passaic	Thermal
Home Fuel Oil Comp	0027910	Diamond Brook	Glen Rock Boro	Ind/Storm
Bergen Cable Techn	0035262	Lodi Brook	Lodi	Thermal
Phillips Electronic Instruct	0033235	Masonicus Creek	Mahwah	Industrial
Interstate Motor Plaza	0098485	Masonicus Creek	Mahwah	Thermal
Amerace Corporation	0072605	Passaic Creek	Livingston Twp/Essex	Ind./Comm

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: LOWER PASSAIC RIVER,Continued**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Duro Test Corp	0029815	McDonalds Brook	Clifton/Passaic	Ind/Comm
Hoffman LaRoche Inc	0034185	St. Pauls Brook	Nutley/Essex	Ind/Comm
ITT-Avionics	0020214	Passaic River	Nutley/Essex	Ind/Comm
Henkel Process Cem	0002801	Passaic River	Harrison/Hudson	Thermal
Tenneco Oil Corp	0031348	Passaic River	Harrison/Hudson	Ind/Oil/WS
BASF Corp Chem Div	0001112	Passaic River	Kearny/Hudson	Industrial
Western Electric Works	0020443	Passaic River	Kearny/Hudson	Ind/Thermal
Clara Maass Memorial Hospit	0032280	Passaic River	Belleville/Essex	Mun/Ind
Mansol Ceramics Corp	0034193	Passaic River	Belleville/Essex	Industrial
Mansol Ceramics Comp	0034223	Passaic River	Belleville/Essex	Industrial
Esgraph Incorporated	0034428	Deepavaal Brook	Fairfield/Essex	Industrial
Borough of Totowa	0022080	Tributary to Passaic	Totowa/Passaic	Municipal
Newark, City of	0024724	Passaic River	Newark/Essex	Municipal
Broe WN Bovert-Recoma Inc	0035424	Passaic River	Fairfield/Essex	Industrial

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: LOWER PASSAIC RIVER Continued**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
River Oil Term., Inc	0027901	Passaic River	Passaic/Passaic	Ind/Comm
Custom Chem Corp	0033146	Fleischers Brook	Paterson/Passaic	Ind/Comm
West Patterson Boro STP	0022098	Passaic River	W. Paterson/Passaic	Ind/Comm
Singer Co Kearfott Div	0021288	Passaic River	W. Paterson/Passaic	Ind/Comm
Singer Co Kearfott Div	0021270	Passaic River	W. Paterson/Passaic	Ind/Comm
Totowa-Riverview STP	0022071	Passaic River	Totowa/Passaic	Municipal
ATI Chem Spray Div	0029571	Passaic River	Totowa/Passaic	Ind/Comm

37. HACKENSACK RIVER

Watershed Description

The Hackensack River drains an area of 202 square miles, which includes parts of Hudson and Bergen Counties. The Hackensack originates in New York State and flows south to Newark Bay. The river is 31 miles long in New Jersey. Major tributaries include the Pascack Creek, Berry's Creek, Overpeck Creek, and Wolf Creek. The major impoundments on this river are Oradell Reservoir, Lake Tappan, and Woodcliff Reservoir. This region of the State is very populated; major cities being Paramus, Bergenfield, Secaucus, Hackensack, Fort Lee, Jersey City and Englewood. Much of the Lower Hackensack watershed is tidal marshes known as the Hackensack Meadowlands.

About 50 percent of the land use in this watershed is undeveloped, with more than 30 percent being residential. The remainder is commercial/industrial. Of the approximately 78 NJPDES permitted discharges here, 67 are industrial/commercial and 9 are municipal. Waters in the Hackensack River and its tributaries have been classified as FW-2 Nontrout, FW-2 Trout Production (Creskill Brook), SE-1, SE-2 and SE-3.

Water Quality Assessment

The Hackensack River is routinely monitored at two locations: at River Vale and at New Milford. The New Milford station is directly downstream of the Oradell Reservoir dam. The Hackensack River has overall good quality waters at River Vale, and at New Milford.

Elevated total phosphorus and fecal coliform concentrations are present in the Hackensack River at River Vale. Fecal coliform had a geometric mean of 148 MPN/100ml from 1983 to 1987, with 37 percent of the values above State criterion. Total phosphorus averaged .21 mg/l during the period of review. Seventy-eight percent of the phosphorus readings were greater than the .05 mg/l criterion for prevention of eutrophication in impoundments. Dissolved oxygen concentrations are adequate throughout the year, although saturation often falls below 80 percent during the summer. Biochemical oxygen demand is for the most part under 4.0 mg/l. Conditions in the Hackensack at River Vale worsen significantly during the late summer months. Biological monitoring (macroinvertebrate and periphyton community analysis) has strongly reflect nutrient enrichment at this station.

Monitoring of the Hackensack River at New Milford reflects the condition of the Oradell Reservoir discharge, rather than true stream conditions. Pollutant concentrations tend to be reduced because of settling in the reservoir. This is why the Hackensack River can be considered good at this location. Both fecal coliform and nutrients are low, occurring at problematic levels in 30 and 38 percent respectively, of the samples collected. Dissolved oxygen concentrations were above 4.0 mg/l in all samples from 1983 to 1987. One elevated mercury concentration has been found in the Hackensack River during the period of review.

The Hackensack Meadowlands Development Commission has conducted an annual summer monitoring program of the tidal Hackensack River and tributaries since 1971. Cheng and Konsevick (In press) have summarized the results of monitoring from 1978 to 1987 for the mainstem tidal Hackensack River. Monitoring results show very low dissolved oxygen (less than 1.0 mg/l) in the river during summer months, along with high levels of biochemical oxygen demand, oil and grease, and fecal coliform. The 10 mile stretch of the river analyzed had no significant changes in water quality for selected indicators over the period reviewed. The river shows important differences between monitoring sites indicating that impacts do occur locally.

Fishery assessments by the NJ Division of Fish, Game and Wildlife were limited to the Cresskill River in the Upper Hackensack watershed and to Overpeck Creek, a tributary to the Lower Hackensack. Both are evaluated as supporting moderately degraded fish communities. The Cresskill contains cold water fish species while the Overpeck supports warm water forms.

Problem and Goal Assessment

Point Source Assessment

The Upper Hackensack River as monitored at River Vale and New Milford does not show severe water quality problems. However, in the lower tidal sections of the river, extremely high bacterial and nutrient levels are present, as well as reduced dissolved oxygen, and thermal pollution. A large number of industrial and municipal wastewater discharges are present in the lower watershed. Twenty-six dischargers in the watershed which are under enforcement action as of 1988, and are having deleterious impacts on stream water quality. Problems range from raw sewage bypasses, to illegal discharges and not meeting permit limitations. In addition, nonpoint pollution contributions from urbanized and industrial areas, landfills and sediment oxygen demand are also considered to be significant.

Seven hazardous waste or Superfund sites are found in the Hackensack watershed which are known or suspected to be contaminating local surface waters. In addition, extensive mercury contamination of Berry's Creek has occurred. Certain fish from the Lower Hackensack River have been identified to contain high PCBs and chlordane concentrations. As a result, the sale and consumption of striped bass and blue crabs is prohibited. Large thermal discharges in this area also have water quality impacts on the tidal Hackensack River by reducing the water's ability to hold dissolved oxygen.

Nonpoint Source Assessment

Water quality in the Hackensack River above the Oradell River appears to primarily be affected by nonpoint sources. Oradell Reservoir is highly eutrophic and the Hackensack Water Company occasionally treats the reservoir to kill aquatic weed growth. Nonpoint source pollutants include those brought about by extensive urban/suburban development, and by the land disposal of waste materials. The Upper Hackensack is reported to be impacted by runoff from construction activities, urban surfaces, storm and combined sewers, roads, and by landfill leachate. These sources have resulted in flooding, habitat destruction for biota, fish community degradation, reduced dissolved oxygen levels, excessive nutrients, and accelerated eutrophication. In the Lower Hackensack River the presence of these sources continues and their impacts become even more severe. Habitat destruction becomes more intense in the lower river due to riparian vegetation removal and flow regulation efforts. There are also severe impacts from chemical spills, local landfills, hazardous waste disposal sites, and inplace contaminants.

Designated Use and Goal Assessment

The Upper Hackensack River (above the Oradell Reservoir) will achieve the fish propagation and maintenance goal of the Clean Water Act and the State's designated use, but it is not of swimmable quality. In the tidal Hackensack, both the fishable and swimmable goals cannot be met. Based on the Hackensack Meadowland Development Commission's sampling of the tidal Hackensack and tributaries this region is not considered to be meeting the designated uses for SE-2 and SE-3 waters.

Monitoring Station List

Map Number	Station Name and Classification
1	Hackensack River at River Vale, FW-2 Nontrout
2	Hackensack River at New Milford, FW-2 Nontrout

a number of somewhat smaller bays, rivers, creeks and their tributaries. These include Shark River, Manasquan River, Metedeconk River, Toms River, Forked River, Oyster Creek, Manahawkin Bay, Little Egg Harbor, Cedar Run, Westecunk Creek, Tuckerton Creek, Big Thorofare, and Big Creek.

Fully open shellfish harvesting acreage constitutes 70-75 percent as of 1989 of the total available acreage in this basin. These areas are generally located in Barnegat Bay and Little Egg Harbor. This leaves 10-15 percent (1989) of the total available acreage Condemned, and 10-15 percent (1989) classified as Seasonally Approved. Under the Shellfish Relay Program, clams are removed from certain Condemned and Special Restricted waters of the Raritan River Basin as well as Manasquan and Shark Rivers and deposited in specified Approved waters in Barnegat Bay, Little Egg Harbor Bay in Tuckerton Cove, or Great Bay for purification.

Reclassification on the North Coastal Basin since 1985 include:

June 1985
Barnegat Bay (Applegate Cove): approximately 100 acres downgraded from Approved to Condemned

June 1986
Barnegat Bay (Potter Creek to Laurel Harbor) approximately 140 acres Seasonal to Approved and 33 acres Condemned to Approved

Manahawkin Bay: 180 acres Approved to Seasonal

Little Egg Harbor: 160 acres Approved to Seasonal

July 1987
Shark River: Prohibited to Special Restricted: 1180 acres

Barnegat Bay: north (off Swan Point) Seasonal to Special Restricted: 290 acres

Barnegat Bay (Barnegat Inlet Area): Approved to Special Restricted: 200 acres

May 1988
Little Egg Harbor: 15 acres Approved to Special Restricted

July 1988
Little Egg Harbor (Tuckerton Cove): 112 acres, Seasonal to Approved

WATER QUALITY INDEX PROFILE

Hackensack River

WATER QUALITY INDICATORS

STATION		TEMP	OXYGEN	PH	BACTERIA	NUTRIENTS	SOLIDS	AMMONIA	METALS	OVERALL AVERAGE AND CONDITION
Hackensack River At River Vale	AVG WQI	2	13	4	20	32	9	6	6	23 Good
	WORST3 MONTHS	July-Sept	August-Oct	March-May	August-Oct	July-Sept	Jan-March	July-Sept	Sept-Nov	40 Fair Aug-Oct
Hackensack River at New Milford	AVG WQI	4	9	8	17	17	9	1	17	15 Good
	WORST3 MONTHS	June-August	Nov-Jan	May-July	May-July	May-July	Jan-March	Nov-January	August-Oct	22 Good May-July

LEGEND - Water Quality Index Description

WQI	Condition	Description
0-10	Excellent	No or minimal pollution; water uses met throughout the year.
11-25	Good	Generally low amounts of pollution; water uses periodically not met.
26-60	Fair	Pollution amounts vary from moderate to high levels; certain water uses prohibited.
61-80	Poor	Pollution in high amounts, water uses not met.
81-100	Very Poor	Pollution occurs at extremely high levels; severe stress to stream life; water uses not met
ID	Insufficient Data	

An index of 20 is equivalent to the level of water quality criteria.

N.J.P.D.E.S. DISCHARGE INVENTORY	WATERSHED: HACKENSACK RIVER

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Hackensack Water-New Milford	0003310	Hackensack River	Ordell Boro/Bergen	Ind/Comm
Amerada Hess Corp.	0001414	Hackensack River	Bogota Boro/Bergen	Ind/Comm
Hoke, Inc.	0003786	Tenakill River	Cresskill Boro/Bergen	Ind/Comm
Texaco, Inc. (IASD)	0031194	Hackensack River	S. Hackensack/Bergen	Ind/Comm
Wood-Ridge SA	0021586	Berrys Creek	Wood-Ridge Boro/Ber	Mun.
Diamond Shamrock Corp.	0002798	Berrys Creek	Carlstadt/Bergen	Ind/Comm
Randolph Prod. Co.	0028991	Berrys Creek	Carlstadt/Bergen	Ind/Comm
Tech. Oil Prod.,Inc	0005754	Berrys Creek	Carlstadt/Bergen	Ind/Comm
Arsynco. Inc	0030970	Berrys Creek	Carlstadt/Bergen	Ind/Comm
Becton-Dickinson	0001074	Berrys Creek	E.Rutherford/Bergen	Ind/Comm
Matheson Gas Prod., Inc. Co	0002721	Ackermans Creek	E.Rutherford/Bergen	Ind/Comm
US Printing Ink Co	0003646	Berrys Creek	E.Rutherford/Bergen	Ind/Comm
Joint Mfg.	0022756	Berrys Creek	E.Rutherford/Bergen	Mun
NJ Sports & Expo Auth	0023345	Berrys Creek	E.Rutherford/Bergen	Mun/Storm
Howmedica, Inc.	0003468	Berrys Creek	Rutherford/Bergen	Ind/Comm
Penreco	0031607	Kingsland Creek	Lyndhurst Twp/Bergen	Ind/Comm
Sika Chem. Corp.	0002011	Berrys Creek	Lyndhurst/Bergen	Ind/Comm
Benedict-Miller, Inc	0001031	Hackensack River	Lyndhurst/Bergen	Ind/Comm
Secaucus Town STP	0025038	Miller Creek	Secaucus/Hudson	Mun
N. Arlington-Lyndhurst Jt. Mg	0025291	D. to Hackensack R.	N. Arlington/Bergen	Mun
Amerada Hess-Little Ferry	0001406	Hackensack River	Little Ferry/Bergen	Ind/Comm
Teterboro Airport	0028941	Berrys Creek	Teterboro/Bergen	Ind/Comm

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: HACKENSACK RIVER**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
PSE&G Kearny Generating	0000655	Hackensack River	Kearny/Hudson	Ind/Comm
Marzahl Chem Co	0000451	Hackensack River	Kearny/Hudson	Ind/Comm
Eastern of NJ, Inc	0031747	Hackensack River	Jersey City/Hudson	Ind/Comm
Kearny Town STP	0022161	Hackensack River	Kearny/Hudson	Ind/Comm
Degen Oil & Chem Co	0030791	Hackensack River	Jersey City/Hudson	Mun
Secaucus MUA Harts MT.	0032921	Hackensack River	Secaucus/Hudson	Ind/Comm
Gilbert Ind PK	0028584	Hackensack River	Secaucus/Hudson	Ind/Comm
Clipper Express Co. WWTP	0027251	Penhorn Creek	Jersey City/Hudson	Ind/Comm
PSE&G Hudson Generating Sta	0000647	Hackensack River	Jersey City/Hudson	Ind
Standard Chlorine Chem. Co.	0001856	Hackensack River	Kearny Town/Hudson	Ind/Comm
Spinnerin Yarn Co., Inc.	0002038	East Riser Ditch	S. Hackensack/Bergen	Ind/Comm.
Bendix Corp.	0002097	West Ditch	Teterboro/Bergen	Ind/Comm
General Auto. Spec. Co.	0030996	Hackensack River	Carlstadt Boro/Bergen	Thermal
PSE&G	0000574	Hackensack River	Jersey City/Hudson	Ind/Comm
Kleer Kast Inc.	0031313	Hackensack River	Kearny Town/Hudson	Ind/Comm
Owens-Corning Fiberglass	0035025	Hackensack River	Hudson County	Thermal
Amerada Hess Corp.	0001368	Hackensack River	Secaucus/Hudson	Industrial
Columbia Terminal Inc.	0025631	Hackensack River	South Kearny	Industrial
Meadowview Hospital	0023566	Hackensack River	Secaucus/Hudson	Municipal
Carlee Corporation	0050113	Sparkill Brook		Thermal
Inversand Company Sewell	0004146	Berrys Creek	Carlstadt/Bergen	Thermal
Cosan Chemical Corp	0032522	Berrys Creek	Carlstadt/Bergen	Industrial
Spear Packing Corp	0032590	Hackensack River	Carlstadt/Bergen	Thermal
Alfa Inc & Chemical Corp	0050300	Moonachie Creek	Carlstadt/Bergen	Thermal
Weyerhauser Company	0032620	Oradell Res	Closter/Bergen	Industrial
Chemed Corp- Dubois Div	0035769	Hackensack River	East Rutherford/Ber	Industrial
Hackensack City	0030805	Hackensack River	Hackensack/Bergen	Municipal
Classified Inc	0032603	Hackensack River	Hackensack/Bergen	Ind/Oil/Wse
Polycast Technology	0034819	West Rider	Hackensack/Bergen	Thermal
Atlas Plastics	0052736	Hackensack River	Little Ferry/Bergen	Thermal
Standard Tool & Mfg Co	0035131	Hackensack River	Lyndhurst/Bergen	Municipal
Hackensack Meadowlands	0053082	Hackensack River	Lyndhurst/Bergen	Municipal

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: HACKENSACK RIVER**

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Haward Corp	0023868	Saw Mill Creek	North Arlington/Ber	Ind/Thermal
Golding Mfg Inc	0028355	Hackensack River	North Arlington/Ber	Ind
Hackensack Meadowlands	0033448	Saw Mill Creek	North Arlington/Ber	Ind/Munic
Rose Holand Ouse Inc	0003808	Skeet Hill Creek	Ridgefield Park/Ber	Thermal
Stranahan Foil	0033375	Berrys Creek	South Hackensack/Ber	Thermal
Takasago Corp USA	0033669	Hackensack River	Teterboro/Bergen	SW/Thermal
Exxon Company USA	0055719	Lower Hackensack	Teterboro/Bergen	Ind
Teledyne Isotopes	0061808	Lower Hackensack	Westwood/Bergen	Ind
Rail Equipment Maintenance	0031992	Hackensack River	Kearny/Bergen	Ind

N.J.P.D.E.S. DISCHARGE INVENTORY			WATERSHED: HACKENSACK RIVER	
DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
PSE&G Kearny Generating	0000655	Hackensack River	Kearny/Hudson	Ind/Comm
Marzahl Chem Co	0000451	Hackensack River	Kearny/Hudson	Ind/Comm
Eastern of NJ, Inc	0031747	Hackensack River	Jersey City/Hudson	Ind/Comm
Kearny Town STP	0022161	Hackensack River	Kearny/Hudson	Ind/Comm
Degen Oil & Chem Co	0030791	Hackensack River	Jersey City/Hudson	Mun
Secaucus MUA Harts MT.	0032921	Hackensack River	Secaucus/Hudson	Ind/Comm
Gilbert Ind PK	0028584	Hackensack River	Secaucus/Hudson	Ind/Comm
Clipper Express Co. WWTP	0027251	Penhorn Creek	Jersey City/Hudson	Ind/Comm
PSE&G Hudson Generating Sta	0000647	Hackensack River	Jersey City/Hudson	Ind
Standard Chlorine Chem. Co.	0001856	Hackensack River	Kearny Town/Hudson	Ind/Comm
Spinnerin Yarn Co., Inc.	0002038	East Riser Ditch	S. Hackensack/Bergen	Ind/Comm.
Bendix Corp.	0002097	West Ditch	Teterboro/Bergen	Ind/Comm
General Auto. Spec. Co.	0030996	Hackensack River	Carlstadt Boro/Bergen	Thermal
PSE&G	0000574	Hackensack River	Jersey City/Hudson	Ind/Comm
Kleer Kast Inc.	0031313	Hackensack River	Kearny Town/Hudson	Ind/Comm
Owens-Corning Fiberglass	0035025	Hackensack River	Hudson County	Thermal
Amerada Hess Corp.	0001368	Hackensack River	Secaucus/Hudson	Industrial
Columbia Terminal Inc.	0025631	Hackensack River	South Kearny	Industrial
Meadowview Hospital	0023566	Hackensack River	Secaucus/Hudson	Municipal
Carlee Corporation	0050113	Sparkill Brook		Thermal
Inversand Company Sewell	0004146	Berrys Creek	Carlstadt/Bergen	Thermal
Cosan Chemical Corp	0032522	Berrys Creek	Carlstadt/Bergen	Industrial
Spear Packing Corp	0032590	Hackensack River	Carlstadt/Bergen	Thermal
Alfa Inc & Chemical Corp	0050300	Moonachie Creek	Carlstadt/Bergen	Thermal
Weyerhauser Company	0032620	Oradell Res	Closter/Bergen	Industrial
Chemed Corp- Dubois Div	0035769	Hackensack River	East Rutherford/Ber	Industrial
Hackensack City	0030805	Hackensack River	Hackensack/Bergen	Municipal
Classified Inc	0032603	Hackensack River	Hackensack/Bergen	Ind/Oil/Wse
Polycast Technology	0034819	West Rider	Hackensack/Bergen	Thermal
Atlas Plastics	0052736	Hackensack River	Little Ferry/Bergen	Thermal
Standard Tool & Mfg Co	0035131	Hackensack River	Lyndhurst/Bergen	Municipal
Hackensack Meadowlands	0053082	Hackensack River	Lyndhurst/Bergen	Municipal

then take their catches to other states for processing; and 3) shellfish harvested by sports fishermen. When considering these three factors, one can readily see the difficulty involved when attempting to assess past and future harvest trends. Based upon what information the state has, the overall trend appears to have been an increase in total pounds harvested over time.

While the BMWC&A is encouraged by recent gains in classification, there is concern for the immediate future. The change in the economy has created extensive building pressure for commercial, residential and industrial facilities in coastal communities. The major concern regarding this construction is degraded stormwater runoff associated with developed areas. Water quality gains realized through regionalization of wastewater treatment could be negated through extensive new construction and its associated runoff. It is noted that the estuarine waters of the coastal areas which are jeopardized by this development, are among the most productive in the State. Stormwater controls are being required in many of the developments now under construction through the issuance of Coastal Area Facilities Review Act (CAFRA) permits. In addition, the largest projects are also implementing water quality sampling programs to determine whether water quality degradation is resulting from their development.

A coordinated management approach is a requirement if New Jersey's shellfish resource is to be maintained as a national industry. Besides overall water quality improvements in New Jersey's coastal waters, there is a need for protection of shellfish habitats (bay and estuary bottoms), continued protection of significant clam and oyster seed beds, monitoring of annual harvest amounts and shellfish growing rates, and sampling of shellfish tissue for chemical and metals contamination. Depuration and relay programs will also undoubtedly play a greater role in the harvesting of New Jersey's shellfish resource in the future.

N.J.P.D.E.S. DISCHARGE INVENTORY WATERSHED: HACKENSACK RIVER,Continued

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
PSE&G-Bergen Generating	0000621	Hackensack River	Ridgefield Boro/Bergen	Ind/Comm
Bergen Co.Ut. Auth.	0020028	Hackensack River	Little Ferry/Bergen	Ind/Comm
Metro Oil & Chem Corp	0031500	Wolfs Creek	Ridgefield/Bergen	Ind/Comm
Yoo-Hoo Bev. Co.	0003344	Berrys Creek	Carlstadt/Bergen	Ind/Comm
Tec Cast	0033405	Drainage Ditch	Carlstadt/Bergen	Ind/Comm
Grobet File Co of America	0029378	Hackensack River	Carlstadt/Bergen	Thermal/Sto
Colorite Plastics Co.	0000132	Sweetkill Creek	Carlstadt/Bergen	Ind/Comm
Transcontinental Gas Pipeline	0002101	Hackensack River	Carlstadt/Bergen	Ind/Comm
Metal Improvement Com	0003719	Drainage Ditch	Jersey City/Hudson	Ind/Comm
Howard Johnson Co	0028410	Penhorn Creek	Secaucus/Hudson	Ind/Comm
Sears Roebuck & Co	0020508	Penhorn Creek	N.Bergen/Hudson	Ind/Comm
Diamond Shamrock Corp.	0002402	Hackensack River	Jersey City/Hudson	Ind/Comm
US Postal Ser Kearny	0027758	Dead Horse Creek	Kearny/Hudson	Mun.
N.J. Dept. of Transportation	0069094	Kill Van Kull	Bayonne City/Hudson	Ind/Comm

38. Shellfish Resources and Harvesting Area Classifications, 1987 - 1989, and Estuarine Water Quality

Introduction

New Jersey's shellfish resources support an important commercial and recreational fishery. The 1984 commercial landings of shellfish (hard clams, soft clams, surf clams, ocean quahogs, oysters, mussels and sea scallops) in New Jersey had a dockside value in excess of $46.1 million. The recreational fishery in New Jersey concentrates primarily on the harvest of hard clams. Although annual data on recreational landings is not available, a survey conducted by the Division of Fish, Game & Wildlife in 1980 indicates that the recreational landings of hard clams comprise approximately one-third of the total hard clam harvest.

The Bureau of Marine Water Classification and Analysis (BMWC&A), Division of Water Resources, NJ DEP, monitors the sanitary quality of estuarine and ocean waters for the suitability of shellfish harvesting. Their criteria for determining shellfish growing water status is based on the presence of real or potential sources of contamination from both point and nonpoint discharges. The above are determined through actual measurements of coliform concentrations in the water column, hydrographic (tracing), and shoreline surveys.

The Bureau of Shellfisheries (Division of Fish, Game & Wildlife) is responsible for issuance of licenses for the various shellfish harvested. In 1988 approximately 15,422 clamming (hard and soft clams) licenses were issued of which 2,243 were commercial. Also, because of the substantial reduction in the state's oyster populations due to MSX disease, the Bureau issued only 50 oyster tonger licenses during 1987. These were further reduced in 1988 to 39.

The State's shellfish resources are spread throughout its coastal and estuarine waters. The distribution of the shellfish resources can best be described by dividing the State into three basic regions consisting of the Atlantic Coast estuaries, Delaware Bay, and the Atlantic Ocean.

Atlantic Coast Estuaries

The hard clam, Mercenaria mercenaria, is the most widely distributed species being present in abundant quantities in virtually every estuary from Raritan Bay to Cape May. The expansive distribution and high consumptive appeal of this species provides excellent commercial and recreational opportunities.

The soft clam, Mya arenaria, is also found throughout the Atlantic Coast estuaries but the distribution of commercially important beds is limited. Although commercial populations of soft clams may occur occasionally in any estuary, areas supporting a regular fishery are confined to the Navesink and Shrewsbury Rivers and sections of Sandy Hook Bay.

Oyster beds within the Atlantic Coast estuaries have been significantly reduced from historic levels and are now only present in commercial densities in the Mullica and Great Egg Harbor River systems. Commercial harvest from these areas represent at most, five percent of the total oyster landings for New Jersey.

The mussel, Mytilus edulis, is found in the estuaries as well as offshore. Although they may be extremely abundant at certain times they represent a relatively low percentage of the shellfish landed in New Jersey.

Delaware Bay

Today the oyster, Crassotrea virginica, is most abundant in Delaware Bay which accounts for at least 95 percent of New Jersey's annual oyster landings. The oyster fishery in Delaware Bay is almost exclusively a commercial operation. Although hard and soft clams occur in Delaware Bay there are no known areas of abundance and no commercial fishery for either of these species currently exists.

Atlantic Ocean

The surf clam, Spisula solidissima, ocean quahog, Arctica islandica, and the sea scallop, Placopecten magellanicus, are all oceanic species and are harvested off New Jersey's coast. Harvesting of all species is predominantly a commercial enterprise although some bait and recreational harvesting of surf clams along the beaches does occur.

Ocean quahogs and sea scallops do not occur within New Jersey's territorial sea (within three miles of the beach) but considerable quantities are landed by both New Jersey and other vessels at New Jersey ports. Surf clams are found both in New Jersey and federal waters and support a significant fishery. Currently the bulk of the New Jersey inshore (within three miles) resource is located between the Shark River Inlet and the Great Egg Harbor Inlet.

The BMWC&A annually assigns harvest classifications to the State's shellfish growing waters. From January 1971 through January 1979, 18,660 estuarine acres were reclassified from approved to a more restrictive classification. Approximately 25 percent of these areas were reclassified Condemned. The general decline in classification was attributed to increased recreational and development pressure in coastal areas and the declining effectiveness of older municipal wastewater treatment plants. In 1980 a net gain resulting from of an over 5,000 acre upgrade was recorded. During 1981 an additional net gain of approximately 2,500 acres was established. The 1982 reclassifications resulted in a net loss of slightly over 200 acres. The net gain for 1983 was approximately 6,700. A net loss of approximately 8,484 acres in 1984 was a direct result of the seasonal disinfection policy in the Raritan Bay complex and its effect on water quality during the winter. A net increase of 255 acres was shown for 1985. The 1986 regulations were changed to expand the availability of 13,000 acres in Raritan Bay for depuration for an additional two months. The most notable changes for 1987 were the downgrading of 3,740 acres of the Atlantic Ocean in the North Coastal Basin from approval to prohibited, and the upgrading of roughly the same acreage in the South Coastal Basin Ocean area from prohibited to approved. In 1989 approximately 14,946 acres were upgraded, resulting in a net gain. Most of this (13,000 acres) was the result of an upgrade of portions of Raritan Bay from Seasonal Special Restricted to Special Restricted. Of the remaining estuarine and ocean areas, only 240 acres received down graded classifications.

Classification totals for the ocean waters have fluctuated in recent years. Large numbers of acres are initially closed when each regional ocean discharge goes on line. After assessment of observed water quality, operational efficiency and reporting reliability some refinement (reduction) of the Condemned classifications may occur.

The BMWC&A has classified coastal waters into five categories of shellfish harvesting areas. These categories are as follows:

1) Approved - Waters meeting the sanitary standards for approved shellfish harvesting as recommended by the National Shellfish Sanitation Program. Waters not classified as Condemned, Special Restricted, or Seasonal shall be considered Approved for the harvest of shellfish.

2) Seasonal - Waters which are Condemned and opened for the harvest of oysters, clams and mussels each year but open by operation of regulations according to the schedule of 7:12-1.4: seasonal areas Approved November 1 through April 30, Condemned May 1 through October 31; and 1.5: Seasonal areas Approved January 1 through April 30, Condemned May 1 through December 31 yearly.

3) Seasonal Special Restricted - Waters Condemned for the harvest of oysters, clams and mussels. However, harvesting for further processing may be done under special permit from the State Department of Environmental Protection between May 1 and September 30th yearly.

4) Special Restricted Area - Waters Condemned for the harvest of oysters, clams and mussels. However, harvesting for further processing may be done under special permit from the State Department of Environmental Protection.

5) Prohibited - Waters where the harvesting of shellfish is prohibited for any purpose except depletion. Prohibited shellfish growing areas are closed for the harvesting of shellfish at all times.

6) Condemned - Water not meeting the established sanitary standards as recommended by the National Shellfish Sanitation Program of the Federal Food and Drug Administration. Applications for removal of shellfish to be used for human consumption from areas classified as Condemned will be considered for resource recovery programs promulgated by the Department of Environmental Protection. Condemned areas are further divided into the following subclassifications: Prohibited, Special Restricted, Seasonal Special Restricted, and Seasonal.

The Department is responsible for delineating the distribution of the shellfish resources and implementing various management programs to provide for the best utilization of these resources. Some of the management programs that exist today such as relay and depuration are jointly managed by the Bureau of Shellfisheries and Bureau of Marine Law Enforcement (Division of Fish, Game and Wildlife), BMWC&A and Department of Health.

Relay Program

The ability of shellfish to purify themselves of bacterial contamination when relayed to clean water was discovered early in the 1900's. New Jersey's Department of Environmental Protection presently operates a program which relays shellfish from its Special Restricted Seasonal, Special Restricted and Condemned growing areas into Approved growing areas for a minimum of thirty days. This enables shellfish to cleanse themselves of contaminating bacteria and/or viruses. Following the purification period, a sample of clams are analyzed for bacterial quality prior to being released for harvesting and marketing. An additional benefit of the program is that by reducing the quantity of the shellfish resource contained within condemned/restricted waters, illegal clamming operations are discouraged, thus contributing to the protection of consumer health.

The Relay Program was initially begun during the early 1970's in the vicinity of Atlantic City. This area includes Lakes Bay, Absecon Bay and Scull Bay plus the vast complex of interwinding waterways. The program was subsequently expanded to include portions of Raritan and Sandy Hook Bays, the Navesink, Shrewsbury, Manasquan and Shark Rivers and certain areas in Cape May County. The waters in these localities are classified as Special Restricted or Condemned. Hard clams taken from these waters are relayed to beds in Barnegat Bay, Little Egg Harbor, and occasionally to Great Bay.

An individual must comply with two requirements in order to participate in the relay program: (1) A harvester must possess a valid commercial clamming license and, (2) a valid Relay Permit.

The program is under the supervision of the New Jersey BMWC&A and Bureau of Shellfisheries. Day to day patrol is provided by the Division of Fish, Game and Wildlife, Bureau of Law Enforcement. All clams harvested on any one day by clammers involved in the program are bagged, tagged and transported under secured conditions to specified Approved growing areas. Transportation of clams by secured means insures the public that none of the clams will be marketed before being relayed. After arriving at the Approved growing waters, the clams are deposited on the privately leased plots by the clammers. The Bureau of Law Enforcement patrols the area until the clammers are notified that the clams are safe to harvest and market. The BMWC&A and the Division of Fish, Game and Wildlife monitor the relay waters to insure proper water conditions are being met and thus verify the physiological requirements of the clams are such to permit pumping/purging to occur. Clams relayed during the winter are required to stay in the relay beds until early spring because it is known that lower water temperatures (minimum 50 degrees F) inhibits the rate of cleansing action (purging) by the shellfish.

The relay program is now centered in Monmouth County. The Navesink and Shrewsbury Rivers have been the mainstay of the clammers for several years now. Portions of Raritan and Sandy Hook Bays and the Manasquan and Shark Rivers are also being used.

Depuration Program

Currently the State of New Jersey has one licensed plant for the depuration of soft shelled clams. This program, like the relay program, relays on the natural ability of shellfish to purge themselves of bacterial contamination when placed in a clean environment. The program involves harvesting soft shelled clams, under provision of a special permit issued by the BMWC&A, from areas classified as Special Restricted and requires a 48 hour depuration period. At the depuration plant, the shellfish are placed in a water environment closely controlled to provide optimal conditions for efficient purification. Salinity and water temperatures are controlled to maintain maximum pumping/purging rates in the shellfish. The recirculated water in the depuration tanks is also disinfected with ultraviolet light to maintain high bacterial quality. Following the depuration process, laboratory analyses are performed to verify that the shellfish meet market standards. The depurated shellfish are then released for marketing.

New Jersey's one depuration plant is located in Highlands, Monmouth County, the center of the soft clam resource. Primary harvest sites are the Navesink and Shrewsbury Rivers. Specially marked boats are used for harvesting under the direction of the Division of Fish, Game and Wildlife (Bureau of Law Enforcement). At the end of the daily harvest activities, shellfish are loaded aboard a "mother craft" for transportation to the depuration plant. All aspects of harvesting and transportation of these shellfish are closely monitored by the Division of Fish, Game and Wildlife (Bureau of Law Enforcement) to insure complete compliance with program procedures.

A hard clam depuration plant began a pilot operation in July 1984. This operation was for all intents and purposes, almost identical to the soft clam depuration program. However, in response to numerous regulatory infractions associated with the state's only hard clam depuration plant, the New Jersey Department of Health (DOH), through the courts, suspended the plant's certification. In addition, both the DEP and DOH imposed a moratorium on the establishment of any further hard clam depuration operations until new regulations governing the program could be revised and additional enforcement personnel made available.

The revised regulations, which will encompass <u>both</u> hard and soft clam depuration, are expected to be submitted as a proposal to the New Jersey Register either in late 1989 or early 1990.

Status of New Jersey's Shellfish Growing Waters

New Jersey has been divided into four major basins which are subject to shellfish growing water classification regulations. These include the Raritan River Basin, the New Jersey North Coastal Basin, the New Jersey South Coastal Basin and the Delaware River Basin Commission Zones 5 and 6.

Raritan River Basin

Only a small portion of the Raritan River itself need be examined, as most of the upper basin consists of freshwater habitats. Prime consideration here is given to Raritan Bay, Lower New York Bay, Sandy Hook Bay, Navesink River, Shrewsbury River and their tributaries. There are no waters in this basin classified Approved. Seventy-five percent of the available acreage is classified Special Restricted. Based on earlier data collected during the period of disinfection and non-disinfection a new classification (Seasonal Special Restricted) was developed that allowed the harvest of shellfish for depuration during certain periods of the year. Now that wastewater treatment plant effluent discharge to this basin is disinfected on a year round basis, those areas previously classified as Seasonal Special Restricted have been upgraded effective July 1989 to Special Restricted.

Reclassifications in the Raritan River Basin since 1982 include:

June 1984
Raritan Bay: Approximately 13,000 acres downgraded from Special Restricted to Seasonal Special Restricted.

Shrewsbury River: Approximately 680 acres downgraded from Special Restricted to Condemned.

June 1985
Shrewsbury River: Approximately 80 acres downgraded from Special Restricted to Condemned.

June 1986
Atlantic Highlands Marina: 92 acres Special Restricted to Condemned.

Raritan Bay: 13,000 acres, Seasonal Special Restricted expanded dates available for depuration harvest.

November 1987: No change

May 1988: No change

July 1989
Raritan Bay: 13,000 acres, Seasonal Special Restricted to Special Restricted. Expanded dates available for relay and depuration.

Raritan River Basin - Nonpoint Source Assessment

This region has been severely impacted principally from nonpoint source pollution produced as a consequence of agricultural activities, urban/suburban development, local industry, waste storage, and land based waste disposal. Point sources also impact waters in the region. These combined sources have contributed to silt and nutrient loads, high bacterial levels, and chemical pollution in the bays. Agricultural nonpoint pollution largely comes from run-off from cropland, feedlots, and animal holding areas. The stockpiling of horse manure both on farms and at race tracks is a significant source of bacterial pollution in this region. Active suburban development within the watersheds draining into the Raritan River basin have brought about increasing levels of run-off from construction sites, urban surfaces, and roads. It is this urban surface run-off which is suspected of being one of the more important contributors to excess levels of bacteria in the shellfish beds. Several landfills and hazardous waste sites, as well as petroleum processing sites, are all known to be sources of chemical pollution in Raritan and Sandy Hook Bays. Aside from human activity, natural sources such as waterfowl are cited as having a significant contribution to high bacterial levels here and throughout the State's bays and estuaries.

Designated Use And Goal Assessment

All of the Raritan River Basin fails to meet the shellfish harvesting goal and designated use for SE-1 waters based upon criteria established by the BMWC&A, Division of Water Resources, NJDEP.

New Jersey North Coastal Basin

This basin consists of a large portion of the Atlantic Ocean coastal environment in New Jersey. Most of the acreage classified in this basin is in Barnegat Bay. Barnegat Bay comprises the largest percentage of the total acreage available for shellfish harvesting in this basin. The remainder of the basin is made of a number of somewhat smaller bays, rivers, creeks and their tributaries. These include Shark River, Manasquan River, Metedeconk River, Toms River, Forked River, Oyster Creek, Manahawkin Bay, Little Egg Harbor, Cedar Run, Westecunk Creek, Tuckerton Creek, Big Thorofare, and Big Creek.

Fully open shellfish harvesting acreage constitutes 70-75 percent as of 1989 of the total available acreage in this basin. These areas are generally located in Barnegat Bay and Little Egg Harbor. This leaves 10-15 percent (1989) of the total available acreage Condemned, and 10-15 percent (1989) classified as Seasonally Approved. Under the Shellfish Relay Program, clams are removed from certain Condemned and Special Restricted waters of the Raritan River Basin as well as Manasquan and Shark Rivers and deposited in specified Approved waters in Barnegat Bay, Little Egg Harbor Bay in Tuckerton Cove, or Great Bay for purification.

Reclassification on the North Coastal Basin since 1985 include:

June 1985
Barnegat Bay (Applegate Cove): approximately 100 acres downgraded from Approved to Condemned

June 1986
Barnegat Bay (Potter Creek to Laurel Harbor) approximately 140 acres Seasonal to Approved and 33 acres Condemned to Approved

Manahawkin Bay: 180 acres Approved to Seasonal

Little Egg Harbor: 160 acres Approved to Seasonal

July 1987
Shark River: Prohibited to Special Restricted: 1180 acres

Barnegat Bay: north (off Swan Point) Seasonal to Special Restricted: 290 acres

Barnegat Bay (Barnegat Inlet Area): Approved to Special Restricted: 200 acres

May 1988
Little Egg Harbor: 15 acres Approved to Special Restricted

July 1988
Little Egg Harbor (Tuckerton Cove): 112 acres, Seasonal to Approved

North Coastal Basin - Nonpoint Source Assessment

The bays north of Barnegat Bay, specifically those fed by the Shark, Manasquan, and Metedeconk Rivers are believed to be impacted by both urban/suburban and agricultural nonpoint source pollution. It is urban run-off from stormsewers (urban surfaces) coupled with natural pollution from waterfowl which have been singled out as important contributors to high coliform levels in bay waters. This in turn has led to losses of shellfish harvesting waters, as well as beach closings. Siltation is reported to be coming from construction activities occurring within the watersheds. Agricultural sources of pollution include run-off from crop production, pasture lands, feedlots and animal holding areas.

Throughout Barnegat Bay waterfowl and other wildlife, as well as urban/suburban surfaces feeding into stormsewers, are assessed as the principal contributors to the excess bacterial levels which are found in many regions of the bay. In Barnegat Bay and Little Egg Harbor, impacts from agriculture appear to be limited to tree harvesting activities. Siltation is suspected to be elevated by construction activities and by stream bank destablization. In the areas of Forked River and Oyster Creek, local habitat destruction has been reported caused by channelization, dam construction, and efforts to regulate river flow. Also in Barnegat Bay are reports of pollution from landfills in Kettle Creek, as well as inplace contaminants and industrial point sources located near Forked River and Oyster Creek.

Designated Use And Goal Assessment

Based upon criteria established by the BMWC&A, Division of Water Resources, NJDEP; 63 percent of the shellfish waters in the North Coastal Basin fully meet fishable goals and designated use for shellfish harvesting, 13 percent meet partial use, and 24 percent fail to meet designated use and clean water goal for shellfish harvesting.

New Jersey South Coastal Basin

The New Jersey South Coastal Basin, combined with the New Jersey North Coastal Basin, make up more than 90 percent of the Atlantic Ocean coastal zone drainage basin in New Jersey. In comparison with the three other basins (Raritan River, New Jersey North Coastal Basin and Delaware River Zones 5 and 6)) which support shellfish harvesting, this basin is the most productive as far as hard clams are concerned.

The New Jersey South Coastal Basin includes Great Bay, Mullica River, Reed Bay, Absecon Bay, Lakes Bay, Great Egg Harbor, Great Egg Harbor River, Ludlam Bay, Great Sound, Jenkins Sound, Grassey Sound, Richardson Sound, and Cape May Harbor. Reclassifications which have taken place in this basin since 1984 include:

1984
Reed Bay: 119 acres Condemned to Approved

Ocean City (Somers Point): 3,033 acres Seasonal to Approved

Sea Isle (Avalon Area): 658 acres Approved to Condemned

1985
Reed Bay: 119 acres Condemned to Approved

1986
Brigantine: 107 acres Condemned to Seasonal

Great Egg Harbor River: 92 acres Condemned to Seasonal

Townsend and Stites Sound: 442 acres Condemned to Approved

1987
Great Bay (Cape Horn Area): Approved to Special Restricted 23 acres

Atlantic City (Black Hole Area): Prohibited to Seasonal 10 acres

Townsend Sound and Mill Thorofare: Prohibited to Seasonal 245 acres

May 1988
Absecon Bay Area: 540 acres Special Restricted to Seasonal, 120 acres Seasonal to Approved

Gull Island Thorofare: 280 acres Prohibited to Special Restricted

Cresse Thorofare: 480 acres Special Restricted to Seasonal

Atlantic Ocean (Wildwood Area): 2795 acres Approved to Prohibited

July 1989
Reed Bay: 10 acres, Seasonal to Special Restricted

Shelter Island Bay: 57 acres Special Restricted to Seasonal

Great Egg Harbor Bay: 706 acres Seasonal to Approved

Ludlam Bay: 285 acres Special Restricted to Approved

Townsend Sound and Mill Thorofare: 243 acres Seasonal to Approved

Great Channel: 248 acres Special Restricted to Seasonal

Atlantic Ocean: 295 acres Prohibited to Approved, 230 acres Approved to Prohibited

South Coastal Basin - Nonpoint Source Assessment

Bays and estuaries in the South Coastal Basin are suspected of receiving excess silt and coliform bacteria primarily from urban/suburban sources such as construction activities, surface run-off. Additional bacterial inputs are believed to be from the extensive waterfowl population present through out the bays in this Basin. Additional pollution is suspected from boat docking facilities which are present along the shorelines of Brigantine, Great Egg Harbor, Lakes Bay, and the Cape May Atlantic tributaries.

Designated Use And Goal Assessment

Based upon criteria established by the BMWC&A, Division of Water Resources, NJDEP; 61 percent of the shellfish waters in the South Coastal Basin fully meet designated use and fishable goals for shellfish harvesting, 12 percent meet partial use, and 27 percent fail to meet this designated use.

Delaware River Basin - Zones 5 and 6

Delaware Bay contains 97 percent of the total classified acreage in the basin and is the only area in the basin that contains waters classified as Approved for shellfish harvesting. The remaining areas are classified either Condemned or Seasonally Approved. In the past, problem areas have included the Maurice River and Cove area, the Cohansey River area, the Back Creek area, the Cedar Creek area and the Nantuxent Creek area. Of the total acreage available for shellfish harvesting, 80 percent is classified Approved, and roughly 20 percent is either Condemned or Seasonally approved in 1989.

Delaware Bay is the major oyster producing area of the State. Although the bay and its tributaries still produce approximately 98 percent of the oysters harvested, their numbers have been severely reduced due to MSX (Minchinia nelsoni disease and the presence of the oyster drill Urosalpinx cinerea and Euplaura candata). Most oysters which are harvested in New Jersey originate in Delaware Bay seed beds and are transplanted to the leased grounds for growing and harvesting. Roughly 28,000 acres in the Bay are leased for planting oyster seeds.

Delaware River Basin - Nonpoint Source Assessment Pollution, Source Assessment

The Delaware River Basin, because of its vast size, is subject to numerous natural and anthropogenic sources of pollution, their sources being both on and offshore. Significant land based point sources are wastewater treatment plants with effluent discharges to the bay's tributaries. Nonpoint sources of pollution include urban, suburban, and rural runoff, sanitary landfills, agriculture, wildlife, and marinas. Offshore sources of pollution to Delaware Bay include the many commercial ships plying the shipping lanes of the estuary. Pollutants associated with this industry include everything from sanitary discharges to accidental toxic chemical spills. With regard to shellfish harvesting, Delaware Bay over the past 11 years has experienced some localized water quality degradation as reflected in various downgrading classifications.

Designated Use And Goal Assessment

Based upon criteria established by the NJDEP; 78 percent of the shellfish waters in the Delaware River Basin fully meet designated use and clean water goals for shellfish harvesting while some 22 percent fail to meet this use and goal.

Atlantic Ocean

None of the basins previously discussed included figures on the Atlantic Ocean. There are 280,708 acres of marine waters which are regulated by the BMWC&A. Of this total area 72 percent of the waters are classified as Approved while the remainder is classified as Condemned (1986 data). The reclassifications in the Atlantic Ocean since 1984 are as follows:

1984
Atlantic City area: 3,170 acres Condemned to Approved

1985
Atlantic City area: 700 acres Condemned to Approved and 130 acres Approved to Condemned

Wildwoods: 670 acres Condemned to Approved and 315 acres Approved to Condemned

1986
Wildwoods: 62 acres Condemned to Approved and 1,190 acres Approved to Condemned

1987

July 1987
Atlantic Ocean (Bay Head Area): Prohibited to Approved 460 acres

Atlantic Ocean (Avalon Area): Approved to Prohibited 3740 acres

Atlantic Ocean (Cape May County Area): Prohibited to Approved 3350 acres

May 1988
Atlantic Ocean (Ocean County - Dover Township Area): Prohibited to Approved 1045 acres

Atlantic Ocean (Absecon Inlet Area): Prohibited to Approved 590 acres

Atlantic Ocean (Wildwood Area): Approved to Prohibited 2795 acres

July 1989

Atlantic Ocean (Cape May Area): Prohibited to Approved 295 acres, Approved to Prohibited 230 acres

Summary of Shellfish Waters and Resources

It is important to be aware, when examining the historical records pertaining to shellfish landings in New Jersey, that these figures represent the total amount of shellfish (clams, oysters, mussels and scallops) produced/processed in New Jersey and not necessarily the total amount harvested from New Jersey's territorial waters. Three major factors that are not evaluated but nevertheless affect these statistics are: 1) catches from non-state harvest areas that are included in these figures; 2) out-of-state fishermen who use New Jersey's harvest areas and then take their catches to other states for processing; and 3) shellfish harvested by sports fishermen. When considering these three factors, one can readily see the difficulty involved when attempting to assess past and future harvest trends. Based upon what information the state has, the overall trend appears to have been an increase in total pounds harvested over time.

While the BMWC&A is encouraged by recent gains in classification, there is concern for the immediate future. The change in the economy has created extensive building pressure for commercial, residential and industrial facilities in coastal communities. The major concern regarding this construction is degraded stormwater runoff associated with developed areas. Water quality gains realized through regionalization of wastewater treatment could be negated through extensive new construction and its associated runoff. It is noted that the estuarine waters of the coastal areas which are jeopardized by this development, are among the most productive in the State. Stormwater controls are being required in many of the developments now under construction through the issuance of Coastal Area Facilities Review Act (CAFRA) permits. In addition, the largest projects are also implementing water quality sampling programs to determine whether water quality degradation is resulting from their development.

A coordinated management approach is a requirement if New Jersey's shellfish resource is to be maintained as a national industry. Besides overall water quality improvements in New Jersey's coastal waters, there is a need for protection of shellfish habitats (bay and estuary bottoms), continued protection of significant clam and oyster seed beds, monitoring of annual harvest amounts and shellfish growing rates, and sampling of shellfish tissue for chemical and metals contamination. Depuration and relay programs will also undoubtedly play a greater role in the harvesting of New Jersey's shellfish resource in the future.

TABLE III-16. YEARLY NEW JERSEY SHELLFISH CATCHES

YEAR	CATCH (IN POUNDS)	YEAR	CATCH (IN POUNDS)
1973	24,896,494	1980	37,616,000
1974	25,501,852	1981	44,961,664
1975	38,325,940	1982	50,377,267
1976	31,519,713	1983	50,510,727
1977	39,302,494	1984	65,662,700
1978	34,925,000	1987	65,274,800
1979	45,281,000	1988	59,264,000

TABLE III-17. COMPARISON OF 1987 AND 1988 CATCHES AND MONETARY VALUES

SPECIES	CATCH (LBS.)	VALUE DOLLARS	CATCH (LBS.)	VALUE DOLLARS
	1987		**1988**	
Hard Clam	1,539,800	$5,862,558	1,384,200	$5,260,119
Soft Clam	5,200,700	$116,009	22,600	$53,545
Oyster	14,700	$62,064	0	0
Surf Clam	35,821,200	$16,564,955	37,150,600	$17,078,590
Quahog(ocean)	24,394,900	$6,929,495	17,537,400	$5,028,047
Mussels			5,500	$3,864
Scollop(ocean)	3,451,500	$13,484,683	3,163,700	$13,027,039
TOTALS	65,274,800	$43,019,764	59,264,000	$40,451,204

TABLE III-18. CLASSIFICATION OF NEW JERSEY SHELLFISH GROWING AREAS

BODY OF WATER	**ACREAGE**				
BAYS & ESTUARIES	OPEN	FULLY CLOSED	SPECIAL RESTRICTED	SEASONAL	TOTAL
January 1967	313,760	77,221		1,871	392,852
January 1968	313,068	77,221		2,131	392,852
April 1968	312,822	77,899		2,131	392,852
November 1968	312,937	77,784		2,131	392,852
July 1969	298,110	69,966	20,426	4,350	392,852
January 1971	295,513	68,592	23,478	5,209	392,852
January 1972	293,235	70,930	23,478	5,209	392,852
January 1973	289,053	73,464	25,723	4,612	392,852
January 1974	284,185	74,012	27,243	7,412	392,852
May 1975	281,852	74,230	27,243	9,527	392,852
January 1976	280,088	74,951	28,193	9,620	392,852
March 1977	281,645	73,394	28,193	9,620	392,852
July 1978	281,381	72,902	27,669	10,900	392,852
January 1979	276,853	73,170	27,669	15,160	392,852
March 1980	276,716	69,276	26,087	20,773	392,852
May 1981	278,974	69,149	25,881	18,848	392,852

TABLE III-18 Continued. CLASSIFICATION OF NEW JERSEY SHELLFISH GROWING AREAS

BODY OF WATER	ACREAGE				
BAYS & ESTUARIES	OPEN	FULLY CLOSED	SPECIAL RESTRICTED	SEASONAL	TOTAL
June 1982	278,974	69,510	25,866	18,502	392,852
	(71%)	(17.7%)	(6.5%)	(4.7%)	
June 1983	278,974	65,323	25,593	22,96	392,852
	(71%)	(16.6%)	(6.5%)	(5.8%)	
June 1984	281,030	67,010	*11,913	19,899	**392,852
	(72%)	(17%)	(3%)	(5%)	
June 1985	280,287	67,740	*11,833	19,992	**392,852
	(71%)	(17%)	(3%)	(5%)	
June 1986	280,562	68,139	*11,741	19,410	**392,852
	(71%)	(17%)	(3%)	(5%)	
November 1987	280,339	36,933	*43,205	19,375	**392,852
	(71%)	(9%)	(11%)	(5%)	
May 1988	280,094	36,653	*42,480	20,625	**392,852
	(71%)	(9%)	(11%)	(5%)	
June 1989	281,688	36,653	55,148	19,363	**392,852

*In addition, 13,000 (or 3%) were classified Seasonal Special Restricted during 1983.

**Includes seasonal Special Restricted.

-1987 included a change in definition for Special Restricted

TABLEIII-18 Continued. CLASSIFICATION OF NEW JERSEY SHELLFISH GROWING AREAS

BODY OF WATER	ACREAGE		
ATLANTIC OCEAN	OPEN	FULLY CLOSED	TOTAL
1975	144,750	85,650	*230,400
1976	185,944	94,764	*280,708
1977	184,274	96,434	280,708
1978	179,138	101,570	280,708
1979	186,399	94,309	280,708
1980 AS OF 5-80	195,255	85,453	280,708
1981	198,077	82,631	280,708
1982	198,277	82,481	280,708
1983	200,467 (71%)	80,241 (29%)	280,708
1984	203,637 (73%)	77,071 (27%)	280,708
1985	204,622 (73%)	76,086 (27%)	280,708
1986	203,494 (72%)	77,214 (28%)	280,708
1987	203,564 (73%)	77,144 (27%)	280,708
1988	202,404, (72%)	78,304 (28%)	280,708
1989	202,469	78,239	280,708

*Based on 3 statute mile jurisdictional limit.

39.

DELAWARE RIVER AND BAY

WATER QUALITY ASSESSMENT

1988-1989 305(b) REPORT

DELAWARE RIVER BASIN COMMISSION

WEST TRENTON, NEW JERSEY

MARCH 1990

EXECUTIVE SUMMARY

Delaware River and Bay Water Quality Assessment
1988-89 305(b) Report

The Delaware River is one of the smallest U.S. rivers, draining 0.4 percent of the U.S. land area. It is, however, one of the most intensely used rivers serving almost 10 percent of the nation's population for potable and industrial water supply.

The Delaware River and Bay comprise part of the boundary of four states: Delaware, New Jersey, New York and Pennsylvania. The non-tidal portion from Hancock, New York to Trenton, New Jersey is 197 miles long and is one of the nation's premier recreational rivers. Fifty-six percent of the non-tidal Delaware has been included in the National Wild and Scenic Rivers System and over one-half million visitors use the non-tidal river for fishing, boating, canoeing and swimming each year.

The Delaware Estuary from Trenton, New Jersey to Liston Point, Delaware is 85 miles long and flows through the nation's fifth largest urban area: the Philadelphia-Camden metropolitan area. Including Trenton, New Jersey and Wilmington, Delaware, this area is one of the world's greatest concentrations of heavy industry, the second largest U.S. oil refining-petrochemical center and the world's largest freshwater port. Historically, this section of the Delaware has also been one of the nation's most grossly polluted rivers. Water quality in 1988-89, however, reflects substantial water quality improvements as the result of water pollution control efforts extending back 40 years.

The 782 square mile Delaware Bay is 48 miles long and from 4 to 20 miles wide. The Bay is biologically productive and the home of commercially important fin and shellfish. Recreation and navigation are important as well.

Summary of Conditions

The water quality of the Delaware River, the Delaware Bay and interstate portion of the West Branch Delaware River was assessed for the degree to which the goals outlined in Section 101 of the Clean Water Act (fishable/swimmable) have been met for the 1988-89 period. The following U.S. Environmental Protection Agency criteria were used to prepare the assessment:

> **FISHABLE SUPPORTED** -- Waters which are of such chemical and bacteriological quality as to support fish, shellfish, and wildlife populations that are balanced and at their optimum health and reproductive viability. Waters that naturally could support only a limited variety of fish/shellfish species are fishable if those species are healthy and viable. This includes waters meeting a lower fishery use for which EPA has approved the use.

FISHABLE PARTIALLY SUPPORTED -- Waters in which the fish/shellfish community suffers some adverse effect (e.g., lowered species diversity) due to pollution or habitat degradation, yet is still generally viable.

FISHABLE NOT SUPPORTED -- waters which have fishing advisories or bans due to toxics in fish/shellfish or pathogens in water at a level of concern, or waters in which the fish community is altered relative to the designated use due to pollution or habitat degradation, and the health and reproductive viability of the fish/shellfish have been adversely affected.

FISHABLE NOT ATTAINABLE -- Waters which are naturally unable to support any fish/shellfish populations at any time, or suffer from irrevocable human-induced impacts where the State has obtained approval, based on a use attainability analysis, for standards that exclude aquatic uses.

SWIMMABLE SUPPORTED -- Waters which are of such chemical and bacteriological quality as to safely and continuously support primary contact recreation. Waters that naturally support swimming only during a limited period of use should be considered swimmable if, during that time, water quality is good enough to permit contact recreation.

SWIMMABLE PARTIALLY SUPPORTED -- Waters that are occasionally subject to short-term restrictions on swimming due to pollution, yet support swimming throughout most of their annual period of use.

SWIMMABLE NOT SUPPORTED -- Waters which are of such chemical and bacteriological quality as to be unsafe or unsuitable for primary contact recreation. Waters with frequent temporary or long-term swimming restrictions should be considered not swimmable.

SWIMMABLE NOT ATTAINABLE -- Waters that could naturally support swimming or suffer from irrevocable impacts and where a State has obtained approval, based on a use attainability analysis, for standards that exclude swimming goals.

A reach-by-reach assessment of water quality is presented in Table 1. Note that the free-flowing portion of the river is presented in river miles, while the tidal portion is expressed in square miles.

Water pollution control in the Delaware River is the joint responsibility of the federal government, the four Delaware River Basin states and the Delaware River Basin Commission. The Commission conducts monitoring, regulatory and other water quality management programs as part of its basinwide responsibilities.

The DRBC conducted a use attainability study of the Delaware Estuary which included special studies of sediment oxygen demand, toxics, fish health, combined sewers, bacterial quality and others. Final recommendations, directed at the attainment of the federal fishable and swimmable water quality goals in the Delaware Estuary have been completed. The 1988-89 305(b) report reflects the data gathered as part of the use attainability study as well as special studies such as the seasonal disinfection study, the Delaware Estuary Toxics Management Program, the Commission/National Park Service Scenic Rivers Monitoring Program and the Commission/National Park Service water resources planning effort.

TABLE 3
DESIGNATED USE, TOXICS AND FISHABLE/SWIMMABLE GOAL ATTAINMENT USING EPA 305(b) CRITERIA

	MILES	SQUARE MILES	GENERAL WATER QUALITY	MEETS FISHABLE GOAL	MEETS SWIMMABLE GOAL	SUPPORTS DESIGNATED USES	USES[1] THREAT-ENED	TOXICS MONITORED	TOXICS ELEVATED	COMMENTS
West Branch Delaware	9		Good	Yes	Yes	Yes	9	0		Impacted by reservoir releases
Zone 1: Hancock to Port Jervis	74		Excellent	Yes	Yes	Yes	74			Uses impacted by malfunctioning municipal point source, Growth and development is a major concern particularly potential non point source increases
Zone 1: Port Jervis to Delaware Water Gap	46		Excellent	Yes	Yes	Yes	46	120	10	
Zone 1: Delaware Water Gap to Trenton	77		Good	Yes[a]	Yes(70 mi) No(7 mi)	Yes(70 mi) No(7 mi)	70			
Zone 2: Trenton to Northeast Philadelphia		8	Good to Fair	yes(3 mi^2)	Yes	Yes	8	8	8	Urban and municipal point source impacts; PCB and other toxics affect fish edibility
Zone 3: Philadelphia-Camden Area		6	Poor	No*	No	No		6	6	Elevated toxics in sediment and fish. Impacts due to municipal industrial and combined sewer point sources
Zone 4: Schuylkill R. to Marcus Hook, PA		11	Poor to Fair	No*	Yes(6 mi^2) No(5 mi^2)	Yes(6 mi^2) No(5 mi^2)	6	11	11	
Zone 5: Marcus Hook to New Castle, DE		14	Fair	Yes	Yes	Yes	14	14	b/	Primary impact from Zones 3 and 4 plus municipal and industrial point sources
Zone 5: New Castle, DE to Delaware Bay		45	Good	Yes	Yes	Yes	45	14	b/	
Zone 6: Delaware Bay		782	Good	Yes(740 mi^2) No**(38 mi^2) Partial***(4 mi^2)	Yes	Yes	782	0		Assessment based on limited data

a Advisories on the consumption of White Suckers taken at the Delaware Water Gap and American Eels taken at Yardley, PA have been issued; areal extent not defined
b Toxic monitoring initiated in July '89
* Advisories issued on consumption of selected fish species
** Advisories/prohibition on the taking of shellfish
*** Advisories on the taking of shellfish during specific months
1 Uses are considered threatened because of frequency of spills and discharges from combined sewers

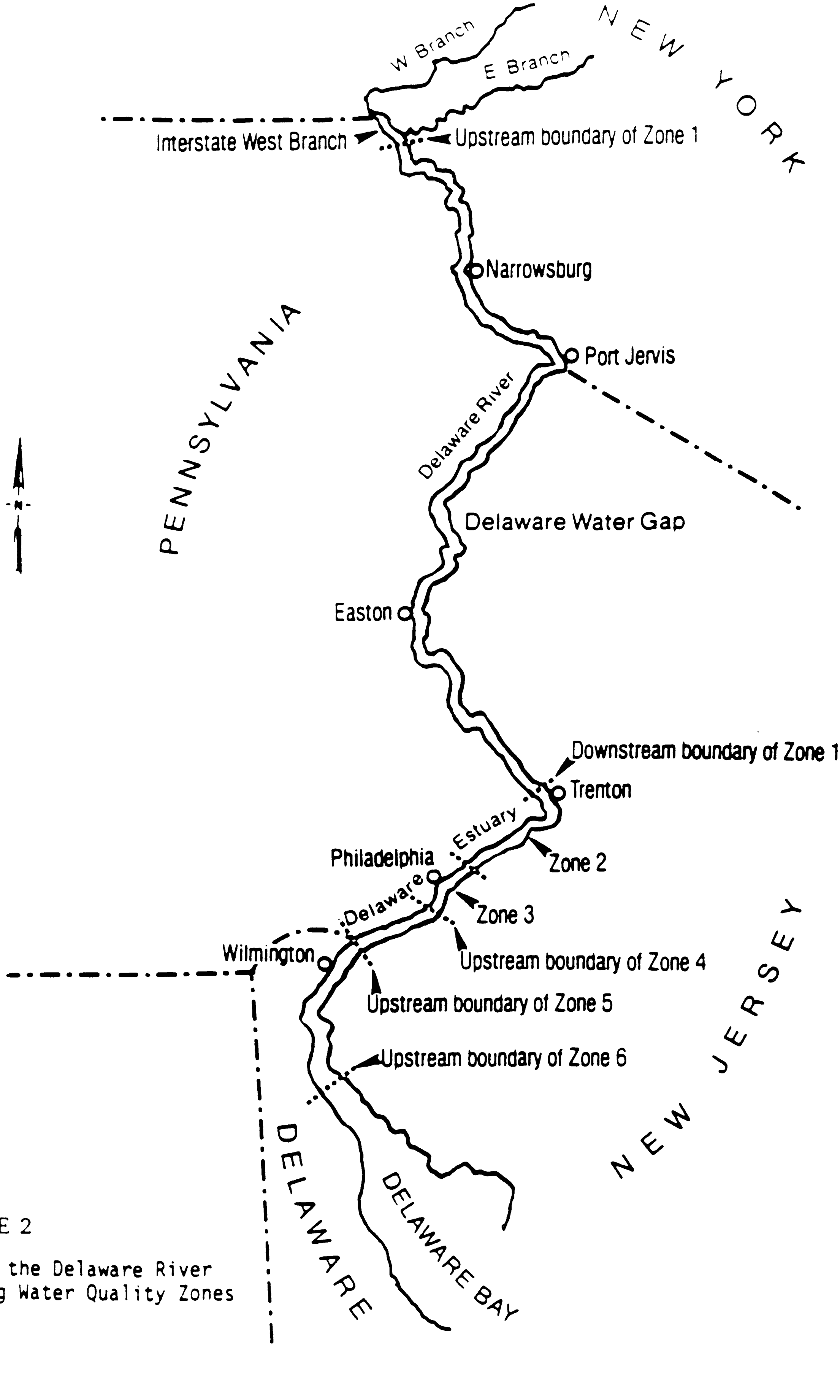


FIGURE 2

Map of the Delaware River Showing Water Quality Zones

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: DELAWARE RIVER ZONE 1A**

Port Jervis to Delaware Water Gap

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Riggins & Robbins	0026166	Delaware River	Millville/Morris	

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: DELAWARE RIVER ZONE 1B**

Delaware Water Gap to Trenton

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Frenchtown, Borough of	0029831	Delaware River	Frenchtown/Hunterdon	Sanitary
Frenchtown Ceramics Co.	0004782	Delaware River	Frenchtown/Hunterdon	Ind./Comm.
Lambertville Sewage Authority	0020915	Delaware River	Lambertville/Hunterdon	Ind./Comm.
Milford Mill	0004456	Delaware River	Milford/Hunterdon	Sanitary
Alexandria Twp Bd of Ed	0027553	Delaware River	Pittstown/Hunterdon	Sanitary
Delaware Twp MUA	0027561	Delaware River	Sergeantsville/Hunt.	Sanitary
Van Buren Assoc.-White MEA	0029149	Delaware River	Long Valley/Warren	
Windtryst Apartments	0030007	Delaware River	Mt.Laurel/Warren	Sanitary
Belvidere Area WWTF	0035114	Delaware River	Belvidere/Warren	Sanitary
Cramer Plating & Anodizing	0032204	Delaware River	White Twp/Warren	
Witco Corp.	0008460	Delaware River	Harmony Twp/Warren	Ind./Comm.
Atlantic States Cast IronPipe	0005592	Delaware River	Phillipsburg/Warren	
Our Lady of Lake Reg. School	0026239	Delaware River	Mt.Arlington/Morris	Sanitary

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: DELAWARE RIVER ZONE 2**

Trenton to Northeast Philadelphia

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Hoeganaes Corp.	0004375	Delaware River	Riverton/Burlington	Ind./Comm.
Palmyra STP	0024449	Delaware River	Palmyra/Burlington	Sanitary
State of N.J. Johnstone Ting	0027375	Delaware River	Bordentown/Burlington	San/Ind/Comm
Riverton Sewage Treatment	0021610	Delaware River	Riverton/Burlington	Sanitary
Fieldsboro,Borough of	0031810	Delaware River	Fieldsboro/Burlington	Sanitary
Beverly STP	0027481	Delaware River	Beverly/Burlington	Sanitary
US Pipe & Foundry Comp.	0005266	Delaware River	Burlington/Burlington	Ind./Comm.
Burlington City STP	0024660	Delaware River	Burlington/Burlington	Sanitary
Exxon Corp. Burlington	0026131	Delaware River	Burlington/Burlington	
Cinnaminson Sewerage Auth.	0024007	Delaware River	Cinnaminson/Burlington	Sanitary
Kaiser Gypsum Company Inc.	0025372	Delaware River	Delanco/Burlington	
Stepan Chemical Co. Inc.	0005410	Delaware River	Fieldsboro/Burlington	
Amsted Ind/Griffin Pipe Prod	0005096	Delaware River	Florence/Burlington	Ind./Comm.
Florence Twp. STP	0023701	Delaware River	Florence/Burlington	Sanitary
N.J. Water Co. Beverly	0005193	Delaware River	Palmyra/Burlington	
Roebling Industries	0005274	Delaware River	Roebling/Burlington	
E.J. Koenig Inc.	0028517	Delaware River	Trenton/Mercer	
Naval Air Prop. Test Ctr.	0031283	Delaware River	Mount Holly/Mercer	
Trenton Sewage Treatment	0020923	Delaware River	Trenton/Mercer	Sanitary
Trenton Water Plant,City of	0025747	Delaware River	Trenton/Mercer	Ind./Comm.
Consumers Oil Corp.	0031291	Delaware River	Trenton/Mercer	Ind./Comm.
Champale, Inc.	0004740	Delaware River	Trenton/Mercer	

N.J.P.D.E.S. DISCHARGE INVENTORY **WATERSHED: DELAWARE RIVER ZONE 3**

Philadelphia to Camden Area

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Windtryst Apartments	0030007	Delaware River	Mt.Laurel/Warren	Sanitary
GATX Terminals Corp.	0026298	Delaware River	Gloucester/Camden	
Pennsauken Sewerage Auth.	0025348	Delaware River	Pennsauken/Camden	Sanitary
Robert T Winzinger Inc.	0032816	Delaware River	Hainesport/Salem	Sanitary
Peter Cooper Corp.	0027162	Delaware River	Camden/Camden	
Camden County MUA	0026182	Delaware River	Camden/Camden	Sanitary
Georgia Pacific Corp.	0004669	Delaware River	Delair/Camden	Ind./Comm.
N.J. Water Co. Camden Sta.	0005215	Delaware River	Haddon Hgts./Camden	
Merchantville-Pennsauken	0032107	Delaware River	Merchantville/Camden	San/Ind/Comm
Oaklyn WWTP	0025003	Delaware River	Oaklyn/Camden	Sanitary
Tubifex Inc.	0033766	Delaware River	Pennsauken/Camden	
Citgo Petroleum Corp.	0004511	Delaware River	Pennsauken/Camden	Ind./Comm.
Amerada Hess Corp.	0004383	Delaware River	Pennsauken/Camden	Ind./Comm.
Star Enterprise Pennsauk. Ter	0005436	Delaware River	Pennsauken/Camden	Ind./Comm.
GAF Corp. Glouc. City NJ.PLW	0005371	Delaware River	Wayne/Camden	Sanitary

N.J.P.D.E.S. DISCHARGE INVENTORY — WATERSHED: DELAWARE RIVER ZONE 4

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Gloucester County UA	0024686	Delaware River	Deptford/Gloucester	Sanitary
Paulsboro Prop. Inc.	0005088	Delaware River	Paulsboro/Gloucester	Ind./Comm.
Paulsboro Terminal	0004197	Delaware River	Paulsboro/Gloucester	Ind./Comm.
Sun Oil Comp.	0025861	Delaware River	Paulsboro/Gloucester	Ind./Comm.
Peabody Clean Industry Inc.	0030431	Delaware River	Paulsboro/Gloucester	Ind./Comm.
Mobil Oil Corp.	0021661	Delaware River	Paulsboro/Gloucester	

N.J.P.D.E.S. DISCHARGE INVENTORY — WATERSHED: DELAWARE RIVER UPPER ZONE 5

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
Monsanto Comp.	0005045	Delaware River	Bridgeport/Gloucester	Ind./Comm.
Logan Twp. MUA	0027545	Delaware River	Bridgeport/Gloucester	Sanitary
E.I.Du Pont De Nemours Carney	0004201	Delaware River	Carneys Point/Salem	
Exxon Chemical Comp.	0030406	Delaware River	Pedricktown/Salem	Ind./Comm.
USATC and Fort Dix	0024635	Delaware River	Pedricktown/Salem	Sanitary
Airco Indus. Gases	0004553	Delaware River	Pedricktown/Salem	
Penns Grove Sewerage Auth.	0024023	Delaware River	Penns Grove/Salem	Sanitary

N.J.P.D.E.S. DISCHARGE INVENTORY — WATERSHED: DELAWARE RIVER LOWER ZONE 5

DISCHARGE NAME	NJPDES NO	RECEIVING WATERS	MUNICIPALITY/COUNTY	TYPE
PSE&G	0028690	Delaware River	Lower All.Creek/Salem	
Pennsville Sew. Auth.	0021598	Delaware River	Pennsville/Salem	Sanitar

INTERSTATE SANITATION COMMISSION

A TRI-STATE ENVIRONMENTAL AGENCY

STATUS REPORT

ON THE

INTERSTATE SANITATION DISTRICT WATERS

Prepared by the

Interstate Sanitation Commission
for the
State of New Jersey 305(b) Report
to the
U.S. Environmental Protection Agency

April 1990

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I. EXECUTIVE SUMMARY

The creation of the Interstate Sanitation Commission (ISC) was a direct result of the recommendations of the Tri-State Treaty Commission of 1931. The States of New York and New Jersey agreed to enact the Tri-State Compact in 1936; it was ratified by Connecticut in 1941. As a regulatory agency, it is the Commission's mandate to address the abatement of existing water pollution and the control of future negative impacts to the tidal waters of the Metropolitan Area. In 1962, air pollution was added to the Commission's regional responsibilities. The Commission was designated as the official planning and coordinating agency for the New Jersey-New York-Connecticut Air Quality Control Region in 1970.

The Commission's programs for water pollution abatement have continued to provide assistance in effectively coordinating approaches to regional problems. Priorities have been set for enforcement, minimization of the effects of combined sewers, compliance monitoring, pretreatment of industrial wastes, toxics contamination, participation in the National Estuary Program, ocean disposal and monitoring the ambient waters -- especially with regard to opening new areas for swimming and shellfishing.

The Interstate Sanitation District encompasses approximately 797 square miles of estuarine waters in the Metropolitan Area and includes waterways that are shared by the States of New Jersey, New York and Connecticut. New Jersey surface waters, specifically the Arthur Kill/Kill Van Kull, lower Hudson River, Newark Bay, Raritan Bay, Sandy Hook Bay and Upper New York Bay comprise approximately 72 square miles of the District.

During the 1988-89 reporting period, District waters have improved, in general, with respect to dissolved oxygen and coliform bacteria densities. Although ambient surface waters meet disolved oxygen requirements during the winter, episodes of hypoxia have occurred. Coliform bacteria densities tend to rise during storm events due to treatment plant bypassing, urban runoff and combined sewer overflows and in some instances, require the closing of area beaches. It should be noted that only two public beaches in Middlesex and Monmouth Counties that border the lower Raritan River, Raritan Bay and Sandy Hook Bay have been approved for bathing for the majority of the past decade. However, discharges from several primary treatment facilities have been eliminated during 1989 and are to be followed by additional diversions in 1990. More stringent criteria are applied to shellfish harvesting waters. In 1989, the New Jersey Department of Environmental Protection (NJ DEP) upgraded 13,000 acres in Raritan Bay to a year-round shellfish growing water classification of "special restricted" from a previous classification of "seasonal

B. OVERVIEW: GENERAL QUALITY AND QUANTITY OF THE STATE'S GROUND WATER

QUANTITY STATUS: The available data suggest that at present there is an ample supply of good quality ground water in the State of New Jersey. However, ground-water quantity (and quality) problems are usually concentrated in areas where the greatest volumes of ground water are needed. For example, ground-water pollution and overpumping are usually concentrated in areas with high population densities. Overpumping in these areas has created hydraulic gradients that sometimes result in the recharge of aquifers from undesirable sources such as seawater, polluted surface waters, or severely contaminated shallow ground water. Proper management of ground-water resources in these areas is critical to insure a constant supply of good-quality water. Also, the statewide impact of ground-water quality degradation from nonpoint sources of pollution, like agricultural areas, has not been fully assessed. Studies leading to a better understanding of the State's ground-water resources are being conducted to guide management practices.

QUALITY STATUS: Ambient ground-water quality throughout the State is generally good for most purposes. Treatment for some undesirable naturally occurring contaminants is needed however in some areas due to the physical and chemical nature of geologic materials comprising the aquifer. The most widespread violations of naturally occurring contaminants involve the State's recommended secondary drinking water regulations. These contaminants include iron, total dissolved solids, sulfate and hardness. Less common yet significant naturally occurring contaminants that violate the primary drinking water regulations also exist. These contaminants include radium, lead, barium , and possibly mercury. Radon will be included in this group when a final MCL has been established.

Anthropogenic contaminant discharges to ground water have had a significant undesirable impact on water quality in the State. As of December 1989, there were 3086 ground-water pollution investigations in the State (figure IV-1a). When the distribution of these pollution cases in figure IV-1a is compared to population density throughout the State in figure IV-1b it is obvious that the two are directly related. This clearly shows man's deleterious effect on ground-water quality.

An extensive database that includes the number of ground-water pollution investigations by major source, type of site, remedial program, and pollutant type(s), is being compiled by the Bureau of Ground-Water Pollution Assessment. These data were compiled by county, and as of December 1989, seven counties had been completed. Figure IV-2 shows the distribution of ground-water

II. Background

Atlas - New Jersey Portion of the Interstate Sanitation District

Population *	3,635,700
Interstate border miles (sq. miles)	67
Square Miles of estuaries/harbors/bays	72
Total coastal miles	48
Names of Interstate border waterways	Hudson River The Kills Raritan Bay Upper New York Bay

* Estimated population served by wastewater treatment plants discharging into Interstate Sanitation District waters

Summary of Classified Uses

New Jersey Portion of the Interstate Sanitation District

Classified Use	Total Size (sq. mi.) of Estuaries (1) Classified For Use
ISC Class A Waters (2)	54
ISC Class B-1 Waters (3)	9
ISC Class B-2 Waters (4)	9

(1) All waters in the Interstate Sanitation District are considered estuarine.

(2) Denotes primary contact recreation, shellfish culture and development of fish life.

(3) Denotes secondary contact recreation and fishing.

(4) Denotes fish passage and maintenance.

III. Surface Water Assessment

Chapter One: Summary Data

As a result of meetings with the state environmental departments and the U.S. Environmental Protection Agency, the Commission has been conducting intensive ambient water quality surveys only; repetitive sampling at the fixed station network has been discontinued. The following data summaries reflect the data collection, analysis and interpretation of sampling in specific waterbodies. All monitoring was conducted to evaluate each waterbody's ability to support its intended designated use and/or for specific data needs.

Raritan Bay and Sandy Hook Bay

The Interstate Sanitation Commission conducted a series of water quality surveys in the Atlantic Ocean off the Rockaways, and in Raritan and Sandy Hook Bays from January through May 1988. The study consisted of 30 sampling trips for a total of 48 stations -- 15 trips at 24 stations in the Atlantic Ocean and 15 trips at 24 stations in Raritan and Sandy Hook Bays. A total of 720 samples were taken -- each being analyzed for total and fecal coliforms for a total of 1,440 analyses.

Prior to 1989, the New Jersey portion of Raritan Bay and Sandy Hook Bay were open for depuration from May 1st through September 30th and closed the rest of the year. The field surveys were carefully scheduled to collect the water samples during the worst case conditions -- on the outgoing tide and under wet weather conditions. All samples were taken on the outgoing tide and, whenever possible, subsequent to wet weather. The sampling protocol and analysis procedure was in conformance with Section B of the National Shellfish Sanitation Program (NSSP) Operations Manual (1986); a three-tube decimal dilution MPN test was used.

The sampling data showed complete compliance with both the NSSP's total and fecal coliform criteria for depuration during February, March, and April of 1988. In 1989, NJ DEP upgraded 13,000 acres to the shellfish growing water classification of "special restricted" on a year-round basis.

Hudson River

During the summer of 1988, a coliform sampling survey was conducted at 16 stations in the Hudson River. Three of the stations were located on the New Jersey shore of the river. Prior to conducting the survey, the agencies responsible for opening swimming areas were contacted for the necessary sampling protocols and were also asked for suggested sampling locations. The survey conducted in 1988 reflects the input from those agencies.

The 16 stations along the west and east shores of the Hudson River were sampled 10 times during July and August. The samples were taken at the shoreline from marinas, waterfront parks and beaches. The analyses were performed at the ISC laboratory using the 5-tube, 3-dilution MPN test for fecal and total coliforms.

The sampling results are encouraging. Although seven of the stations did not meet all the applicable coliform criteria, they are not far from the values necessary for swimming purposes. Bloomer Beach, in New Jersey just south of the upgraded portion of the Hudson River, came close to meeting the criteria. There is a long stretch of both shores of the Hudson River that are meeting the coliform standards for swimming. If all other applicable criteria are being met, it appears that some areas that have been closed for swimming for over 40 years can again be used for that purpose. Additional water quality improvements are necessary, such as CSO remediation, before the waters in the lower portion of the primary recreational area of the Hudson River meet swimming criteria.

Arthur Kill

At the request of the NJ DEP, the Commission conducted two special sampling surveys in the Arthur Kill in 1988. The data were needed by NJ DEP for their toxics program. ISC performed analyses for those substances on the U.S. EPA List of Priority Pollutants. Eight stations were each sampled twice -- once at high tide and once at low tide. For all stations, composite samples were made from samples taken at three transverse points across the Arthur Kill.

Heavy metals were detected throughout the Arthur Kill. Of the 111 U.S. EPA Priority Pollutants scanned for using a gas chromatograph/mass spectrophotometer (GC/MS), only one was found -- bis(2-Ethylhexyl) phthalate (commonly known as dioctyl phthalate). This compound is a plasticizer which seems to be prevalent in the ambient waters of the Interstate Sanitation District.

DESIGNATED USE SUPPORT

Type of Waterbody: ESTUARINE (1)

Degree of Use Support	Assessment Basis		Total Assessed (Sq. Mi.)
	Evaluated (Sq. Mi.)	Monitored (Sq. Mi.)	
Size fully supporting		0	
Size partially supporting		54	54
Size not supporting		18	18
TOTAL		72	72

ATTAINMENT OF CWA GOALS

Type of Waterbody: ESTUARINE (1)

Goal Attainment	Fishable Goal (Sq. Mi.)	Swimmable Goal (Sq. Mi.)
Size meeting	0	0
Size not meeting	54	54
Size not attainable	18	18

(1) All waters in the Interstate Sanitation District are considered estuarine.

Size of Waters Affected by Toxics

Waterbody	Size Monitored	Size with elevated levels of Toxics
Estuaries (sq. miles)		72

Municipal, industrial, and commercial wastewater discharges; CSOs; urban runoff and atmospheric deposition contribute toxics to District waterways. Available data from the Commission's 1986/87 intensive water quality surveys within the New York-New Jersey Metropolitan Area indicated that concentrations of heavy metals appeared to be in the same order of magnitude throughout the New York-New Jersey Harbor Complex. In general, the metals concentrations were low except for copper. During another 1987 survey of Cheesequake Creek in Middlesex County, New Jersey, samples were analyzed for the presence of 1195 organic compounds and heavy metals. Copper concentrations exceeded the U.S. EPA marine acute criteria, although the order of magnitude was consistent with values detected in other District waters. Nitrobenzene and hexachlorobenzene, as well as dioctyl phthalate were found in low concentrations. The Commission's 1988 Arthur Kill survey showed concentrations of heavy metals and dioctyl phthalate.

Fish Kills/Abnormalities

In the Interstate Sanitation District, conditions which cause fish kills are associated with very low dissolved oxygen levels and can be attributed to anthropogenic loads combined with natural phenomenon.

Natural conditions which contribute to causing fish kills occur during those critical summer months of high temperatures and stagnant weather. Fish kills which are associated with specific spills caused by municipal treatment plants or industrial discharges are usually isolated instances and generally affect all indigenous or migratory species of the biological community. More often then not, menhaden, Brevoortia tyrannus, is the primary species impacted by typical low summer dissolved oxygen concentrations.

During the 1988-89 reporting period, three fish kill events

Fishing Advisories and Bans Currently in Effect

Waterbody Name	Pollutants of Concern	Type of Restriction	Area (Sq. Mi)	Date Established	Source of Pollution	Species (1) Affected
Hudson River	PCBs	A	8.6	Dec. 1982	Ft. Edward, Washington County, NY	Striped Bass(2) Large Bluefish White Perch White Catfish American Eel(2) Blue Crab
Raritan Bay/Sandy Hook Bay	PCBs	A	48	Dec. 1982		
Raritan River - Tidal Portion	PCBs	A	(3)	Dec. 1982		
KVK/AK	PCBs	A	4.63	Aug. 1984	Diamond-Alkali, Newark, NJ	
Newark Bay	PCBs	A	5	Aug. 1984		
Passaic River - Tidal Portion	Dioxin	B	(3)	Aug. 1984		
Hackensack River - Tidal Portion	PCBs	A	(3)	Aug. 1984		
Upper NY Bay	PCBs	A	6	Aug. 1984		

A - Health advisory: Limited consumption.
B - Ban on consumption and/or sale of all organisms.
1 - These species can be found in all waterbodies.
2 - Commercial sale prohibited from waters of the Newark Bay Complex.
3 - Beyond yet adjacent to the Interstate Sanitation District.

Shellfish Restrictions/Closures Currently in Effect in the New Jersey Portion of the Interstate Sanitation District

Waterway	Status
Arthur Kill	Prohibited
Hudson River	Prohibited
Kill Van Kull	Condemmed and Closed
Newark Bay	Condemmed and Closed
Raritan Bay	Prohibited Special Restricted (1)
Sandy Hook Bay	Special Restricted (1)
Upper New York Bay	Condemmed and Closed

(1) Combined area of 13,000 acres upgraded from seasonal special restricted to special restricted by New Jersey Department of Environmental Protection, Bureau of Shellfish Control in 1989.

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CHAPTER IV

GROUND WATER QUALITY AND MANAGEMENT IN NEW JERSEY

CHAPTER IV

GROUND-WATER QUALITY AND MANAGEMENT IN NEW JERSEY

A. INTRODUCTION

IMPORTANCE OF GROUND WATER

Ground water is subsurface water that occurs beneath the water table in soils and geologic formations that are fully saturated (Cherry and Freeze, 1979). It is not an isolated body of stored water but is part of a greater **hydrologic cycle.** This cycle describes the constant circulation of water between ocean, atmosphere and land. For example, water evaporated from the ocean forms water-saturated clouds that may travel over land dropping precipitation that either enters a stream channel directly as runoff, seeps into porous ground and recharges ground water, or is evapotranspired back to the atmosphere. Ground water eventually discharges chiefly to surface water (streams, wetlands, lakes or ocean) at or enroute to the ocean or it may be intercepted by a well for human use. Therefore, any undesirable constituent that enters the hydrologic cycle may be intercepted by humans or discharged to surface water.

Ground water is an extremely important resource for the people of New Jersey. It provides approximately 50 percent of the State's potable water, with 39 percent coming from public-supply wells and 11 percent from domestic-supply wells. It also provides baseflow to streams, and is intimately associated with the ecology of the State's wetlands. New Jersey maintains regulations and programs aimed at protecting this precious resource. This chapter summarizes information on the State's ground-water quality, quantity and protection programs.

GROUND-WATER HYDROLOGY AND APPLICABLE DEFINITIONS

An **aquifer** is a saturated permeable geologic unit that can transmit significant quantities of water under ordinary hydraulic gradients (Cherry and Freeze, 1979). An **aquitard** is a saturated geologic unit that is incapable of transmitting significant quantities of water. Gravel and fractured bedrock are examples of aquifer materials and clay an aquitard material.

There are two main types of aquifers: **unconfined** and **confined.** Unconfined (water table) aquifers are shallow and have a water table in contact with the atmosphere through the unsaturated zone. Confined aquifers generally have aquitards as an upper and lower boundary and potential ground-water levels higher than the lower surface of the upper boundary. Therefore the water is under pressure. A formation that is confined in one area may be unconfined elsewhere. Pumping-induced water level changes in a confined aquifer are mostly from changes in hydraulic pressure while those in an unconfined aquifer are mostly from dewatering of pores or fractures. Water level changes due to pumping wells are transmitted farther in confined than unconfined aquifers producing more regional cones of water-level depression around those wells.

Like surface water, ground water flows from areas of higher potential energy to those of lower ones. However, unlike surface water which always flows from higher to lower elevation, ground water flows from higher to lower hydraulic head which considers both fluid pressure and elevation. For example, in ground-water recharge areas ground water flows downward because the elevation and the hydraulic head are lower in the discharge area. However, in the discharge area ground water can flow upward because the head at the discharge point is lower than it is deeper in the aquifer. Pumping wells induce their own hydraulic-head and gradient changes that can affect ground-water flow on local and regional scales.

The conduits through which ground water flows are intergranular pore spaces, fractures, and solution channels. Each of these conduits is characteristic of particular formations. For example, ground water flows through intergranular pore spaces in an unconsolidated sand, fractures in unweathered bedrock, and solution channels in limestone. However, a carbonate-rich sandstone may possess all three conduit types.

Ground water flow characterization is a function of many variables. The most important are the hydraulic conductivity, or ease which water can pass through a saturated formation, and hydraulic gradient, or change in water level per unit of distance along the direction of maximum head decrease. Hydraulic conductivity is generally a function of the grain size in granular material, and the size, density and interconnectivity of fractures or solution channels in consolidated materials. The hydraulic gradient controls the direction in which ground water flows.

A contaminant is defined by the New Jersey Safe Drinking Water Act (N.J.A.C. 7:10) as "any physical, chemical, biological or radiological substance or matter in water." Accordingly, a contaminant can be natural or artificially introduced. Most contaminants are dissolved, like Na (sodium) and Cl (chloride) in water, or immiscible, like oil in water. Their migration is controlled by the hydrodynamic and hydrogeochemical setting, and the physical and chemical characteristics of the specific contaminant. Some contaminants are highly mobile in the aqueous environment whereas others are highly immobile. Dissolved contaminants generally flow with ground water, light nonaqueous-phase liquids such as light oils float on the water table, and dense nonaqueous phase liquids like the undissolved fraction of trichloroethylene will sink in ground water.

Other important definitions used in this chapter are: **pollutant** as paraphrased from N.J.D.E.P. (1988, N.J.A.C. 7:14A-1.9); **maximum contaminant level** (MCL); **primary drinking water regulations**; and **secondary drinking water regulations**, from N.J.D.E.P. (1985b the New Jersey Safe Drinking Water Act, N.J.A.C. 7:10-1.1 through 7.3). A pollutant, in brief, is any contaminant discharged directly or indirectly by humans to land, ground or surface waters. The maximum contaminant level is "the maximum permissible level of a contaminant in water measured at the point at which water is delivered to the free-flowing outlet of the ultimate user of a public water system or other water system to which state primary drinking water regulations apply. "The primary drinking water regulation "...specifies contaminants which, in the judgment of the Commissioner, may have an adverse affect on the health of persons.... The secondary drinking water regulation "...specifies the recommended upper and/or lower levels of substances that are necessary to protect the public welfare...".

Pollutants enter the ground-water system either by migrating from at or near the surface down through the unsaturated zone or by direct discharge into the saturated zone from a manmade vessel like a leaking underground storage tank. The unconfined aquifer is usually the first aquifer affected and may be the only one impacted depending on the hydrogeologic setting and the physical and chemical character of the contaminant. If ground water flows downward and/or contaminants sink because of their density then confined units may also be affected.

Sources of ground-water pollution are thought of as either **point** or **nonpoint sources**. These are defined somewhat differently when the same terms are applied to surface water pollution. Point sources are localized discharges, such as a leaking underground storage tank or chemical spill, and nonpoint sources are larger area discharges of regional significance, such as agricultural chemicals from agricultural areas or septic wastes from areas with a high septic use. Under surface water terminology, all these sources are regarded as nonpoint.

Undesirable constituents in ground water are not always anthropogenic in origin. In many cases exceedences of the federal and state primary and secondary drinking water regulations are due to natural or ambient ground-water chemistry. Ambient ground-water quality is mainly a function of the composition of the water recharging the ground-water system, the composition and mineralogy of the formation material that the ground water passes through, and the residence time of the ground water in the formation. The longer the residence time of ground water in a formation the more time water has to dissolve minerals and become more mineralized.

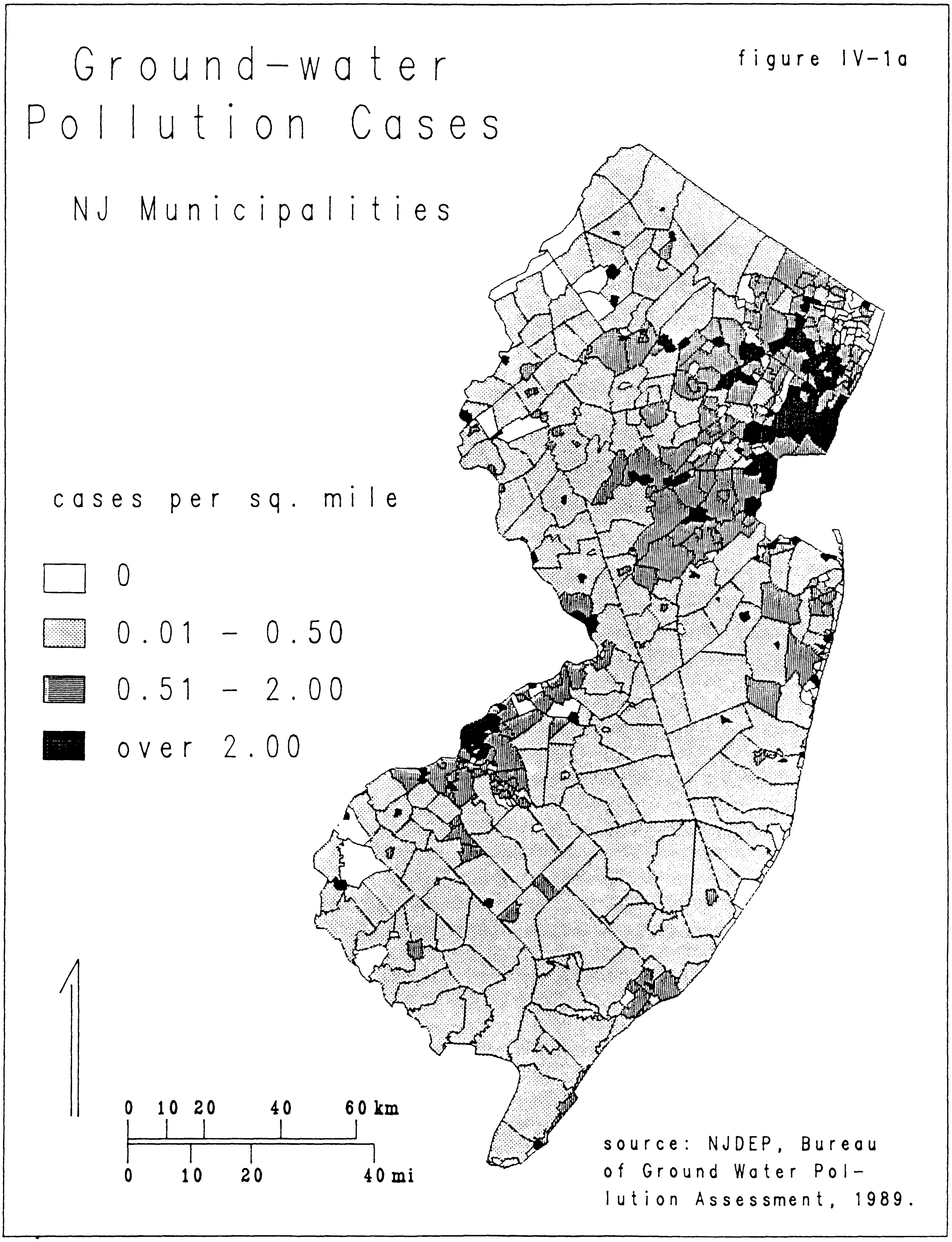
B. OVERVIEW: GENERAL QUALITY AND QUANTITY OF THE STATE'S GROUND WATER

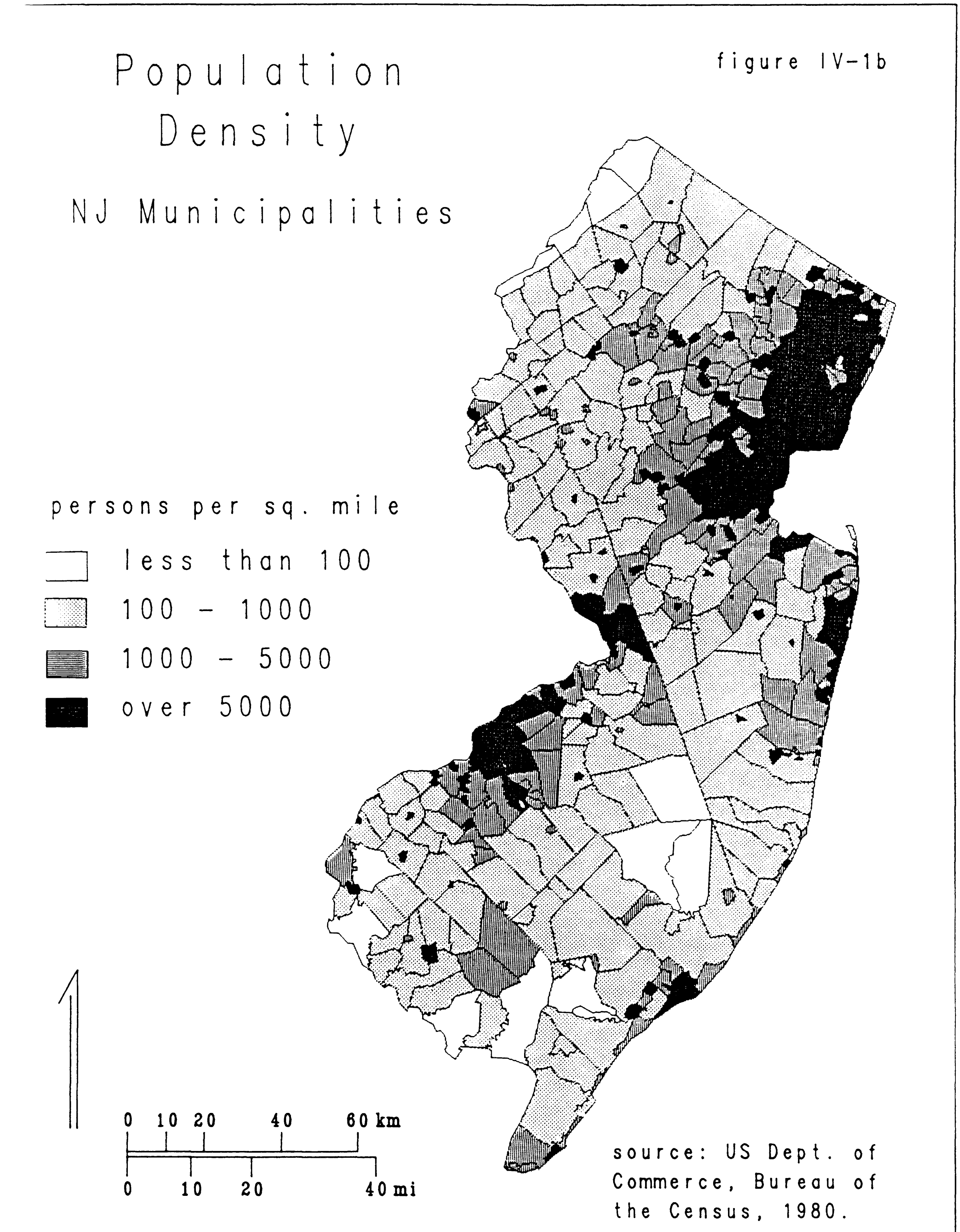
QUANTITY STATUS: The available data suggest that at present there is an ample supply of good quality ground water in the State of New Jersey. However, ground-water quantity (and quality) problems are usually concentrated in areas where the greatest volumes of ground water are needed. For example, ground-water pollution and overpumping are usually concentrated in areas with high population densities. Overpumping in these areas has created hydraulic gradients that sometimes result in the recharge of aquifers from undesirable sources such as seawater, polluted surface waters, or severely contaminated shallow ground water. Proper management of ground-water resources in these areas is critical to insure a constant supply of good-quality water. Also, the statewide impact of ground-water quality degradation from nonpoint sources of pollution, like agricultural areas, has not been fully assessed. Studies leading to a better understanding of the State's ground-water resources are being conducted to guide management practices.

QUALITY STATUS: Ambient ground-water quality throughout the State is generally good for most purposes. Treatment for some undesirable naturally occurring contaminants is needed however in some areas due to the physical and chemical nature of geologic materials comprising the aquifer. The most widespread violations of naturally occurring contaminants involve the State's recommended secondary drinking water regulations. These contaminants include iron, total dissolved solids, sulfate and hardness. Less common yet significant naturally occurring contaminants that violate the primary drinking water regulations also exist. These contaminants include radium, lead, barium , and possibly mercury. Radon will be included in this group when a final MCL has been established.

Anthropogenic contaminant discharges to ground water have had a significant undesirable impact on water quality in the State. As of December 1989, there were 3086 ground-water pollution investigations in the State (figure IV-1a). When the distribution of these pollution cases in figure IV-1a is compared to population density throughout the State in figure IV-1b it is obvious that the two are directly related. This clearly shows man's deleterious effect on ground-water quality.

An extensive database that includes the number of ground-water pollution investigations by major source, type of site, remedial program, and pollutant type(s), is being compiled by the Bureau of Ground-Water Pollution Assessment. These data were compiled by county, and as of December 1989, seven counties had been completed. Figure IV-2 shows the distribution of ground-water


Ground-water
Pollution Cases
figure IV-1a
NJ Municipalities
cases per sq. mile
0
0.01 - 0.50
0.51 - 2.00
over 2.00
0 10 20 40 60 km
0 10 20 40 mi
source: NJDEP, Bureau of Ground Water Pollution Assessment, 1989.



Population Density
NJ Municipalities
figure IV-1b
persons per sq. mile
less than 100
100 - 1000
1000 - 5000
over 5000
0 10 20 40 60 km
0 10 20 40 mi
source: US Dept. of Commerce, Bureau of the Census, 1980.

pollution cases in these seven counties. For detailed investigations, the database also includes estimated volume of polluted ground water, number of private and community wells affected and threatened by ground-water pollution, the monitor wells, and the well restriction and ground-water impact areas.

The seven completed counties are diverse in terms of geographic distribution, hydrogeologic setting, population density, and land use/land cover. Hunterdon, Morris, Passaic, and Somerset lie north of a line separating the hard rock Piedmont from the lower lying Coastal Plain known as the "fall line". Camden, Monmouth, and Ocean Counties are located south of this feature. Infiltration rates, aquifer characteristics, and ground-water flow patterns vary significantly between northern and southern counties. Land use/land cover characteristics are similarly diverse in these two areas. Both have significant industrial, urban, and suburban areas, as well as farmlands, forests, and wetlands. The different land uses and land covers in these two regions create a variety of ground-water pollution settings. It is believed that the ground-water pollution situation in these seven counties is somewhat indicative of Statewide conditions.

Of the 1,200 pollution cases in the seven counties, more than 40 percent have unknown sources. Of those sources that are known, the number of underground storage tank (UST) cases is highest with 236 (19.7 percent of the total share of cases). Landfills, surface spills, lagoons, and industrial/commercial septic systems each account for at least 5 percent of all cases. Table IV-1a shows the major sources of ground-water pollution, the number of cases by source, and their percentage of the total. Table IV-1b ranks the major sources based on the number of threatened and affected wells per case.

All of the contamination sources listed in table IV-1a and IV-1b are based on data from the ground-water pollution investigation database. In some instances, the actual number of ground-water contaminant investigations associated with a particular major source may be much less than the potential number of cases from that source. For example, only one agricultural pollution case is listed out of a total of 1,200 cases for the seven counties. Data gathered for the pesticides and nutrients in ground-water studies clearly showed that there are violations of the State's drinking water quality regulations from agricultural inputs. This discrepancy is due to past program focus. Such discrepancies should decline as new initiatives are undertaken and the program focus broadens.

The most common pollutants encountered at the approximately 1200 ground water investigations were: volatile organic compounds (VOs), metals, base neutrals, acid extractables, and PCBs/pesticides. Table IV-2a summarizes the sampling results of

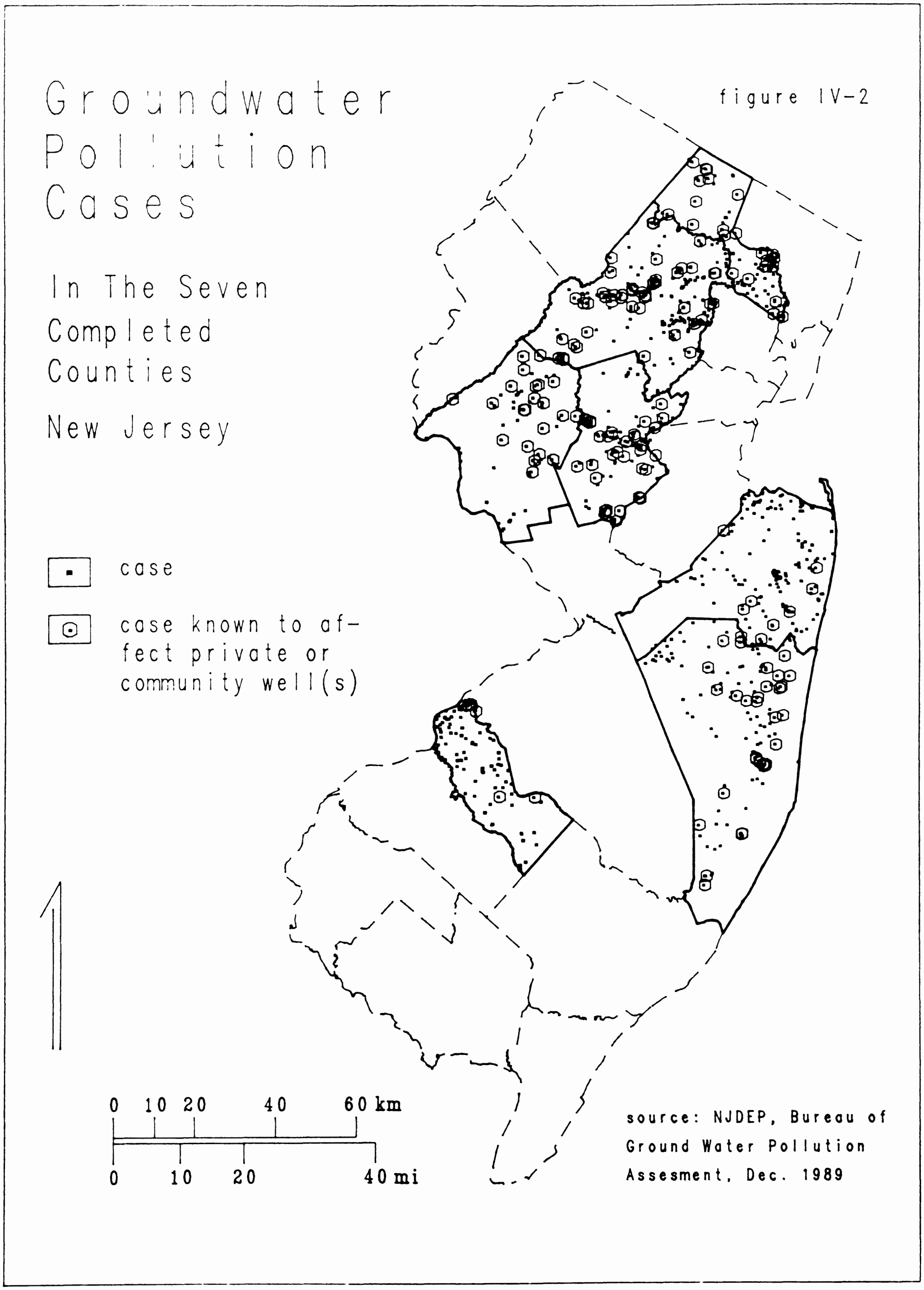

Groundwater Pollution Cases
In The Seven Completed Counties
New Jersey
figure IV-2
case
case known to affect private or community well(s)
0 10 20 40 60 km
0 10 20 40 mi
source: NJDEP, Bureau of Ground Water Pollution Assesment, Dec. 1989

Table IV- 1a: Major Sources of Ground-Water Pollution

Source	No.of Cases	% of Total Cases
Agriculture	1	0.08
Above Ground Storage Tank	4	0.33
Coal Tar	8	0.67
Drums	11	0.92
Lagoon	72	6.00
Land Spray Application	1	0.08
Landfill	159	13.25
None	4	0.33
Other	16	1.33
Road Salt Pile	1	0.08
Septic System	67	5.58
Surface Spill	134	11.17
Unknown	486	40.50
Underground Storage Tank	236	19.67
Total	1200	100.00

source: NJDEP, Bureau of Ground Water Pollution Assessment, 12/89.

Table IV- 1b: Ground-Water Contamination Sources, Ranked

Source	Relative Priority	Wells Per Case
Underground Storage Tanks	1	22.1
Industrial/Commercial Septic Systems (incl. class V injection wells)	2	11.2
Surface Spills	3	7.4
Landfills (incl. municipal, industrial, and other)	4	6.1
Unidentified and Miscellaneous Sources	5	4.7
Drums	6	2.6
Above Ground Storage Tanks	7	2.5
Road Salt Piles	8	2.0
Lagoons (incl. surface impoundments)	9	1.2
Residential Septic Systems	10	unknown
Coal Tar Discharges	11	0
Agricultural Activities	11	0
Land Spray Application/Treatment	11	0
Salt Water Intrusion	11	0
Injection Wells (class I-IV)	11	0
Oil and Gas Brine Pits	11	0

*Rank is based on the number of private and community wells affected or threatened per case with identified specific major sources of pollution in the seven counties for which data is available.

source: NJDEP, Bureau of Ground Water Pollution Assessment, 2/90.

Table IV-2a: Most Commonly Encountered Ground-Water Pollutants

Pollutant	Total Sampled	No. of Positive	Percent Positive
Volatile Organics(VOs)	595	520	87.4
Metals	327	180	55.0
Base Neutrals	295	172	58.3
Acid Extracbles	234	83	35.5
PCBs/Pesticides	192	39	20.3

source: NJDEP, Bureau of Ground Water Pollution Assessment, 12/89.

Table IV-2b: Ground-Water Contamination Substances, Priority Checklist

Substance	Relative Priority
Volatile Organic Chemicals (incl.volatile petroleum hydrocarbons)	1
Metals (incl. chromium, mercury, and lead)	2
Radionuclides	2
Inorganic Miscellaneous (excluding metals)	3
Base Neutral Chemicals (incl. base/neutral petroleum hydrocarbons)	3
Other Metals	4
PCB/Pesticides	4
Acid Extractable Chemicals	4
Asbestos	4
Dioxin	5
Bacteria	5
Other Substances	5

Highest Priority = 1 Lowest Priority = 5

*Relative Priority based on several factors including number of private and community wells affected or threatened by each substance and the number of cases reporting identification of the substance in the ground water in the seven counties for which data is available.

source: NJDEP, Bureau of Ground-Water Pollution Assessment, 1/90.

the five pollutants. Of all the investigations where ground water was sampled for VOs, 87.4 percent were positive, a far greater percentage than the next two highest, base neutrals and metals with 58.3 percent and 55.0 percent respectively. Landfill contaminants, undifferentiated petroleum hydrocarbons, gasoline and fuel oil also ranked high in the long list of ground-water pollutants. The contaminants found in the State's ground water are listed and assigned relative priority in table IV-2b.

Table IV-3 lists the number of private and community wells affected by major pollution sources. A total of 1,610 wells in the seven counties are known to be affected by ground-water pollution. Of this total, 1,519 are private wells and 91 are community supply wells. As is the case in table IV-1a (number of cases by major source of pollution), unknown sources tops the list with 737 affected wells. An unknown source is one that is affecting wells but has either not yet been identified or not yet been investigated.

Of the known sources, USTs affect the most wells (405). Industrial and commercial septic systems affect a disproportionately large number of wells (202) considering the number of septic system cases (table IV-1a).

Table IV-4 shows the number of ground-water pollution cases in the seven counties by major source of pollution by county. Morris County, which is north of the Fall Line, has the highest number of ground-water pollution cases, 282, while Monmouth, in the Coastal Plain, has the second highest, 192. These two counties are similar not only in their high numbers of pollution cases, but also in terms of their land use characteristics which range from moderately high density town centers to large-lot residential areas. Both have large rural areas as well, and lack the large, very dense cities and heavy industrial areas that are found in, for example, Camden and Passaic Counties. They are also similar in population and population density. Like most New Jersey counties, both have experienced high rates of growth during the past decade.

TABLE IV-3: Number of Private and Community Wells Affected by Major Pollution Sources

MAJOR SOURCES OF POLLUTION	PRIVATE WELLS AFFECTED		PRIVATE WELLS THREATENED		COMMUNITY WELLS AFFECTED		COMMUNITY WELLS THREATENED	
	#	%	#	%	#	%	#	%
AGRICULTURE	0	0.0	0	0.0	0	0.0	0	0.0
ABOVE GROUND STORAGE TANK	3	0.2	7	0.1	0	0.0	0	0.0
COAL TAR	0	0.0	0	0.0	0	0.0	0	0.0
DRUMS	8	0.5	21	0.2	0	0.0	0	0.0
LAGOON	38	2.5	44	0.5	0	0.0	6	5.1
LAND SPRAY APPLICATION	0	0.0	0	0.0	0	0.0	0	0.0
LANDFILL	89	5.9	868	10.0	0	0.0	14	11.9
NONE	2	0.1	0	0.0	0	0.0	1	0.8
OTHER	10	0.7	2	0.0	0	0.0	0	0.0
ROAD SALT PILE	2	0.1	0	0.0	0	0.0	0	0.0
SEPTIC SYSTEM	178	11.7	536	6.2	23	25.3	15	12.7
SURFACE SPILL	105	6.9	852	9.8	10	11.0	28	23.7
UNKNOWN	689	45.4	1590	18.3	48	52.7	31	26.3
UNDERGROUND STORAGE TANK	395	26.0	4776	54.9	10	11.0	23	19.5
TOTAL	1519	100.0	8696	100.0	91	100.0	118	100.0

TABLE IV-4: Major Sources of Anthrpogenic Pollution.

Numbers denote number of pollution cases (both as absolute and as a percentage of total cases) segragated by county.

MAJOR SOURCES OF POLLUTION BY COUNTY	CAMDEN		HUNTERDON		MONMOUTH		MORRIS	
	#	%	#	%	#	%	#	%
AGRICULTURE							1	100.0
ABOVE GROUND STORAGE TANK			1	25.0				
COAL TAR			1	12.5				
DRUMS			1	9.1	5	45.5		
LAGOON	10	13.9	5	6.9	25	34.7	13	18.1
LAND SPRAY APPLICATION			1	100.0				
LANDFILL	24	15.1	6	3.8	38	23.9	21	13.2
NONE			1	25.0			2	50.0
OTHER			3	18.8	4	25.0	1	6.3
ROAD SALT PILE								
SEPTIC SYSTEM	2	3.0	8	11.9	4	6.0	30	44.8
SURFACE SPILL	11	8.2	10	7.5	30	22.4	11	8.2
UNKNOWN	88	18.1	37	7.6	45	9.3	152	31.3
UNDERGROUND STORAGE TANK	28	11.9	15	6.4	36	15.3	51	21.6
TOTAL	**163**		**89**		**192**		**282**	

TABLE 4: continued.

COUNTIES CONTINUED	OCEAN		PASSAIC		SOMERSET		7-COUNTY TOTALS
	#	%	#	%	#	%	
(both as absolute and as a percentage of total cases)							
AGRICULTURE							**1**
ABOVE GROUND STORAGE TANK	2	50.0			1	25.0	**4**
COAL TAR	2	25.0					**8**
DRUMS	3	27.3	1	9.1	1	9.1	**11**
LAGOON	5	6.9	6	8.3	8	11.1	**72**
LAND SPRAY APPLICATION							**1**
LANDFILL	43	27.0	7	4.4	20	12.6	**159**
NONE					1	25.0	**4**
OTHER	7	43.8			1	6.3	**16**
ROAD SALT PILE					1	100.0	**1**
SEPTIC SYSTEM	9	13.4	7	10.4	7	10.4	**67**
SURFACE SPILL	13	9.7	37	27.6	22	16.4	**134**
UNKNOWN	61	12.6	53	10.9	50	10.3	**486**
UNDERGROUND STORAGE TANK	19	8.1	26	11.0	61	25.8	**236**
TOTAL	**164**		**137**		**173**		**1200**

C. GROUND WATER IN THE STATE'S PHYSIOGRAPHIC PROVINCES

New Jersey has four geomorphologically distinct physiographic provinces covering the states approximately 7,800 square miles (figure IV-3a,b). They are from south to north: the Coastal Plain, Piedmont, Highlands, and Valley and Ridge. There are general structural and lithologic disparities existing between each physiographic province which makes them hydrogeologically distinct from one another. In addition, the northern three provinces contain glacially deposited materials which have a unique hydrologic character. The geology, hydrology, and water quality characteristics of each province, and the glacial deposits, are discussed below.

COASTAL PLAIN

The Coastal Plain is the largest of the physiographic provinces in New Jersey, covering an area of 4,689 square miles (figure IV-3a). It is a southeasterly dipping and thickening wedge of stratified unconsolidated sediments that vary in age from Cretaceous (144-66.4 million years ago) to the end of the Tertiary (1.6 mya). A veneer of more recent alluvial sediments has been locally deposited on the older wedge. This seaward thickening sedimentary wedge of sand, gravel, silt and clay overlies an eroded surface of pre-Cretaceous bedrock. The sediment thickness is known to vary from a feather edge along the Fall Line to at least a documented 6407 feet in Cape May County (LLoyd Mullikin, oral communication, 1990).

The changing depositional environment during the Coastal Plains formational history produced a multilayered aquifer system consisting of 1 major unconfined aquifer and 4 major confined aquifer systems. These systems from youngest to oldest (and shallowest to deepest) are the unconfined Kirkwood-Cohansey aquifer system, and the confined, Kirkwood 800-Foot Sand, Wenonah-Mount Laurel aquifer, Englishtown aquifer system, and Potomac-Raritan-Magothy (PRM) aquifer system (Zapecza, 1984). All of these confined aquifers become unconfined in their outcrop areas to the northwest. Additional confined aquifers such as the Vincentown and Piney Point may be found in local areas of Monmouth County and the southernmost counties respectively.

Ground water supplies most of the potable water to the inhabitants of the Coastal Plain. Seventy-one percent of the total purveyor-supplied water in the province consists of ground water and seventy-five percent of its inhabitants rely on municipal or domestic ground-water supplies. Population growth in the Coastal Plain to the year 2000 is estimated to average 20

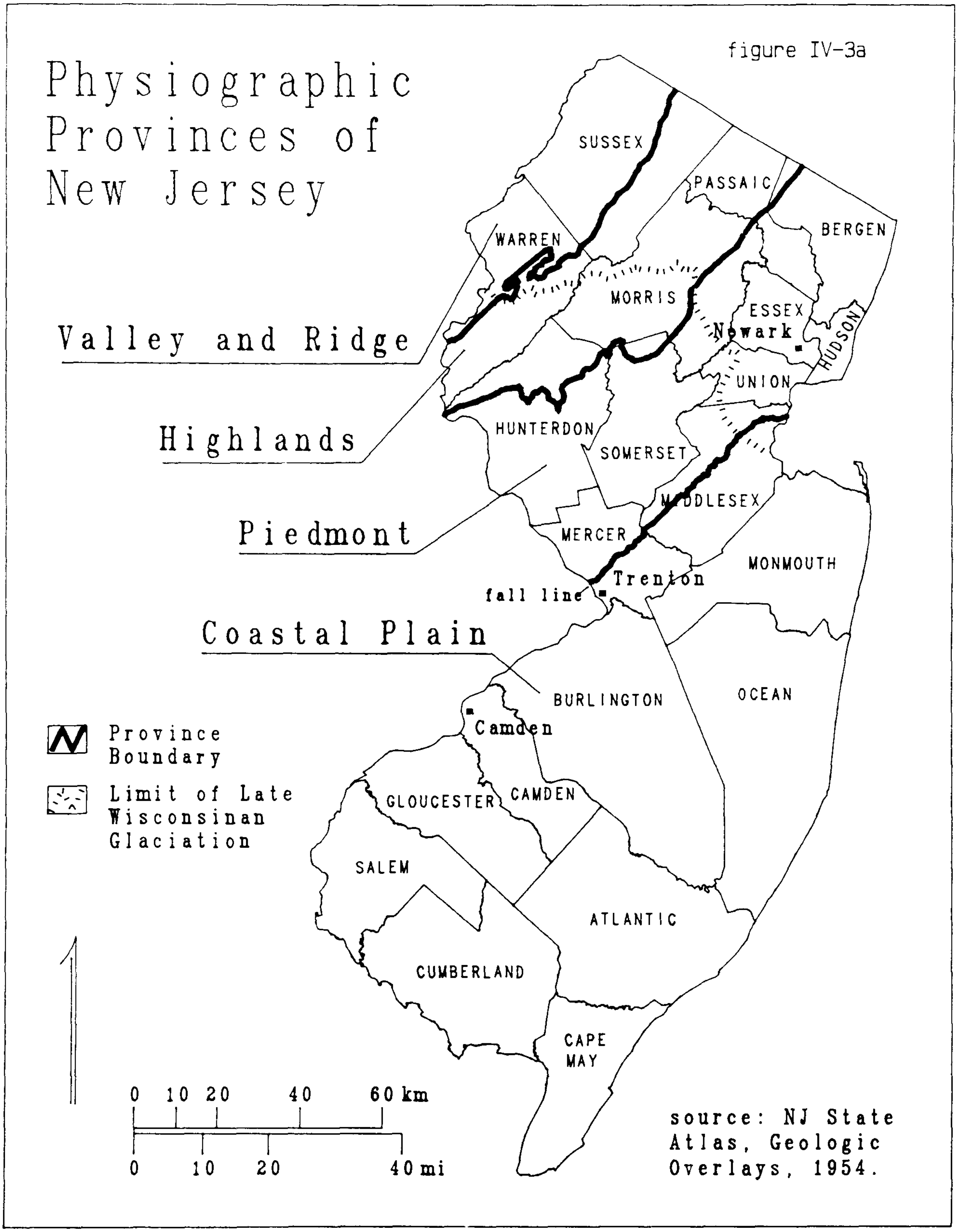
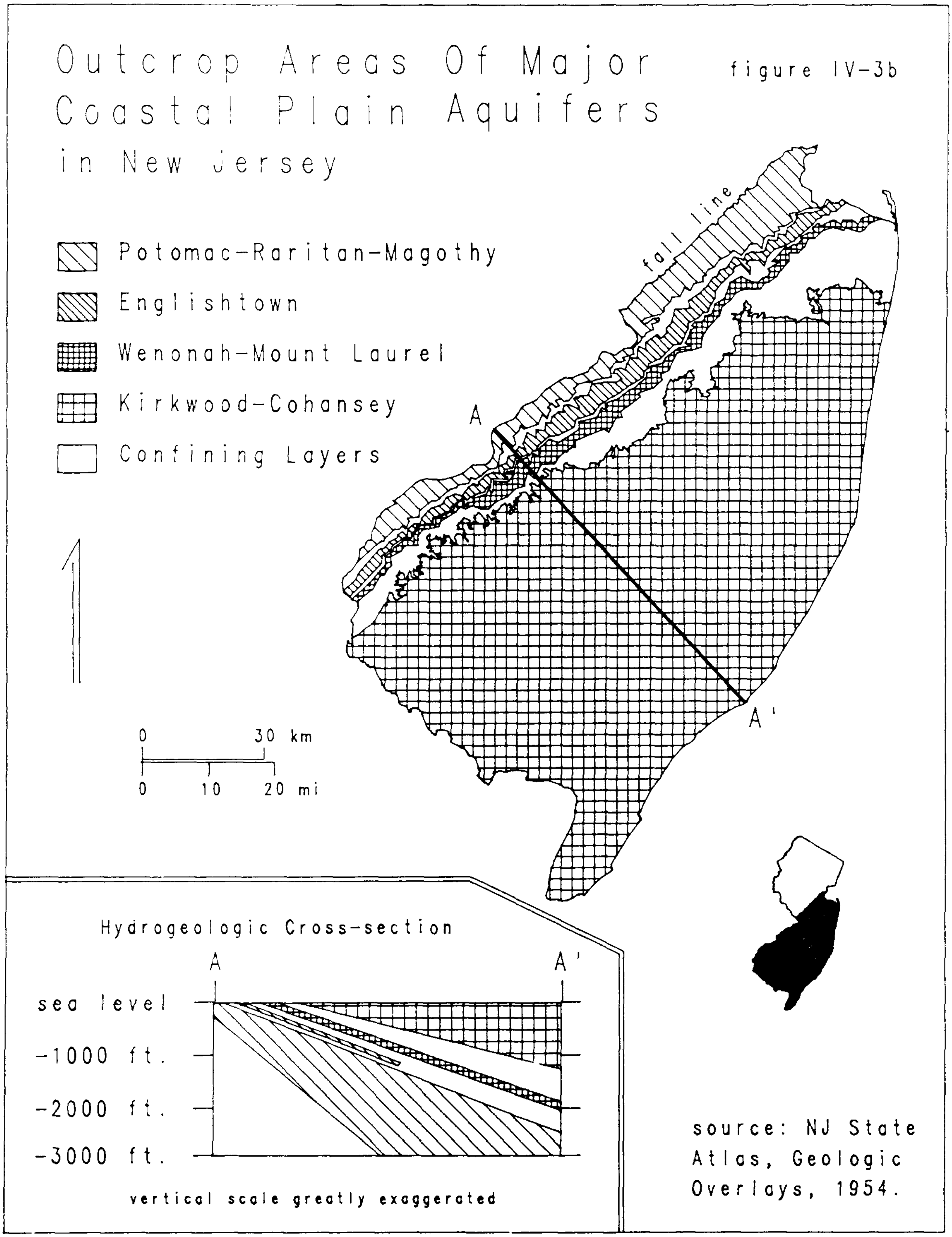


figure IV-3a
Physiographic Provinces of New Jersey
Valley and Ridge
Highlands
Piedmont
Coastal Plain
Province Boundary
Limit of Late Wisconsinan Glaciation
SUSSEX
PASSAIC
BERGEN
WARREN
MORRIS
ESSEX
Newark
HUDSON
UNION
HUNTERDON
SOMERSET
MIDDLESEX
MERCER
Trenton
fall line
MONMOUTH
BURLINGTON
OCEAN
Camden
GLOUCESTER
CAMDEN
SALEM
ATLANTIC
CUMBERLAND
CAPE MAY
0 10 20 40 60 km
0 10 20 40 mi
source: NJ State Atlas, Geologic Overlays, 1954.


Outcrop Areas Of Major Coastal Plain Aquifers in New Jersey
figure IV-3b
Potomac-Raritan-Magothy
Englishtown
Wenonah-Mount Laurel
Kirkwood-Cohansey
Confining Layers
fall line
A
A'
0
30 km
0
10
20 mi
Hydrogeologic Cross-section
A
A'
sea level
-1000 ft.
-2000 ft.
-3000 ft.
vertical scale greatly exaggerated
source: NJ State Atlas, Geologic Overlays, 1954.

percent, which will undoubtedly put further demands on the ground water in the province (NJDEP, 1985).

The unconfined Kirkwood-Cohansey aquifer system is composed mostly of quartz sand and covers approximately 3000 square miles of the Coastal Plain. Here, shallow ground-water flow is mostly controlled by local topography and deeper regional flow by the location of major discharge areas. Ground water in the shallow local flow systems discharges chiefly to streams or, in the regional flow system chiefly to the Atlantic Ocean through submarine outcrops. The environmentally sensitive Pine Barren region, that is protected by the New Jersey Pinelands Protection Act of 1979, is directly underlain and intimately associated with the Kirkwood-Cohansey aquifer system. In much of the Coastal Plain this aquifer system is the major supplier of water to domestic wells.

Previous work on this unconfined system (for example Rhodehamel, 1970, Means and others, 1981) has shown that because of the chemical inertness of the quartz aquifer material, the major element cycles are mainly controlled by precipitation chemistry. Work by Demir (1989) in McDonalds Branch Basin, Lebanon State Forest, Burlington County, New Jersey showed that some minor and trace elements are also controlled by precipitation chemistry. For example, iron and manganese in shallow ground water here are mostly derived from geochemical weathering whereas most of the lead, copper and cadmium originated from precipitation. The lead levels fluctuated seasonally and sometimes exceeded the MCL of 50 parts per billion. Ground water in the Kirkwood-Cohansey aquifer is acidic with a pH generally less than 6.0. It is low in total dissolved solids, usually less than 100 mg/L. Such water can be strongly corrosive to plumbing systems (Barringer 1989). Because of the chemical inertness of the quartz sands, ground water in this aquifer is highly susceptible to pollution from anthropogenic sources (Rhodehamel, 1970; Means and others, 1981).

Natural flow in the confined aquifers is from the outcropping recharge areas in the northwest, with an area of approximately 1400 square miles, to suboceanic discharge areas to the southeast. Water may flow from one confined aquifer to another; such flow is controlled by the hydraulic gradient between aquifers and the conductivities of intervening confining layers. Overpumping in some of these aquifers has resulted in water level declines in three major regional areas (Leahy and others, 1987). These are 1) the Potomac-Raritan-Magathy aquifer around Camden, 2) the Atlantic City 800-Foot Sand aquifer around Atlantic City, and 3) the Old Bridge and Farrington aquifers of the PRM system at the South River/Raritan Bay area. These areas are characterized by extensive cones of depression in the regional flow field deep enough to cause saltwater encroachment from nearby saltwater bodies. The lower hydraulic head in these areas also results in increased flow or recharge from adjacent aquifers. Studies are being conducted by the New Jersey Geological Survey (NJ Department of Environmental Protection) in cooperation with the United Stated Geological Survey (U.S. Department of the Interior), to more fully understand this problem so that water supply planners can effectively manage the State's ground-water supply.

In general, **ground water quality** in the major confined aquifers of the Coastal Plain is suitable for most uses with minor treatment. The most ubiquitous problems are iron, manganese, and high chloride concentrations in aquifers affected by saltwater intrusion. The confined aquifers are most susceptible to anthropogenic pollution in their outcrop areas where they lack a protective layer of low permeability. Water quality in the Kirkwood-Cohansey aquifer system is generally good but the water may require treatment for high iron, sometimes manganese, and corrosiveness (Rhodehamel,1970; Harriman and Sargent, 1985). Water from some wells near the Kirkwood outcrop area have reported radium and gross alpha levels above the EPA-established maximum contaminant levels of 5 picocuries per liter and 15 picocuries per liter respectively. These radiological contaminants are thought to occur naturally and at present (1990) the USGS is studying their occurrence in the Coastal Plain. Mercury levels exceeding the MCL of 2 parts per billion have also been found in ground water from other wells in the same geologic setting. The origin of the mercury is unknown, however, this problem is being investigated by the NJDEP.

PIEDMONT

The Piedmont Physiographic Province covers 1580 square miles and coincides with the Newark Basin in New Jersey. This basin is underlain by rocks of the Newark Supergroup which extend discontinuously from South Carolina to Nova Scotia. Rocks in the Newark Basin, include igneous rocks (chiefly diabase and basalt) which intruded the sedimentary rocks of the Brunswick Group (Jurassic), the Passaic Group, and the Lockatong and Stockton Formations (early Jurassic, 208-187 mya; and Triassic 245-208 mya) (Olsen, 1980). Basically, the sedimentary units are comprised of mudstone, siltstone, sandstone, and minor conglomerate. Reddish-brown mudstone, siltstone, and sandstone of the Passaic Formation are the most widespread at the land surface.

Approximately two thirds of New Jersey's population resides in this Province. It is estimated that approximately 59 percent of the purveyor-supplied water here is ground water. In addition more than 71,000 domestic wells supply approximately 9 percent of the inhabitants with water (NJDEP, 1985). Most ground-water flow in the bedrock is through a complex network of interconnected fractures, bedding-plane partings, and intergranular pores. Preferential fracture alignment throughout much of this basin results in anisotropic ground-water flow. The density of hydraulically connected fractures decreases with depth and Kasabach (1966) noted that most ground-water storage in the Stockton and Passaic (Brunswick Shale) Formations is restricted to the upper 500 feet in Hunterdon County, New Jersey. The bedrock aquifers are generally unconfined near the surface and semiconfined at depth. Wells chiefly case off the unconsolidated overburden and draw water from bedrock in an open borehole. Based on available data, Houghton and Flynn (1988) determined that the mean yields for residential wells in the Newark Basin aquifers are:

Aquifer	Mean yield (gpm)	no. wells used in mean
Stockton	20.0	309
Passaic	16.3	1196
basalt	11.8	94
Lockatong	9.5	393
diabase	7.4	141

Ground water quality throughout the Newark Basin is generally satisfactory but locally may require treatment for undesirable contaminants. The most common water-quality violations are for the state-recommended secondary drinking water regulations. The contaminants include iron, manganese, sulfate, total dissolved solids and hardness (Kasabach,1966; Nichols, 1968; Anderson, 1968; Szabo and others, 1989). In the urbanized lower Hackensack River basin and the nearby Newark area, water quality is generally poor due to anthropogenic and natural factors. Saltwater intrusion due to overpumping and the pumping of deep, slowly moving, naturally mineralized water has resulted in poor water quality here. Localized saltwater intrusion has degraded ground-water quality with chloride concentrations as high as 1900 parts per million (Nichols, 1968) being recorded. Total dissolved solids, hardness, iron and sulfate at concentrations requiring treatment are characteristic of the deep ground water in this area (Carswell, 1976). Others have noted a decline in water quality with depth in this basin (Kasabach, 1966; Anderson, 1968).

A study of natural radioactivity in the ground water of the Newark Basin was conducted by Zapecza and Szabo (1987a,b). They showed that uranium enrichment occurs in black mudstones near the Lockatong-Passaic contact and that complex hydrogeochemical relationships account for radionuclide activities. Gross alpha particle activities and radium-226 activities are directly related to uranium decay, and locally exceed MCLs of 15 and 5 picocuries per liter respectively. The MCL of 5 pCi/L for radium is for radium-226 plus radium-228. Radium-228 was outside the scope of the 1987 study. Based on 260 ground-water samples, gross alpha particle activities ranged from less than 0.1 to 124 pCi/L; 5 percent exceeded the MCL. Radium-226 concentrations ranged from less than 0.01 to 22.5 pCi/L. Barium levels exceeding the primary drinking water standard or MCL of 1.0 mg/L were reported in Zapecza and Szabo (1987b) and a level of 2.13 mg/L in Hunterdon County is under investigation by the DEP. Barite ($BaSO_4$) mineralization occurs locally throughout the Newark Basin (Dombroski, 1980) and accounts for most of the barium found in ground water here. However, anthropogenic inputs of barium into the ground-water environment are also possible at this location.

HIGHLANDS

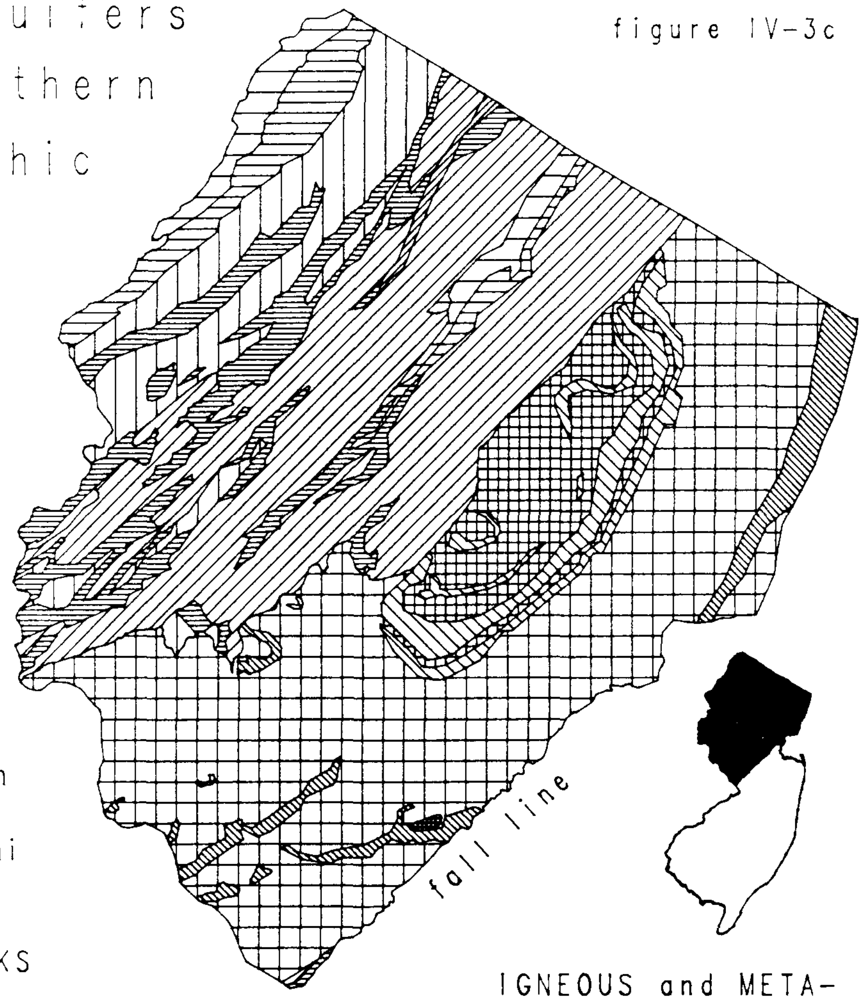
The Highlands Province is 1016 square miles in area and consists of a belt of Precambrian (< 570 mya) crystalline metamorphosed rocks that were originally igneous and sedimentary. The rocks are a major source of water for domestic, industrial, and municipal consumers in the Highlands (fig. IV-3c).

Ground-water flow in the Highlands is mainly unconfined and is controlled by topography, fracture, and foliation plane geometry. Flow is from upland areas to valleys where ground water either discharges to surface waters, or continues to flow down-valley within the saturated zone. Local flow systems dominate and intervalley regional flow is not known to occur (NJDEP, 1985b). The optimum depth for domestic wells in crystalline rocks is considered by Davis and Turk (1964) to be 150 - 250 feet. This depth agrees closely with the findings of Gill and Vecchioli (1965), Kasabach (1966), and Miller (1974). Well yields vary locally but James (1967) found that yields are generally higher in lowland than upland areas. He also observed that yields in different rock types become progressively less as one progressed from pyroxene granite and gneiss, through hornblende granite, biotite gneiss, amphibolite, to quartz diorite.

Ground-water quality in the Highlands is satisfactory for most uses, however, localized high iron, hardness, marginally low pH, and total dissolved solids problems occur (Kasabach,1966; Miller, 1974). Minerals containing radioactive elements are found in a variety of crystalline rocks in the Highlands (Volkert, 1988), and therefore, the potential exists for radionuclide release to ground water. In 1987, 129 wells in these crystalline rocks were sampled by DEP for radon. The radon values in the water ranged from 36 to 24,000 pCi/L, and 5.4 percent of the wells exceeded 10,000 pCi/L. No MCL for radon in ground water had been established by the EPA as of 1989.

figure IV-3c

Bedrock Aquifers of the Northern Physiographic Provinces, New Jersey



0 30 km

0 10 20 mi

SEDIMENTARY ROCKS

PALEOZOIC

- Devonian: conglomerate, sandstone, shale, limestone
- Silurian: conglomerate, sandstone, shale, limestone
- Ordovician: shale, limestone
- Cambrian: limestone, sandstone

MESOZOIC

- Cretaceous: sand, clay, greensand marl
- Jurassic: siltstone, shale, sandstone, conglomerate
- Triassic: siltstone, shale, sandstone, conglomerate

IGNEOUS and METAMORPHIC ROCKS

MESOZOIC

- Jurassic: basalt
- Jurassic: diabase

PRECAMBRIAN

- marble
- gneiss, granite

source: NJ State Atlas, Geologic Overlays, 1954.

VALLEY AND RIDGE

This province is 515 square miles in area and is comprised mostly of thick sequences of Paleozoic (570-245 mya) sedimentary rocks but also has some small, unrooted slices of Precambrian crystalline rocks to the southeast near the Highlands province and younger intrusives. Sedimentary-rock types include dolomite, limestone, sandstone, shale and siltstone. The Paleozoic rocks are folded and faulted with the most intense deformation found in the southwest.

This province has a relatively low population and the predominant land uses are recreational in the northwest and agricultural in the southeast. A compilation of hydrologic data by Miller (1974) showed that ground water supplied 60 percent of the daily water consumption and most of the ground water was obtained from bedrock wells.

Ground-water flow is through fractures in all rock types, in solution channels through limestone and dolomite, and through pores in the unconsolidated stratified drift. The structural controls on local and regional ground-water flow in these rocks are complex as discussed in Herman (1988). Moderate to large supplies of water are obtained from stratified drift, cavernous limestone and dolomite, and shear zones near faults. Lesser yields are obtainable from Precambrian crystallines, noncavernous limestone and dolomite, shale and quartzite (Miller, 1974). Most of the ground-water storage is within 300 feet of the land surface.

The ambient ground-water quality in this province is generally satisfactory for most purposes. However, in places ground water must be treated for hardness, low pH, high iron, and high sulfate content (Miller, 1974). Some of these problems are more characteristic of one rock type than another. For example, water from limestone and dolomite generally is harder than from other rock types, however, this water is also rarely low in pH, and iron problems are less common. Lead exceeding the MCL of 50 parts per billion was found in water from some domestic wells in the Lafayette Meadows area in Sussex County. An investigation by NJDEP in the early 1980s indicated that the source of this lead is a nearby lead-zinc mineralized zone occupying secondary fractures within the limestone bedrock. Similar undiscovered problem areas may exist in this province. The New Jersey Geological Survey is currently promoting studies to better understand this problem so that a systematic approach to recognizing similar problem areas can be developed.

GLACIAL DEPOSITS

New Jersey has been glaciated at least three times. The last major glaciation, and most important for aquifer formation, peaked approximately 21,000 years ago during the late Wisconsinan stage of the Pleistocene epoch (Ridge, 1983). From 21,000 to approximately 17,000 years ago the ice front receded and the meltwater deposited stratified drift in most valleys north and south of the Terminal Moraine.

Where stratified drift is thick and permeable it may produce significant quantities of water. For example, in Morris and Essex counties, 77 percent and 81 percent respectively of the pumped ground water is from stratified-drift deposits with yields from individual wells ranging from 20 to 2,200 gallons per minute (gpm) (Van Abs, 1986).

Ground-water chemistry in these aquifers is variable and is mainly a function of the source of the recharge water, the chemistry and grain size of the aquifer material, and the residence time of the ground water. Water quality in the glacial aquifers is generally suitable for most uses, however, concentrations may locally exceed the secondary drinking water standards for iron, dissolved solids and hardness (Miller, 1974). Many of these aquifers have ground-water pollution problems.

D. GROUND-WATER MANAGEMENT IN NEW JERSEY

INTRODUCTION

New Jersey is taking an active and progressive approach to the management of the State's ground water. Several Federal, State and sub-state offices are involved in ground-water management activities ranging from resource evaluation to the cleanup and restoration of contaminated aquifers. New Jersey considers its efforts in ground-water protection and pollution control to be a priority and has made major commitments to managing its ground water. New Jersey's ground water management program has seven major components:

1 **Strategy Development:** The Department's Ground Water Strategy for New Jersey coordinates the many ground water programs that have been established by the Legislature. The Strategy outlines the State's fundamental ground water policies, describes the major management issues, and outlines the Department's approach to solving these issues.

2 **Program Planning:** Statewide water quality and supply planning is performed by the Division of Water Resources (DWR), which develops the Ground Water Quality Standards, prepares and updates the New Jersey Statewide Water Supply Master Plan, and plans initiatives proposed by the Ground Water Management Strategy. Regulatory planning is conducted by regulatory elements as needed.

3 **Resource Evaluation:** Resource evaluation involves the monitoring, investigation, and assessment of ground water resource quantity and quality, the collection of basic quantity and quality data, and the development of methodologies to evaluate and model ground water.

4 **Research:** Research (as distinct from resource evaluation) provides an understanding of fundamental processes in ground water movement, pollution migration, and physical/chemical interactions between ground water and the subsurface environment.

5 **Program Implementation:** Implementation involves all regulatory programs that manage, protect and restore ground water. These actions are accomplished through various permit and review functions and through remedial programs.

6 **Enforcement:** Enforcement includes all actions designed to ensure compliance with Department's regulations for ground water, including permit compliance monitoring, enforcing against

unpermitted or illegal activities, and identifying the party responsible for pollution.

7 **Outreach/Education:** The Department provides education and information programs for the general public, local and county governments, and the news media. The department conducts research aimed at more effective risk communication. Citizens advise the Department on ground water issues through advisory councils and task forces.

PROGRAM PLANNING AND A GROUND WATER STRATEGY FOR NEW JERSEY

Coordination of New Jersey's many laws and programs affecting ground water management will occur through A Ground Water Strategy for New Jersey. It establishes major new initiatives for protecting the potability of aquifers and enhancing the effectiveness of pollution mitigation programs. The Strategy was approved in 1989. Coordination of programs is necessary for effective management. The most critical initiatives are outlined below.

The Case Management System will coordinate case assignments, priorities and technical standards for pollution cases involving hazardous substances. This system will result in faster action to protect public health where wells are polluted, through concurrent analysis of water supply remedies and ground water pollution mitigation options so that the fastest, most effective and least costly remedies will be implemented.

Also, the Department will develop rapid remedies for imminent or existing pollution of drinking water wells or sensitive ecosystems (known as a "proximate risk"). The lengthy schedules of normal remedial efforts are not acceptable in such situations. After a remedy is in place, any remaining pollution at the site will be addressed through the normal remedial process.

Ground Water Quality Standards establish objectives for controlling the discharge of pollutants to ground water and the correction of pollution from past discharges. The standards contain numerical criteria for many pollutants, and are fundamental to the implementation of the New Jersey Water Pollution Control Act. New standards will be promulgated in 1990. The standards will contain a new system for classifying ground water of the state, numerical criteria for many pollutants, and a policy which protects good quality ground water from significant degradation due to future discharges.

Well Head Protection will further protect the quality of water which flows into drinking water wells, both public and domestic. Congress required in 1986 that all states develop and implement well head protection programs. Public water supply wells and clusters of domestic wells will receive protection due to their importance as water supply sources. The department intends to adopt a program plan in 1990.

Aquifer Recharge Area Protection: The Department will prepare guidance for voluntary municipal use in mapping and protecting their aquifer recharge areas by June 1990, and then prepare maps of major aquifer recharge areas by 1992, as required by State law.

Nonpoint Sources of Pollution: Certain nonregulated sources are a major concern for ground water quality, as they are for surface water quality. Nonpoint sources of pollution include urban runoff, road runoff, agricultural and lawn care practices, and myriad sources of pollutants (e.g. residential septic systems) which are individually small but so ubiquitous as to pose significant pollution concerns. Nonpoint source management is needed which ensures that ground water quality standards are met to the greatest extent practicable. Best Management Practices (BMPs) will be developed to implement these policies.

RESOURCE EVALUATION

The State, both alone and in conjunction with other agencies, as shown in Table IV-5, has been conducting ground water resource investigations for several decades. The scope of the resource investigations has been expanded in recent years. Resource evaluation results in the description of surface and subsurface geology, and an analyses of aquifer quality and quantity. Both the N.J. and U.S. Geological Surveys help implement resource assessment management strategies by conducting field investigations and developing ground water data bases.

New Jersey has two long-term, continuous ground water quality monitoring networks. One is the **Saltwater Monitoring Network.** It consists of over 400 wells located along the Atlantic Ocean, Delaware Bay and Raritan Bay, and provides an early warning system for saltwater intrusion. The Saltwater Monitoring Network has been in existence since 1923. A second network, the **Ambient Ground Water Quality Network**, provides water quality information on 39 common chemical parameters, as well as volatile organic compounds (VOCs), on a regional basis. This baseline information will regionally characterize ground water quality, as a function of aquifer and rock type, throughout the state. This information will help support public, private and governmental inquiries, environmental and scientific studies, and applicable public and scientific information publications. The Ambient Ground Water Quality Network has been in existence since 1982.

The USGS has a large scale computerized system, WATSTORE for the storage and retrieval of the nation's water data. The national database in Reston, Virginia and a smaller database in the USGS branch office in New Jersey have much ground water quality and quantity data for the state. The NJGS is currently developing an ambient ground water quality and aquifer parameter database that will store data from NJGS projects and other programs that gather applicable data in the state. Much of that type of data is not entered into WATSTORE. For example, most ambient ground water quality data gathered from the NJPDES permit program and the Bureau of Safe Drinking Water's New Well DataBase are not in WATSTORE.

RESEARCH

Basic research on ground water quality issues is limited in the Department, due to budgetary restrictions. However, some research is conducted through the various Divisions, including the Division of Science & Research. The Department first attempted an overview of ground water quality in a study conducted from 1977-80. More recent research has studied the fate of toxic substances in soil and aquifer systems. Current research is studying the presence of fertilizers and the newer pesticides in ground water, radon levels in drinking water, the effects of acid deposition on the State's ground water resources, new methods of detecting ground water contamination, and ground water related community health problems.

GROUND WATER QUALITY MANAGEMENT

Methods to regulate and control sources of ground water pollution are, to a large degree, a function of the variability of the sources themselves. As shown in Tables IV-1a and 1b, not all sources of ground water pollution are from activities where a discharge is intended. Many activities cause ground water pollution due to poor design, operation, or awareness of potential pollution problems. Further, many causes of ground water pollution are due not to intentional waste disposal, but rather to accidental discharges (i.e., leaking underground storage tanks), incidental discharges (i.e., leaching of pesticides) or induced contamination (i.e., saltwater intrusion).

State ground water pollution programs focus first on the prevention -- control of the sources and causes of ground water pollution -- and then on the correction of pollution. This emphasis acknowledges the difficulty and cost of restoring ground water to standards once polluted. Current regulatory programs address three categories of ground water quality concerns:

regulated discharges, remedial action at pollution sites, and indirect sources of pollutants.

Five programs regulate the actual or potential discharge of pollutants from active facilities: the Resource Conservation and Recovery Act (RCRA); the NJ Pollutant Discharge Elimination System (NJPDES); the Underground Storage Tank (UST) program; the Realty Improvement Act (Chapter 199); and the Solid Waste Management Act. Additional site remedial actions occur under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, also called Superfund), the NJ Spill Compensation and Control Act (Spill Act), and the Environmental Cleanup Responsibility Act (ECRA).

Resource Conservation and Recovery Act (RCRA): This program controls the treatment, storage, and disposal of hazardous wastes. The universe of facilities with regulated activities has dropped from approximately 600 in 1980 to approximately 200 today. RCRA permitting is integrated with the NJPDES program, where there is an existing, planned or potential discharge of pollutants to ground water or surface water. Performance, operational, and construction (minimum technology) standards are used. The performance standard is zero discharge for all hazardous constituents. Stringent closure, post-closure and remedial standards include additional ground water protection requirements. Past disposal units on a site may also be evaluated, and cleanup compelled.

New Jersey Pollutant Discharge Elimination System (NJPDES): Pursuant to the New Jersey Water Pollution Control Act, all potential sources of ground water pollution are regulated by NJPDES. The program has five major steps, consisting of permitting, monitoring, site analysis, remedial action, and reporting. All NJPDES permits require the installation of monitor wells and periodic monitoring of ground water quality. If significant ground water pollution has occurred, then a detailed study must define the full nature and areal extent of the pollution. Based on the results of the study, the permit may require remedial action to modify or control the source of pollution and reduce residual contamination in the soil and ground water, with periodic reporting.

NJPDES presently regulates nine basic activities: 1-major septic systems, 2-land application-infiltration/percolation lagoons, 3-injection wells, 4-landfills, 5-surface impoundments, 6-resource recovery uses of sludge and compost, 7-sewage treatment plant sludge, 8-discharge activities or ground water restoration actions at ECRA, (NJ Environmental Cleanup Responsibility Act, see below) cases, and 9-ground water aspects of RCRA cases. CERCLA (The Federal Comprehensive Environmental Response, Compensation and Liability Act, see below) remediation projects by responsible parties may also involve NJPDES permits. The NJPDES program expects to gradually enforce permit requirements regarding other discharge sources.

Underground Storage Tanks -- New Jersey's Underground Storage of Hazardous Substances Act, as passed in 1986, regulates underground storage tanks (UST) containing hazardous substances. In accordance with the act, DEP's Bureau of Underground Storage Tanks (BUST) is identifying and registering all tanks containing hazardous substances or petroleum products. Approximately 125,000 USTs at 85,000 facilities are subject to the State law. A subset consisting of 50,000 tanks at 15,000 facilities are also subject to Federal law. Facilities regulated under the State law contain heating oil or motor fuel above a certain storage volume, or any underground storage tank used to contain any regulated hazardous substance or waste.

Program components include registration, annual certification, and technical standards. Standards include: new tank design standards, construction permits, closure approvals, retrofitting existing tanks, periodic testing, monitoring systems, corrosion control, inventory control, and financial responsibility. Certain size and use categories of USTs need not comply with all standards.

Chapter 199, Realty Improvement Act -- "Chapter 199" refers to P.L. 1954, Chapter 199, the Realty Improvement Act. Under this act, the local planning board approves the construction of individual sewage disposal systems and the construction official monitors compliance. The NJPDES program regulates multiple connections to a single septic system. The State also must review subdivisions with 50 or more dwelling units for adequate water and sewerage and compliance with applicable State standards.

Regulation of Landfills -- The Department regulates the design, construction, operation, closure and post-closure monitoring of all solid waste facilities, including landfills. The Department has required a large number of existing facilities to either close or prepare designs and plans for upgrading to reflect the required level of technical sophistication. Facilities must be permitted by the Division of Solid Waste Management. Landfills and other facilities often require both the solid waste facility permit and a NJPDES permit for ground water monitoring.

Under the Sanitary Landfill Facility Closure and Contingency Fund Act, all facilities are required to submit and obtain approval of a Closure Plan, which describes the activities necessary to properly terminate the facility, estimates the closure costs, and ensures sufficient funds for these costs.

Remedial Action -- The NJPDES and RCRA programs, discussed above, involve ground water discharge permits which require ground water monitoring, set discharge limits, and may set technology requirements for the regulated facilities. Remedial action may be required, with two levels of action: control or removal of the discharge source and pollution mitigation. Discharge sources must be controlled to minimize damage.

There are four laws which focus on remedial action for nonpermitted discharges of hazardous substances: 1- the NJ Environmental Cleanup Responsibility Act (ECRA); 2- the NJ Spill Compensation and Control Act (Spill Act); 3- the Federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, also known as Superfund); and 4- the Underground Storage Tank Law (UST). In each program, ground water pollution is a major facet of the site assessment and remedial action. The programs also deal with the contamination of soil, surface water, air, surface disposal and physical facilities.

1) **ECRA** imposes preconditions on the sale, transfer or closure of industrial establishments involved in the generation, manufacture, refining, transportation, treatment, storage, handling or disposal of hazardous substances or wastes. The facility owner must provide information on site conditions and receive approval that no remedial actions are needed or that planned remedial actions will resulted in acceptable site quality.

2) **The Spill Act** mandates that responsible parties notify the Department of discharges of hazardous substances. The Department may take emergency remedial action, and may implement long term cleanups when the responsible party will not. The Department may seek treble damages against responsible parties where public funds are used.

3) **CERCLA** is similar in many ways to the NJ Spill Compensation and Control Act. Triple damages against responsible parties may be sought when public funds are used for remedial action. CERCLA provides for an assessment and ranking of sites nationally on the National Priority List.

4) Under **UST**, the State law requires maximum expediency to correct ground water contamination. Tank owners must certify that all requirements were met. If ground water pollution has occurred, additional requirements are imposed which extend beyond the self-certification program.

GROUND WATER SUPPLY MANAGEMENT (Quantity Protection)

One major purpose for ground water quality management is the protection of potable ground water supplies. The department is responsible for protecting ground water through the allocation of supplies and regulation of public water supply systems. The Water Supply Management Act of 1981 is the primary authority for these programs. The department must approve any withdrawals of water, including ground water, which exceeds 100,000 gallons per day on average. Approximately 1,000 water allocation permits exist, many of which are for ground water. The department also must approve the drilling and construction of any new well, including monitor wells, test holes, and supply wells for potable, industrial, commercial and agricultural uses. Over 20,000 well drilling permits are approved each year.

The State Water Supply Management Act of 1981 also serves as the basis for the General Water Supply Management Regulations (N.J.A.C. 7:19) which provide for the establishment of **Water Supply Critical Areas**, where severe water supply problems exist. In order to alleviate these supply problems, the State has been empowered to exercise regional water management controls not applicable in other areas of the State.

Responding to severe water level declines and increased development in the northern Coastal Plain, New Jersey established Water Supply Critical Area Number 1 in 1985. The four aquifers included in this area are: Englishtown, Mount Laurel-Wenonah, and the Upper and Lower Potomac-Raritan-Magothy formations. The authority of the State to impose water withdrawal limitations in Critical Area Number 1 has been legally challenged. A 1989 court decision refuted the State's authority on this matter. New regulations are currently being written for this area. Critical Area Number 2 includes portions of Camden, Burlington, Gloucester, Salem, Cumberland, Atlantic, Monmouth, and Ocean Counties. The affected aquifer is the Potomac-Raritan-Magothy. The regulation for the establishment of critical areas allows for the reduction of existing diversion allocations when alternative supplies become available, and promotes water conservation and the development of alternative supplies.

Should the need arise, the Water Supply Management Act allows the Governor to designate other Water Supply Critical Areas, upon the recommendation by the Commissioner of the DEP that severe water supply problems exist. In such areas, stringent water withdrawal controls may be exercised on a regional basis. The Governor has not as yet designated any new Critical Areas, but the department has identified several potential candidate areas.

In recognition of the importance of New Jersey's ground water for potable water supplies (almost 50 percent of population relies on ground water), the Environmental Protection Agency responded to a petition by the Department in 1985 and designated most of New Jersey as **"sole source aquifers"** which provides additional protection of the aquifers from actions by federally-funded programs. This petition recognized the vulnerability of the State's ground water to many known and potential pollution sources in the State. At present, approximately 80 percent of the state, the highest percentage of any state, is located within these designated Aquifers.

ENFORCEMENT

The Divisions of Water Resources (DWR) and Hazardous Waste Management (DHWM) have enforcement responsibilities under the programs described above. They can enforce the statutes and regulations, mitigate immediate hazards, seek permit compliance or require the responsible party to clean-up ground water pollution.

The Division of Regulatory Affairs (DRA) is responsible for ensuring the legal and policy consistency of the Department's programs. DRA advises the programs on general legal issues and the promulgation of rules concerning ground water protection, and helps the divisional enforcement elements develop case strategy and resolve legal enforcement issues. Through DRA, the Department may refer cases to the Office of the Attorney General to pursue court action.

GROUND WATER PROGRAMS OF OTHER AGENCIES

Other agencies have ground water programs which complement or supplement NJDEP roles in ground water protection through management strategies, monitoring and legislation. More information is available by contacting the various agencies themselves.

U.S. Geological Survey (Water Resources Division)

The U.S. Geological Survey, Water Resources Division (USGS/WRD) is the Nation's largest water resource investigating agency. The USGS/WRD investigates the occurrence, quantity, quality, distribution, uses and movement of surface and ground waters to develop and disseminate scientific knowledge and understanding of the nation's water resources, including New Jersey's. The USGS/WRD (NJ) and the State of New Jersey have had a cooperative agreement since 1923 to work on water related projects. The

USGS/WRD conducts various special studies in cooperation with the department.

U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency (USEPA) coordinates USEPA funded ground water programs in New Jersey. They provide both monetary and technical support for the implementation of the USEPA's ground water protection goals. USEPA is responsible for implementing the Safe Drinking Water Act, RCRA, CERCLA, and the Clean Water Act which include ground water protection measures. USEPA provides funding to the State under these laws for planning, development of regulations, and program implementation. USEPA provides extensive support for hazardous waste cleanup work. New Jersey administers most of the federal programs on behalf of USEPA. USEPA's Region II office in New York City is the New Jersey's liaison with USEPA.

Delaware River Basin Commission

The Delaware River Basin Commission (DRBC) is a regulatory and planning agency for the Delaware River basin, established in 1961 by Congress and the States of Delaware, New Jersey, New York and Pennsylvania. The Commission provides consistent management of the water resources of the basin, under the Commission's Comprehensive Plan. DRBC issues permits for water resources projects, conducts research and studies, forecasts stream and ground water levels and future water demand, monitors water quality, and enforces its water resource requirements.

Counties

Counties have the authority to implement environmental health programs through the County Environmental Health Act (N.J.S.A. 26:3A2-21), as long as certain overall performance standards are met. Cooperative program agreements are used for monitoring, inspection, and enforcement activities among local agencies, counties and the Department.

Municipalities

Municipalities have the authority to protect ground water on the local level through ordinances. The Municipal Land Use Law empowers the municipality to protect the environment and public health through zoning and subdivision and site plan control. The **Reality Improvement Sewerage and Facilities Act** requires that the Local Board of Health review the sufficiency of any proposed water supply system and sewage treatment facility for proposed reality improvements.

Public/Private Organizations

New Jersey has nine major watershed organizations, over one hundred environmental organizations, and over two hundred municipal Environmental Commissions and Committees. Many of these organizations deal with the protection and enhancement of water resources management, including ground water. Their activities include public education programs, newsletters, research, technical assistance, recycling drives, lobbying, and outdoor recreational activities.

E. FINDINGS OF CURRENT RESEARCH ON GROUND-WATER IN NEW JERSEY

Studies of ground-water quality and quantity problems in New Jersey are continuing. Recent investigations are examining

- -naturally occurring radionuclides in ground water,
- -pesticide and fertilizer pollution of ground water,
- -models that demonstrate the effect that hypothetical ground-water withdrawals will have on stressed aquifers in the Passaic River basin,
- -the water levels in Coastal Plain aquifers inorder to determine the potential for saltwater intrusion.

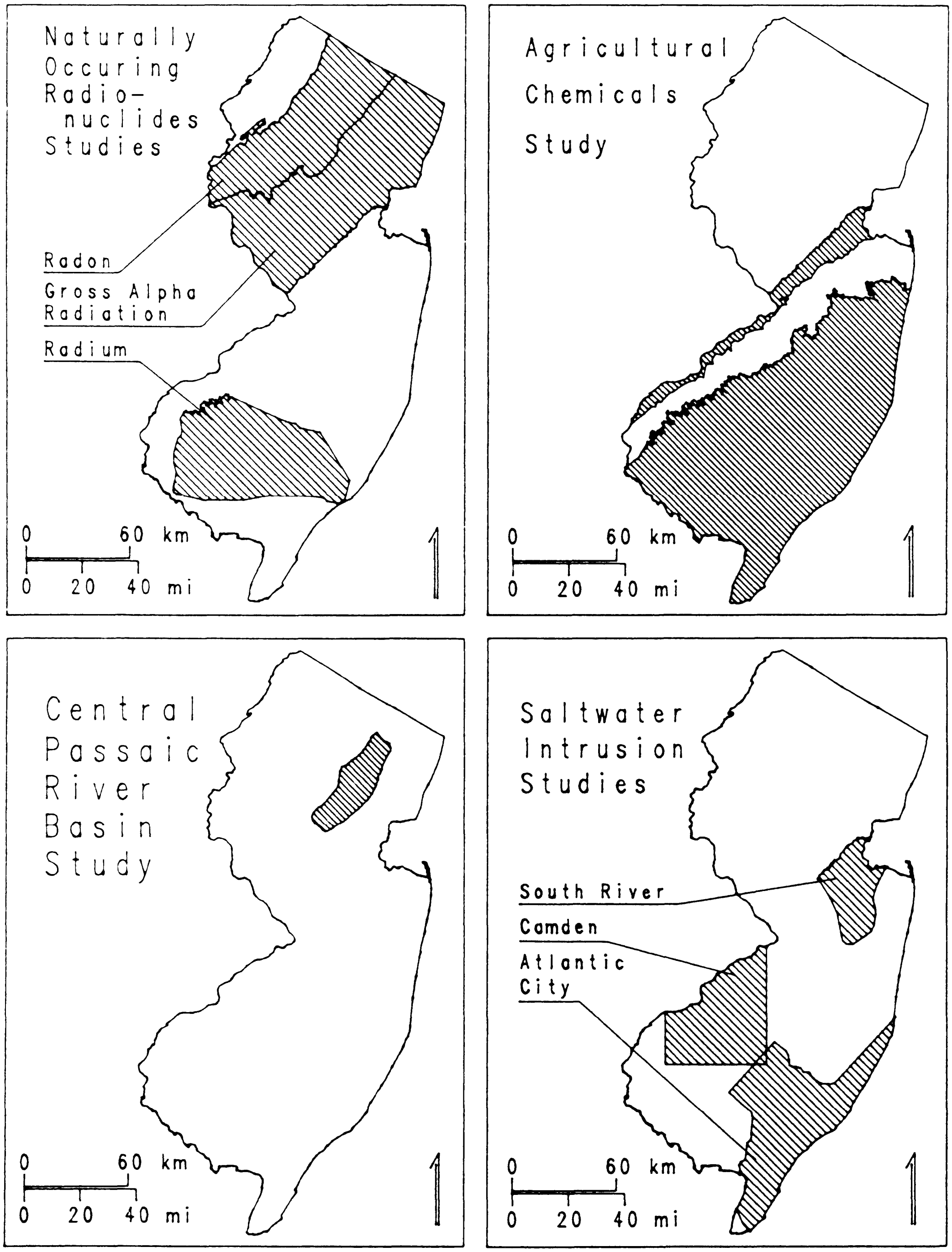
Figure IV-4 shows the general locations of each of the major studies discussed below.

Three separate studies focusing on the occurrence of naturally derived radionuclides in ground water in three geologically distinct areas have been or are being conducted.

i. In 1987 the NJDEP, in cooperation with Princeton University, sampled 129 wells that draw water from crystalline rocks in the Reading Prong for radon. These radon levels were observed to range from 36 to 24,000 picocuries per liter (pCi/L), and 5.4 percent of the wells sampled were found to have levels exceeding 10,000 pCi/L. A level of 10,000 pCi/L in ground water is believed to correlate with a level of 1 pCi/L in the air of a residence (Cothern, 1987).

ii. A study in the Newark Basin by the U.S. Geological Survey (USGS), in cooperation with the NJDEP, determined gross alpha-particle activity and geochemical field parameters in 260 wells (Zapecza and Szabo, 1987a,b). Selected samples were analyzed for radium-226, uranium, radon-222 and trace metals. Gross alpha-particle activities ranged from less than 0.1 to 124 pCi/L, 5.7 percent exceeding the MCL of 15 pCi/L. Radium-226 levels ranged from 0.1 to 22.5 pCi/L, 3.9 percent exceeded the MCL of 5 pCi/L. However this is a minimum percentage exceedence because radium-228 was not considered. Radon-222 ranged from 71 to 15,900 pCi/L and uranium ranged from 0.1 to 40 pCi/L. The figure IV-4

Major Ground-water Studies in New Jersey
General Study Areas



major source of the radionuclides is a laterally continuous, vertically narrow, uranium-rich layer that is shallow enough in the far northeast and southwest parts of the basin to be tapped by some wells. The highest radionuclide concentrations in ground water in the basin coincide with the distribution of the two parts of the layer.

iii. A USGS study, in cooperation with the NJDEP, is focusing on high radium levels in the Kirkwood-Cohansey aquifer system in the Coastal Plain of southern New Jersey. Levels of radium-226 plus -228, and gross alpha particle activities exceed their MCLs in many wells. Preliminary results (Karl Muessig, NJDEP/N.J. Geological Survey; oral communication, 1990) indicate that out of 82 widely distributed wells tested, 26 percent exceeded the MCL for radium. Radium-226 usually exceeds radium-228 but here radium-228 frequently predominates. This indicates that its parent isotope, thorium-232 occurs in widespread concentrations. Higher radium concentrations correlate with decreasing pH and increasing barium concentrations.

A study by the NJDEP, in cooperation with the USGS, sought to determine if agricultural chemicals such as pesticides and nutrients have adversely affected the quality of ground water in New Jersey (Louis and Vowinkle, 1989; and Louis written communication, 1989). The project was designed to examine agricultural wells in areas where ground-water is most susceptible to contamination. The outcrop areas of Coastal Plain aquifer systems were studied: the Potomac-Raritan-Magothy, the Kirkwood-Cohansey, and the bedrock aquifers in northwestern New Jersey. Water samples were collected from domestic, irrigation, and public-supply wells located within 800 meters of agricultural land. One hundred and twenty wells in ten counties were sampled from 1986 to 1988. The samples were analyzed for nutrients, volatile organic fumigants, herbicides and insecticides. Residues of 22 pesticides and 3 pesticide metabolites were detected in concentrations ranging from 0.01 to 13 parts per billion (ppb). Dissolved nitrate concentrations exceeded the primary drinking water standard of 10 milligrams per liter (mg/L) in 24 percent of the samples. This study clearly indicates that agricultural chemicals are having an adverse affect on ground-water quality.

Ground-water quantity in the Central Passaic River basin is currently being studied by the NJGS in cooperation with the USGS. Here, the buried valley aquifer system has experienced increasingly heavy ground-water withdrawals. Ground-water levels here have declined as much as 80 feet since the turn of the century. To better manage the limited ground-water resources in this basin the NJDEP is using a three-dimensional computer model to predict the aquifer-system's response to variable ground-water withdrawals (Hoffman, 1988). This will help predict aquifer-system response to any proposed ground-water withdrawals.

Overpumping of ground water and its relationship to saltwater intrusion have been the subject of several recent studies in the New Jersey Coastal Plain. One on-going study showed significant declines in ground-water levels in major artesian aquifers of the Coastal Plain. Overpumpage has caused large regional cones of depression to develop, the most extensive of these are in the Potomac-Raritan-Magothy aquifer system. Here, from 1978 through 1983, heads declined as much as 23 feet. In the Englishtown aquifer system, heads declined as much as 29 feet during the same period; however, the cones were not as extensive (Eckel and Walker, 1983). From 1983 to 1988 declines were as much as 52 feet. The lowering of heads indicates not only potential ground-water-quantity problems, but also potential quality problems. Saltwater from adjacent surface-water bodies may recharge the aquifers in response to the lowered heads. Recent USGS and NJGS investigations have found signs of saltwater intrusion in several coastal plain aquifers including those in the South River, Camden, and Atlantic City areas (Leahy and Paulachok, 1987). A study in progress in Cape May County focuses simultaneously on ground-water pumpage and saltwater intrusion. The goal is to define optimal withdrawals that will safeguard water quality.

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CHAPTER V

NEW JERSEY'S SURFACE WATER QUALITY MANAGEMENT PROGRAMS

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INTRODUCTION

New Jersey has an active and progressive approach for the protection of water quality. New Jersey's programs to provide this protection are briefly described in this chapter. For the purposes of the discussion, the programs are grouped in the following categories: point source control, nonpoint source control, wetlands protection, lakes management, and surface water monitoring efforts. This chapter also discusses the Water Quality Index and Water Use Index; methods by which water quality and the current resource use intensity are compared between waterways in the State on a relative bases.

The direction and activities of New Jersey's water quality management programs are outlined in the Statewide Water Quality Management Program Plan, produced by the Division of Water Resources in 1985. That document presents more than 25 Departmental policies, procedures, and strategies for a number of water quality and wastewater management issues. The Statewide Water Quality Management Program Plan satisfies State and federal continuing planning requirements. The document will be updated periodically to reflect new or revised water quality needs and priorities.

As discussed in Chapter III, total phosphorus and fecal coliform concentrations are the most severe water quality problems in New Jersey's rivers and streams. Other common pollutants or pollution indicators often found at problematic levels include nitrogen-containing compounds (including ammonia), biochemical oxygen demand, reduced dissolved oxygen, and locally, various toxic substances. These pollutants originate from both point and nonpoint sources.

Despite these current problems, progress has been made in improving the quality of our waters. These improvements are due to such measures as greater pollutant rate removals at wastewater treatment plants, and the elimination of many older and antiquated wastewater treatment facilities.

A. POINT SOURCE CONTROL

The protection of water quality through the provision of proper wastewater treatment has long been a program priority in New Jersey. Since 1972, more than $ 3.2 billion in federal and State funds have been obligated in the State for the construction of wastewater treatment works. The 1988 National Needs Survey, however, reports that approximately $3.3 billion of new investment in wastewater treatment projects is required to meet current needs in the State. Table V-1 presents the costs for the various categories assessed in the 1988 Needs Survey.

New Jersey's point source-related programs are described in the narrative below. The program discussions are divided into the following major subject areas: the New Jersey Municipal Wastewater Assistance Program, the New Jersey Pollutant Discharge Elimination System program, the sewer extension permit program (including sewer extension ban restrictions), the industrial pretreatment program, and enforcement-related activities.

1. New Jersey Municipal Wastewater Assistance Program: The NJDEP, through its Municipal Wastewater Assistance Element, administers various funding sources for the construction of wastewater treatment facilities throughout New Jersey. These are collectively referred to as the New Jersey Municipal Wastewater Assistance Program. That program consists of the traditional federal Construction Grants Program administered by the State on behalf of the USEPA and the State Wastewater Treatment Financing Program. The State Wastewater Treatment Financing Program consists of the combined Wastewater Treatment Fund and the New Jersey Wastewater Treatment Trust Program. The Wastewater Treatment Trust derives its monies from revenue bonds and it operates under the jurisdiction of an "independent financing authority." The Wastewater Treatment Fund is a State program administered by the NJDEP and is capitalized with federal funds. Together, these programs provide for loans at approximately 50% of the market interest rate. Terms of the loans are from 20-23 years. The State Wastewater Treatment Financing Program issued low interest loans in State Fiscal Years 1988, 1989, and 1990 for approximately $240 million, $190 million, and $147 million, respectively.

In applying for funding, applicants must meet deadlines for each of the following steps: commitment, planning, design, and formal application.

2. New Jersey Pollutant Discharge Elimination System: New Jersey was delegated the federal discharge permit program in 1982, and

TABLE V-1. NEW JERSEY 1988 NEEDS SURVEY RESULTS FOR SEWERAGE SYSTEMS.

CATEGORY - CURRENT 1988 PUBLICLY OWNED WASTEWATER TREATMENT NEEDS ELIGIBLE FOR FEDERAL FINANCIAL ASSISTANCE

	1988 NEEDS
Secondary Treatment	1380
Advanced Treatment	167
Infiltration/Inflow	240
Replacement/Rehabilitation	319
New Collector Sewers	301
New Interceptor Sewers	153
Combined Sewer Overflows	791
Total	3351

(All figures are January 1988 Dollars in Millions)

* As Reported By: US Environmental Protection Agency. Feb. 1989. <u>1988 Needs Survey Report to Congress</u>. EPA 430/9-89-001.

subsequently the program became known as the New Jersey Pollutant Discharge Elimination System or NJPDES. The NJPDES program regulates facilities and activities discharging or releasing pollutants into the surface waters or ground waters of the State.

Of the permitted municipal wastewater facilities, 328 discharge to surface water, 22 to ground water, and 24 to both the ground water and surface water. Of the industrial facilities, 650 discharge to surface water, 179 to ground water, and 135 to both surface water and ground water. In addition, there are also approximately 375 landfills with NJPDES permits.

In 1985, a revised schedule for the NJPDES was adopted. It utilizes a more comprehensive assessment of potential environmental damage resulting from discharges and imposes a fee based on the extent of projected water quality damage. In Fiscal Year 1987, the NJDEP collected $6.6 million in NJPDES permit fees.

As part of New Jersey's NJPDES program to control the effects of point source discharges on water quality, toxics-related effluent limits are being applied. One of the major mechanisms to control toxic point source discharges is the "whole effluent (or toxicity testing) approach." This approach establishes permit limits on the toxicity of an effluent as a whole, utilizing bioassay toxicity tests with fish or aquatic invertebrates.

Whole effluent limits are being incorporated into industrial wastewater permits for all process water discharges and other selected wastewaters. There are presently such limits in permits for approximately 130 industrial wastewater dischargers, including 45 permits which contain water quality based acute toxicity limits. Currently, there are also approximately 200 municipal dischargers which have whole effluent limits.

3. Sewer Extension Permit Program: The NJDEP issues sewer extension permits for discharges to wastewater treatment facilities. Permits may only be issued for projects in compliance with the provisions and requirements of applicable Water Quality Management Plans and Wastewater Facilities Plans. A component of the sewer extension permit activity is the sewer extension ban program.

The imposing of sewer bans prevents overloading of sewage treatment plants and resultant discharges of improperly treated sewage. The sewer connection regulations (N.J.A.C. 7:14A-12.1 et seq.) require that municipalities place a moratorium on sewer extensions once the treatment plant has reached capacity or exceeded its permit limits. The moratorium can only be lifted when capacity has been increased or treatment upgraded. As of

February 1988, there were 114 sewer moratoriums in effect in the State, affecting a total of 99 municipalities. Aggressive use of the program, and resulting pressure from local communities and developers, has resulted in numerous solutions to long standing non-compliance problems.

4. Industrial Pretreatment Program: New Jersey has in effect an industrial pretreatment program to help control the following problems which may result from untreated industrial wastewater discharged into municipal wastewater treatment plants:

- toxic industrial pollutants may pass through the treatment plant, polluting a receiving water body and posing a threat to aquatic life, and, through the food chain, to human health,

- toxic industrial wastes may interfere with the operation of the treatment plant, rendering the treatment of other wastes less effective,

- industrial wastes containing high levels of toxic metal or organic compounds can contaminate sludge, making disposal options more expensive and more limited (NJDEP, 1987)

In 1981, New Jersey was delegated authority from the USEPA for a pretreatment program. In implementing this program, the NJDEP is responsible for approving the pretreatment programs developed by publicly operated treatment facilities and for developing pretreatment programs for the remaining wastewater treatment facilities in the State. Presently, there are NJDEP-approved pretreatment programs for 22 facilities. It is estimated that 80 to 90 percent of the State's industrial indirect dischargers are located within the service districts of those facilities.

Information from Department audits of publicly owned treatment works (POTWs) may be used in gauging the effectiveness of the pretreatment program. Those findings indicate that of the six POTWs disposing of their sludge by ocean dumping, only one received a rating of "unacceptable" on the most recent audit of their program implementation. All six had reductions in most of their heavy metals ranging from 32 to 91 percent (NJDEP, 1987).

5. Enforcement-Related Activities: New Jersey has an active enforcement program that ensures NJPDES permit compliance, correction of the problem of nonpermitted discharges, and assists in the cleanup of hazardous waste disposal areas. Table V-2 summarizes the numbers of inspections conducted by the Division of Water Resources' Enforcement Element, the percentage of dischargers found to be out of compliance (i.e., not meeting permit limitations), and the penalties assessed.

TABLE V-2 SUMMARY OF NJDEPS PERMIT COMPLIANCE INSPECTIONS

FISCAL YEAR 1989

	MUNICIPAL		INDUSTRIAL	
Surface Water Inspections	In comp.	138	In comp.	549
	Non-comp	242	Non-comp.	581
	Total	380	Total	1130
	% NC	64%	% NC	51%
Groundwater Inspections	In comp.	26	In comp.	532
	Non-comp.	44	Non-comp.	717
	Total	70	Total	1249
	% NC	63%	% NC	57%
Penalties Assessed	SW	8,480,425	SW	14,946,751
	GW	60,050	GW	2,899,210
	Total	**8,540,475**	**Total**	**17,845,961**

FISCAL YEAR 1990 (6 mo. thru Dec. 89)

	MUNICIPAL		INDUSTRIAL	
Surface Water Inspections	In comp.	53	In comp.	267
	Non-comp.	51	Non-comp.	203
	Total	104	Total	470
	% NC	49%	% NC	43%
Groundwater Inspections	In comp.	25	In comp.	151
	Non-comp.	34	Non-comp	90
	Total	59	Total	241
	% NC	58%	% NC	37%
Penalties Assessed	SW	6,186,725	SW	27,537,909
	GW	316,750	Gw	1,092,750
	Total	**6,503,475**	**Total**	**28,630,659**

One of the responsibilities of the Enforcement Element is to maintain a "Municipal Management Strategy List" of facilities which have not achieved compliance with effluent limits and have no compliance schedule to do so. As of January 1988, 85 of those facilities achieved compliance with effluent limits or are on a compliance schedule through a Construction Grants project, NJPDES permit, or an enforcement action.

As of July 1, 1988 (pursuant to Section 301 of the federal Clean Water Act), publicly operated treatment works are required to meet secondary or water quality based effluent limitations, whichever is more stringent. Certain facilities are unable to meet this deadline and it will be necessary for the NJDEP to issue Administrative Consent Orders (ACO's) to bring the facilities into compliance. The ACO's will establish schedules to ensure that delinquent facilities come into compliance with treatment standards set forth in their NJPDES permits at the earliest possible date. These ACO's also contain interim effluent limitations as well as provide for stipulated penalties should they not meet their schedules or limits.

During 1987, approximately $44 million was spent on hazardous waste cleanups by responsible parties (NJDEP, 1987). This program is entirely separate from the State Spill Fund and federal Superfund programs in that the hazardous waste cleanups are funded by those responsible for the pollution, at no additional expense to the taxpayers. The privately funded cleanup program provides for an equivalent type of remedial action as the Spill Fund and Superfund. Thus, the State has the flexibility of providing for cleanup at hazardous waste sites using a variety of funding methods, all capable of achieving the same goal. With the privately funded cleanup program there is the added benefit that taxpayers do not have to bear the cost for remediating the consequences of private parties' actions.

B. NONPOINT SOURCE POLLUTION CONTROL

Nonpoint source (NPS) pollution originates from a variety of diffuse sources, such as urban stormwater or agricultural runoff, rather than from a specific source such as a wastewater treatment plant outfall pipe. Pollution sources which can be traced to a definite, discrete, conveyance are termed "point sources." Both point and nonpoint pollution sources contribute to water quality degradation.

Degraded water quality affects public health, safety, and welfare; endangers the marine ecosystem; and creates other damaging environmental affects. Nonpoint sources contribute such pollutants as sediment, nutrients, pesticides, salts, fecal bacteria and other organisms, ammonia, toxic substances, organic chemicals, metals, oil and grease, and miscellaneous solid wastes to New Jersey's water ways. Many of these pollutants in turn adversely affect water quality by altering temperature, turbidity, and dissolved oxygen levels.

As required by section 319 of the Clean Water Act, and in an effort to address the problem of NPS pollution, the Department has initiated planning activities with the development of the Nonpoint Source Assessment and Management Program (NPS Program). As its title implies, this document consists of two main components: an assessment of the NPS pollution problem in New Jersey and a program strategy to manage nonpoint sources. The State's management program has received approval from the USEPA as of January 1990.

Legal Authority for Nonpoint Source Control:

State and local governments, as well as the Federal government, have broad legal authority for NPS control. The Department of Agriculture's soil conservation program for example has been an effective agent for NPS control in agricultural areas. In other situations in need of control measures, this authority has often not been exercised because of uncertainty about which NPS controls to require, limited funds and staff available for NPS control programs, and concern about NPS control costs.

It is apparent that although both Federal and State statutes have provided ample authority to control NPS, little from a practical standpoint has been accomplished in New Jersey or other states with the possible exception of the soil conservation program which has had a positive impact on NPS control. In many instances NPS control has been authorized through existing regulatory programs which were created primarily to control point sources of pollution. Given the emphasis placed on point source control in the past, these programs have not fully exercised their regulatory authority to control nonpoint source pollution.

In addition to specific regulatory programs in effect or anticipated in the near future, there are certain State legislative actions and Department regulations that clearly indicate an intent to control NPS pollution in New Jersey. Under existing State law and regulations, Category I surface waters are given priority for protection from pollution (N.J.A.C. 7:9-4.1 et seq.). Similarly, draft ground-water regulations (not yet formally proposed) will provide a special degree of protection for Class I ground-waters. The Sewage Infrastructure Improvement Act, discussed in detail below, sets a clear priority for establishing unspecified NPS pollution controls in coastal areas, backed up by substantial appropriations. In addition, while not yet specified by State legislation, the wellhead protection program authorized under the Federal Safe Drinking Water Act has won general approval for priority protection of aquifer recharge areas (see Chapter IV: Ground Water Quality In New Jersey). Such protection will soon be established under regulations to the extent authorized under present State law.

Therefore, in addition to making use of already existing State and Federally mandated NPS related programs, the State has recognized the need to supplement its NPS control effort through new strategies aimed toward the management of environmentally important surface, ground, and coastal waters, buffer zones around water supply reservoirs, as well as aquifer recharge zones, and wellhead protection areas. Towards this goal the Nonpoint Source Assessment and Management Program was developed.

Nonpoint Source Assessment And Management Program:

The NPS Program provides an assessment of the NPS pollution problem in New Jersey. The assessment was based, in large part, on a questionnaire which was sent to various agencies and government bodies for completion. Information was obtained from county planning departments, the State's soil conservation districts, the N.J. Division of Fish Game and Wildlife, and the Division of Water Resources' Bureau of Marine Water Classification and Analysis. The questionnaire asked these bodies to specify the suspected sources of NPS pollution and types of pollutants believed to be impacting the various waterbodies in the State. This information was incorporated into the New Jersey 1988 State Water Quality Inventory Report. The NPS evaluations are based upon the best professional judgment of the assessor and not, necessarily, actual monitored data.

The NPS Program document also provides a strategy for the management of nonpoint pollution sources. The strategy incorporates a four phase approach based on the following basic concepts:

a. The State will not extend permit authority over municipalities until mandated by the USEPA, or until an analysis and preparation stage is complete. However, in some cases, immediate action may be warranted without the need for analysis such as in Category I watersheds.

b. The DEP is currently developing statewide Best Management Practices (BMPs), and criteria for the development of zoning controls for NPSs. BMPs are officially approved procedures for reducing NPS through structural and non-structural controls, including operation and maintenance procedures. The State will implement as many BMPs as possible through already existing regulatory programs, voluntary action, or specific legislative authorities. BMPs which are more stringent than statewide BMPs will be developed for implementation in water supply areas or ecosystems regarded as unusually sensitive.

c. Regional approaches will be developed, where appropriate, through watershed associations, county planning boards, water quality planning agencies, the Pinelands Commission, and the Soil Conservation Districts, etc.

d. Municipal permits will be considered on a regional bases in Water Quality Limited water segments, based upon total maximum daily loads (technical basis needs to be determined).

e. Legislation will be utilized to require local consideration of BMPs during site plan and subdivision approvals. Legislation presently provides for the control of erosion, sedimentation, and stormwater in new developments by way of the local soil conservation districts.

f. Grants will be given to municipalities or other local agencies for preparatory work, to the extent that funds become available, for such tasks as: mapping storm and sanitary sewers, determining sanitary sewer overflows, monitoring stormwater quality, identifying sources of pollution, determining violators and proceeding against them, and formulating municipal NPS plans (within regional context, if appropriate, and in accordance with statewide BMPs).

g. Municipal permits shall be approved, within the context of approved regional plans, on the condition of enforcing the plan and BMPs.

h. The State will provide loans for implementation, if funds are available, and if major construction is required.

Utilizing these concepts, the NPS Program provides strategies for NPS management in urban and developing areas. It proposes to initiate new authorities or strengthen various existing measures to reduce NPS pollution where necessary statewide through a phased approach over the next four fiscal years.

Phase I will be a period of planning for future program implementation and is expected to require two years. Initiating this phase is an education program which began with the public involvement used in finalizing this strategy. This education program will continue as the preparation and implementation phases of the NPS management program proceeds. The NJDEP will concentrate on developing new and revising existing regulations to address NPS as an adjunct to other programs already in place. Financing of the NPS program will need to be established in this phase which will enable the NJDEP to develop procedures for issuing grants. As NPS management involves considerable interagency coordination, agreements between NJDEP and the Departments of Transportation and Agriculture will be negotiated.

Also, during this phase, Statewide initiatives establishing programs and BMPs for the control and disposal of used crankcase oil, household chemicals, pesticides, lawn and garden fertilizing, and infiltration of runoff into the ground will be prepared and, where necessary, additional statutory authority will be sought. Legislation will be sought providing that stormwater management requirements currently implemented on a voluntary basis under the Municipal Land Use Law will become mandatory in developing areas and for stormwater discharges into environmentally sensitive waters where water quality control is critical. Preparations will be made to implement USEPA's regulations for stormwater control, when issued. All new stormwater management regulations will consider the Standards for Soil Erosion and Sediment Control to prevent conflicting requirements.

Also during Phase I, the NJDEP will implement the provisions of the Sewage Infrastructure Improvement Act regarding surveys and planning in coastal areas. In Phase I, the NJDEP will develop and start implementation of a wellhead protection plan, develop an aquifer recharge area protection plan, and initiate the management of NPS pollution sources in buffer zones adjacent to water supply reservoirs. In all of these high priority areas, provision will be made to mandate BMP controls to the extent practicable under existing State regulatory programs and to encourage local agencies under their own powers to implement BMPs and to exercise land use planning powers for NPS control in the course of site plan approval.

Priorities will be determined for monitoring and other planning which will be required as preparation for later phases. During Phase I, decisions may be made to exercise powers of the Clean Water Act to require municipal or other permits for additional NPS control under provisions of Section 402(p).

Phase II will begin with intensive surveys of existing stormwater sewerage systems in high priority areas to identify illegal sanitary sewer connections as well as significant NPS. In addition, a system involving appropriate governmental agencies at various levels for monitoring water quality, will be developed and initiated. As the results of these surveys and monitoring activities become available, plans for NPS control will be required of responsible management agencies. Although surveys and monitoring will be required primarily at municipal level, the planning in Phase II will be conducted also by WQM planning agencies, counties, and other agencies with planning responsibilities. Providing that legislative authority is obtained, various BMPs will be implemented Statewide or initially in high priority areas. Phase II is also expected to last for two years.

Phase III will be characterized by the implementation of control practices in selected municipalities, including provisions for meeting water quality standards in identified important waterways. Selective retrofitting of stormwater sewerage systems in areas draining to environmentally sensitive waters, or significantly impacting water quality, in conjunction with remedial abatement actions at significant sources will be the focus of this phase. Various BMPs will be implemented Statewide. As source and discharge permit programs are implemented, enforcement will begin to assume a greater prominence through its function of ensuring permit compliance.

Phase IV of the NPS Management Program will continue implementation with additional focus on operation and maintenance of management practices. Phase IV will involve continued program implementation, assessment of progress, and adaptation of programs where necessary.

Sewage Infrastructure Improvement Program:

A significant proportion of the State's NPS control effort in 1988 and 1989 was and still is directed toward the Sewage Infrastructure Improvement Program. On August 3, 1988 the New Jersey State legislature passed the Sewage Infrastructure Improvement Act (SIIA). This Act is designed to address both point and nonpoint sources of pollution originating from stormwater sewer systems and combined sewer overflow points. As stated by the legislation, these sources of pollution contribute greatly to the biological and chemical degradation of coastal and other surface waters of the State.

In order to locate and plan for the control of these sources of pollution the SIIA requires municipalities with stormwater systems discharging into salt waters of Atlantic, Cape May, Monmouth, and Ocean counties to adopt a final map of their stormwater sewer system on or before February 3, 1990. The Act also includes a requirement that the Department establish standards for the preparation of the final map by February 3, 1989. Although the Act requires the establishment of final mapping guidelines and the adoption of a final map, the Department was not able to complete the standards for final mapping by the date established in the Act. Therefore, affected municipalities will be required to adopt a final map within 12 months after the effective date of the Department's final mapping regulations.

The sewer system map will include all stormwater sewer and sanitary sewage lines that are part of any stormwater system within the municipality that discharge to surface waters. By using the maps and performing sampling these municipalities will be able to identify pollution problems arising from cross-connections and interconnections between stormwater sewer and sanitary sewage systems. Any cross-connections and\or interconnections found within the municipality must be eliminated by February 1991. This map will also aid municipalities in finding and correcting other pollution sources originating from their stormwater sewer systems.

In addition, these municipalities are required under the SIIA to perform quarterly monitoring of the water quality at the outfall locations of stormwater systems discharging into salt waters. This will ensure early detection of pollution problems arising from these systems. Measures shall also be taken by these municipalities to eliminate nonpoint sources of pollution directly entering salt waters of the State.

Furthermore, the SIIA addresses pollution originating from combined sewer overflow points. The Act requires any public entity throughout the State, including any local government unit, operating a combined sewer system to provide abatement measures by February 1991 at any combined sewer overflow point where a permit is required.

At this time, the Division of Water Resources within DEP is finalizing the Phase I rules to implement this Act, and is also in the process of completing final rules. The Phase I rules set forth the procedures for providing grant monies to municipalities who will be required to map their stormwater sewer system and establishes standards for completing a preliminary map and inventory of these stormwater systems. These rules also outline the procedures for providing grant monies to public entities and local government units authorized to control or operate a combined sewer system.

C. WETLANDS PROTECTION:

Over the past two decades, the public perception of wetlands has changed significantly. Once commonly regarded as waste areas with little or no value, wetlands are now recognized by many as a vital link in our ecological system. In New Jersey the chemical, physical, and biological integrity of wetlands are protected under the New Jersey Water Quality Planning Act (N.J.S.A. 58:11A-1) and the New Jersey Water Pollution Control Act (N.J.S.A. 58:10A-1). Wetlands can provide many important benefits including: flood control, pollution filtration, aquatic and wildlife habitat, soil erosion and sedimentation control, ground water recharge, water supply, recreation, aesthetics, and research.

Wetlands have become increasingly threatened by development, as suitable land for building is rapidly diminishing. Since wetlands are scattered throughout the State, this impact is widespread. Table V-3 shows the spatial distribution of wetlands by county. As indicated, while the central and southern counties contain much of the wetlands in the State, there is significant acreage in all of New Jersey's counties. It is estimated that New Jersey may have lost at least 20 percent of its wetlands since the mid-1900's (Tiner, 1985). While some of the early losses were due to agriculture; for the last 30-40 years, filling of wetlands for residential, commercial, and industrial development has predominated.

Wetlands in New Jersey have in recent years been regulated under the authority of seven different State laws:

1. Wetlands Act of 1970 (N.J.S.A. 13:9A-1 et seq.),
2. Pinelands Protection Act of 1979 (N.J.S.A. 13:18-1 et seq.),
3. Hackensack Meadowlands Reclamation and Development Act (N.J.S.A. 13:17-1 et seq.),
4. New Jersey Flood Hazard Control Act (N.J.S.A. 58:16A),
5. Coastal Area Facility Review Act (N.J.S.A. 13:19-1 et seq.),
6. Waterfront Development Law (N.J.S.A. 12:5-3),
7. New Jersey Water Quality Planning Act.

In addition, the U.S. Army Corps of Engineers, in coordination with the U.S. Environmental Protection Agency, administers provisions of the federal Clean Water Act and the federal River and Harbor Act, which address regulation of wetlands and waters of the State (NJDEP, 1988). On July 1, 1987, the strategy for the protection of freshwater wetlands in the State changed significantly as a new law was enacted: the Freshwater Wetlands Protection Act of 1987 (N.J.S.A. 13:9B-1 et seq.), effective July 1988. The Freshwater Wetlands Protection Act (FWPA) defines a freshwater wetland as 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. Further, the hydrology, soils, and vegetation are considered in determining whether an area is wetland.

The FWPA authorizes the issuance of permits by the NJDEP for regulated activities. These regulated activities include: (1) removal, excavation, disturbance, or dredging of soil, sand, gravel, or aggregate material; (2) drainage or disturbance of the

TABLE V-3 WETLANDS ACREAGE (APPROXIMATE) IN NEW JERSEY

County	Land Area (sq. mile)	Wetland Area* (acres)	% of County Represented by Wetlands
Atlantic	569	148,149	40.7
Bergen	234	10,084	6.7
Burlington	819	136,297	26.0
Camden	221	20,922	14.8
Cape May	267	89,581	52.4
Cumberland	500	98,950	30.9
Essex	130	6,833	8.2
Gloucester	329	36,844	17.5
Hudson	47	3,897	13.0
Hunterdon	423	5,450	2.0
Mercer	228	11,819	8.1
Middlesex	312	24,022	12.0
Monmouth	476	32,700	10.7
Morris	468	40,264	13.4
Ocean	642	128,531	31.3
Passaic	192	5,042	4.1
Salem	365	58,987	25.3
Somerset	307	11,127	5.7
Sussex	527	30,771	9.1
Union	103	3,053	4.6
Warren	362	12,637	5.5
State Total	7,521	915,960	19.0

Source: Tiner, 1985

* Based upon aerial photography

water level or water table; (3) dumping, discharging, or filling; (4) driving of pilings; (5) placing of obstructions; and (6) destruction of vegetation which would alter the character of a wetland.

The permit program does not affect wetlands regulated under the Wetlands Act of 1970. In addition, in the Pinelands Area and the Hackensack Meadowlands District, the NJDEP issues permits only for the discharge of dredged or fill material as part of a State-administered "404 Program." Other than these activities, areas under the jurisdiction of the Hackensack Meadowlands Development Commission or the Pinelands Commission will not require a freshwater wetlands permit or be subject to transition area requirements.

The FWPA also contained a provision for the protection of transition areas, ecological "buffer" zones adjacent to freshwater wetlands. On July 3, 1989, the rules to implement the transition area provisions of the FWPA were adopted. Under the new transition area rules, the size of the transition area is determined by the resource value classification of the freshwater wetland it encompasses. Exceptional resource value wetlands are those which provide habitat for threatened or endangered species and those which feature high water quality. A transition area of 150 feet is required adjacent to these wetlands. Ordinary resource value wetlands are defined as small, isolated, human-impacted wetlands, drainage ditches or swales. There is no transition area required adjacent to ordinary resource value wetlands. All other wetlands are defined as intermediate resource value wetlands and require a fifty-foot transition area.

The FWPA authorizes the issuance of waivers by the NJDEP for prohibited activities in transition areas. These prohibited activities include: (1) removal, excavation, or disturbance of the soil; (2) dumping or filling with any materials; (3) erection of structures; (4) placement of pavements; and (5) destruction of plant life which would alter the existing pattern of vegetation.

The FWPA also indicates that the State take appropriate action to assume the Federal 404 Permit program, presently the responsibility of the U.S. Army Corps of Engineers. Presently, the FWPA rules are undergoing an amendment to clarify and correct problem areas and to prepare an acceptable package for submittal to the U.S. Environmental Protection Agency to pursue assumption of the federal program.

D. LAKES MANAGEMENT

The New Jersey Department of Environmental Protection administers a program whereby public lakes may be eligible for grants for lake restoration projects. These projects have been funded by a combination of Federal, State, and local monies. The lakes management process is divided into two processes or phases. Phase I includes an assessment of the trophic status of the lake, a determination of the possible causes of lake deterioration, and the development of restorative measures and long term management strategies to maintain the resource value of the lake. The second process, or Phase II, is the actual implementation of the restorative and conservation measures recommended in Phase I.

A major factor determining the awarding State grants (and Federal grants when available) is a strong local involvement in, and commitment to the project. To be considered for a grant award, a problem assessment of the lake (Phase I Project Proposal) must be submitted to the New Jersey Division of Water Resources. Lakes with the highest likelihood for successful restoration will be selected from a priory list. Preliminary approval will lead to funding by the State (or EPA when available),

In FY87, EPA Region II provided $265,000 for lakes restoration projects in New Jersey, while state funding of restoration projects was $1.1 million dollars. In 1987 the funding formula for State funded restoration projects was revised to provide a 75% State share for Phase II Restoration projects. The formula for Federally funded Phase II projects remains 50% Federal, 40% State, and 10% local. State funding for this program however, has been eliminated in FY 90, and future funding prospects are uncertain at this time.

Phase I studies have determined that sediments and nutrients were entering all the lakes via nonpoint sources. All lakes were experiencing sedimentation problems, either from erosion in the watershed or from a combination of erosion and accumulated decaying macrophytes. The remedial practice most often utilized was dredging, usually in combination with erosion control measures. A fisheries survey was conducted for four of the Phase I studies. All four lakes were considered to be only partially fishable because of habitat degradation.

The following is a list of lakes that are presently in a Phase I, Phase II, or Special Appropriations Restorative Process.

Phase I Diagnostic-Feasibility studies presently in progress:

Name	Total($)	Fed Share	State Share($)
Bell Lake	20,000	0	10,000
Blackwood Lake	40,000	0	20,000
Burnt Mill	61,200	0	30,600
Cranberry Lake	51,800	0	25,000
Franklin Lake	93,600	0	46,800
Manahawkin Lake	74,200	0	37,100
Spring Lake	27,500	0	13,750
Swartswood Lake	47,294	0	23,647
Tuckerton Lake	74,200	0	37,100
Weamaconk Lake	83,000	0	41,500

Phase II

Name	Total($)	Fed Share	State Share
Deal Lake	1,209,762	604,881	466,141
Greenwood Lake	904,800	452,400	225,000
Hammonton Lake	280,000	0	210,000
Lake Hopatcong	520,000	260,000	208,000
Lake Hopatcong	140,000	0	105,000
Weequahic Lake	1,854,000	927,000	0
Woodbury Lake	530,000	0	460,000

Special Appropriations

Name	Total($)	State Share($)
Alberta Lake	60,000	60,000
Lake Topanemus	150,000	150,000
Sylvan Lake	200,000	200,000
Takanassee Lake	100,000	100,000
Thomas West Pond	125,000	125,000
Wall Twp. Pond	25,000	25,000
Wesley Lake	270,000	270,000

For privately-owned lakes, there are no Federal or State financial assistance programs available. Assistance is limited to dissemination of available technical information. Many lake communities have developed their own programs in response to symptoms of deteriorating water quality, with most activities being limited to the application of aquatic herbicides.

In 1989, the State received a USEPA Lake Water Quality Assessment Grant to assemble a Lakes Classification Report (see Chapter 3, Lake Quality). The objective of the project is to acquire limited water quality data for 21 public lakes. The data base will be used to determine baseline trophic status for each lake and to aid in assessing future water quality trends in the lakes studied. Lakes chosen to be studied were regarded as significant in terms of their recreational and resource value.

E. SURFACE WATER MONITORING PROGRAMS

Introduction

This section discusses the water quality monitoring activities which are being conducted in the State. Monitoring data is used to establish baseline conditions, determine trends, and identify solutions to or further study water quality problems. The NJDEP's primary water quality monitoring unit is the Division of Water Resources' Bureau of Monitoring Management, although monitoring functions are also performed by other units.

Since approximately 1981, there has been a gradual shift in the emphasis of the Bureau of Monitoring Management's monitoring activities. One such trend has been a deemphasizing of fixed station ambient monitoring with emphasis, instead, being placed on intensive surveys. Another trend is the broadening in scope of the ambient monitoring program to include both surface water and ground water monitoring.

While these changes have taken place there has been no appreciable increase in staff; and, as a result, less long-term trend data have been obtained. In addition, areas studied are necessarily smaller as intensive surveys increased at the expense of routine ambient monitoring. The information for a given area, however, over a short temporal span, has increased. Another trend, in the Bureau's monitoring activities, has been an emphasis on the coastal area with a corresponding decrease in inland surface water monitoring.

To make up for the lessened emphasis on ambient monitoring, the Division has been delegating certain monitoring responsibilities to the counties. To date, six agencies have been delegated monitoring responsibilities (Ocean County, Cape May County, Atlantic County, Monmouth County, Burlington County, and Passaic County).

To date, the emphasis in the State's monitoring activities has been on point sources and as a result, little nonpoint source-related monitoring data is available.

The present and anticipated water quality monitoring activities in New Jersey are summarized in the following paragraphs. For the purposes of the discussion, the activities are divided into the following categories: state-wide routine fresh water monitoring, coastal biological monitoring, regional intensive surveys/special studies. It should be understood that although an activity falls within a particular category within the discussion, there may be aspects of the project which overlap with other categories. All of the monitoring activities discussed below are conducted by the Bureau of Monitoring Management unless otherwise indicated.

1. State-Wide Fresh Water Routine Monitoring

Basic Water Fresh Water Monitoring Network: This is a component of EPA's national 1,000 station network, of which 26 monitoring sites occur in New Jersey. This program is designed to establish baseline water quality; characterize and define trends in physical, chemical, and biological conditions; identify new and existing water quality problems; and measure progress towards meeting national water quality goals. The program has been active since 1976. The sampling frequency is four times per year for "routine" parameters and once per year for "supplemental" parameters.

Routine parameters and observations include: gage readings, weather conditions, water temperature, dissolved oxygen, pH, specific conductance, fecal strep, total coliforms, BOD, nitrite, nitrite + nitrate, ammonia, TKN, color, turbidity, and suspended solids. Supplemental parameters include: COD, chloride, sulfate, petroleum hydrocarbons, dissolved minerals (Ca, Mg, Na), and metals (As, Cd, Cr, Cu, Hg, Pb).

Primary Monitoring Network: The purpose of this program, which has been active since 1975, is to establish baseline water quality; to define trends in physical, chemical, and biological conditions; and to identify existing water quality problems. A total of eighty-two sites are monitored in New Jersey, of which 46 are monitored by the Bureau of Monitoring Management. The USGS monitors the remainder. The sampling frequency is six times per year for routine water column parameters, two times per year for supplemental water column parameters, and one time per year for supplemental sediment parameters.

Routine water column parameters and observations include: water temperature, gage readings, weather conditions, dissolved oxygen, pH, specific conductivity, BOD, nitrite, nitrate, nitrite + nitrate, TKN, total P, fecal coliforms, fecal strep, TOC, and dissolved minerals (chloride, fluoride, calcium, magnesium, potassium, sodium, silica, sulfate). Supplemental water column parameters include: sulfide, total hardness, arsenic, beryllium, boron, cadmium, chromium, copper, iron, lead, manganese, nickel, zinc, aluminum, selenium, mercury, phenol). Supplemental sediment parameters include: metals, organic pesticides, herbicides, and PCBs.

<u>National Stream Quality Accounting Network (NASQUAN), and National Hyrologic Benchmark Network</u>: These are USGS water quality monitoring programs. The purpose of the NASQUAN network is to determine the quality of the Nation's waters. There are six NASQUAN network stations in New Jersey. Samples are analyzed for several conventional parameters, although at one station (Delaware River at Trenton) samples receive radiochemical tests.

The National Hydrologic Benchmark Network includes one monitoring station (McDonalds Branch in Lebanon State Forest). National Hydrologic Benchmark Network monitoring stations are selected based on their remoteness from the activities and influence of man. Parameters and observations include: specific conductance, water temperature, streamflow, pH, DO, fecal coliforms, fecal strep, BOD, suspended sediment, sand-silt fraction, common ions, nutrients, dissolved solids, TOC, trace metals, and radiochemicals.

2. Estuarine and Ocean Water Monitoring:

Routine water quality monitoring in New Jersey bays, estuaries, and coastal reaches is performed by various governmental agencies. The interstate estuary and bay waters shared by New Jersey and New York which include the Arthur Kill, the Kill Van Kull, the Hudson River, Newark Bay, and the tidal Hackensack River as well as the Raritan and Sandy Hook Bays are monitored by the Interstate Sanitation Commission. The Delaware River and Bay are overseen by the Delaware River Basin Commission. Both of these agencies monitor sanitary conditions (bacteria), dissolved oxygen, nutrients, and toxic substances.

The waters of the Atlantic Coastal Plain, both estuarine and coastal, as well as parts of Delaware Bay, are monitored by two networks overseen by the NJDEP: the Cooperative Coastal Monitoring Program (CCMP) discussed below, and the New Jersey Bureau of Marine Water Classification and Analysis (BMWC&A). The Bureau of Marine Classification and Analysis under the Division of Water Resources is concerned with the fitness of waters for the purposes of shellfish harvesting. This agency monitors waters, both bay and coastal, from Raritan Bay down to Delaware Bay. Both the CCMP and BMWC&A sampling has been traditionally limited to coliform bacteria measurements in bathing beaches and shellfish harvesting waters respectively. Recently however, the CCMP has expanded its sanitary monitoring to include sampling for enterococcus bacteria (see CCMP below). The BMWC&A has expanded its monitoring role by significantly increasing the water quality parameters for which it monitors (see <u>New Jersey Marine and Estuarine Water Quality Monitoring Network</u>, below).

In addition, daily helicopter observations are performed by the New Jersey Geological Survey during the bathing season. The program provides for a rapid assessment of coastal conditions which could impact bathing beaches such as the presence of floating material, pollution slicks, and algal blooms. In the 1989 summer season there were approximately 120 such low level flights along the New Jersey coast.

The USEPA annually conducts monitoring of chemical and biological conditions in the New York Bight region from early April to late September. This sampling network performs bacteria, phytoplankton, and chemical monitoring along the coast out to nine miles.

<u>Cooperative Coastal Monitoring Program (CCMP)</u>: The CCMP is authorized by the County Environmental Health Act (NJAC 7:18 et seq.) and is designed to monitor sanitary water quality (bacteria levels) in coastal waters with respect to both public health and water quality perspectives. The program (see NJDEP 1989b, 1990) is overseen by the New Jersey Department of Environmental Protection and the Department of Health in cooperation with the county health departments of Cape May, Monmouth, Atlantic, and Ocean; as well as the regional health agencies of Atlantic City, Long Beach Island, Long Branch, Matawan, and Middletown.

The program monitors bathing zone waters in the ocean and bay areas of the previously mentioned counties. Water column samples are taken once a week, May through September. In 1989 the program sampled a total of 175 ocean stations and 157 Bay stations for fecal coliform bacteria.

USEPA has recommended replacing the older fecal coliform criterion with those using enterococci originating from human sources in order to improve the accuracy of the States methods of assessing the sanitary quality of bathing waters. This is because enterococci exhibit a survival time which more closely approximates that of viral pathogens known to cause gastrointestinal disease in bathers. This method is confounded however, by the presence of enterococci originating from animal sources, hence New Jersey must first assess the current background levels of this microorganism before EPA's recommendations can be put into effect. Towards this end enterococci concentrations were examined at 51 stations of the CCMP network in addition to fecal coliform concentrations.

New Jersey Marine and Estuarine Water Quality Monitoring Network: Historically water quality sampling in the State's coastal waters has focused on sanitary quality (bacterial sampling) due largely to the intense concentration of recreational bathing and shellfish harvesting in New Jersey's coastal waters. Efforts are currently under way to expand coastal monitoring so as to encompass a wider range of water quality parameters.

This monitoring network represents an effort by the State to provide baseline data on general water quality throughout the State's coastal waters beyond sanitary traditional monitoring to include both conventional and toxic pollutants. The program covers all major bodies of saline waters including the Atlantic Ocean to within two nautical miles of the coastline. All stations represent preexisting shellfish sanitation monitoring network.

Parameters sampled are divided in to four general categories:

1. Metals: sampled twice a year

2. Inorganic parameters: nutrients, DO, solids, salinity: Sampled seasonally, four times per year.

3. Biological: Enterococcus bacteria, fecal coliform bacteria

4. Organic Compounds: PCB's, Pesticides, Acid Extractables/Base Neutrals, and Purgeables, collected at thirty six stations twice a year

All samples will be taken from the water column. No sediment sampling as yet is scheduled

Delaware Estuary Toxics Management Program: An interstate cooperative effort coordinated by the DRBC designed to develop policies and procedures to control the release of toxic substances from point sources to the tidal portion of the Delaware River. The first year of the study will involve the establishment of a database of toxic substances inpacting the estuary (DRBC, 1990).

3. Biological Monitoring

NJDEP/USEPA Cooperative New York Bight Water Quality Survey: This project involves phytoplankton and chlorophyll "a" analysis on twelve stations along the New Jersey coast and within the Raritan estuary. Samples are collected weekly, May through September.

NJDEP Ambient Biomonitoring Program: This study is comprised of the collection, analysis, and reporting of periphyton and macroinvertebrate data for 18 freshwater stream stations, once per year.

4. Compliance Monitoring

NJPDES Compliance Sampling: This is a continuing program of 24 hour compliance sampling at selected NJPDES permittees throughout the State to determine their compliance with permit conditions.

DRBC Compliance Sampling: This is a cooperative 24 hour sampling program carried out under a contract with the Delaware River Basin Commission on facilities located in the Delaware River drainage system.

Industrial Pretreatment 24 Hour Sampling Program: This program involves the sampling of certain municipal sewage treatment plants to determine what impact industrial effluents are having on municipal treatment systems.

5. Region Specific Intensive Surveys/Special Studies

Upper Delaware River Bacterial Study: This is a cooperative project between the Delaware River Basin Commission (DRBC) and the State of Pennsylvania designed to determine the source of high levels of fecal coliform discovered on the upper portion of the Delaware River during sampling conducted by the Delaware River Basin Commission in 1987.

DRBC/NPS Scenic Rivers Study: In order to protect that portion of the Delaware River included in the National Wild and Scenic River System, the Delaware River Basin Commission in cooperation with the National Park Service has supplemented the water quality monitoring performed by the three states bordering the river (DRBC, 1990).

Regional Pinelands Surface Water Quality Monitoring and Data Management Program: The Pinelands Commission in cooperation with the participating county health departments initiated a regional pinelands surface water quality monitoring and data management program in 1987. The objectives of the program are to "incorporate elements of existing programs into one with a regional perspective and to provide a mechanism for the collection, organization, and distribution of Pinelands surface water quality data" (New Jersey Pinelands, 1989). Water quality monitoring is performed at 214 stream stations located within Ocean, Burlington, and Cape May Counties.

Navesink River Water Quality Improvement Project: Both the Navesink River and the Shrewsbury River represent the only significant commercial source of soft shell clams in the State. The Navesink, in addition, supports a large population of hard clams. Because of excessive bacterial contamination, these shellfish resources have been closed to direct harvesting since the 1960's. The Navesink River Water Quality Improvement Project is part of the DEP's overall Water Quality Management Program Plan pursuant to the New Jersey Water Quality Planning Act, and the Federal Clean Water Act. The major goal of this Project is to reduce bacterial pollution brought about by nonpoint source pollution to a degree sufficient to allow the direct harvesting of shellfish from the Navesink. In 1986 the USEPA, US Department of Agriculture, the NJDEP, the NJ Department of Agriculture, and eleven local and academic agencies signed a Memorandum of Understanding, pledging support to the project.

The primary focus of the program since 1980 has been to assess the sources of fecal coliform contamination in the Navesink River. Towards that end, numerous intensive surveys assessing bacterial contamination, land use analysis, and shoreline surveys have been performed. These studies represent cooperative efforts between the DEP, local health departments, as well as other local, state, and federal agencies.

Efforts to identify pollution sources are now evolving towards the institution of nonpoint source control measures throughout the watershed. The most notable move toward pollution control at this point in time is a comprehensive $1.3 million Watershed Plan established by the US Department of Agriculture and administered by the Soil Conservation Service and the Freehold Soil Conservation District.

Interest in improving the water quality of the Navesink River continues to grow, especially on the local level. An Implementation Plan guiding the institution of best management practices, further monitoring and research has been developed. Success of this plan will rely on the continued cooperation of many agencies at all levels, with significant input from local interest groups.

National Estuary Program: The National Estuary Program was established by section 320 of the Water Quality Act of 1987. The purpose of the National Estuary Program is to identify nationally significant estuaries, protect and improve their water quality, and enhance their living resources.

New Jersey has two estuaries involved in the NEP; the NY-NJ Harbor Estuary and the Delaware Estuary. A Management Conference has been convened for each estuary. The Management Conferences have a five year life-span during which time they are required by law to carry out seven major tasks: 1) assess trends in the estuary's water quality, natural resources and uses; 2) identify causes of environmental problems by collecting and analyzing data; 3) assess pollutant loadings in the estuary and relate them to observed changes in water quality, uses, and natural resources; 4) recommend and schedule priority actions to restore and maintain the estuary, and identify the means to carry out these actions; 5) ensure coordination on priority actions among Federal, State, and local agencies involved in the conference; 6) monitor the effectiveness of actions taken under the plan; 7) and ensure that Federal assistance and development programs are consistent with the goals of the plan.

These tasks are carried out via a phased management approach in that each stage of the program must be completed in order to go on to the next step. In the National Estuary Program the first phase is the building of a management framework. This has been completed in both programs. Next, characterization of the estuary and problem definition must be established, so that the management conference can go on to construct Action Plans for pollution control and resource management. The sum total of these action plans is the Comprehensive Conservation and Management Plan, which will be the blueprint for the future of the estuary.

This phased management approach is coupled with consensus building among the parties which have an interest in the estuary. Since these parties will be responsible for carrying through with the Comprehensive Conservation and Management Plan once it is established, strong public support and subsequent political commitments are needed to accomplish the actions agreed upon in the CCMP. For this reason the Management Conferences seek to involve every concerned party having an interest in the estuaries from the onset of the programs including, federal, state and local governments, academic and scientific institutions, industries, and citizens groups. These groups participate through the three advisory committees to the Management Conference: the Citizen's Advisory Committee, the Local Government Committee and the Science and Technical Advisory Committee, all of which are currently holding regular meetings in both programs. By involving the public in an open manner; it is hoped that widespread, long-term local support for the National Estuary Program will be developed.

At present, both estuary programs are involved in the scientific characterization and problem definition of the estuaries. The topics for which studies will be conducted in the NY-NJ Harbor Estuary Program are 1) pathogen contamination, 2) floatables, 3) ambient toxics, 4) ambient dissolved oxygen, nutrients and organic carbon, 5) habitat and living resources, 6) hydrologic modifications, 7) pollutant loadings. Proposals have been selected for funding and studies will be conducted during Fiscal Year 1989. Topics to be studied in the Delaware Estuary Program include 1) general water quality, 2) metals, 3) xenobiotic organic compounds, 4) key animal and plant resources, 5) habitat. Proposals are being solicited, and studies will be conducted during Fiscal Years 1989 and 1990.

Toms River Bacterial Study: This represents a survey of the Toms River estuary during the summer of 1988 to determine the sources of bacterial contamination (i.e., storm sewers, marinas, etc.) to the public bathing areas (NJDEP, 1989a). Analysis included locating contaminated stormwater pipes, assessing trends in water quality along the river bank, and estimating the relative impacts to the river coming from local marinas.

Operation Clean Shores: A cooperative program between the DEP, the State Department of Corrections, and local municipalities. The program uses prison labor and heavy equipment supplied by the municipalities. The program successfully cleaned 23.4 miles of shoreline from the George Washington Bridge along the Arthur Kill and Raritan Bay to Sandy Hook, removing almost 6 million pounds of floatable material from these beaches. This effort has removed a potential source of contamination to the more southern beaches should this material be resuspended into coastal waters.

F. SURFACE WATER RATING SYSTEM

The 1982 New Jersey 305(b) Report contained a Surface Water Rating System which was designed to give a comparative assessment of water quality and water uses in 29 individual or grouped watersheds. Results from this rating system have been utilized in the State's Construction Grants Project Priority System and List and the NJDEP's Municipal Management Strategy. However, the rating system had a number of limitations, as was discussed in the State's 1984 305(b) Report. These limitations included: 1) the potential for water quality/uses to be restored was not included; 2) ratings were generated for only 29 segments statewide and therefore reflected generalized areas; and, 3) much of the previous water use information failed to accurately reflect true water use.

The 1984 305(b) Report described plans for updating and refining the Surface Water Rating System so as to alleviate the weaknesses outlined. Among the changes made were breaking the State into nearly 150 small watersheds which were evaluated separately, employing a new methodology for determining the Water Quality Index, and gathering additional information on the suitability of waters for recreation in and on the water, and the healthiness of a stream's fish community.

The Surface Water Rating System presented in the 1986 report reflected the changes outlined above, as well as presenting updated data. This system is also used in this report. Table V-4 presents the results of the Surface Water Rating System with water quality indices calculated using water quality data collected from 1983 through 1987, and a Water Use Index updated through mid-1989. Each segment contains a Water Quality Index and a Water Use Index, both having a scale from 0 to 100. The Water Quality Index is based on the same Water Quality Index described in Chapter III. - Water Quality Inventory, and used to assess ambient water quality conditions in monitored waterways. The Water Use Index incorporates information on potable water supplies, freshwater fisheries, shellfisheries, and bathing beaches. Although in theory the index does go up to 100 as stated previously, values calculated up till now have not exceeded fifty. The index results from the 1986 report were utilized in the fee formula for all NJPDES permits.

Potable water supply points are based on the amount of surface waters diverted for this purpose during 1986 to 1987. Fisheries points are assigned on the basis of fishes (both cold and warm-water types) stocked in the segment from 1986 to 1988 by the Division of Fish, Game and Wildlife. The percentage of open, special restricted, and seasonally classified shellfish harvesting areas in a coastal/estuarine segment serves as the basis for shellfisheries points. The number of bathing beaches in a segment is utilized for assigning swimming points to a segment.

Each of the four components in the Water Use Index receives 0 to 25 points and is based on the percentage of a given water use in a segment compared to the segment with the greatest use. For instance, the Middle South Branch Raritan River has received from 1982 to 1984 the greatest amount of stocked fish of all waters of the State, and therefore, is assigned 25 fisheries points. The Lamington River has stocked in it approximately one-fifth as many fish as the Middle South Branch, and gets a fisheries rating of 5.

Additional or supplemental information was collected for the rating system which is not used in the quantitative ratings. As was discussed in the 1984 305(b) Report qualitative information such as the potential for use restoration or the condition of an aquatic system, is also necessary to fully assess a waterway and prioritize water quality management activities. The Division of Fish, Game and Wildlife completed a questionnaire regarding the quality of fish communities in the State's streams. The questionnaire also reviews where water quality has degraded existing fisheries. This information was utilized in the individual watershed assessments in Chapter III. The Green Acres Program also provided information on where park facilities have been constructed or are planned, and those that contain water-based recreational activities.

A detailed analysis of water quality and resources for the State's shellfish producing waters is currently being performed. This study is determining the potential for water quality restoration where conditions are degraded, and where the shellfish resource is commercially and recreationally valuable. Results of the study will be used in assessing coastal development permits and prioritizing restoration activities.

The Surface Water Rating System will continue to be applied to certain water quality management activities, as needed. In addition, the system will undergo further refinement and updating as better information becomes available. When developing a system for rating surface waters, many factors that are both quantitative and qualitative, appear to be necessary for a good, workable system. However, meshing these factors together into a single "rating" or measure is difficult. As such, the Water Quality Index and Water Use Index can only be considered as an initial evaluation. Further and more detailed analysis is then necessary.

TABLE V-4 RESULTS OF THE SURFACE WATER RATING SYSTEM

Note: N.A. = No ambient water quality data available
* = Water Quality data from before 1985

SEGMENT	WATER QUALITY INDEX	WATER USE INDEX
- Wallkill River Basin		
Upper Wallkill Rive	20	26
Papakating Creek	35	4
Black Creek	32	5
Lower Wallkill River	23	3
- Upper Delaware Basin		
Mill Brook	N.A.	0
Delaware Tribs. (Sussex Cnty)	N.A.	5
Little Flat Brook	N.A.	0
Big Flat Brook	7*	0
Flat Brook	12	0
Van Campens Brook/Dunfield Creek	N.A.	0
Swartswood Lake	N.A.	11
Upper Paulins Kill	39	20
Lower Paulins Kill	17	7
Delawanna Creek	N.A.	1
Upper Pequest River	29	14
Bear Creek	N.A.	0
Lower Pequest River	19	7
Upper Musconetcong River	17	43
Lower Musconetcong River	28	22
Beaver Brook	21*	2
Delaware Tribs. (Warren Cnty)	21	1
Lopatcong Creek	51*	1
Pohatcong Creek	37	8
Delaware Tribs. (Up. Hunterdon)	N.A.	2
Delaware Tribs.: (Hakihokake Creek - Warford Creek)	30*	2
Delaware Tribs.: (Lockatong Creek - Wickecheoke Creek)	29	1
Delaware Tribs.: (Alexauken Creek - Gold Run)	24*	10
Upper Assunpink Creek	16	2
Lower Assunpink Creek	54	1
Delaware River Zone 1A	6	37
Delaware River Zone 1B	13	37
Delaware River Zone 1C	15	37
- Lower Delaware Basin		
Upper Crosswicks Creek	80*	0
Mid-Crosswicks Creek	24	1
Doctors Creek	32	0
Lower Crosswicks Creek: (w/ Duck Creek)	25	0
Blacks Creek	48*	0

TABLE V-4 Continued

SEGMENT	WATER QUALITY INDEX	WATER USE INDEX
Crafts Creek and nearby Delaware Tribs.	38*	2
Assiscunk Creek	36*	0
Upper North Branch Rancocas Creek	14	3
Cranbury/Mt. Misery Brooks	44	1
Lower North Branch Rancocas Creek	16	1
Upper South Branch Rancocas Creek	20	1
South West Branch Rancocas Creek	30	11
Lower Rancocas	N.A.	2
Lower South Branch Rancocas Creek	44	0
Rancocas Creek - Mainstem	36	1
Swedes Run and Pompeston Creek	N.A.	0
Pennsauken Creek	65	0
Cooper River	68	1
Big Timber Creek & Woodbury Creek	27	7
Mantua Creek	26*	2
Repaupo Creek	30	0
Raccoon Creek	16	2
Oldmans Creek	20	2
Delaware Tribs.: (Burington County)	N.A.	1
Delaware Tribs.: (Gloucester County)	N.A.	1
Delaware Tribs.: (Upper Salem County)	29	1
Upper Salem River	35	1
Lower Salem River	35	1
Delaware Tribs. (Central Salem County)	N.A.	0
Alloways Creek	N.A.	0
Stow Creek	N.A.	0
Upper Cohansey River	38	1
Lower Cohansey River	47*	3
Back, Cedar, and Natuxent Creeks	12	0
Dividing Creek	14	0
Still Run	9	4
Scotland Run	9	1
Upper Maurice Run	7	1
Muddy Run	N.A.	3
Maurice River/Union Lake	18	1
Mid-Maurice River	24	1
Manantico Creek	N.A.	0
Manumuskin Creek	24	0
Lower Maurice River	34	0
East and West Creeks	14	4
Dennis Creek	13	3
Delaware Bay Tribs.: (Cape May County)	11	1

TABLE V-4 Continued

SEGMENT	WATER QUALITY INDEX	WATER USE INDEX
Delaware River Zone 2	23	9
Delaware River Zones 3 & 4	72	0
Delaware River Zone 5	38	0
Delaware Bay Zone 6	27	21
- Passaic River and Hackensack River Basins		
Elizabeth River: (incl. Morses Creek)	59	0
Rahway River	38	7
Arthur Kill, Kill Van Kull, Newark Bay, Upper N.Y. Harbor, Bound Creek	56	0
Upper Passaic River	40	19
Mid-Passaic River: New River to Pompton River	70	0
Whippany River	61	2
Rockaway River	28	28
Pequannock River	12	30
Wanaque River	3	39
Ramapo River	32	12
Pompton River	20	7
Mid-Passaic River: Pompton River to Garfield	38	9
Lower Passaic River	69	8
Saddle River	69	6
Upper Hackensack River	19	30
Lower Hackensack River	49	1
Hudson River and Minor Tribs.	47	0
- Raritan River Basin		
Lamington River	23	7
Upper North Branch Raritan River	22	2
Lower North Branch Raritan River	15	7
Upper South Branch Raritan River	20	19
Middle South Branch Raritan River	19	31
Neshanic River	54	0
Lower South Branch Raritan River	18	9
Upper Millstone River	41	0
Stony Brook	31	6
Lower Millstone River	27	6
Lawrence Brook	23*	9
Manalapan Brook	21	1
Matchaponix Brook	30	1
South River	17*	0
Upper Raritan River	17	8
Raritan River	31	25
Raritan Bay and Tribs.	23	31

TABLE V-4 Continued

SEGMENT	WATER QUALITY INDEX	WATER USE INDEX
- Atlantic Ocean Basin		
Navesink River	32*	40
Shrewsbury River	23	24
Shark River	9	20
Manasquan River	31	28
North Branch Metedeconk River	27*	3
South Branch Metedeconk River	22*	5
Metedeconk River	N.A.	11
Kettle Creek & North Barnegat Bay	21*	4
Upper Toms River	25*	2
Ridgeway Branch	29*	0
Lower Toms River	14	11
Cedar Creek	15*	18
Central Barnegat Bay and Tribs.	10	16
Forked River	18*	24
Oyster Creek & Central Barnegat Bay	20*	22
Mill Creek, Cedar Run, Westecunk Creek & Lower Barnegat Bay	21*	24
Tuckerton Creek & Little Egg Harbor	16*	25
Harbor Bay (Low Little Egg)	N.A.	23
Batsto River	6	0
Upper Mullica River	5	4
Mid-Mullica River	51	3
Oswego River	5	0
West Branch Wading River	4	0
Lower Mullica River	10	22
Great Bay	N.A.	24
Upper Great Egg Harbor River	57	0
Mid-Great Egg Harbor River	27	5
Lower Great Egg Harbor River	44	3
Patcong Creek and Lakes Bay	N.A.	25
Cape May/Atlantic Tribs.	13	33
Tuckahoe River	11*	24
Doughty Creek, Reeds Bay, Absecon Bay	7	26
Absecon Bay	N.A.	1
Absecon Cr.	N.A.	1

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