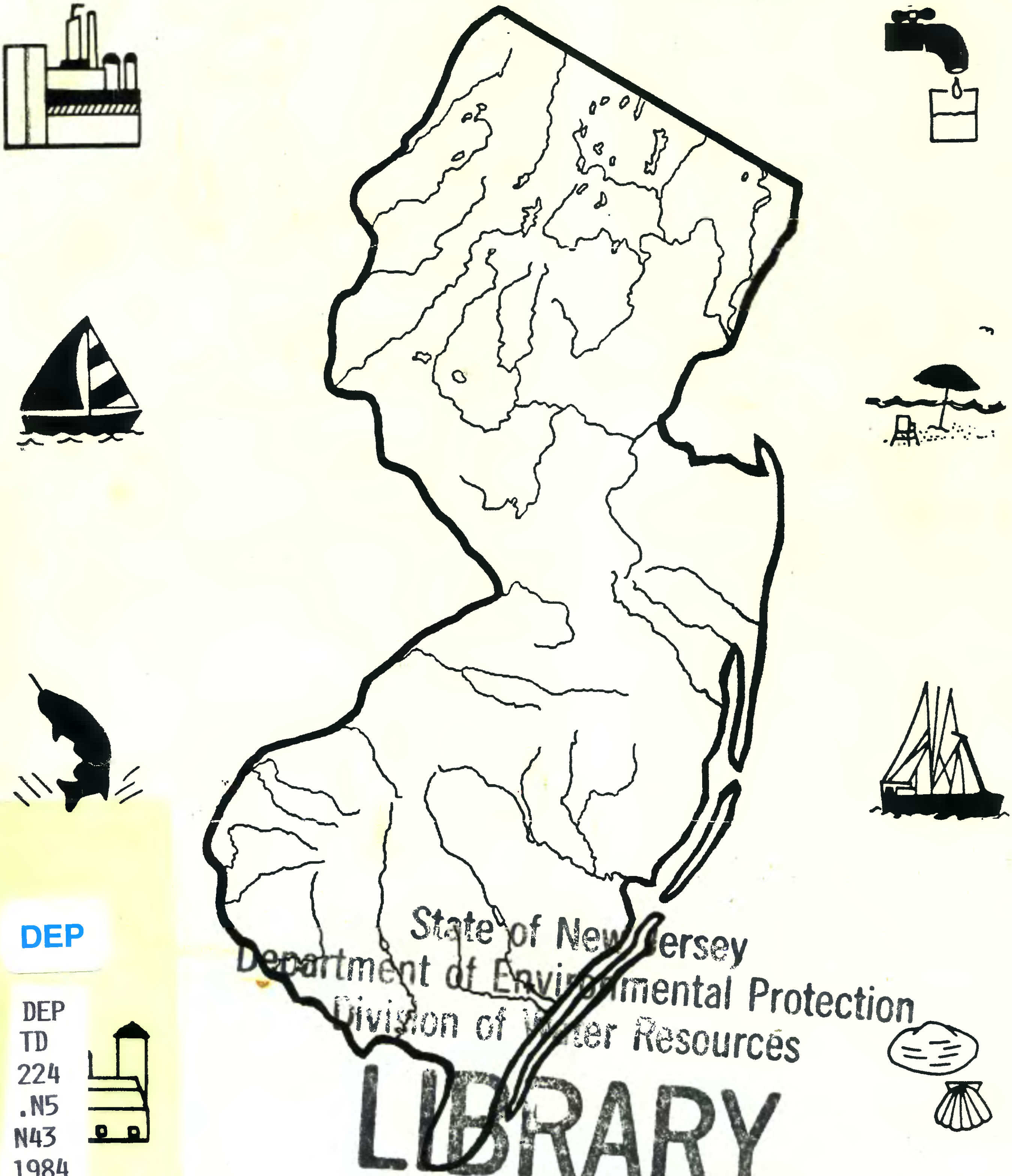
New Jersey 1984
State Water Quality Inventory Report



New Jersey Department of Environmental Protection • Division of Water Resources

NEW JERSEY 1984 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

New Jersey Department of Environmental Protection
Division of Water Resources
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May, 1984

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CHAPTER I. INTRODUCTION

The New Jersey 1984 State Water Quality Inventory Report is the sixth such report produced by the New Jersey Department of Environmental Protection, Division of Water Resources since 1975. The report's overall purpose is to assess water quality conditions throughout the state, determine trends in water quality and to make recommendations for furthering improvements in water quality. The report is produced every two years as a requirement of the federal Clean Water Act's (P.L. 92-500 as amended by P.L. 95-217) Section 305(b). Thus, the report is commonly called the 305(b) report. Each of the state's reports are compiled by the federal Environmental Protection Agency into a National Water Quality Inventory Report. This national report is then submitted to Congress for use in gauging clean water progress throughout the nation.

The New Jersey 1984 305(b) report has been designed to update and supplement the 1982 305(b) report so as to present an accurate and current picture of water quality conditions in the state. Whereas the 1982 305(b) report reviewed in detail the results of water monitoring during the period 1977 to 1981 and how water quality affected a number of in-stream uses (drinking water supplies, primary contact recreation, shellfish harvesting and fisheries resources), the 1984 305(b) report provides a summary evaluation of the progress in New Jersey's clean water programs, and selected supplemental water quality information based on intensive surveys and other specific programs. Since only two additional years of ambient data (from 1982 and 1983) would be available for evaluating water quality in the state, it was determined that a comprehensive reevaluation of water quality information is not warranted until additional ambient data is collected. As such, descriptions of ambient water quality in the comprehensive 1982 305(b) report along with information in this 1984 report, together present current conditions for rivers and streams throughout New Jersey. Future issues of New Jersey's 305(b) report will contain new and revised water quality assessments for waters throughout the state, based on the additional water quality data collected since 1981.

The 1984 305(b) report is composed of three chapters (besides the Introduction): Chapter II, Water Quality Management Progress Report - A Review of Water Quality Trends and Benefits of New Jersey's Water Quality Management Activities; Chapter III, Selective Monitoring Results 1981-1983; and Chapter IV, A System for Rating Waterbodies and their Water Quality Management Needs.

The Water Quality Management Progress Report looks at changes in water quality throughout New Jersey by comparing water quality conditions from 1972 and 1982, evaluating the effectiveness of higher treatment levels for pollution removal at municipal treatment plants, reviewing New Jersey's Clean Water programs, and summarizing major remaining water quality issues. Chapter III, Selective Monitoring Results 1981-1983, summarizes the findings of intensive surveys conducted by the Division of Water Resources (DWR) during the years 1981 to 1983 and the State's Clean Lakes Program, and includes status reports by the Delaware River Basin Commission and Interstate Sanitation Commission on water quality in their jurisdictional areas. The final chapter contains a description of a system the DWR is developing in cooperation with other Departmental agencies which rates waterbodies by water quality and the ability of a waterbody to maintain or restore specific water-based uses (primary contact recreation and aquatic biota). The rating system incorporates the intensity of water uses and the potential for maintaining or restoring those uses as decision-making factors. It is anticipated that the results of the rating system will be applied towards future Division programming. Annual program planning in the Division is now placing greater emphasis on water resource quality and usage priorities.

CHAPTER II. WATER QUALITY MANAGEMENT PROGRESS REPORT - A REVIEW OF WATER QUALITY TRENDS AND BENEFITS FROM NEW JERSEY'S WATER QUALITY MANAGEMENT PROGRAMS

The Water Quality Management Progress Report presents a synopsis of New Jersey's clean water programs and their results on water quality in the ten years since the passage of the federal Clean Water Act in 1972. The progress report presented in this chapter is a modified version of the States Evaluation of Progress ("STEP") Report completed in 1983 by the Division of Water Resources. The STEP Report was prepared in conjunction with the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA) which received a grant from the US Environmental Protection Agency for the purpose of developing a standardized reporting format for evaluating progress towards achieving clean water goals. A National STEP report was compiled by ASIWPCA on the basis of information supplied in the individual state reports. One major outcome of the STEP report has been the incorporation of many STEP features into the EPA guidance for use by the states in preparing the 1984 305(b) report.

The Water Quality Management Progress Report contains seven sections which review the following subjects within the state: geographic description or atlas, ambient water quality, point sources, nonpoint sources, water quality management program elements, water quality successes, special concerns and important remaining issues. Each section provides a one to two page summary of the particular subject. Information in the report was supplied by offices throughout the Division, as well as by the Delaware River Basin Commission and Interstate Sanitation Commission. A guide describing what background information was used to generate the data in the Water Quality Management Progress Report is presented in the appendix to the 305(b) report.

The Water Quality Management Progress Report provides some interesting insights concerning New Jersey's progress in clean water programs during the years 1972 to 1982, in addition to pointing out certain informational weaknesses when attempting to make statewide assessments. From the progress report though, the following significant conclusions are made:

- New Jersey's instream water quality monitoring programs evaluate approximately only one-fifth of the State's total fresh water stream miles.

- Where monitored, stream water quality has generally improved since 1972 but many pollution indicators still do not meet State Water Quality Standards.

- All of the State's publically owned lakes were monitored in the late 1970's for the first time.

- Reduced bacteria concentrations in certain coastal bays and estuaries have occurred because of improved municipal sewage treatment plants, and has resulted in less restrictive shellfish harvesting classifications. This is considered New Jersey's greatest water quality improvement over the past decade.

- The estimated overall removal of oxygen-demanding wastes by municipal sewage treatment plants went from 10-30 percent in 1972 to 76 percent in 1982. As a result of the improvement in treatment efficiencies at municipal plants, with the combination of reduced industrial wastewater contributions, possibly as much as 83 percent less of the oxygen-demanding wastes were discharged in 1982 compared to 1972.

-In 1982 approximately 75 percent of the municipal sewage treatment plants were in compliance with their discharge permits, but they accounted for only 40 percent of the total municipal flows. With regard to industrial facilities, nearly 80 percent were in compliance representing 65 percent of the total industrial flows (estimated).

-Total municipal sewage treatment plant investment in New Jersey from 1972 to 1982 exceeded $3.8 billion.

It is anticipated that future versions of New Jersey's 305(b) report will contain similar progress reports. Modifications to more accurately reflect current conditions, Department data strngths or changing EPA guidance, will undoubtably be made.

The Water Quality Management Progress Report is presented below.

Water Quality Management Progress Report

Prepared by the N.J. Division of Water Resources

August 1983

I. ATLAS

State Population 1970 7,171,112 1980 7,364,823
State Surface Area 8,204 sq. miles (7,505 land sq. miles)
# of River Systems/Basins 5
# of River and Stream Miles 6,448 mi.; # of Border Miles* 439 mi
# of Lakes and Ponds and Acreage 380 / 23,977 ac.
# of Marsh or Wetlands ac./sq.mi. 900,000 ac. or 1400 sq. mi. (fresh and saline wetland
# of Coast Miles 120 mi.
# of Estuary sq. mi. 420 sq. mi. (estuarine open waters)

* Border Rivers:
Name/Mileage Hudson River/Upper New York Bay 26 mi Name/Mileage Atlantic Ocean 127 mi.
Name/Mileage Delaware River and Bay 253 mi Name/Mileage Arthur Kill/Raritan Bay 33 mi

II. AMBIENT WATER QUALITY

Surface Water Uses Supported Based on 1982 Designated Uses

A. Streams and Rivers (Fresh waters)*

1. a. Miles Assessed: 6100
   b. Miles Designated for Uses More Stringent than Fishable/Swimmable: 1300
   c. Miles Designated for Uses Less Stringent than Fishable/Swimmable: 0
   d. Miles Monitored: 1030 miles

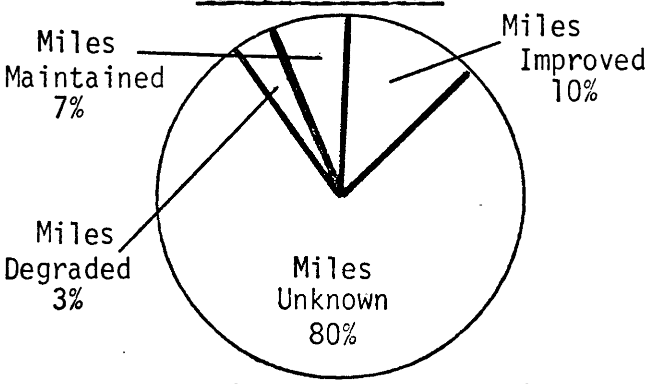
2. Evaluation of Support of Designated Uses

	Supported	Partially Supported	Not Supported	Unknown	Total Miles Assessed
1972	235 mi.	770	110	4985	6100 mi.
	4 %	13%	2%	81%	100%
1982	365 mi.	640	95	5000	6100 mi.
	6 %	10%	2%	82%	100%

* Approximations

3. Changes In and Within Use Support Between 1972 and 1982

By Percentage



	Within Category	Change Category
Miles Improved:	400	150
Miles Degraded:	100	50
Miles Maintained:	450	
Unknown:	5000	

B. Lakes and Reservoirs

1.a. Acres Assessed: 18,923

b. Acres Designated for Uses More Stringent than Fishable/Swimmabl 488

c. Acres Designated for Uses Less Stringent than Fishable/Swimmabl 0

d. Acres Monitored: 5728

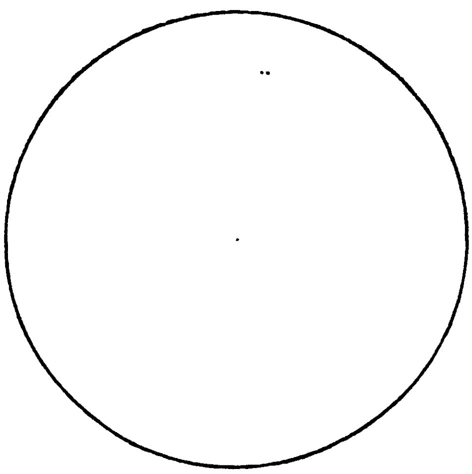
2. Evaluation of Support of Designated Uses

	Supported	Partially Supported	Not Supported	Unknown	Total Acres Assessed
1972	ac.			18,923	18,923
				100%	100%
1982	ac. 13,593	3788	1542	0	18,923
	% 72 %	20%	8%	0	100%

3. Changes In and Within Use Support 1972 - 1982

By Percentage

NOT AVAILABLE



	Within Category	Change Catego
Acres Improved:		
Acres Degraded:		
Acres Maintained:		
Unknown:		

C. Estuaries and/or Oceans*

1.a. Square Miles/ Miles Assessed: 1225 sq mi

b. Sq.Mi./ Miles Designated for Uses More Stringent than Fishable/Swimmable: 5 sq mi

c. Sq.Mi./ Miles Designated for Uses Less Stringent than Fishable/Swimmable: 450 sq mi

d. Sq.Mi./ Miles Monitored: 1100 sq mi

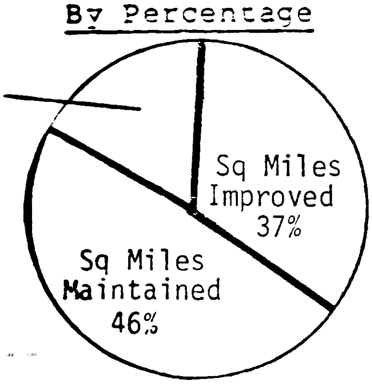
2. Evaluation of Support of Designated Uses

	Supported	Partially Supported	Not Supported	Unknown	Total Assessed
1972	72 sq mi	83 sq mi	380 sq mi	0	1225 sq mi
	62 %	7%	31%	0	100%
1982	772 sq mi	162 sq mi	291 sq mi	0	1225 sq mi
	63 %	13%	24%	0	100%

3. Changes In and Within Use Support Between 1972 and 1982

a. Estuaries:

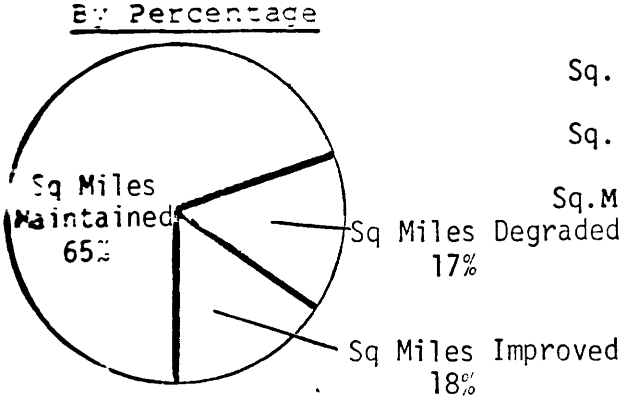
By Percentage



	Within Category	Change in Category
Sq.Mi.Improved:	200	80
Sq.Mi.Degraded:	100	30
Sq.Mi.Maintained:	350	
Unknown:	0	

b. Oceans

By Percentage



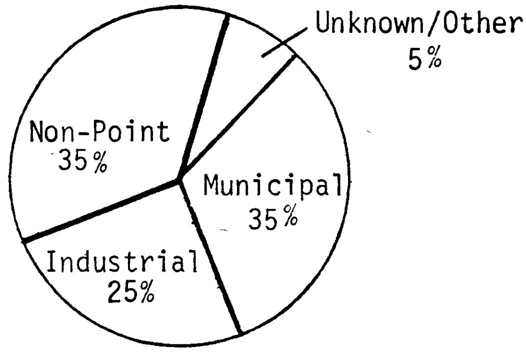
	Within Category	Change in Category
Sq. Miles Improved:	50	31
Sq. Miles Degraded:	25	50
Sq.Miles Maintained:	285	
Unknown:	0	

* Approximations

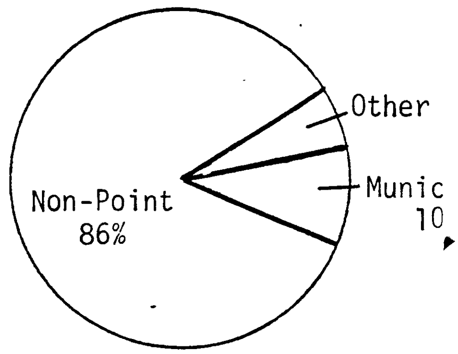
E. Causes for Less Than Full Support of Designated Uses in 1982

1. By Pollutant Sources --- By Percentage

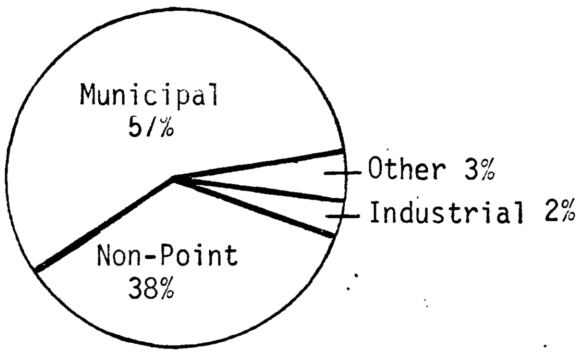
a. Streams and Rivers



b. Lakes and Reservoirs



c. Estuaries and/or Oceans



2. By Major Parameters of Concern:

Discharge Sources	Parameters: Coli.	D.O.	Nut.	pH	Temp.	Toxics*	Turb.	** Other	2 M Ser
Municipal	X	X	X						DO.
Industrial		X			X	X	X	X	
Non-Point	X		X			X	X	X	Col
Other (inc. natural)		X							

** Iron and Cobalt

Sus 1

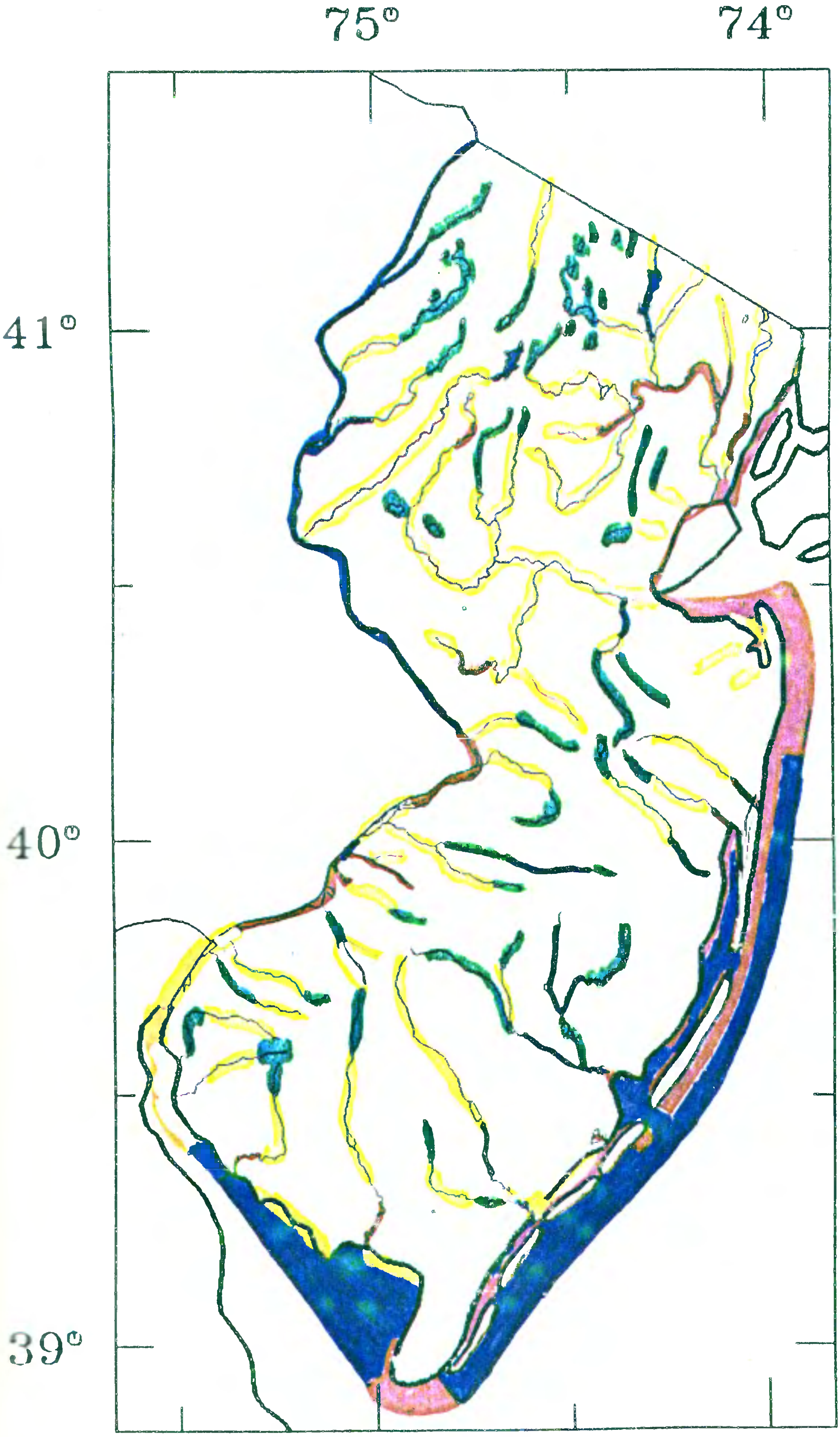
* Number of Stream/River Miles Affected by Toxics:[1] 30

* Number of Lake/Reservoir Acres Affected by Toxics:[1] 212

* Number of Estuary and Ocean Square Miles Affected by Toxics:[2] 40

F. State Maps for 1972 and 1982 Showing Extent of Support of Designate Uses in Streams and Rivers. Parallel Table II.A.2.

NEW JERSEY
PERENNIAL WATER BODIES



Blue = Meets Designated Uses

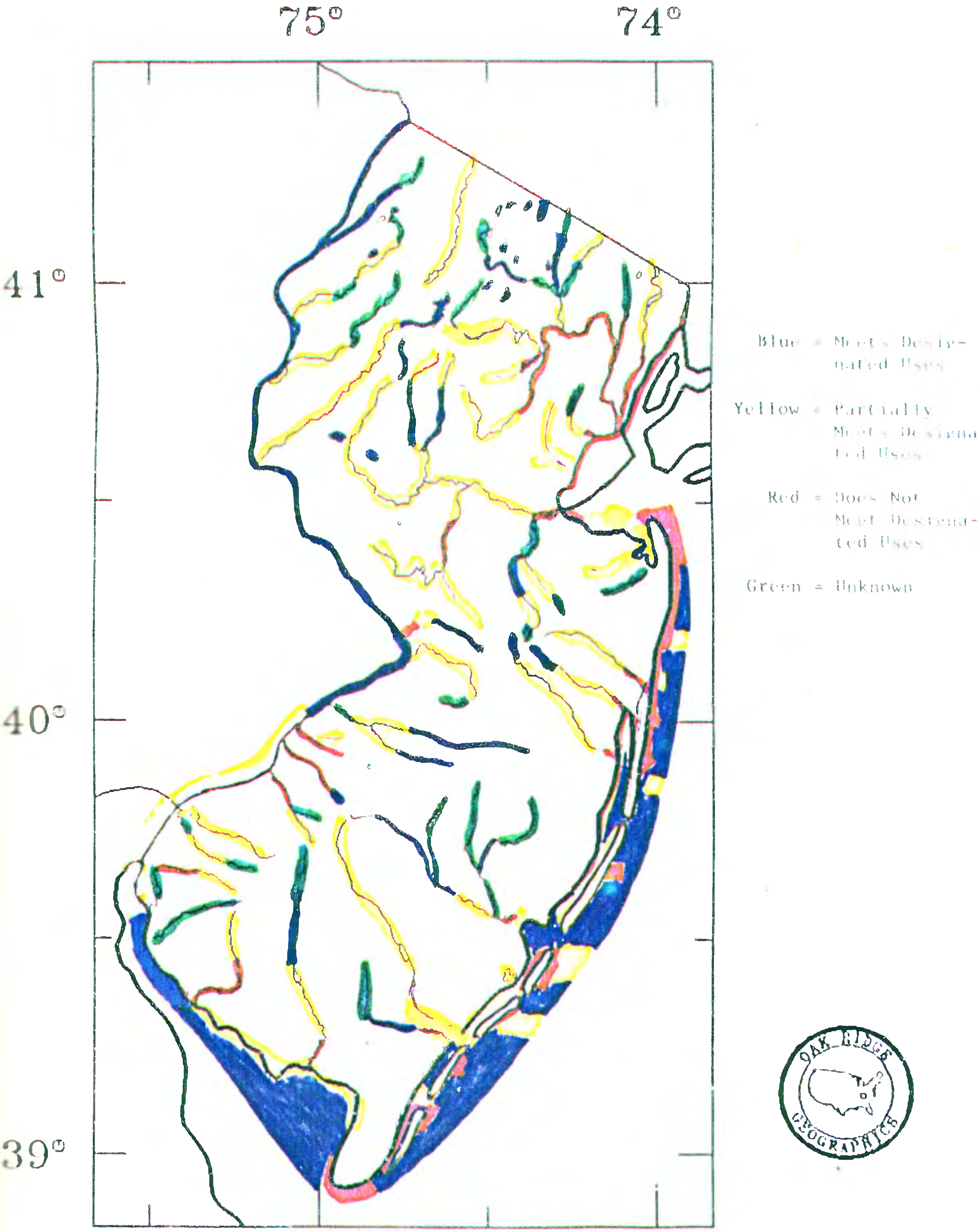
Yellow = Partially Meets Designated Uses

Red = Does Not Meet Designated Uses

Green = Unknown

1972

NEW JERSEY
PERENNIAL WATER BODIES

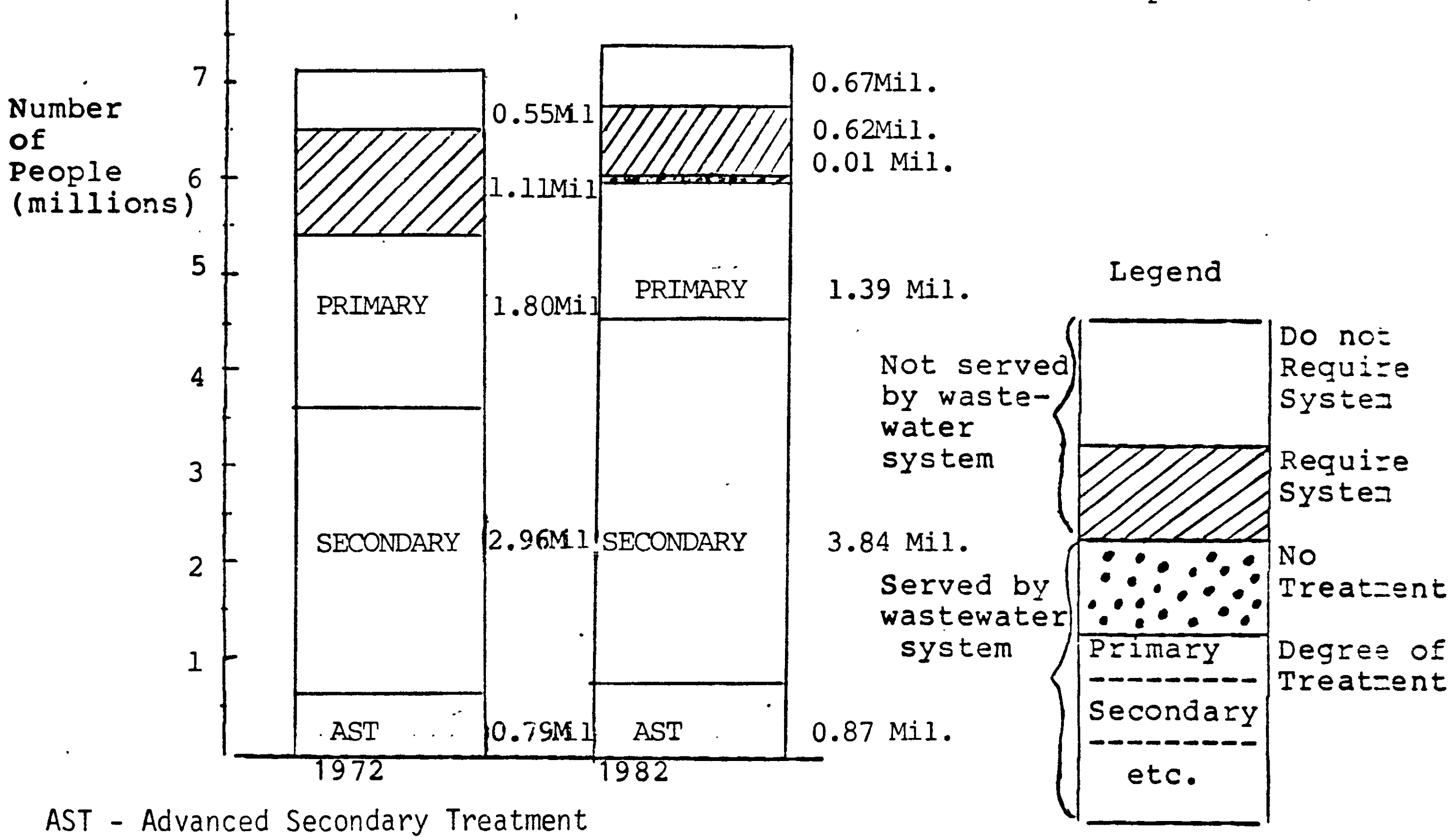


1982

III. POINT SOURCES

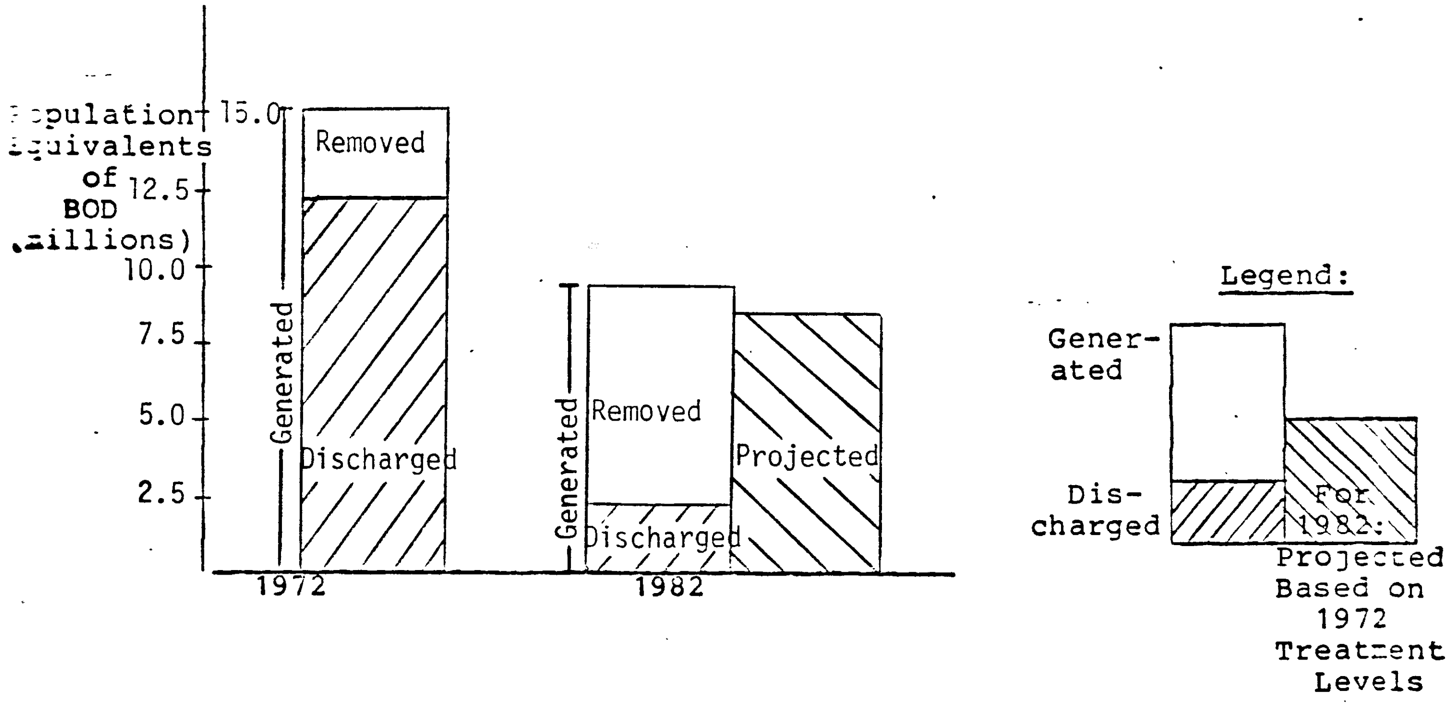
A. Municipal

1. Level of Wastewater Treatment Provided to State's Population:



AST - Advanced Secondary Treatment

2. Annual Population Equivalents of BOD Loads Generated vs Loads Discharged by Municipal Treatment Facilities Compared to 1982 Load Projections*



* Includes loads to municipal facilities from other than domestic sources

3. ~~Significant~~ Municipal Facility Compliance

a.

	1972	~~1982~~ ~~Interim Permits~~	Total 1982 ~~Final~~ Permits
Facilities with Permits	N/A		298
Facilities Meeting 1982 Permit Requirements+	N/A		230
Percentage of Facilities For Which Requirements Being Met	N/A		77%
Percentage of Flow For Which Requirements Met*	N/A		40%
Facilities Needing Upgrading / Regionalization	N/A		100

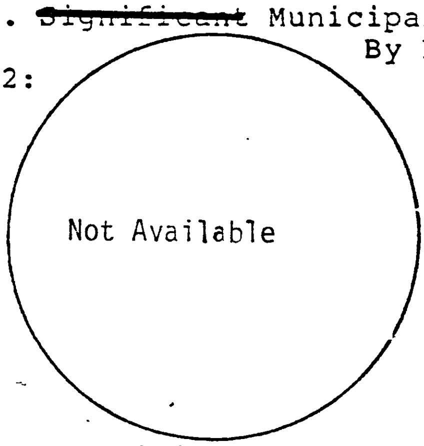
Total Permits in Effec in 1982

298

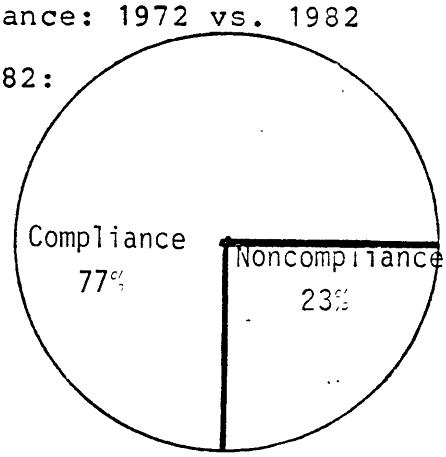
* Includes "No-Discharge" Facilities

b. ~~Significant~~ Municipal Facility Compliance: 1972 vs. 1982 By Percentage

1972:



1982:



B. Non-Municipal Facility Compliance

a. ~~Significant~~ Industrial & Other ~~Significant~~ Non-Municipal Facilit

	1972	~~1982~~ ~~Interim Permits~~	Total 1982 ~~Final~~ Permits
Facilities With Permits	N/A		1018
Facilities Meeting 1982 Permit Requirements+	N/A		804
Percentage of Facilities for Which Requirements Being Met	N/A		79%
Percentage of Flow for Which Requirements Met*	N/A		65%

Total Permit in Effe in 198

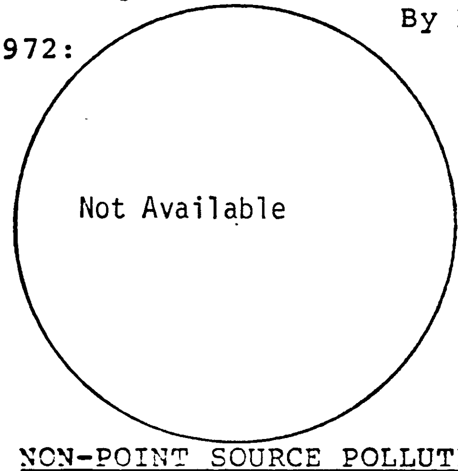
1018

*Includes No Discharge Facilities

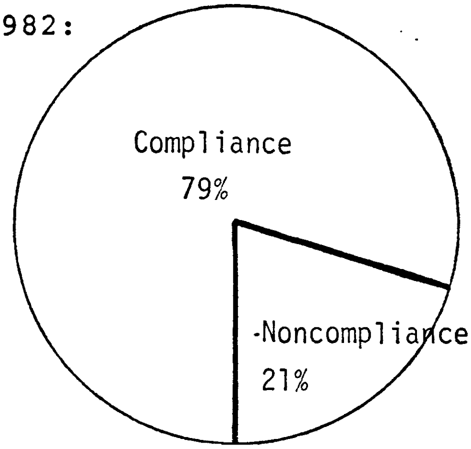
N/A = Not Available

b. ~~Significant~~ Non-Municipal Facility Compliance: 1972 vs.1982
By Percentage

1972:



1982:



IV. NON-POINT SOURCE POLLUTION CONTROL

The quality of New Jersey's surface waters are effected by nonpoint sources of pollution. Nonpoint source pollution is particularly complex because of the diversity and intensity of land uses in most watersheds of the State. Prominent nonpoint sources in New Jersey include drainage from agricultural areas (bacteria from animal wastes, nutrients and pesticides) and contaminated runoff from urban/suburban areas including the heavily urbanized and industrialized regions (runoff consisting of toxics, sediment, nutrients, bacteria, petrochemicals and metals). New Jersey's 12 Water Quality Management (208) Plans identify nonpoint sources as contributing various pollutants at levels often equal to, or greater than, loads generated from point sources. This has frequently resulted in difficulty in meeting designated stream uses.

In an effort to mitigate the impacts of nonpoint sources in New Jersey, federal, state and local agencies have been increasingly active in the area of water quality management planning and implementation. Agricultural nonpoint source pollution, such as soil erosion, loss of cropland nutrients and manure storage runoff, have been receiving much attention through the U.S. Soil Conservation Service (SCS) and State Soil Conservation Districts (SCDs). The SCS has completed 11 watershed protection projects in the State designed to reduce soil erosion and agricultural related water quality problems (3 additional projects have been authorized for installation). The 16 state SCDs review construction, mining, silvicultural and land disturbance activities for compliance with State Soil Erosion and Sediment Control Standards. The NJ Stormwater Management Act, passed in 1981, amends the State's Municipal Land Use Law to require that updated Municipal Land Use Plans and Ordinances contain provisions for stormwater quality/quantity management. A number of New Jersey counties have stringent stormwater control ordinances for new development, requiring ground recharge for both water quality and ground water protection.

Other activities in New Jersey directed at reducing nonpoint source pollution include the Stream Encroachment Permit program which currently proposes environmental standards for stream and hydrological modification projects; Water Quality Certificates (Section 401 of the federal Clean Water Act) for dredge and fill projects; New Jersey Pollutant Discharge Elimination System (NJPDES) permits for significant nonpoint sources and ground water discharges; and special nonpoint source controls in the State's coastal zone (through the Coastal Area Facilities Review Act of 1972). The NJ Department of Environmental Protection is seeking to sponsor county demonstration projects for various watershed protection issues in the State. These projects will focus on stormwater detention/retention basin maintenance, aquifer protection, remedial measures for nonpoint source control and on-site system management.

Increasing concern in New Jersey is being centered on the spread of toxic and hazardous substances through nonpoint sources. Major commitments by the State have been made to study and correct this problem. There now exists statewide spill containment requirements for industrial and chemical/fuel storage sites, and known hazardous waste sites receive NJPDES permits as site mitigation and clean-up activities are underway.

The increasing number of existing and proposed nonpoint source control programs and activities in New Jersey signifies the recognition of this pollutant source as a major water quality problem that must be effectively dealt with if state and national clean water goals are to be met.

	Urban / Suburban	Ag/Irr.	Silv.	Mining	Cons.	Hydro.	Salt. Int.*	Re Land
Severity & Extent[3]	S,W	S/M,L	I,L	I,L	M,L	M,L	S/M,L	S,
Primary Pollutants[3]	C,M,Nut DxDe	C,Nut., OxDe,P, SS	0	SS,T	SS,T	LoFlo	Sal	M,Ox P, p

* = Primarily a ground water concer

V. WATER QUALITY MANAGEMENT PROGRAM ELEMENTS

A. Enforcement

1. State's Approach: Enforcement efforts are initiated on routine compliance monitoring inspections, review of self-monitoring reports and/or complaints received from public and private concerns. Enforcement is undertaken in a progressive process unless the severity of the situation would warrant immediate referral to the Attorney General with the issuance of court ordered injunctions. This progressive approach begins with consultation or negotiations via telephone calls, letters and conferences to arrive at a agreeable solution to the given situation. This initial effort is highly successful and averts formal actions in many cases. The formal actions proceed with the issuance of directives that detail the violation, direct a remedy within a given time frame and notifies the party of its potential liabilities. Failure to comply with a directive results in an Administrative Order which may include a penalty assessment. Further failure to comply results in a referral to the A.G.'s office for formal litigatio

2. Actions Taken Since January 1982 Against Municipal and Non-Munic Facilities in [redacted] Non-Compliance in 1982

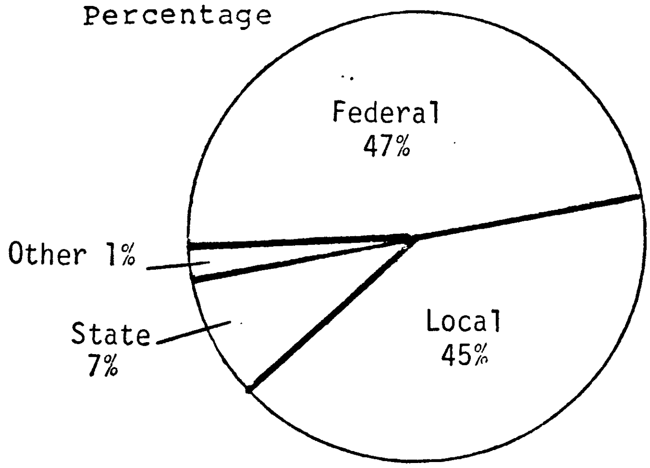
Total Number of Facilities:	1,491
Number of Pre-Administrative Actions:	1,047
Number of Administrative Actions:	171
Number of Judicial Actions:	43

B. Municipal Facility Investment

1972 - 1982
Cumulative Capital Investment for Municipal Wastewater Facilities
By Source of Funds

TOTAL INVESTMENT = $ 3874 Million

By Percentage



Categories of Sources:

Federal - EPA:	$ 1824 mi
Other Federal:	$ 16
State:	$ 292
Local Match:	$ 316
Other Local:	$ 1426

C. Program Activities:

Water Quality Monitoring The basic need for sound water quality monitoring programs has not decreased in the 10 years since the passage of the National Clean Water Act, but rather increased. New Jersey has utilized primarily fixed-station monitoring networks in cooperation with the Environmental Protection Agency and United States Geological Survey. Although the actual number of surface water monitoring stations sampled by the Department of Environmental Protection has decreased over the last ten years, the type of monitoring conducted has diversified. Intensive surveys for waste load allocations and system analyses purposes number 2-3 per year; lake surveys have been performed on all public lakes in the State; baseline sampling programs for determining the extent of carcinogenic and toxic substances statewide is among the most comprehensive in the nation; greater resources are being used for ground water ambient and pollution monitoring; and cooperative monitoring agreements with sub-state agencies is now underway. Quality assurance of data gathering and analysis techniques; and computerized data storage, retrival and analysis require seperate programs. Bacterial sampling of the State's ocean, coastal and estuarine waters will continue as in the past so that shellfish harvesting areas can be properly classified.

For the future DEP anticipates greater levels of effort in the following: intensive surveys for the purpose of identifying specific water pollution sources and stream conditions, sub-state ambient monitoring activities, and ground water quality data collection and analysis. DEP performed fixed-station monitoring will play a lesser role.

Water Quality Management Planning Water quality management planning in New Jersey has evolved full circle since initial planning activities were performed under the auspices of the Clean Water Act. Basin plans, for the purpose of identifying basin-wide wastewater treatment needs, were generated for the State in the mid-1970s as the first comprehensive planning activity. Subsequently, the 12 areawide Water Quality Management (208) Plans analyzed both point and nonpoint source impacts and named management agencies for control of these forms of pollution. A Statewide Water Quality Management Plan has recently been produced by the DEP as part of the continuing planning process, while designated Water Quality Management agencies continue work on various projects of local interest. Water Quality Management Plan consistency determinations and amendments are major planning activities that are currently underway and will be ongoing in the future. The DEP is requesting and encouraging the local Water Quality Management agencies to perform these consistency determinations. In addition, the preparation and revision of State Water Quality Standards and Water Quality Inventory Reports are considered an integral part of the State's water quality planning work. Other planning activities underway in DEP include waste load allocation/stream system analysis, sludge and septage management planning and numerous site/watershed-specific problem solving projects.

Permitting The proper permitting of point sources and other actions having adverse environmental impacts is a major goal of the DEP. Prior to EPA's delegation of the NPDES program to New Jersey in April, 1982, (subsequently, known as the New Jersey Pollutant Discharge Elimination System/NJPDES program), the Department reviewed and certified NPDES permit applications/renewals for EPA Region II. Upon delegation the State inherited a backlog of 500 unissued and expired permits which will take over 2 years to eliminate (there are currently approximately 1600 permitted discharges in the State). NJPDES permits are issued to surface and ground water point source discharges, selected runoff sources (primarily industrial sites known or suspected of containing hazardous substances and or petroleum products), sludge disposal locations and solid waste disposal sites. Support activities include wasteload allocation studies; sewer ban reviews; development of a comprehensive municipal ordinance strategy addressing sewer bans; technical and conceptual review of sewerage treatment plants; preparing and computerizing permits, their associated limitations and self-monitoring data; and maintaining fee schedules so that the NJPDES program is adequately funded. Industrial pretreatment programs are being developed that rely heavily upon local agencies for implementation, with some programs funded by Construction Grants monies.

The DEP has also streamlined the issuance and review of Division-required permits. Water quality certificates, NJPDES and Division of Coastal Resources permits are coordinated through a centralized office for technical review and consistency determination with Water Quality Management Plans. This coordinated permit effort, along with operation of the NJPDES program, will better identify and mitigate impacts on our water resources.

Construction Grants Program The building of new, enlarged and advanced municipal sewerage treatment facilities through the Construction Grants Program (CGP) has been a major accomplishment of the Clean Water Act. Since 1973 $3.8 billion have been obligated for the construction of water pollution control facilities in the State, with an estimated $6.4 billion additionally needed through the year 2000. To ensure the most effective allocation of these monies the DEP performs these functions: reviews all facility plans (including construction plans and specifications); develops and implements new plans where necessary; monitors and tracks projects; prepares project priority lists and systems; conduct need surveys; maintains computerized grant files; develops innovative/alternative systems for wastewater treatment and land disposal systems; and coordinates review of projects with other programs as necessary. In October, 1981 the DEP was granted total program assumption under the Delegation Agreement excuted with EPA. This delegation expedites the project review and approval process by consolidating the process into 1 program within DEP.

The CGP has been involved in 2 issues that will become of greater concern in the future. First, DEP engineers have been working with local agencies to solve operational problems occurring at treatment facilities. The success rate for correcting these problems has been high. Secondly, the DEP has proposed an innovative funding mechanism to spread limited monies to as many needed existing and proposed facilities as possible. The proposed "Infrastructure Bank" would convert construction grant monies to zero or low interest loans for use in a revolving account. National and State legislation is required to bring about this proposal, however.

VI. SITE-SPECIFIC SUCCESSES

Southern Coastal Estuarine Waters

New Jersey's shellfisheries resources have continued to support viable commercial and recreational interests, largely because of water pollution control efforts. This is especially true in the resource rich estuarine waters of Ocean, Atlantic and Cape May Counties. The estuarine waters of these southern coastal counties, while only comprisi 20% of the bays and estuaries monitored for shellfish growing water quality in the State accounts for approximately 65% of the State's total annual shellfish harvest. This represents a significant portion of the State's annual shellfish dockside value of $28.5 million.

The coastal estuaries and bays of Atlantic County have appeared to be the prime benefic of higher treatment efficiencies at municipal sewerage facilities and the abandonment of small , poorly operating facilities into regional system. In the early to mid 1970s the County's estuarine waters were classified by the NJDEP Bureau of Shellfish Control primarily as condemned or special restricted (meaning shellfish can be harvested but the must undergo further processing to cleanse themselves). Because of the large resource b found in these poor quality waters they were able to support a relay program. This invo taking clams from special restricted or condemned waters to approved waters for a minimu 30 days. This allows the clams to purge themselves of contaminating bacteria and or vir Antiquated and primary municipal treatment plants discharging to the County's back bays the principal reason for the poor quality of these shellfish growing waters. Atlantic C and the DEP recognized early in the Construction Grants program the need to eliminate th primary treatment plants for the purpose of restoring shellfish harvesting areas and protecting the many bathing beaches in the region. As a result, the proposed Atlantic C Sewerage Authority's Coastal Region sewerage project progressed at a fast pace and rece high priority in the State's early Construction Grants Project Priority List. The resu was the completion of a secondary treatment facility in 1977 discharging to the Atlanti

Water quality benefits to the County's back bays became evident in only 2 years. Shell growing areas monitoring in 1978 and 1979 for Atlantic County's back bays resulted in approximately 5000 acres being upgraded from condemned to seasonal, special restricted approved categories. Water bodies like Reed Bay, Absecon Bay, Lakes Bay, Scull Bay and Somers Cove once again became viable shellfish harvesting areas. Bacterial data collec 1979 showed further water quality improvements in Steelman Bay, the Broad Creek area of Bay and Scull Bay, resulting in approved status to nearly 2200 acres.

The upgrading and or regionalization of municipal treatment facilities up and down New coast has had positive impacts on water quality, and subsequently, the State's shellfis industry. The elimination of primary treatment plants discharging to the ocean has als produced the upgrading from condemned to approved status of over 22,000 ocean acres. T considers these water quality improvements just one of the most significant in the Stat the early 1970s.

VII. SPECIAL STATE CONCERNS AND REMAINING PROBLEMS

Part A. Special State Concerns Over Past Decade:

The number of major issues concerning water quality in New Jersey have grown over the past decade. This is not due to an inability to solve existing problems, but rather the identification of new and or unanticipated problems. Improving treatment efficiencies at the majority of the municipal and industrial wastewater facilities was the prime concern for the State in the 1970s. The construction of new regional facilities, upgrading existing treatment works and ensuring permit compliance made up much of the DEPs early water pollution control efforts. However, the new issues that developed were numerous and varied, and included: maintaining water quality while developing new diversions for water supply needs and meeting existing needs; expanding our knowledge of ground water quantity and quality in the State, developing a ground water permitting program, and responding to major increases in ground water pollution incidents; identifying the presence of toxic and potentially carcinogenic substances in the State's water environment; controlling the spread of toxic and hazardous substances from abandoned and existing landfills, accidential spills and industrial facilities; initiating pretreatment guidelines and programs; developing alternatives to the ocean dumping of sewage sludge and studying the impacts of such dumping on the marine environment; developing alternatives to centralized and conventional municipal sewerage works; controlling the illegal disposal of septage; monitoring and studying the occurrence of red tide in near shore ocean waters; and understanding and controlling where possible nonpoint pollution sources.

Part B. Major Remaining Problems:

- X - Surface water quality maintenance and/or quantity assurance in light of population and industrial growth.
- X - Groundwater resource quality protection or supply assurance.
- X - Identification and control of toxic pollutants from industrial and non-point sources.
- X - Municipal wastewater plant operation, maintenance, and rehabilitation
- X - Pollution arising from abandoned industrial and/or mining facilities.

New Jersey has placed heavy emphasis on the correction of the first 3 problems noted above. The recent 1980-1981 drought precariously reduced many community water supplies to only a few days reserve and underscored the need to develop additional water supply sources. Protecting the instream quality of the State's major water supplies is an integral part of developing these new sources. New Jersey has nearly 140 landfill/dump sites that are known to be contaminating surface and/or ground waters. This, in combination with the high number of operating and abandoned chemical, petroleum and other industrial facilities points to the potential for harmful toxic substance contamination in many areas of the State. Ground waters are of major concern as demand for it increases (approximately one-half of the State currently relies on it for water supply), pollution incidences rise, water levels drop and salt water intrusion occurs. Operationally within the DEP, the NJPDES permit program remains backlogged with unissued and expired permits it inherited when the program was delegated; an improved working framework for NJPDES ground water permits is needed; proper fee schedules reflecting administrative costs must be devised; and, if municipal treatment needs are to be met to the year 2000 and beyond, innovative/alternative funding mechanisms will be required in the face of severely reduced federal support.

Footnotes

1 Reflects only miles/acres where toxics have prevented a designated use (i.e. waters where closures and fishing bans are in effect due to toxic substance contamination). Mileage/acreage figures do not reflect areas identified with low levels of toxic substance contamination, but only where a use has been prevented.

2 Square mileage figure represents area of tidal and coastal waters where PCB contamination has resulted in a closure of the waters for a use, (specifically, the sale of striped bass and American eel taken from specified waters is prohibited In addition to this closure, fishing advisories have been issued by the State of New Jersey on the following fishes in specified coastal waters, because of PCB contamination. The advisory recommends that they not be consumed more than once weekly (area of advisory extends beyond State's jurisdictional waters. The fish include:

- bluefish, (individuals exceeding 24 inches in length or 6 pounds in weight)
- white perch
- white catfish
- striped bass
- American eel (all waters statewide)

3 The following defines the letters used to explain severity, extent and pollutants with regard to nonpoint source pollution.

Severity

S = Severe or Impairment of designated use
M = Moderate or Some interference with designated use, but use not precluded
I = Minor or Minimal effect on designated use

Geographic Extent:

W = Widespread or 50% or more of state's waters are affected by this category of nonpoint source
L = Localized or Less than 50% of waters are affected

Primary Pollutants:

C = Coliform
M = Metals
Nut = Nutrients
OxDe: Oxygen Demanding Materials
O = Temperature/Stream Shading
P = Pesticides and Herbicides
SS = Sediments or Suspended Solids
T = Turbidity
LoFlo = Low Flow
Sal = Salinity
pH = Acidity/Alkalinity

CHAPTER III SELECTIVE MONITORING RESULTS 1981 - 1983

Water quality monitoring is a continuous and ongoing activity throughout New Jersey. Surface water monitoring is for the most part performed at specific or fixed locations on a periodic basis, usually four to six times per year. The results of these monitoring activities served as the primary data source for the 1982 State Water Quality Inventory Report. However, the 1984 Water Quality Inventory (305(b)) Report does not include the most recent two years of fixed-station water quality data. A comprehensive reevaluation of water quality will be made when more ambient data is collected. As such, overall water quality conditions described in the 1982 305(b) report are considered as representive of current water quality for most waters throughout New Jersey.

In waters where more intensive monitoring has been performed since 1981, or where a more extensive data base is routinely generated in a one year period, then the results of these activities are included in this report. Four subject areas are reviewed: a summary of intensive surveys performed by the Division of Water Resources from 1981 and 1983, which have been fully evaluated; a summary of the State's Clean Lakes Program results through the end of 1983; and reviews of water quality in the Delaware River by the Delaware River Basin Commission, and of New York-New Jersey boundary waters by the Interstate Sanitation Commission.

Monitoring activities in New Jersey have been going in two overall directions. First, the DWR is attempting to rely on and perform more intensive surveys instead of fixed-station monitoring. Secondly, the DEP is entering into cooperative agreements with county agencies for monitoring fixed stations.

The New Jersey 1982 305(b) Report identified improvements needed in the statewide fixed-station or ambient surface water monitoring network being used throughout New Jersey. The 1982 report included recommendations to correct deficiencies in the statewide monitoring program associated with (a) the difficulty in identifying specific water pollution sources, (b) broadening the narrow scope of water quality information, and (c) increasing the frequency of sampling for various parameters. The objectives which underly the present refinement in statewide monitoring include improvement in identifying sources of water pollution; assessing more precisely the effects of identified pollution sources on stream quality, biota, and uses; estimation of the assimilative capacity or removal of pollutants by the stream environment; and determining the effectiveness of specific water pollution control activities. Long-term fixed station or ambient monitoring is still valuable because it identifies overall water quality conditions which may not be available with intensive surveys.

A. Intensive Surveys 1981 - 1983

Three watersheds, Beden Brook, and the Upper Wallkill and Millstone Rivers, are evaluated below on the basis of intensive surveys performed by the DWR during 1982 and 1983. Intensive surveys for other waterbodies were also conducted in 1983, but the analysis of data has not been completed to date. Approximately twenty intensive or special surveys are planned for by DWR during calendar year 1984.

Upper Wallkill River

The Upper Wallkill River from its origin at Lake Mohawk to Franklin Pond was the subject of a chemical and biological investigation during the summer of 1982. Twelve stations were monitored to assess the impacts of the Sparta Plaza and Sparta High School Sewage Treatment Plants on the Wallkill River. The results indicate that these point sources had no appreciable effect on river water quality in terms of dissolved oxygen, nitrogenous biochemical oxygen demand or carbonaceous biochemical oxygen demand. The degraded conditions measured in the upper two miles were attributed to the highly eutrophic Lake Mohawk waters which formed the headwaters flow of the river. Increased high quality ground and surface water contributions, in conjunction with natural biological processes greatly improved downstream water quality. Phosphorus concentrations measured in tributaries to Franklin Pond averaged less than the 0.05 mg/l, the State Water Quality Standard. The eutrophic condition of Franklin Pond was attributed to its shallow nature, excessive nutrients from upstream Lake Mohawk waters and background nonpoint sources.

A separate survey was also conducted on the chemical and biological effects of an industrial discharge, (Accurate forming, Inc.) having a known pollution problem, on the Wallkill River below Franklin Pond. Results from the survey showed that the Wallkill River upstream from Accurate Forming's industrial effluent was relatively clean and supported a healthy biological community. A second industrial discharge upstream of Accurate Forming had a deleterious effect on the macroinvertebrate population in the left channel upstream from State Highway 94; but no effect was detectable 250 feet downstream of the discharge. This industrial discharge and/or the Accurate Forming sanitary effluent were apparently responsible for increases in benzene, 1,1,1-trichloroethane, trichloroethylene and fecal colifc bacteria measured upstream from the Accurate Forming industrial effluent.

Accurate Forming's industrial effluent had a devastating effect on the macroinverte population 60 feet downstream from the discharge, reducing population density by 88 and number of genera by 49%. Effluent concentrations of methylene chloride, trival chromium, hexavalent chromium and nickel were excessive. Effluent temperature and were outside permit limitations.

Methylene chloride continued to be detected 300 feet downstream from the effluent discharge. Although the number of macroinvertebrate genera increased to values similar to those measured upstream from the effluent, the population density remain significantly reduced (16% of the upstream population). Despite the knowledge that Accurate Forming's discharge contained a complex mixture of chlorinated hydrocarbons and metals, it was not possible to attribute the deterioration of the downstream macroinvertebrate community to any one component of the Accurate Forming discharge.

Upper Millstone River

Stony Brook, a major headwater tributary of the Millstone River, was studied to determine the effects from point and nonpoint source pollutants. Both chemical and biological data collected during 1982 indicates that segments of the Stony Brook are in varying states of nutrient enrichment. Nonpoint source runoff contributed most of the nutrients to the stream. Impacts from point sources were most evident during low flow periods. Macroinvertebrate communities were subject to increased stress on the middle stream segment. This was reflected by lower species diversity and equitability indices, along with a decline in the percentage of individuals classified as intolerant of organic pollution.

Carnegie Lake (237 acres), which receives drainage from Stony Brook and the Upper Millstone River, was sampled in 1982 to determine the sources responsible for persistent algae blooms and excessive sedimentation, which reflects an accelerated eutrophic condition in the lakes. Although the water quality data was collected, further study is needed to fully assess the information for specific nutrient loadings, and the contribution of point and nonpoint sources to the loadings.

Beden Brook

Beden Brook, a tributary to the Lower Millstone River, flows through Mercer and Somerset Counties in central New Jersey. Biological and chemical sampling was conducted on four mainstem and two tributary stations (Rock Brook and Pike Run) during the Spring and Summer of 1982. The purpose of the survey was to collect background nutrient information for the watershed prior to the completion of the Hopewell Borough Sewage Treatment Plant, so that the necessity of advanced wastewater treatment for nutrient removal could be determined. The results indicated that both Beden Brook and Pike Run were of generally good water quality. However, nutrient levels in Lower Rock and Beden Brooks were significantly elevated due to an institutional sewage treatment plant discharge. The State Water Quality Standard for total phosphorus (0.10 mg/l) was violated in both streams during low flow conditions. Maximum values recorded were 0.25 mg/l in Beden Brook and 2.51 mg/l in Rock Brook.

The macroinvertebrate community in Beden Brook reflected the presence of good water quality. The communities were dominated by species classified as clean water organisms; their percent abundance at collection sites ranging from 57 to 82% of the recovered populations.

B. New Jersey Lake Classification Survey

Lake management and restoration programs for 25 of New Jersey's priority lakes were completed in 1983. Study lakes were chosen through consultation with areawide planning agencies. The project was supported by state funds and a USEPA Clean Lakes Program grant. Criteria for selecting the priority lakes included:

- Size and location,
- Present water quality,
- Public accessibility,
- Historical use of the lake and
- Practicality of restoration.

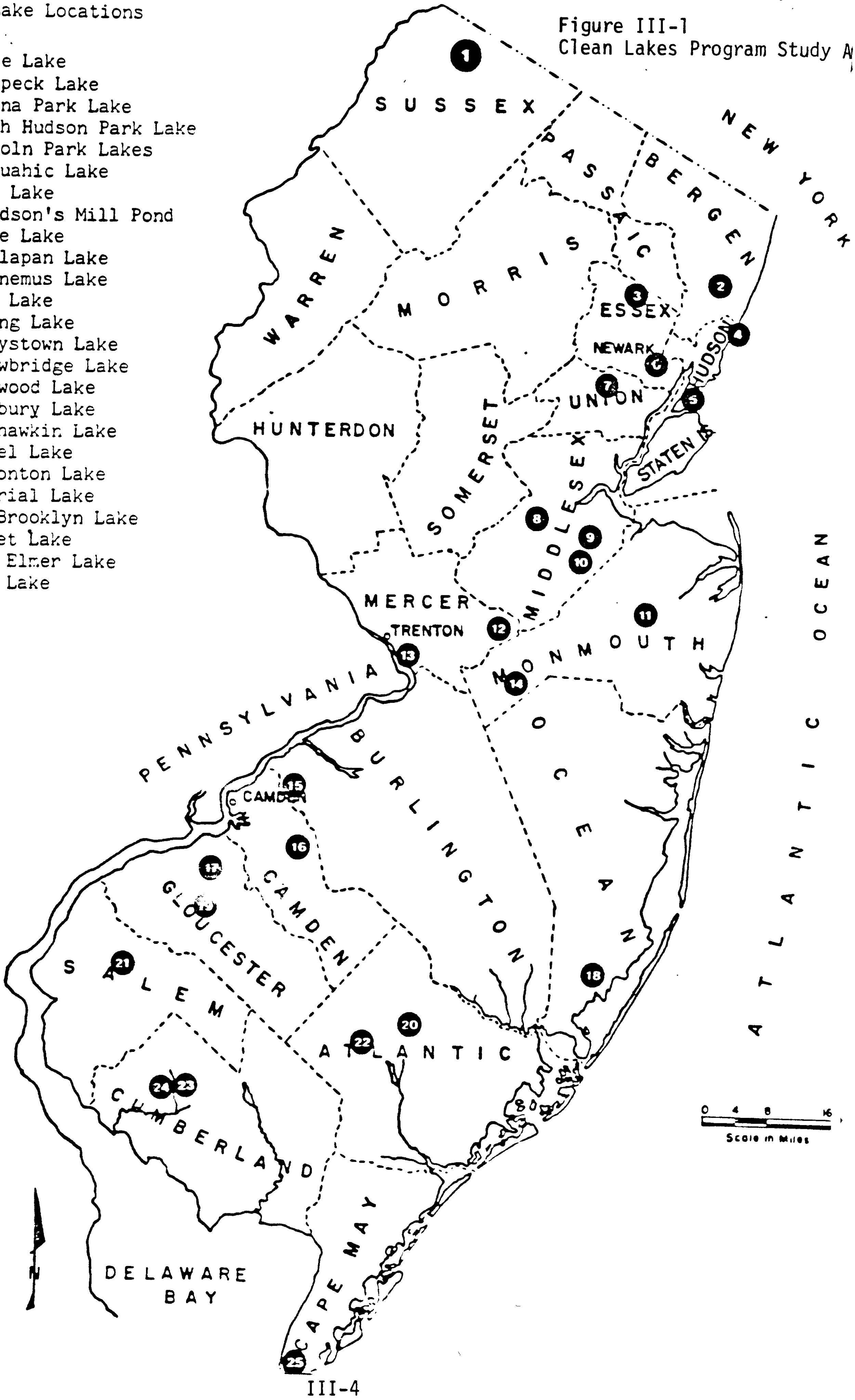
The lakes studies are shown and listed in Figure III-I.

A one year monitoring program was conducted on each lake and major tributaries draining into the lake. Parameters sampled included pH, alkalinity, dissolved oxygen, phosphorus, nitrate, nitrite, and Kjeldahl nitrogen. This field data was supplemented by land use delineations, and nutrient (phosphorus and nitrogen) and solids loading estimates utilizing areal loading methodology. Short and long-term

Key to Lake Locations

1. Clove Lake
2. Overpeck Lake
3. Verona Park Lake
4. North Hudson Park Lake
5. Lincoln Park Lakes
6. Weequahic Lake
7. Echo Lake
8. Davidson's Mill Pond
9. DeVoe Lake
10. Manalapan Lake
11. Topanemus Lake
12. Etra Lake
13. Spring Lake
14. Imlaystown Lake
15. Strawbridge Lake
16. Kirkwood Lake
17. Woodbury Lake
18. Manahawkin Lake
19. Bethel Lake
20. Hammonton Lake
21. Memorial Lake
22. New Brooklyn Lake
23. Sunset Lake
24. Mary Elmer Lake
25. Lily Lake

Figure III-1
Clean Lakes Program Study A



management recommendations were made whenever possible.

Objectives of the study were:

1) Develop a chemical and biological data base to measure future improvement or deterioration.

2) Estimate nutrient reduction necessary to achieve a healthy eutrophic condition (chlorophyll a equivalent of 6-10 mg/m^3).

3) Present management or restoration recommendations and

4) Obtain insight into the general characteristics and conditions of New Jersey lakes.

As expected, due to morphologic and watershed characteristics, the great majority of these lakes and, by inference, the majority of New Jersey's impoundments are in an "unhealthy" eutrophic condition. Not only are they in an "unhealthy" condition, but nutrient loading estimates point to the presence of accelerated euthrophication of lakes throughout the state.

Phosphorus levels are elevated with many samples exceeding the State Water Quality Standard limitation of 0.05 mg/l for waters entering lakes and impoundments. Phosphorus loading is so excessive that with most estimates, reductions of 50-80% is needed to achieve marginal conditions, not states of mesotrophy or oligotrophy. While phosphorus is the normal limiting nutrient, excessive phosphorus loading can produce nitrogen limiting conditions. This phenomenon is especially apparent in mid to late summer in many of the lakes studied. Common symptoms of these accelerated eutrophic conditions are nuisance aquatic weed growths, noxious algal blooms, and sedimentation through the accumulation of plant material or watershed erosion. Although too shallow to thermally stratify, bottom dissolved oxygen concentrations were often severely depleted. The excessive production of algae and/or aquatic plants in most systems is also expected to cause severe nighttime dissolved oxygen reductions due to plant respiration.

Nonpoint source pollution was the predominant cause of this deteriorating water quality. Urban, suburban, and agricultural land uses are, by far, the most important sources of nutrients entering our lakes. This runoff has also served to contaminate many lake sediments with low levels of toxic substances, which includes metals, PCB's and pesticides.

When point sources are upstream of lakes, they are major contributors of phosphorus and need to be controlled. However, they are not significant on a statewide basis as the cause for eutrophication of the state's lakes.

Numerous lake restoration options were examined at the conclusion of each lake study. The majority of recommendations involve a combination of stormwater control measures and dredging. Weed harvesting was also a recommended option in several cases. These recommendations are being pursued with local governments, many of which are anxious to begin implementing restoration plans. While state and federal funds are not widely available it is the scarcity of local funds which will most hamper restoration of New Jersey's priority public lakes.

Lake Hopatcong and Greenwood Lake are considered New Jersey's two most important lakes. Both are presently undergoing eutrophication. Because of their importance for many water-related activities, a review of their management and restoration findings are explained below.

Lake Hopatcong

Lake Hopatcong is New Jersey's largest (2686 acres) and most heavily utilized inland freshwater recreational resource for boating, swimming, fishing, and waterskiing. It has also served as an emergency source of potable water.

A Clean Lakes Program study, completed in October 1983, has concluded that the lake is undergoing accelerated eutrophication. Visible symptoms include massive algal blooms, excessive aquatic weed growth, depletion of dissolved oxygen in the hypolimnion, accumulation of heavy metals in the sediments and a general degradation of the fishery.

Phosphorus has been identified as the limiting nutrient. Septic tank leachate (38%) and overland runoff (28%) have been determined to be the main sources of pollutants entering the lake. In contrast, point sources are estimated to contribute only 4% of the nutrient load.

Management recommendations include sewering of the basin, a stormwater control program including retrofitting existing stormwater delivery systems, and an aquatic weed harvesting program. A $217,000 Clean Lakes Program grant proposal has been submitted to the EPA to initiate the weed harvesting portion of the restoration program.

Greenwood Lake

Greenwood Lake is a major bi-state lake straddling the New Jersey-New York State border. A Clean Lakes Program study to determine present trophic conditions, identify major nutrient sources, and prepare a long-term management plan was complet in 1983.

The condition of this 15 kilometer lake was found to be quite similar to that of Lake Hopatcong. The lake is eutrophic, having visible symptoms of nuisance aquatic weed and algae growths, sediment deposition and hypolimnetic oxygen depletion. The decline in hypolimnetic oxygen is particularly critical to the maintenance of the trout fishery (supported through stocking). While the lake is not conducive to trout reproduction, it is viewed as trout maintenance waters.

Nonpoint source pollution was again identified as the major source of nutrients. Fifty percent of the total phosphorus entering the lake was from diffuse (nonpoint) sources entering tributaries. Nine percent was attributed to septic tank leachate. In addition, internal phosphorus recycling was found to be an important nutrient pollutant source (30%). This was attributed to the morphology of the lake and the depletion of bottom water oxygen in large areas of the lake. This has served to encourage chemical changes in the sediments resulting in the release of previously precipitated input.

Management recommendations for the lake include the implementation of sewage planning in Greenwood Lake Village, the development and execution of a stormwater management plan, the dredging and stabilization of Belchers Creek and the harvesting of aquatic weeds. Research is also planned to evaluate the potential for in-lake phosphorus "stripping" through large scale alum treatment.

Water Quality Inventory Report for the Delaware River

A Status and Progress Report
Prepared under the Auspices of Section 305(b) of the
Federal Clean Water Act

Delaware River Basin Commission
West Trenton, New Jersey
March 1984

Report prepared by the Delaware River Basin Commission staff -
Gerald M. Hansler, Executive Director. Richard C. Albert was the principal
author assisted by other members of the technical staff.

The following table summarizes the findings of the water quality assessment by state:

	DE	NJ	NY	PA	Total
Total number of miles	79	253	86	260	339
Miles in Nat. Wild and Scenic R. Sys.	0	37	72	109	109
Miles supporting designated uses	79	224	86	231	310
Miles not supporting designated uses	0	29 1/	0	29 1/	29 1/
Miles of fishable water quality	68	213	86	231	299
Miles of non-fishable water quality	11	40	0	29	40
Miles of swimmable water quality	79	224	86	231	310
Miles of non-swimmable water quality	0	29	0	29	29

1/ In Zones 3 and 4 the following designated uses are not fully met: maintenance of resident fish, passage of anadromous fish and secondary contact recreation.

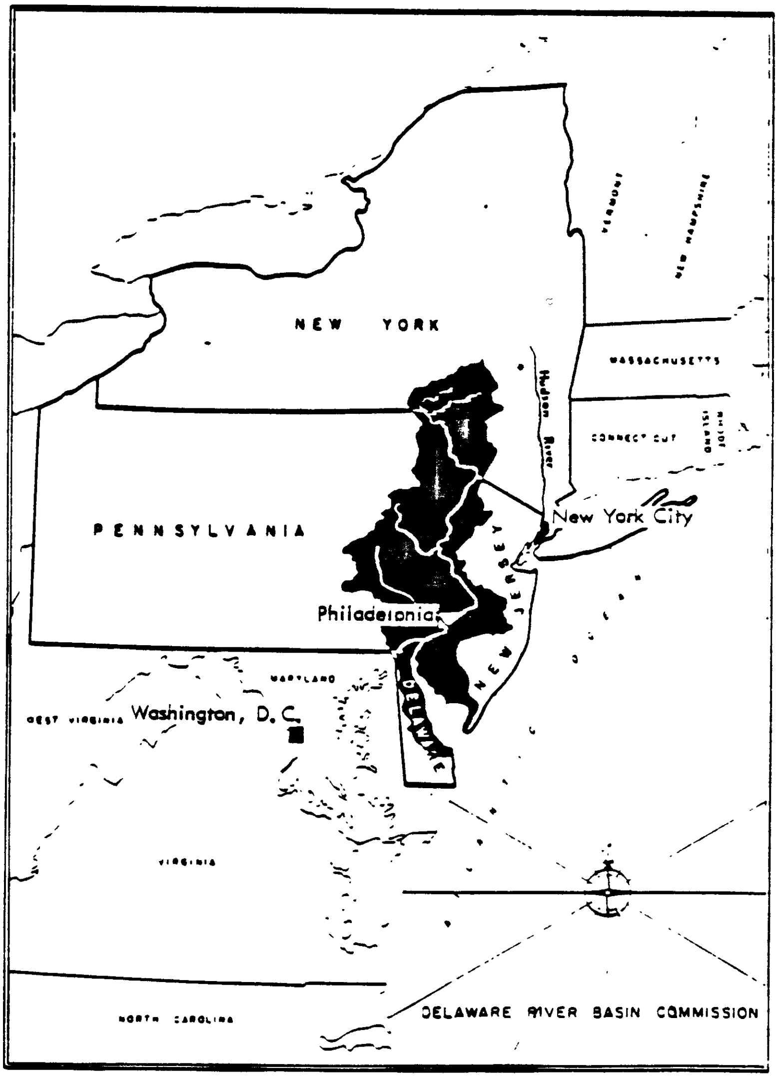


Figure 1. Location of Delaware River Basin.

INTRODUCTION

Section 305(b) of the Federal Clean Water Act requires a biennial assessment of the water quality of the nation's rivers, streams and lakes. The required reports are prepared by state agencies and several interstate commissions with water pollution control responsibilities. From these reports the U. S. Environmental Protection Agency prepares a national report for the U. S. Congress. The report helps Congress determine how the Federal Act is working, whether new legislation is needed and what additional resources, if any, are needed. The 305(b) reports serve a similar function at the regional, state and local level.

Unlike state 305(b) reports, the Delaware River Basin Commission report is concerned with only one river - the Delaware. This 339 mile long river (including the Delaware Bay and nine miles of the West Branch, Delaware) is part of the boundary of four states: Delaware, New Jersey, New York and Pennsylvania. The DRBC 305(b) report is part of each Basin state's 305(b) submittal and is published as a separate document because of the public interest in Delaware River water quality.

In March 1982 DRBC published a 305(b) report entitled "Cleaning Up the Delaware" The report marked the 20th anniversary of the Delaware River Basin Compact by summarizing the history of water pollution control in the Basin particularly emphasizing the gains made in the 1958 to 1981 period. The 1984 305(b) report describes the current status of water quality in the Delaware, the attainment of water quality standards and designated uses and changes in water quality and pollution control that have occurred since 1981. Similar information concerning tributaries of the Delaware River will be found in the Delaware, New Jersey, New York and Pennsylvania 305(b) reports.

Description of the Delaware River

The Delaware River Basin is a 13,500 square mile area including porions of Delaware, New Jersey, New York and Pennsylvania. The River itself is formed by the confluence of its East and West Branches near Hancock, New York, on the Pennsylvania-New York state border (Figure 2). For its first 77 miles the Delaware River flows southeast across the Appalachian Plateau, represented in the Delaware River Basin by the Pocono and Catskill Mountains. In this reach the Delaware drops half the elevation to sea level. The reach is characterized by rapids and pools contained in a steep-sided, narrow valley. Seventy-two miles of this reach of the Delaware has been included in the National Wild and Scenic Rivers system.

At Port Jervis, New York the Delaware River turns southwest and flows through the Minisink Valley to the Delaware Water Gap. This reach of river includes the Delaware Water Gap National Recreation Area and thirty-seven miles have been included in the National Wild and Scenic Rivers System.

At the Delaware Water Gap, the Delaware cuts through the Appalachian Ridge and flows 77 miles to Trenton, New Jersey. Enroute, the Delaware River passes through the Easton-Phillipsburg area. Here the Lehigh River, the Delaware's second largest tributary, flows into the Delaware River from Pennsylvania. Significant agriculture, urbanization, industry and other cultural influences are found between the Delaware Water Gap and Trenton.

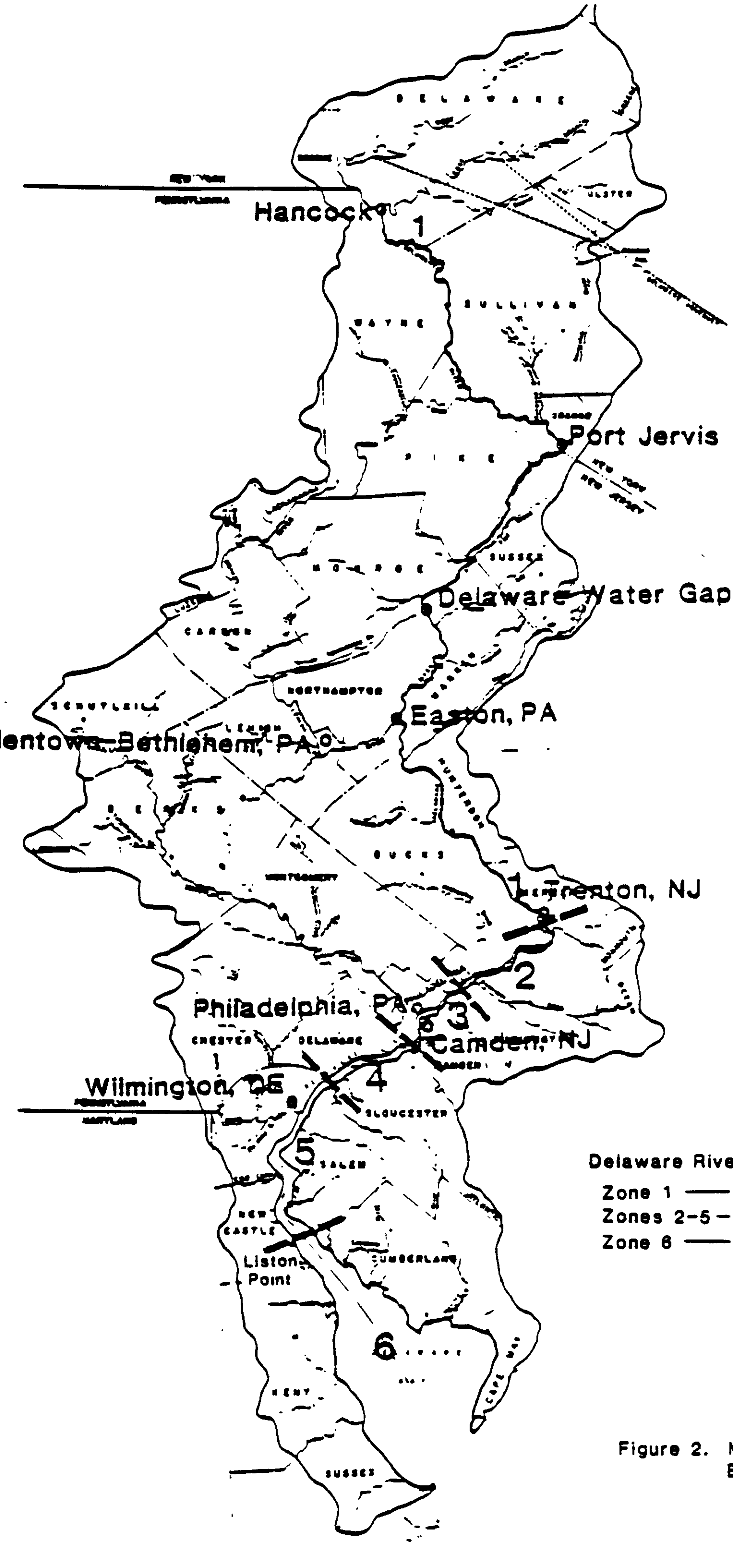


Figure 2. Map of Delaware River Basin

The Delaware River becomes tidal at Trenton, New Jersey. The upper 86-miles of tidal river is the Delaware Estuary, which flows by Trenton, New Jersey; Philadelphia, Pennsylvania; Camden, New Jersey; and Wilmington, Delaware. This area is one of the world's greatest contrations of heavy industry and the Nation's second largest complex of oil refining and petrochemical plants. In this area the Delaware Estuary flows along the boundary between the Piedmont Plateau and the Atlantic Coastal Plain. Aquifers in the Coastal Plain are recharged in part from the river.

Delaware Bay begins at Liston Point, Delaware, 48 miles from the ocean. The Bay area is heavily farmed with many small towns catering to the fishing and resort industry. The Bay serves as a major shipping lane from the Atlantic Ocean to port facilities in the Philadelphia-Camden Area. Commercial fishing and shell fishing are important industries in the Bay.

Including its tidal portion the Delaware River drains one percent of the United States and is the 33rd largest U. S. river. Although a small river, over ten percent of the U. S. population rely on the Delaware River and its drainage area for municipal and industrial water. In addition thousands of people use the Delaware for recreation each year, making it one of the most heavily used recreational rivers in the nation.

As shown in Figure 2 the Delaware River is divided into six zones for water quality management purposes. These zones are as follows: Zone 1 is the entire non-tidal Delaware from Hancock, New York to Trenton, New Jersey, Zones 2 through 5 encompass the Delaware Estuary, a tidal, freshwater river and Zone 6 is the Delaware Bay.

The following sections describe the water quality of the Delaware River on a segment-by-segment basis beginning with the upstream reaches of the river. Presented are descriptions of each segment, designated uses, water quality standards, sources of pollution, and the status of water quality as reflected in the available data. Discussions of pollution sources follow these sections.

NON-TIDAL DELAWARE
ZONE ONE
NEW JERSEY, NEW YORK, PENNSYLVANIA

Description of Zone

The non-tidal segment shown in Figure 3. Included for water quality assessment purposes is the 9-miles of the West Branch, Delaware River that forms the boundary between Pennsylvania to the west and New York State. At Hancock, New York the West Branch unites with the East Branch to form the Delaware River. Both branches originate in the Catskill Mountains and drain rural areas characterized by woods, small towns and extensive dairy and poultry farming. On each are major impoundments built and operated by New York City: Cannonsville Reservoir on the West Branch and Pepacton Reservoir on the East Branch. Releases from Cannonsville impact the West Branch but in recent years releases from the reservoir have been modified to protect cold water fisheries.

The Delaware River from Hancock, New York (River Mile 331)[2/] to Millrift, Pennsylvania (R.M. 258) was designated as the Upper Delaware Scenic and Recreational River and included in the National Wild and Scenic Rivers System by Congress in 1978. The scenic and recreational river is administrated by the National Park Service. In 1983 the National Park Service recorded 151,190 boaters (boats, canoes, rafts, tubes, etc.), almost 15,000 swimmers, over 9,000 fishermen plus other visitors.

The Upper Delaware is characterized by small towns, woodlands, open fields and farmland. The major population centers include Hancock (pop. 1700), Callicoon (pop. 800), Narrowsburg (pop. 500), and Barryville, New York (pop. 500); none of which have major industrial activity. The major tributaries to this Delaware River reach are the Lackawaxen River (Pennsylvania) and the Mongaup River (New York). Both rivers have major hydroelectric power generating facilities located in their drainage area.

Port Jervis, New York (pop. 9,000) and Matamoras, Pennsylvania (pop. 2,100) lie within the eight mile river reach above Milford, Pennsylvania which is not included in the National Wild and Scenic Rivers System. The Neversink River, whose watershed includes a New York City reservoir, enters the Delaware at the junction of the New York, Pennsylvania and New Jersey boundaries. New York City owns and operates the Port Jervis area sewage treatment plant.

From Milford, Pennsylvania to a point one mile downstream of the Delaware Water Gap, the Delaware runs through the Delaware Water Gap National Recreation Area, a 70,000 acre unit of the National Park System. Land acquisition for the recreation area has resulted in the removal of most homes, farms and commercial establishments that formerly existed in this reach of the river. In 1978 Congress designated the Delaware River in the Delaware Water Gap National Recreation Area as the Middle Delaware Scenic and Recreational River and added it to the National Wild and Scenic Rivers System. Milford, Pennsylvania (pop. 1,200) is the only town of any size located on this reach of the Delaware. Brodhead Creek, however, enters the Delaware just above the Delaware Water Gap. Located on Brodhead Creek nine miles above the confluence

2/ River miles are abbreviated R.M.

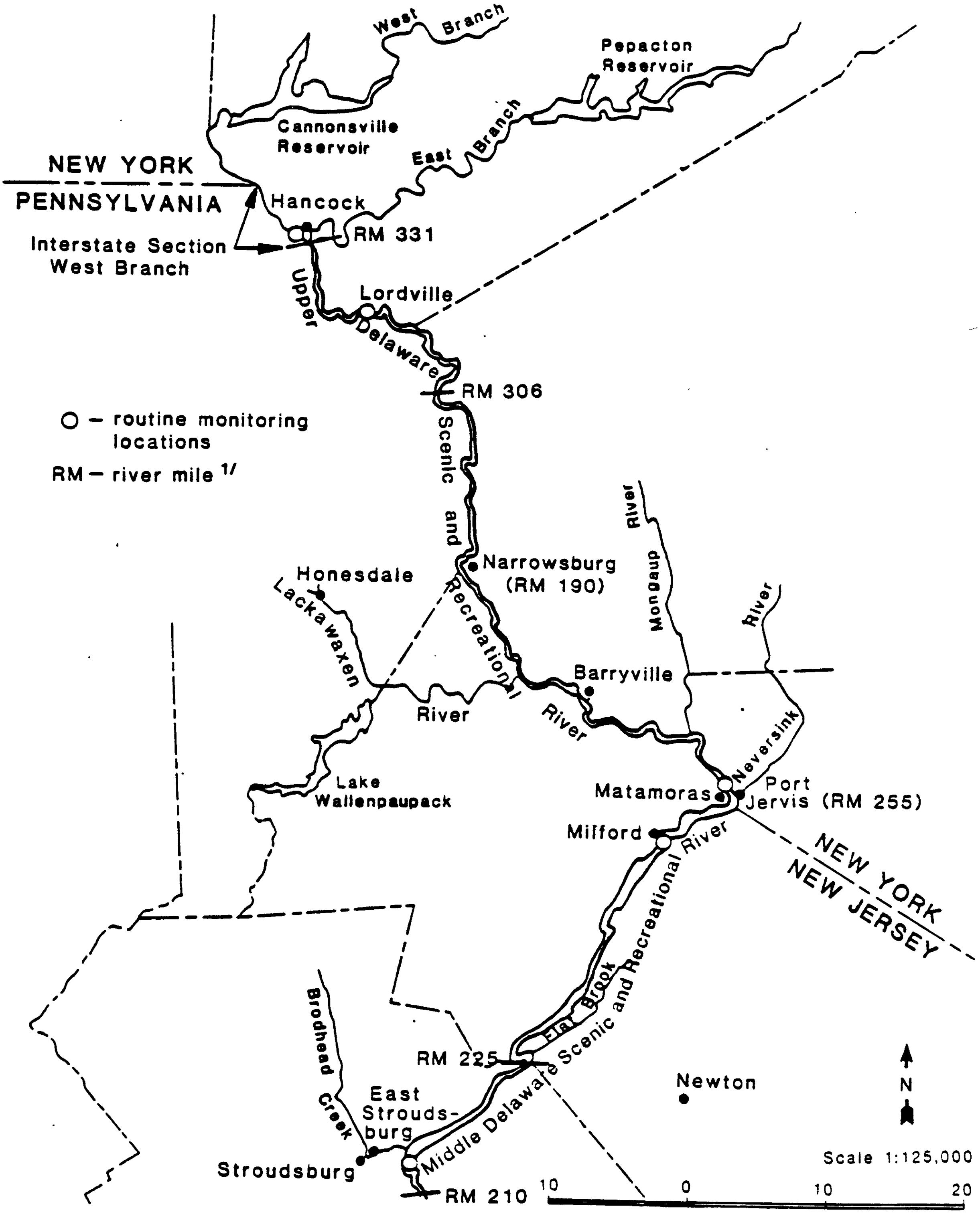


Figure 3. Non-Tidal Delaware River, Zone One and Environs (Northern Half)

1/ River Miles refer to the distance from the Atlantic Ocean.

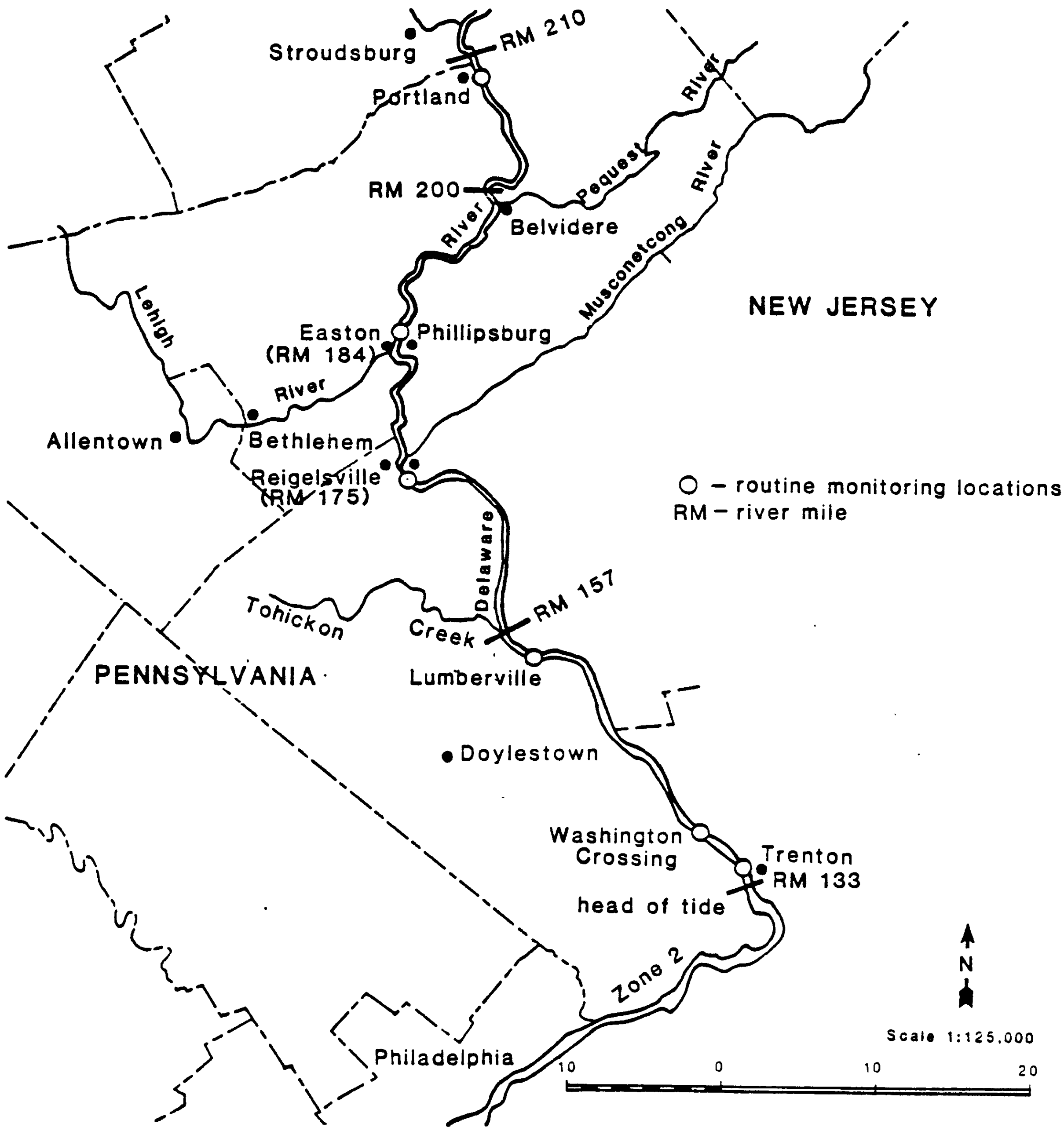


Figure 3 (cont'd). Non-Tidal Delaware River, Zone 1 and Environs (Southern Half) are Stroudsburg (pop. 5,000) and East Stroudsburg, Pennsylvania (pop. 8,000). On other tributaries, particularly in Pennsylvania, are resorts, second home developments and various commercial establishments that may affect water quality.

The Middle Delaware is intensively used for various recreational activities. Two public bathing beaches are operated by the National Park Service; Milford Beach at Milford, Pennsylvania and Smithfield Beach, 6 miles above the Delaware Water Gap. In 1983 the National Park Service recorded 16,800 swimmers at their beaches. Swimming also occurs in non-designated areas. Boating (boats, canoeing, tubing) is the primary recreational activity in the Middle Delaware. Boating participation (including fishing boats) was in excess of 160,000 boaters in 1983, with approximately 70% involved in canoeing. Shore fishing was enjoyed by over 16,000 fishermen during the same year.

After passing through the Delaware Water Gap, the Delaware River flows 77 miles to the head of tide at Trenton, New Jersey. The adjacent terrain is gentler than upstream areas. Agriculture, industrial activity and small towns are located along the river. At R.M. 184 the Delaware passes through the Easton Pennsylvania/Phillipsburg, New Jersey urban area (pop. 43,000). Also influencing water quality in this reach of river is the Lehigh River which enters the Delaware at Easton. The Lehigh River drains a 1360 square mile area that includes former coal mining areas in the upper watershed, the intensely farmed Lehigh Valley, and the industrialized Allentown/Bethlehem metropolitan area. The Cities of Allentown and Bethlehem (pop. 200,000) are located along the Lehigh River beginning ten miles upstream from the confluence with the Delaware River. Other major population centers located along the Delaware River from the Delaware Water Gap to Trenton include Portland, Pennsylvania - Columbia, New Jersey (pop. 600); Belvidere, New Jersey (pop. 2,500); Riegelsville, Pennsylvania (pop. 1,000); Milford, New Jersey (pop. 1,400); Frenchtown, New Jersey (pop. 1,600); New Hope, Pennsylvania (pop. 1,500); and Lambertville, New Jersey (pop. 4,000). Most of these towns have one or more industrial plants.

The reach of Delaware River between the Delaware Water Gap and Trenton, New Jersey is also intensively used for water-based recreation. No estimates of usage are available. It is likely however, based on personal observation and the number of canoe/tube outfitters, that use is at least equal to either the Upper or Middle Delaware Scenic Rivers. <u>If so, this would mean that the total recreational use of Zone One in 1983 approached or exceeded 1/2 million visitors</u>. Most of this use occurred in the May-September period.

Zone One supports a wide variety of sport and forage fish, including various species of trout, pickerel, bass, walleye and others depending upon location. North of the Delaware Water Gap are found the most important spawning grounds of the American Shad, an anadromous fish. Shad populations were drastically reduced in the past due to pollution in the Delaware Estuary that prevented passage of migrating shad in the spring and fall months. A resurgence of shad has been noted as the Estuary becomes cleaner due to the upgrading of wastewater treatment. Additional migrating fish using Zone One for spawning are herring, the American eel and others. Small commercial fisheries are centered around the shad and eel migrations and sport fishing is of local economic significance.

Designated Water Uses

Water quality standards in Zone One call for the maintenance of water quality that supports the following designated uses:

1. Public water supplies after reasonable treatment,
2. Industrial water supplies after reasonable treatment,
3. Agricultural water supplies,
4. Maintenance and propagation of resident game fish and other aquatic life,
5. Spawning and nursery habitat for anadromous fish (except West Branch),
6. Passage of anadromous fish (Narrowsburg, New York - R.M. 289.9 to Trenton, New Jersey R.M. 133.4 only),
7. Maintenance and propagation of trout (West Branch and Delaware River from Hancock, New York - R.M. 330.7 to Narrowsburg, New York, R.M. 289.9 only),
8. Wildlife,
9. Recreation.

In addition to these protected uses the inclusion of the two sections of the Delaware River in the National Wild and Scenic Rivers system results in a special segment designation for these reaches. Protection of outstanding features (including water quality) is required by the policies of the Wild and Scenic Rivers Act (P.L. 90-542). The Upper Delaware Scenic and Recreational River has been adopted into the Delaware River Basin Commission Comprehensive Plan with the pledge that the Commission, New York and Pennsylvania would take measures to preserve the existing environmental values of the river corridor.

Water Quality Standards

Water quality standards for Zone One are promulgated by the Delaware River Basin Commission and the States of New Jersey, New York and Pennsylvania. Standards are developed cooperatively and, thus, are generally identical. These standards call for water quality meeting the following key criteria (not all criteria listed):

1. Dissolved oxygen - not to be less than 4.0 mg/l at any time, minimum 24-hour average not to be less than 5.0 mg/l. In the upper reaches where trout spawning is a protected use the dissolved oxygen is not be less than 7.0 mg/l when temperatures are suitable for spawning.

2. pH: between 6.0 and 8.5.

3. Fecal coliform: not to exceed 200/100 ml. as a geometric average (with sufficient number of samples taken).

4. Water temperature: not to exceed 5° F rise above ambient temperatures, after 87° F natural temperatures to prevail.

In addition to its water quality criteria, the Delaware River Basin Commission has adopted a nondegradation policy for interstate waters, particularly applicable to the upper reaches of Zone One. Where existing water quality is better than the established stream criteria, the existing, higher water quality level is to be maintained unless "necessary economic or social development" dictate otherwise.

Table 1
Summary of Zone One Water Quality, 1982 and 1983 as observed
by Routine State Monitoring Stations Zone 1

Parameter		West Branch at Hancock	Lordville RM 322	Port Jervis RM 255	Montague RM 246	Stroudsburg RM 212	Portland RM 207	Easton RM 184	Riegelsville RM 176	Lumberville RM 155	Wash. Crossing RM 142	Trenton RM 134
Dissolved	Ave	9.6	9.7	9.7	11.4	9.9	11.0	10.9	10.9	10.6	10.7	10.4
Oxygen	Max	10.5	11.6	12.6	14.8	16.2	14.6	14.2	13.6	14.6	13.8	13.6
(mg/l)	Min	8.5	7.8	7.6	7.9	4.7	8.1	8.8	7.4	8.4	8.0	7.0
	#	3	2	8	8	13	7	6	10	9	8	10
pH	Ave	6.5	6.6	7.2	7.3	7.0	7.3	7.6	7.4	7.6	7.8	7.9
	Max	7.2 1/	7.2	7.7	7.9	8.1	7.8	8.6	8.0	8.7	8.2	8.5
	Min	5.9 1/	6.1	6.6	6.7	5.6	6.7	6.7	6.7	7.0	7.6	7.0
	#	19	6	10	10	14	8	8	11	9	8	10
Fecal	Ave 2/	76	87	33	22	409	32	46	142	128	71	25
Coliform	Max	180	100	1400	50	5000	140	490	2400	1300	340	460
(#/100ml)	Min	50	75	84	20	25	20	20	8	20	20	4
	#	4	2	10	8	13	7	8	10	8	8	6
Total	Ave	0.13	0.23	0.06	0.08	0.20	0.13	0.10	0.30	0.38	0.28	0.27
Phosphate	Max	0.37	1.07	0.09	0.12	0.49	0.37	0.15	0.77	1.30	0.65	0.34
(mg/l)	Min	0.06	0.03	0.03	0.06	0.03	0.06	0.06	0.12	0.12	0.12	0.15
	#	19	6	10	9	17	6	8	10	8	8	7
Ammonia	Ave	0.02	0.003	0.02	0.14	0.05	0.12	0.11	0.19	0.13	0.13	0.11
Nitrogen	Max	0.09	0.02	0.04	0.22	0.12	0.20	0.26	0.35	0.24	0.25	0.25
(mg/l)	Min	0.01	0	0	0.05	0.01	0.05	0.05	0.09	0.07	0.03	0.02
	#	19	6	5	5	16	7	6	7	9	7	5
Nitrate &	Ave	0.17	0.16	0.44	0.47	0.43	0.39	0.66	0.92	0.99	1.01	1.18
Nitrite	Max	0.34	0.21	0.65	0.62	0.77	0.61	0.90	1.20	1.40	1.30	1.60
Nitrogen	Min	0.08	0.10	0.30	0.30	0.16	0.30	0.50	0.66	0.60	0.70	0.90
(mg/l)	#	19	6	10	10	17	7	8	11	8	8	7
Conducti-	Ave	74	70	73	83	135	87	136	172	179	180	186
vity	Max	85	80	79	99.0	480	98	174	218	242	230	225
(micromho)	Min	60	60	66	64.0	60	64	88	99	109	123	154
	#	19	5	10	9	17	8	8	11	9	8	10
Sampling		PA	PA	NY	NJ	PA	USGS	USGS	NJ	USGS	USGS	USGS

1/ lab pH - Field pH normally higher
2/ geometric mean

Nutrient levels in the Delaware River do not cause problems in the river per se. In recent years, however, indications of minor algal blooms have been noted around islands in the Delaware Water Gap. In 1980 the DRBC limnological program (DRBC 1981) noted that phytoplankton primary productivity increased in a downstream direction from Easton with the highest productivity in the Yardley, Pennsylvania - Trenton, New Jersey area. It was concluded that the latter location was autotrophic and thus an exporter of energy (biomass) to the upper portion of the tidal river. During the warmer months the City of Trenton water treatment plant must remove algae from the river water, a minor problem. Nutrients and the subsequent stimulation of plant activity results in minor violations of adopted pH standards. The only major problem with nutrients to date, however, is the stimulation of aquatic plant growth in the Delaware and Raritan Canal (New Jersey) which withdraws Delaware River water near Lumberville, Pennsylvania for water supply purposes. The canal is considered eutrophic with aquatic weeds and algae causing major water quality problems in the summer (Rutgers 1980).

3. The Delaware River in the vicinity of Stroudsburg, Pennsylvania (the Delaware Water Gap) appears to be slightly degraded. The data indicate that fecal coliform levels are occasionally higher than desired. In 1982 and 1983 69% of the fecal coliform values observed at the routine monitoring station in the Gap were greater than 200/100 ml. During the summer of 1982 two samples yielded values greater than 5000/100 ml. At this location dissolved oxygen values appear to be less than other Delaware River locations also indicating possible degradation.

   The Delaware River Basin Commission and the National Park Service data support the conclusion that the Delaware River in the Delaware Water Gap is degraded to some extent. Limited data indicate that sources in the Brodhead Creek watershed and adjacent watersheds are likely contributors to the excessive bacterial levels. The data also indicate that rainfall runoff is a major factor in the high fecal coliform levels. Available fecal coliform and fecal streptococcus data (DRBC 1984) suggest animal sources of bacteria more so than human. A comparison of data from Pennsylvania's routine monitoring station with the DRBC/NPS Kittatinny Beach data indicates the possibility that higher values occur on the Pennsylvania side of the Gap than the New Jersey side.

4. Violations of fecal coliform standards appear to be occurring at the Riegelsville, Pennsylvania routine monitoring location.

   At Riegelsville 70% of the 1982 and 1983 fecal coliform values (7 dates) were greater than 200/100 ml. On four dates fecal coliform to fecal streptococcus ratios are greater than 4 indicating that the high fecal coliform values on those dates were probably from domestic-human sources rather than animal. At Lumberville, 21 miles down river, 3 of eight values are greater than 200 (38%) and the fecal coliform/fecal streptococcus ratio is greater than 4 in one of the samples.

Fecal coliform data at Riegelsville appear to be from non-point sources. In 1982 and 1983 almost every sample taken was on rainy days or days following rain. A comparison of rainfall values with the observed fecal coliform level indicates that the magnitude of the observed bacteria level is related to the rainfall event. For example the highest fecal coliform level observed occurred during or after a rainstorm that dumped up to 2.5 inches of rain on upstream areas. While some of the fecal coliform-fecal streptococcus levels indicate possible human contamination, contact would have been minimal because of bad weather, or the lack of recreation activity (off-season).

5. Fish data and fishing activity demonstrate that the entire Zone One and lower West Branch support fish maintenance and propagation. In the West Branch the recent New York study (Sheppard 1983) concludes that changes in the modified operation of the New York City reservoir releases benefits the establishment of cold water fishery by reducing the number of days of thermal stress. Other information indicates that the clean-up in the Delaware Estuary has increased the number of American Shad successfully completing migratory trips to Zone One. Increases in the size of smallmouth bass have been reported recently with the presumption that this change is due to increased numbers of young shad, a primary food source.

Overview of Delaware River Zone One Water Quality Including the Interstate Portion of the West Branch, Delaware River

	West Branch		Delaware River			
	NY	PA	NY	PA	NJ	Total
Total Number of Miles	9	9	77	197	120	206
Miles in Nat. Wild & Scenic R. System	0	0	72	109	37	109
Miles supporting designated uses	9	9	77	197	120	206
Miles not supporting designated uses	0	0	0	0	0	0
Miles of "fishable" water quality	9	9	77	197	120	206
Miles of "swimmable" water quality	9	9	77	197 1/	120 1/	206 1/
Miles improved since 1981	0	0	0	0	0	0
Miles degraded since 1981	0	0	0	0	0	0

1/ three miles in Delaware Water Gap (R.M. 213 to 210) and ten miles Easton, PA to below Riegelsville, N.J. considered marginally meeting the "swimmable" water quality goal. Exact status of latter reach requires field study.

DELAWARE ESTUARY
ZONE 2
NEW JERSEY, PENNSYLVANIA

Description of Zone

Zone 2 begins at the head of tide at Trenton, N.J. (R.M. 133)and extends down river twenty-five miles to a point midway between the mouth of Pennypack Creek, a small tributary that runs through the northeast portion of the City of Philadelphia and the Tacony-Palmyra Bridge (Figure 4). Although tidal, Zone 2 is a freshwater reach. In the Torresdale section of Philadelphia, the City withdraws approximately 200 million gallons of water per day for domestic and industrial use (after treatment).

Zone 2 is characterized by diversity. In the upstream portion of the zone are Trenton, New Jersey (pop. 92,000) and Morrisville, Pennsylvania (pop. 10,000). Various industries and urban and suburban development are major land uses. The largest tributary at the head of tide is the non-tidal Delaware River itself, having an average annual flow of 11,671 cfs and a 6780 square mile drainage area. Freshwater flow into the tidal Delaware River, however, varies seasonally and annually causing (along with other factors) changes in water quality.

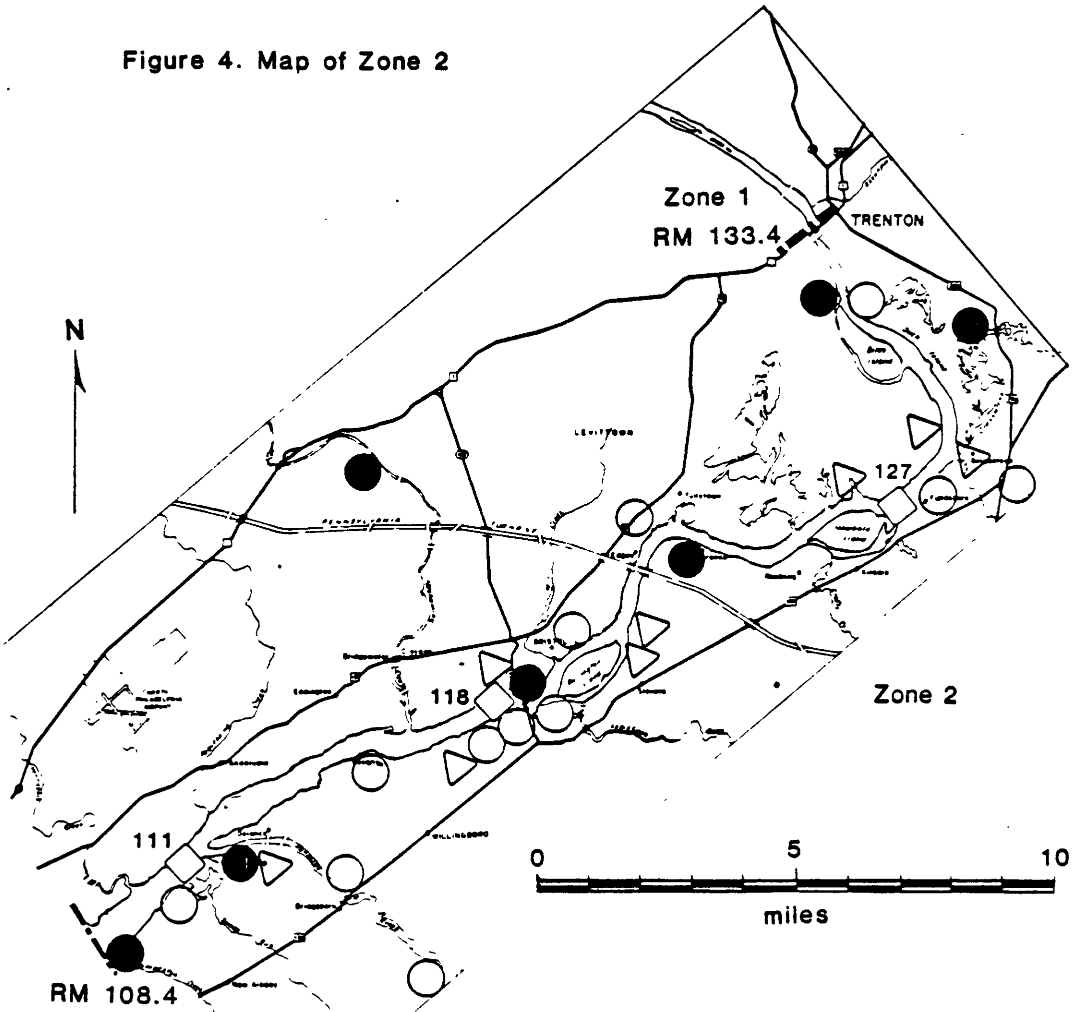
Below Trenton, Zone 2 is characterized by small towns such as Bordentown (pop. 4,500), Fieldsboro (pop. 600), Florence (pop. 9,000), and Burlington (pop. 10,000) in New Jersey and Bristol, (pop. 11,000) in Pennsylvania. Also present are freshwater wetlands, scattered large and small industrial plants, highway complexes and increasing suburbanization of the remaining farmlands. On the Pennsylvania side of Zone 2 is the U.S. Steel Fairless Works, a large integrated steel-making facility. In the lower reach of Zone 2 urbanization increases dramatically, with the last three miles of Zone 2 within the city limits of Philadelphia. Large suburban developments include Levittown in Bucks County, Pennsylvania and Willingboro in Burlington County, New Jersey.

The center channel of Zone 2 is maintained for navigation by dredging. The depth of the navigation channel varies from 40 feet in the lower reach to 35 feet near Trenton with a channel width of 300 to 400 feet. Major tributaries include Crosswicks Creek, Assiscunk Creek and Rancocas Creek in New Jersey and Neshaminy Creek, Poquessing Creek and Pennypack Creek in Pennsylvania. Water quality in each is highly influenced by wastewater discharges and urban-suburban development. New Jersey tributaries are tidal and, thus, in their lower reaches affected by inflow of Delaware River water.

Zone 2 is used, to a great degree, for recreation. Power boating, sailing and fishing are the predominant recreational uses. River sight-seeing boats operate out of Trenton and Philadelphia and at least two dozen marinas, boat yards and public boat ramps are operated. Swimming occurs in undesignated areas.

Fishing in Zone 2 is for a variety of fish species, both migratory and resident. Fish species using Zone 2 waters for spawning, nursery or passage include largemouth bass, walleye, alewife, herring, shad, yellow and white perch, striped bass, catfish, smallmouth bass and at least two dozen others. The short-nosed sturgeon, a federally-designated endangered species, is found

Figure 4. Map of Zone 2



133
□ monitoring locations w/river mile

● municipal dischargers with major violations of wasteload allocations

○ municipal dischargers in compliance with wasteload allocations or with minor violations

▲ industrial dischargers with major violations of wasteload allocations

△ industrial dischargers in compliance with wasteload allocations or with minor violations in Zone 2. Rutgers University scientists (Courier-Post 1983) estimate that the short-nosed sturgeon population in the upper half of Zone 2 may number as many as 10,000.

Designated Water Uses

Water quality standards in Zone 2 call for the maintenance of water quality that supports the following uses:

1. Public water supplies after reasonable treatment
2. Industrial water supplies after reasonable treatment
3. Agricultural supplies
4. Maintenance and propagation of resident fish and other aquatic life
5. Passage of anadromous fish
6. Wildlife
7. Primary contact recreation in the upper 15.5 miles (R.M. 133.4 to R.M. 117.8)
8. Secondary contact recreation in the lower 9.5 miles (R.M. 117.8 to R.M. 108.4)
9. Navigation.

Water Quality Standards

Water quality standards for Zone 2 have been adopted cooperatively by the Delaware River Basin Commission and the States of New Jersey and Pennsylvania. Standards call for water quality meeting the following key criteria (not all criteria listed).

1. Dissolved oxygen: the 24-hour average concentration shall not be less than 5.0 mg/l. During shad migration (April 1 to June 15 and September 16 to December 31) the seasonal average shall not be less than 6.5 mg/l.
2. pH: between 6.5 and 8.5
3. Phenols: not to exceed 0.005 mg/l
4. Fecal coliform: not to exceed a geometric mean of 200 per 100 milliliters above R.M. 117.81 and a geometric mean of 770 per milliliters below R.M. 117.81 (with sufficient number of samples taken)
5. Alkalinity: between 20 and 100 mg/l.

Water Quality Monitoring

Routine water quality monitoring is conducted in Zone 2 by the Delaware River Basin Commission with the actual sampling (boat runs) being performed under contract by the State of Delaware Department of Natural Resources and Environmental Control. The DRBC "boat run" program samples 17 locations in the Delaware Estuary and Bay up to 18 times annually for thirty different parameters. Three Boat Run monitoring locations are located in Zone 2.

Status of Water Quality

Table 2 presents a summary of key parameters from the DRBC monitoring stations. The following conclusions are drawn from these data:

1. Dissolved oxygen standards appear to be attained for most dates and locations. On several dates at the Bristol and the Torresdale monitoring locations, however, it appears likely that the 24-hour average concentration of 5 mg/l was violated slightly. It is unlikely that the nature of these few violations caused any harm to aquatic life or other stream uses. Zone 2 summer dissolved oxygen values are included in the profile of Estuary dissolved oxygen shown in Figure 5.

2. Fecal coliform standards appear to be violated about 40% of the time at Fieldsboro. Most of these apparent violations occur in non summer months, however, and thus do not jeopardize recreational uses. Values in excess of 1000/100 ml occur during spring months and are likely related to rainfall runoff. Fecal coliform values, particularly summer values at Bristol and Torresdale, generally meet the applicable criteria which are less stringent than Fieldsboro. Bristol values meet the criteria for primary contact recreation suggesting that the river upstream from Bristol meets its more stringent water quality standards.

3. Alkalinity and pH standards were violated once each at Bristol and Torresdale. No problems are indicated by these slight and very infrequent violations.

4. Phenol concentrations are normally less than the adopted water quality standard at each of the three monitoring locations. Samples taken on May 5 and May 25, 1982 however, indicate a widespread violation.

Overview of Zone 2 Water Quality

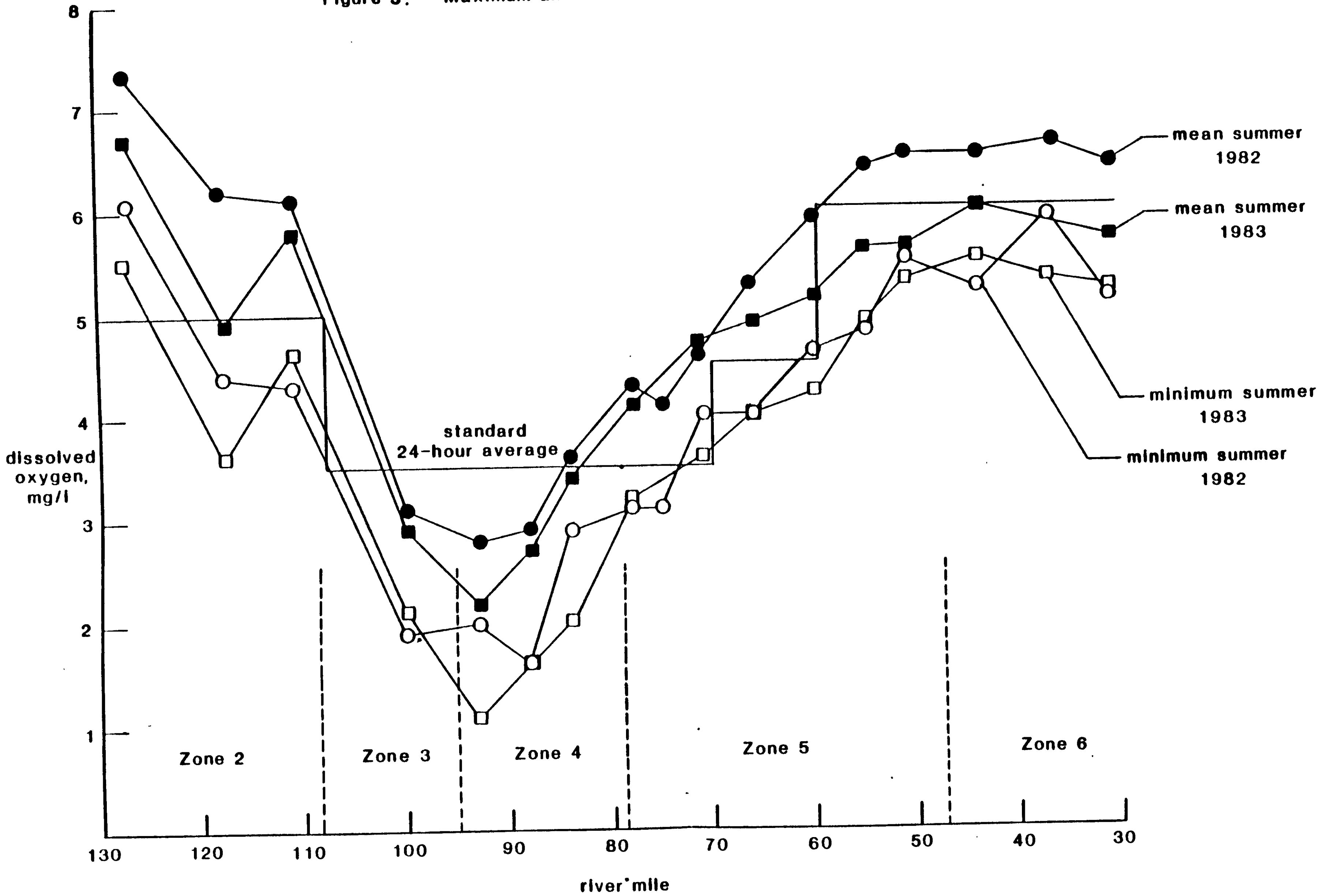
	NJ	PA	Total
Total Number of Miles	25	25	25
Miles supporting designated uses	25	25	25
Miles not supporting designated uses	0	0	0
Miles of "fishable" Water Quality	25	25	25
Miles of "swimmable" Water Quality	25	25	25
Miles improved since 1981	9	9	9
Miles degraded since 1981	0	0	0

Table 2
Summary of 1982 and 1983 Water Quality
Zone 2

Parameter		Fieldsboro RM 127	Bristol RM 118	Torresdale RM 111
Dissolved Oxygen (mg/l)	Ave	8.6	7.5	7.5
	Max	12.7	12.7	12.1
	Min	5.5	3.6	4.3
	#	35	35	35
Fecal Coliform (#/100ml)	Ave*	210	124	282
	Max	3600	1300	12000
	Min	30	20	20
	#	34	34	35
Total Phosphate (mg/l)	Ave	0.11	0.10	0.10
	Max	0.40	0.30	0.20
	Min	0.02	0.02	0.02
	#	32	32	32
Nitrate Nitrogen (mg/l)	Ave	1.1	1.1	1.1
	Max	2.0	1.9	1.9
	Min	0.6	0.2	0.6
	#	35	35	35
Ammonia Nitrogen (mg/l)	Ave	0.19	0.22	0.21
	Max	0.80	0.90	0.65
	Min	0.10	0.10	0.10
	#	35	35	35
pH	Ave	7.5	7.3	7.3
	Max	8.3	7.8	7.8
	Min	6.7	6.3	6.0
	#	34	35	35
Alkalinity (mg/l)	Ave	41.0	41.4	39.5
	Max	68	61	5.8
	Min	3	17	17
	#	35	35	35
Phenols (mg/l)	Ave	.005	0.006	0.006
	Max	.018	0.018	0.020
	Min	.002	0.005	0.005
	#	34	34	34
BOD_5 (mg/l)	Ave	2.5	2.5	2.5
	Max	4.6	4.2	4.4
	Min	2.4	2.4	2.4
	#	35	35	35
Chlorophyll a	Ave	7.3	11	12
	Max	52	48	66
	Min	0	0	0
	#	34	35	35

* Geometric Mean

Figure 5. Maximum and Mean Summer Dissolved Oxygen 1982 and 1983



DELAWARE ESTUARY
ZONES 3 AND 4
NEW JERSEY, PENNSYLVANIA

Description of Zones

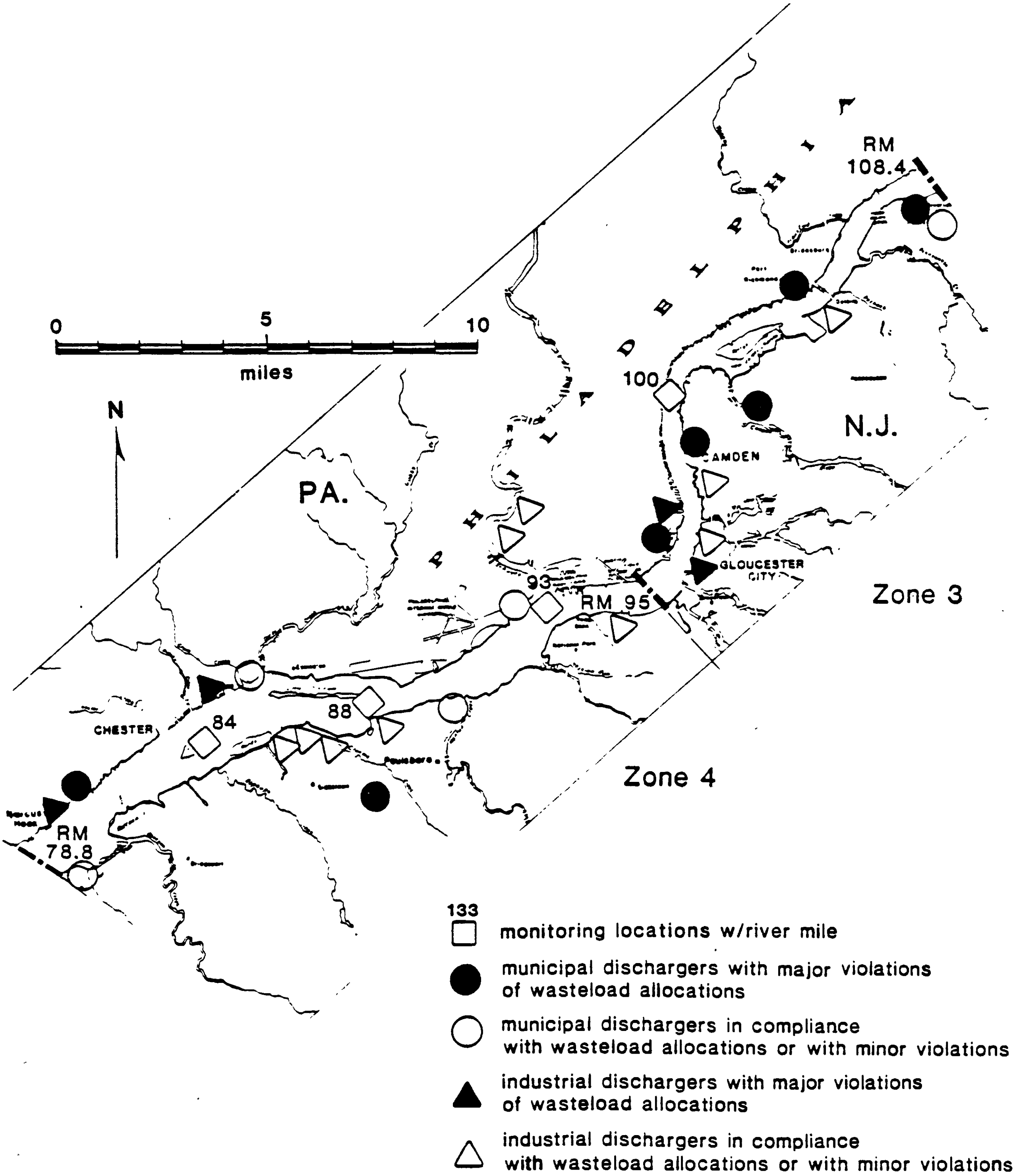
Zones 3 and 4 begin in Northeast Philadelphia and extend down to the Delaware-Pennsylvania-New Jersey stateline at Marcus Hook (Figure 6). The thirty mile reach (R.M. 108 to R.M. 79) has historically been one of the most polluted in the United States. In years past, massive amounts of untreated wastes entered the river in Zones 3 and 4 causing widespread septic conditions and noxious gases in adjacent land areas. Major improvements have been documented in recent years (DRBC 1982).

The Zones 3 and 4 reach of the Delaware Estuary flows through the fourth largest U.S. urban area, the Philadelphia-Camden metropolitan area. Over 4 million people reside in, or near these cities. In both cities and Gloucester City are found extensive networks of combined sewers that discharge untreated wastewater during rain and occasionally during dry periods. Manufacturing, although declining in importance, is still a major factor affecting water quality in the two zones. Major industries include paper-making, chemicals, oil-refining, shipbuilding, food processing, manufacturing and others. Ports along the Delaware are served by a dredged shipping channel forty feet deep. The Philadelphia area ports (including Zones 2 through 5) form the largest freshwater port in the world, the largest U.S. port in terms of international tonnage and the second largest U.S. port in total tonnage.

Major tributaries to Zones 3 and 4 are Pennsauken Creek, Cooper River, Big Timber Creek, Mantua Creek and Racoon Creek in New Jersey; and Frankford Creek, Schuylkill River and Darby Creek in Pennsylvania. The Schuylkill is the largest Delaware River tributary, draining 15% of the Delaware River Basin. The lower 8 miles of the Schuylkill is tidal with a dredged navigation channel and large oil refining and terminal facilities.

The intensive industrial and port development along Zones 3 and 4 preclude much recreational use of the river. Minor amounts of swimming occurs although the polluted water quality and strong tidal currents make such activity dangerous. Boating is the primary recreational activity during the warmer months. At least a dozen marinas are found in Zones 3 and 4 and tour boats are operated out of Philadelphia. In recent years both Philadelphia and Camden have developed recreation areas along the river making visual enjoyment of the river a recreational pursuit. Several waterfront restaurants have opened in recent years, a testimony to cleaner water. Fishing occurs in Zones 3 and 4 although its importance is diminished by pollution and lack of river access. A variety of fish can be found in Zones 3 and 4, but their numbers at any one location or time are uncertain. Important sport fishes include several that migrate through the zones, but do not use them for spawning or as an nursery area. Recent increases in the size of American Shad migrations into the upper Delaware River Basin are thought by some to be the direct result of improvements in the water quality of Zones 3 and 4. In the lower reach of Zone 4 is the Tinicum National Environmental Center which preserves a 1,200 acre freshwater tidal marsh.

Figure 6. Map of Zones 3 and 4



Industrial and domestic water supply are important considerations in both zones. The Delaware Estuary begins to become saline in Zone 4 and to a lesser extent Zone 3. This location varies both seasonally and annually depending upon the amount of freshwater inflow to the Estuary. During drought, salinity intrusion is of particular significance because saline water interferes with industrial processes. Another serious concern is the potential for saltwater intrusion into aquifers serving portions of the Camden metropolitan area. The Delaware River in Zone 4 recharges these aquifers as a result of excessive pumpage of ground water. Delaware River Basin Commission policies would limit the intrusion of saltwater into domestic wells by insuring that the amount of freshwater entering the Delaware Estuary adequately retards the movement of the "salt front" upriver. Freshwater releases from upper basin reserviors are made when necessary in order to achieve adopted chloride and sodium standards in Zone 3.

Designated Water Uses

Water quality standards in Zones 3 and 4 call for the maintenance of water quality that supports the following uses:

1. Public water supplies after reasonable treatment (Zone 3 only)
2. Industrial water supplies after reasonable treatment
3. Agricultural water supplies (Zone 3 only)
4. Maintenance (but not propagation) of resident fish and other aquatic life
5. Passage of anadromous fish
6. Secondary contact recreation
7. Navigation.

Water Quality Standards

Water Quality standards for Zones 3 and 4 have been adopted cooperatively by the Delaware River Basin Commission and the States of New Jersey and Pennsylvania. Standards call for water quality meeting the following key criteria (not all listed):

1. Dissolved oxygen: the 24-hour average concentration shall not be less than 3.5 mg/l. During the shad migration season (April 1 to June 15 and September 16 to December 31) the seasonal average shall not be less than 6.5 mg/l.
2. pH: between 6.5 and 8.5
3. Phenols: not to exceed a maximum of 0.02 mg/l
4. Fecal coliforms: not to exceed a geometric mean of 770 per 100 ml. (with sufficient number of samples taken).
5. Alkalinity: between 20 and 120 mg/l
6. Chlorides: At River Mile 98 (o9ne mile upstream from the Walt Whitman Bridge) 30-day average concentration should not exceed 180 mg/l
7. Sodium: at River Mile 98 the 30-day average should not exceed 100 mg/l.

Water Quality Monitoring

The DRBC Boat Run program, previously described, monitors four locations in Zones 3 and 4. These are Ben Franklin Bridge in Zone 3 (R.M. 100) and Navy

Yard (R.M. 93), Paulsboro (R.M. 88) and Eddystone (R.M. 84) in Zone 4. Data for Marcus Hook (See Zone 5 discussion) is also of use in assessing Zone 4 water quality.

Two U. S. Geological Survey automatic water quality monitors are located in Zones 3 and 4. These monitors obtain continuous information on dissolved oxygen concentrations, pH and specific conductivity at Philadelphia (R.M. 100) and Chester, Pennsylvania (R.M. 82). Water quality is also monitored routinely by the City of Philadelphia.

Status of Water Quality

Table 3 presents a summary of key parameters from the DRBC monitoring stations. The following conclusions are drawn from these data:

1. Dissolved oxygen standards are consistently violated during the summer at the Ben Franklin, Navy Yard and Paulsboro locations. At Eddystone dissolved oxygen concentrations recover with 60% of the 1982 and 1983 samples indicating the likelihood that dissolved oxygen standards are met. Most samples are greater than 3 mg/l a vast improvement over the water quality of past years. As shown in Figure 5 Zones 3 and 4 represent the bottom of the Estuary dissolved oxygen sag curve. At the sag curve bottom are found the lowest dissolved oxygen concentrations. Zone 3 and 4 summer dissolved oxygen values are indicated in the Estuary profile appearing in Figure 5, page 15.

   Because of the frequency of sampling (24 times per day) minimum values recorded at the two U. S. Geological Survey monitors represent the lowest dissolved oxygen concentrations being experienced. During August 1982 the R.M. 100 monitor showed a 15-day period where daily minimum dissolved xoygen ranged from 0.3 mg/l to 0.9 mg/l. Downstream, at the R.M. 82 monitor, the minimum daily dissolved oxygen reached zero occasionally during July and August 1982. Changes in freshwater inflow and the timing of the minimums at both monitors indicate that each monitor was affected by the same influences and that each represented the bottom of the Estuary dissolved oxygen sag.

2. Fecal coliform standards are routinely violated at the Ben Franklin, Navy Yard and Paulsboro locations, although less frequently at the latter location. The available data indicate that fecal coliform standards at Eddystone are generally met.

3. Except for minor and infrequent pH values below 6.5, no other standards appear to be violated. Nutrients appear to be high enough to support algal blooms, but chlorophyll A concentrations remain low.

4. The attainment of the adopted water quality standards in Zones 3 and 4 will not result in fishable and swimmable water quality. Current DRBC and state standards, approved by the U.S. Environmental Protection Agency, are less than needed to support of fish propagation and primary contact recreation.

Table 3
Summary of 1982 and 1983 Water Quality
Zones 3 and 4

Parameter		Ben Franklin Cr. (RM 100)	Navy Yd. (RM 93)	Paulsboro (RM 88)	Eddystone (RM 84)
Dissolved Oxygen (mg/l)	Ave	5.4	5.0	5.2	5.7
	Max	12.7	12.0	12.4	11.2
	Min	1.9	1.1	1.6	2.0
	#	35	36	34	35
Fecal Coliform (#/100ml)	Ave	3253	2485	1381	384
	Max	15000	26000	34000	4500
	Min	220	230	100	20
	#	35	36	34	34
Total Phosphate (mg/l)	Ave	0.13	0.12	0.14	0.22
	Max	0.50	0.23	0.60	2.8
	Min	0.02	0.02	0.02	0.03
	#	32	30	29	32
Nitrate Nitrogen (mg/l)	Ave	1.2	1.4	1.6	1.7
	Max	1.9	2.4	2.7	2.9
	Min	0.8	0.8	0.8	0.9
	#	35	36	34	35
Ammonia Nitrogen (mg/l)	Ave	0.36	0.38	0.36	0.30
	Max	1.00	1.15	1.15	0.85
	Min	0.10	0.10	0.10	0.10
	#	35	36	34	34
pH	Ave	7.2	7.2	7.1	7.2
	Max	7.8	9.8	7.6	7.7
	Min	6.3	6.1	6.2	6.2
	#	35	36	35	35
Alkalinity (mg/l)	Ave	40	39	40	40
	Max	58	73	55	51
	Min	20	24	24	46
	#	35	36	34	35
Phenols	Ave	.005	0.006	0.006	.006
	Max	.018	0.022	0.018	.018
	Min	.005	0.005	0.005	.002
	#	34	35	32	34
BOD_5	Ave	2.7	2.7	2.8	2.6
	Max	4.2	3.9	5.3	4.7
	Min	2.4	2.4	2.4	1.0
	#	35	36	33	35
Chlorophyll	Ave	15	15	14	14
	Max	49	57	49	61
	Min	0	0	0	0
	#	35	36	34	35

Overview of Zones 3 and 4 Water Quality

	Zone 3 NJ	Zone 3 PA	Zone 4 NJ	Zone 4 PA	Total
Total number of miles	13	13	16	16	29
Miles supporting designated uses 1/	0	0	0	0	0
Miles not supporting designated uses	13	13	16	16	29
Miles of "fishable" water quality	0	0	0	0	0
Miles of "swimmable" water quality	0	0	0	0	0
Miles improved since 1981	0	0	0	0	0
Miles degraded since 1981	0	0	0	0	0

1/ Uses not fully met are maintenance of resident fish, passage of anadromous fish and secondary contact recreation. Uses considered met are water supply (public, industrial, agricultural) and navigation.

DELAWARE ESTUARY

ZONE 5

DELAWARE, NEW JERSEY

Description of Segment

Zone 5 extends from the juncture of the Pennsylvania-Delaware-New Jersey border at Marcus Hook (R.M. 79) to Liston Point, Delaware (R.M. 48.2), the officially-designated head of the Delaware Bay (Figure 7). From Marcus Hook to a point five and one-half miles upstream from Liston Point, the Delaware River is solely in the State of Delaware.

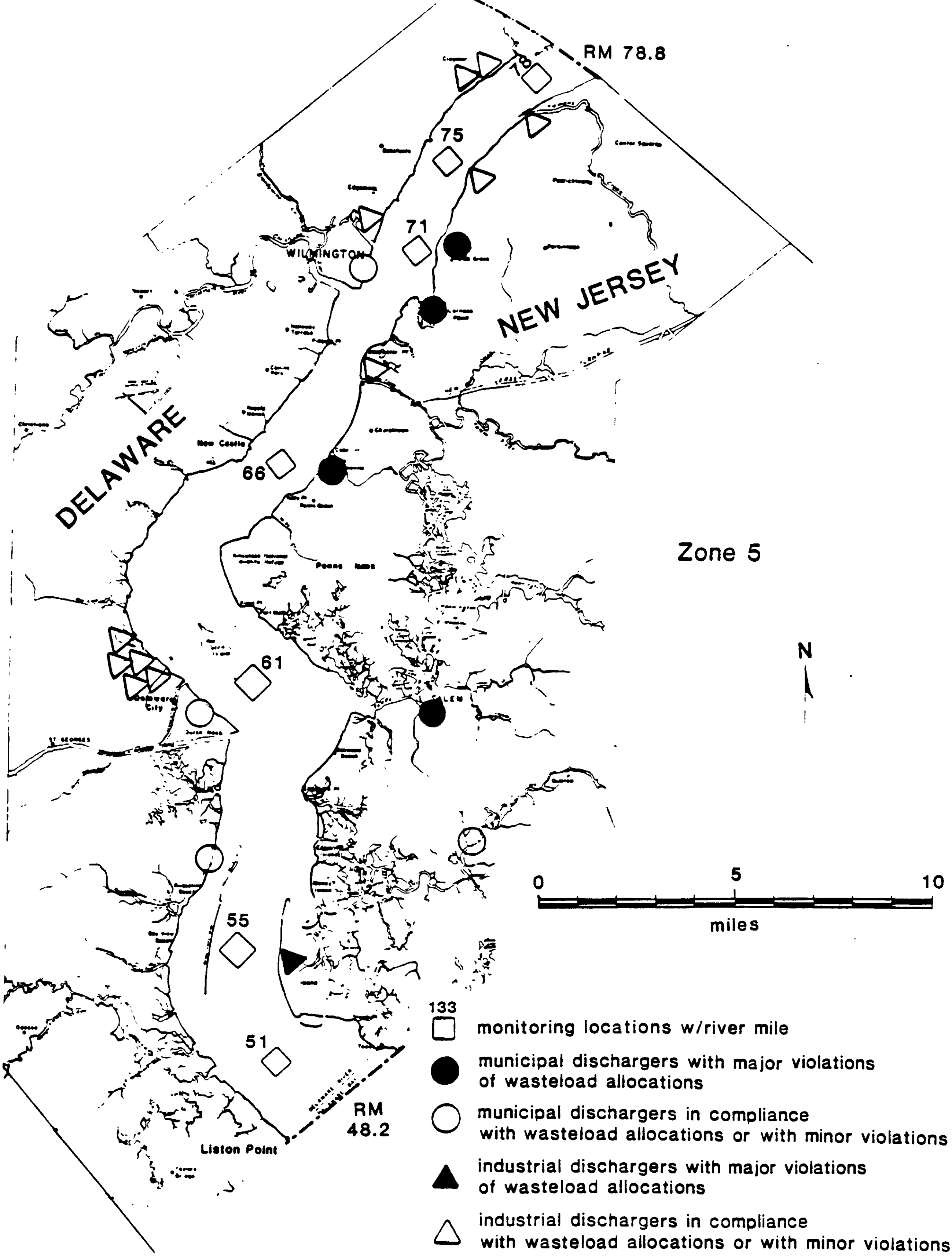
The only major urban area in Zone 5 is the City of Wilmington, Delaware and the surrounding suburban New Castle County (pop. 500,000). Wilmington is an commercial and industrial port city, the largest city in Delaware. In Wilmington and the surrounding area are inorganic and petro-chemical plants, oil refineries, steel-making and manufacturing of various types. A small portion of the City is served by combined sewers which discharge untreated sewage during major rainfalls. Among the electric generating stations in Zone 5 is the Salem Generating Station, a two unit nuclear plant on Artificial Island in New Jersey. When fully operated, this plant withdraws two billion gallons per day from Zone 5 for cooling purposes.

Zone 5 is also characterized by areas of brackish wetlands, small towns, significant farming and several large landfills including dredge spoils disposal areas. Major tributaries are Oldman's Creek, Salem Creek and Alloways Creek in New Jersey; and the Christina River, Brandywine Creek and Appoquinimink Creek in Delaware. Delaware City, Delaware is the eastern terminous of the Chesapeake and Delaware Canal. The shipping canal connects the Delaware with the Chesapeake Bay.

Water-related recreation in Zone 5 includes boating, sailing, fishing, limited swimming and activities related to waterfowl (hunting, etc.). Many marinas boat access and fishing access areas are found in both New Jersey and Delaware and major portions of the wetlands adjacent to the Delaware have been preserved as fish and wildlife management areas (particularly in New Jersey). The Killocohook National Wildlife Refuge is located near Salem, New Jersey. Fort Delaware State Park is located in the center of the Delaware Estuary on Pea Patch Island.

The lower portion of Zone 5 supports an important sport and commercial fishery (see discussion under Zone 6). It serves as a route of passage for migratory fish such as shad, herring and eels and as a nursery for important marine fish. Year-round residents include catfish, white perch, brown bullhead an other forage fish. Native oyster populations found in the lower section of Zone 5 are part of a native population essential to the oyster industry in the region. There are, however, no designated shellfish-taking areas in Zone 5.

Figure 7. Map of Zone 5



Designated Water Uses

Water quality standards in Zone 5 call for the maintenance of water quality that supports the following uses:

1. Industrial water supplies after reasonable treatment
2. Maintenance of resident fish and other aquatic life
3. Propagation of resident fish below River Mile 70 (below the mouth of the Christina River)
4. Passage of anadroumous fish
5. Wildlife
6. Secondary contact recreation from River Mile 79 (Marcus Hook) to River Mile 59 (near mouth of Chesapeake and Delaware Canal).
7. Primary contact recreation below River Mile 59
8. Navigation.

Water Quality Standards

Water quality standards for Zone 5 are promulgated by the Delaware River Basin Commission and the States of Delaware and New Jersey. These standards call for water quality meeting the following key criteria (not all listed):

1. Dissolved oxygen standards presume that Zone 5 represents the recovery leg of the Delaware Estuary dissolved oxygen sag curve. Standards call for a 24-hour average of 3.5 mg/l at River Mile 79, 4.5 mg/l at River Mile 70 and 6.0 mg/l at River Mile 59. The Estuary-wide shad migration standard of a 6.5 mg/l seasonal average also applies between April 1 - June 15 and September 16 - December 31
2. pH: Between 6.5 and 8.5
3. Phenols: not to exceed 0.01 mg/l
4. Fecal coliform standards require a log average concentration of 770 per 100ml between River Miles 78 and 59 and 200 per 100ml between River Miles 59 and 48 (with sufficient number of samples taken)
5. Alkalinity: between 20 and 120 mg/l.

Water Quality Monitoring

The DRBC boat run program monitors seven locations in Zone 5 spaced from 3 to 6 miles apart. Water quality data, including fisheries data, are also available from other organizations; in 1983 the University of Delaware, College of Marine Studies and the New Jersey Marine Sciences Consortium published a report on the lower Estuary and Delaware Bay presenting information collected since 1978 (Sharp 1983).

Status of Water Quality

Table 4 presents a summary of key parameters from the DRBC boat run program. The following conclusions are drawn from these data:

1. Dissolved oxygen standards are generally met in Zone 5. At upstream locations standards may be occasionally violated, but these violations are very infrequent and scattered throughout the year. The adopted standard in the upper sections of Zone 5 (R.M. 79 to RM 60) do not provide for fishable water quality. The available data, however,

Table 4
Summary of 1982 and 1983 Water Quality
Zone 5

Parameter		Marcus Hook RM 78	Oldmans RM 75	Cherry Is. RM 71	New Castle RM 66	Pea Patch RM 61	Ready Is. RM 55	Appoquinimink RM 51
Dissolved Oxygen (mg/l)	Ave	5.9	5.9	6.4	6.7	7.1	7.6	7.5
	Max	11.5	11.3	11.6	10.7	11.0	11.6	11.7
	Min	1.6	2.6	2.4	3.2	4.2	4.8	5.3
	#	35	35	35	36	36	34	32
Fecal Coliform (#/100ml)	Ave*	131	82	69	52	33	25	16
	Max	5100	3700	3900	3600	260	480	70
	Min	10	10	10	10	5	10	10
	#	35	32	35	34	35	36	31
Total Phosphate (mg/l)	Ave	0.13	0.14	0.12	0.16	0.13	0.13	0.12
	Max	0.20	0.21	0.25	1.0	0.30	0.45	0.30
	Min	0.02	0.10	0.02	0.02	0.02	0.01	0.02
	#	31	19	32	32	30	32	29
Nitrate nitrogen (mg/l)	Ave	1.9	1.9	1.9	1.8	1.8	1.6	1.4
	Max	2.9	2.7	2.7	2.7	2.4	2.2	1.9
	Min	1.0	1.1	1.1	0.07	1.1	0.8	0.6
	#	35	19	35	36	36	35	32
Ammonia Nitrogen (mg/l)	Ave	0.30	0.28	0.28	0.3	0.27	0.26	0.24
	Max	0.90	0.75	1.05	1.1	0.95	1.15	0.95
	Min	0.10	0.10	0.10	0.1	0.01	0.10	0.10
	#	35	19	35	36	36	35	32
pH	Ave	7.2	7.4	7.3	7.3	7.3	7.4	7.4
	Max	7.8	7.8	7.8	8.2	8.3	8.3	8.0
	Min	6.2	6.7	6.3	6.3	6.1	6.0	6.5
	#	35	24	35	36	36	34	31
Alkalinity	Ave	418	42	41	41	42	46	50
	Max	51	58	59	60	61	77	77
	Min	26	19	27	23	24	23	25
	#	35	19	35	36	36	35	32
Phenols	Ave	0.007	0.03	0.011	0.020	0.045	0.130	0.124
	Max	0.052	0.255	0.165	0.210	0.330	0.830	0.460
	Min	0.005	0.005	0.011	0.005	0.005	0.003	0.005
	#	34	18	34	33	34	33	31
BOD_5	Ave	2.6	2.5	2.5	2.5	2.4	2.4	2.4
	Max	4.6	3.5	3.7	3.8	3.0	2.4	2.4
	Min	2.4	2.1	2.4	2.4	2.4	2.4	2.4
	#	35	20	35	35	36	35	32
Chlorophyll	Ave	10	9	8	9	7	6	5
	Max	24	21	41	34	21.0	21	15
	Min	0	0	0	0	0	0	0
	#	34	19	35	34	36	35	32

* Geometric Mean

suggest that at Marcus Hook fishable water quality is obtained about 50% of the time with higher percentages accrued at each successive downstream monitoring location until the New Castle station (84%) is reached.

The downstream two monitoring locations, Reedy Island and Appoquinimink, have a dissolved oxygen standard of 6.0 mg/l as a 24-hour average. Data for the summer of 1983 (Figure 5) indicate that this standard was probably not met during that critical season. Dissolved oxygen samples were greater than 5 mg/l, however, indicating generally good water quality. Zone 5 summer dissolved oxygen data are presented in Figure 5 on page 15.

2. Fecal coliform standards are met throughout Zone 5. The maximum observed values as shown in Table 4 were all observed on one of two days in April 1983. Between R.M. 79 and 59, DRBC standards provide for secondary contact recreation, a standard less than the swimmable water quality goal. Data for 1982 and 1983 indicate that bacterial concentrations in this reach met the more-stringent primary contact recreation standard, thus attaining the swimmable water quality goal.

3. pH standards were not violated in 1982. In 1983 pH values below standard were observed on one or two occasions at most Zone 5 locations. The pattern and dates of the pH violations suggest that pH was influenced by a point source discharge(s). On April 27, 1983 low pH values were observed between New Castle and Reedy Island. On July 20, 1983 the low pH values were observed from Marcus Hook to Pea Patch Island. Review of Zone 3 and 4 data indicate that the source of the July 1983 pH depression may have emanated as for upstream as Philadelphia. In no case did pH values fall below 6.0, thus, no harm occurred to aquatic life.

4. Phenol standards appear to be violated in Zone 5. At all locations the maximum phenol value observed in the 1982 and 1983 period exceeded the phenol standard. At locations downstream of Wilmington (Cherry Island) the mean of all samples violated the standard. Phenols are also observed to increase in a downstream direction, a pattern that includes the upper Delaware Bay monitoring locations (Zone 6).

   Although there are sources of phenols in Zone 5 there is no logical reason why phenols should increase in a downstream direction to and including the Zone 6 locations. It was theorized, therefore, that the phenols test results reflected an interference due to chlorides (salinity). To test this hypothesis, regression analyses were conducted comparing phenol and chloride concentrations. When the means (1982-83 period) were compared, the coefficient of determination (R^2) was found to be 0.94, a high value suggesting that the two parameters are interrelated. It was concluded that the high phenols found in Zones 5 and 6 are due either to test interferences or, less likely, natural sources emanating from the Atlantic Ocean.

Overview of Zone 5 Water Quality

	Delaware	New Jersey[1/]	Total
Total number of miles	31	31	31
Miles supporting designated uses	31	31	31
Miles not supporting designated uses	0	0	0
Miles of "fishable" water quality	20	20	20[2/]
Miles of "swimmable" water quality	31	31	31
Miles improved since 1981	0	0	0
Miles degraded since 1981	0	0	0

1/ 31 miles of New Jersey shoreline front on Zone 5. 25.1 miles of the Delaware Estuary in Zone 5 is solely in the State of Delaware.

2/ New Castle (R.M. 66) and downsteam locations.

DELAWARE BAY
ZONE 6
DELAWARE, NEW JERSEY

Description of Segment

Zone 6 encompasses the Delaware Bay. A map of the Bay region appears in Figure 8. The Bay is a legally defined water body that is actually an estuary in oceanographic terms: a highly productive ecosystem where fresh and saline water intermix. The 782 square mile Delaware Bay is 48 miles long (center channel), and varies in width from 4 to 20 miles. The mouth of the Bay is located between Cape Henlopen, Delaware and Cape May, New Jersey. The center of the Bay is a major navigation channel for Philadelphia ports, maintained by dredging to a depth of 40 feet. The first 12 miles is a natural 55 feet deep channel.

The Delaware Bay region is a region of small towns, farmlands and salt marshes. Dover, Delaware (pop. 25,000) is the largest city in the region. Few towns are located directly on the Bay itself. Most, like Dover, are located upstream on tidal tributaries. Along the Bay itself are miles of salt marshes, many preserved as state wildlife management areas. The Prime Hook National Wildlife Refuge is a federal preserve located on the Delaware side of the Bay.

Near the mouth of Delaware Bay in both New Jersey and Delaware are major resort-beach areas located on the Bay (as well as the Atlantic Ocean). These areas experience increased populations in the summer season. Second-home and retirement villages are being developed in both areas. Also in the same region are designated anchorage areas for lightering. In these areas ships off-load part of their loads to barges in order to reduce their draft for travel up the relatively shallow Delaware River navigation channel. Crude oil heading for Delaware River refineries is the only cargo currently lightered. The refineries located in the Delaware Estuary and Bay area consume crude oil at an approximate rate of 900,000 to 1 million barrels per day, most of which is transported through the biologically sensitive Bay.

The Delaware Bay supports a variety of water-based recreation. Swimming beaches are scattered along the upper bay among the salt marshes and near the mouth of the Bay are miles of ocean-like beaches. Boating and sailing are also major recreation activities in the Bay and many marinas or boat access areas exist. Both shore and boats are used for fishing by individuals. Commercial sport fishing boats also operate.

Commercial fishing includes both shellfish and finfish. Oyster, blue crabs, lobsters (very limited), mussels (limited), and clams (limited) are shellfish of some commercial importance. Over 50,000 acres of the Delaware Bay are devoted to oyster culture and yields have improved since 1960 when the oyster harvest reached record low numbers due to early mismanagement and predation by the MSX oyster drill. Blue crab harvests are naturally variable and in good years can exceed 5 million pounds (Sharp 1983). Clams, mussels and lobster fishing are much less important.

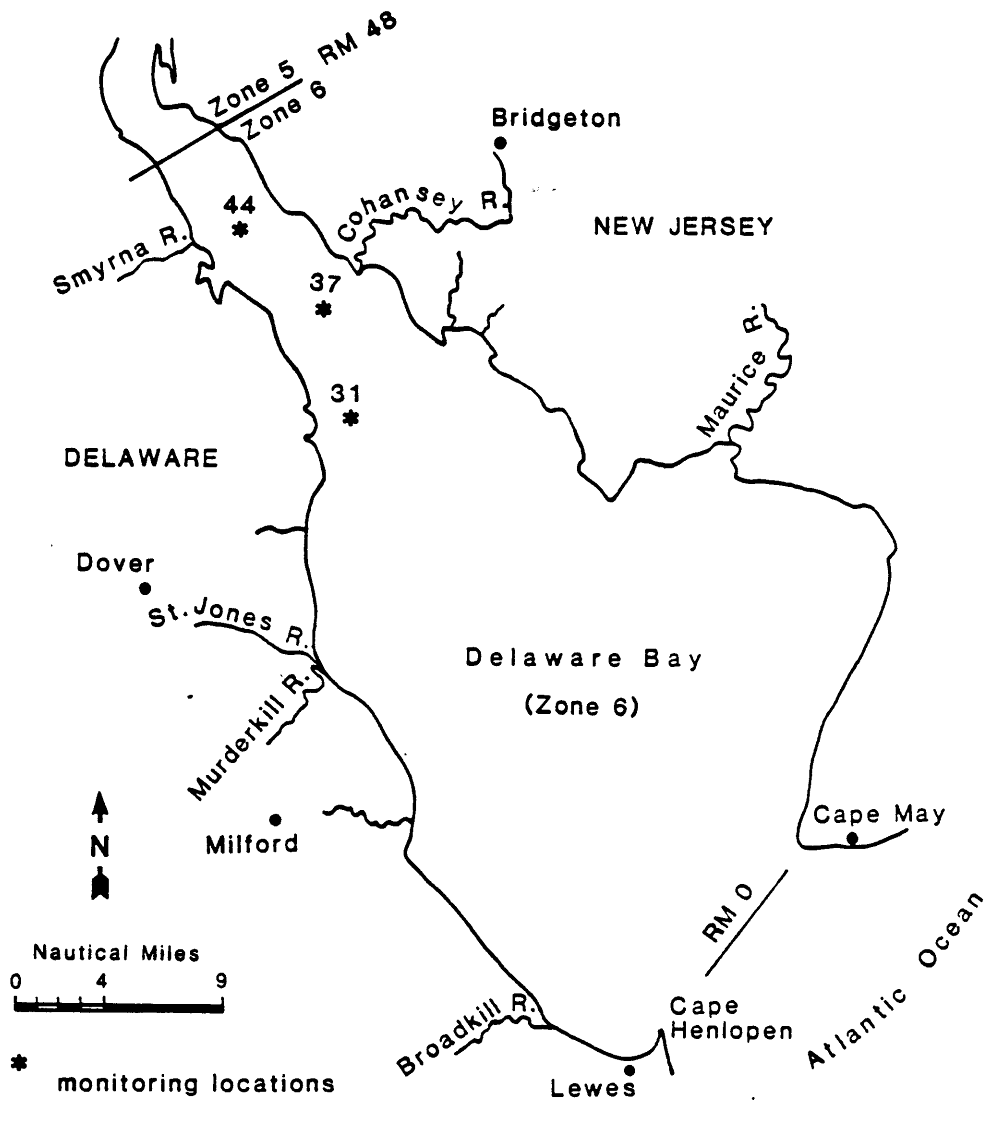


Figure 8. Map of the Delaware Bay Zone 6

Finfish of commercial or sport fishing importance include weakfish, bluefish, Atlantic menhaden, white perch, striped bass, summer flounder, spot, shad, Atlantic Sturgeon, alewife, the American eel and others. Some of these are more important as nearshore marine fish with the Delaware Bay serving as the spawning, feeding and nursery area. Others are transient visitors to the Bay or migrate through the Bay. Examples of the latter include the shad, eels and striped bass. Commercial fishing in the Bay has declined over the last 75 years due largely to overfishing within and without the Bay. A recent report, however, concludes that the Bay is "sufficiently healthy to maintain major fisheries" (Sharp 1983 p.18).

Designated Water Uses

Delaware Bay water quality standards call for the maintenance of water quality that supports the following designated uses:

1. Industrial water supplies after reasonable treatment
2. Maintenance and propagation of resident fish and aquatic life
3. Maintenance and propagation of shellfish
4. Passage of anadromous fish
5. Wildlife
6. Recreation
7. Navigation.

Water Quality Standards

Water quality standards for the Delaware Bay, Zone 6 have been adopted by the States of Delaware and New Jersey and the Delaware River Basin Commission. These standards require that the following criteria be met (not all listed):

1. Dissolved oxygen concentrations - a 24-hour average concentration not less than 6.0 mg/l
2. pH: between 6.5 and 8.5
3. Fecal coliform: a maximum geometric average of 200 per 100 milliliters
4. Alkalinity: between 20 and 120 mg/l
5. Phenols: maximum of 0.01 mg/l.

Water Quality Monitoring

The Delaware River Basin Commission Boat Run program, performed by the State of Delaware Department of Natural Resources and Environmental Resources conducts routine water quality monitoring at three locations in the upper portion of the Delaware Bay. These are at Smyrna (R.M. 44), Ship John (R.M. 37) and Mahon (R.M. 37), the latter the only boat run station not located in the center channel. The boat run program collects samples up to 18 times per year for analyses of 30 parameters.

In recent years additional data for other parts of Zone 6 have been collected by the University of Delaware and others as part of the Delaware Estuary Project. A report presenting the results of this work was released in July 1983 (Sharp 1983).

Status of Water Quality

Table 5 presents a summary of key parameters from the DRBC Boat Run program. The following conclusions are drawn from these data:

1. Dissolved oxygen standards in Zone 6 appear to be violated occasionally. In 1982 and 1983 one or more boat run measurements at each location were below the 24-hour average criterion of 6.0 mg/l suggesting the possibility that minor violations occurred. At no time however, were the concentrations of dissolved oxygen less than 5.0 mg/l; thus water quality was acceptable for aquatic life. Data from the previously mentioned Delaware Estuary Project indicate that dissolved oxygen concentrations downstream from the boat run locations are higher and everywhere greater than 90% saturation.

2. All fecal coliform samples taken by the boat run program (96 in all) were 60/100 ml or less indicating excellent sanitary water quality.

3. pH is generally acceptable in Zone 6. On October 5, 1983 each monitoring location experienced its minimum value for the 1982-1983 period suggesting a single source of pollution or, more probably, a biological phenomenon. Due to the season and timing of the boat run it is likely that the October 5, 1983 boat run monitored the nighttime low pH resulting from plant respiration in the absence of photosynthesis, a natural phenomenon caused by plant and animal carbon dioxide emissions. Diurnal variations in pH due to plant respiration were also noted by the Delaware Estuary Project.

4. Phenol standards appear to be violated. As described previously this appears to be related to test interferences caused by increasing salinity.

Overview of Zone 6 Water Quality

	Delaware	New Jersey	All
Total number of miles 1/	48	48	48
Miles supporting designated uses	48	48	48
Miles not supporting designated uses	0	0	0
Miles of fishable water quality	48	48	48
Miles of swimmable water quality	48	48	48
Miles improved since 1981	0	0	0
Miles degraded since 1981	0	0	0

1/ miles refers to length of Zone 6.

Table 5
Summary of 1982 and 1983 Water Quality
Zone 6

Parameter		Smyrna (RM 44)	Ship John (RM 37)	Mahon (RM 31)
Dissolved Oxygen (mg/l)	Ave	7.7	7.6	7.6
	Max	12.1	11.9	12.8
	Min	5.2	5.3	5.1
	#	32	32	32
Fecal Coliform (#/100ml)	Ave*	12	12	11
	Max	60	60	60
	Min	10	10	10
	#	33	33	30
Total Phosphate (mg/l)	Ave	0.11	0.16	0.16
	Max	0.23	0.60	0.30
	Min	0.01	0.04	0.04
	#	30	29	29
Nitrate Nitrogen (mg/l)	Ave	1.2	1.0	0.7
	Max	1.9	2.0	1.0
	Min	0.4	0.6	0.3
	#	31	32	32
Ammonia Nitrogen (mg/l)	Ave	0.23	0.20	0.24
	Max	0.90	0.80	0.60
	Min	0.10	0.10	0.10
	#	32	32	32
pH	Ave	7.4	7.4	7.3
	Max	8.0	7.9	7.8
	Min	6.5	6.1	5.6
	#	31	31	31
Alkalinity (mg/l)	Ave	56	61	74
	Max	77	86	93
	Min	29	60	47
	#	32	32	32
Phenols (mg/l)	Ave	0.160	0.201	0.270
	Max	0.430	0.370	0.920
	Min	0.005	0.020	0.010
	#	31	31	31
BOD_5 (mg/l)	Ave	2.4	2.4	2.5
	Max	2.4	2.4	3.4
	Min	2.4	2.4	2.4
	#	32	32	32
Chlorophyll a (mg/l)	Ave	4	7	19
	Max	13	29	55
	Min	0	0	0
	#	32	32	32

* *Geometric mean*

CAUSES OF NONSUPPORT OF DESIGNATED USES AND VIOLATIONS OF WATER QUALITY STANDARDS

There are two general sources of water pollutants. Point-sources are usually discharged from a pipe: the outfall from a wastewater treatment plant, a combined sewer that discharges during a rainstorm, a raw-sewage discharge from a "wildcat" sewer that serves one or more houses, an industrial plant floor drain or other similar discharges. Point sources by State and Federal law are required to have permits which limit the amount of pollutants contained in the effluent. In practice many of the small discharges such as floor drains and storm sewers are not yet permitted.

Non-point sources are sources of pollutants that are dispersed and diffuse. Examples of non-point sources include street washoff that enters streams in urban areas during rain; herbicides, fertilizers, manure and other agricultural "pollutants"; malfunctioning septic and other on-lot systems; leachate from landfills; erosion during construcdtion activities; and many other sources. Non-point sources are generally related to land use and precipitation. Some non-point sources such as construction related soil erosion are regulated by state programs. Others are receiving increasing attention as more is learned about their causes and effects.

More is known about point-sources than non-point sources. Point sources have been regulated for many decades whereas non-point sources have only received major attention in the last ten years or so. Still there are many reaches of the Delaware River and Bay where water quality data are inadequate or not available. Without data it is not possible to assess water quality problems (if any) let alone the relative contributions of point and non-point sources. As an example, in the 25 miles between the Delaware Watert Gap and Easton, Pennsylvania are two large thermal discharges, several municipal and industrial wastewater discharges and numerous potential non-point sources of pollutants. Yet there are little data available to assess water quality problems in this reach and relative contribution of various sources of water pollution are unknown.

The following sections present known information concerning point and non-point sources and their contribution to Delaware River water quality.

Zone One

Point Sources: There are at least three dozen wastewater treatment plants discharging to the Delaware River, or to nearby tributaries, in the 200 mile reach of river from Hancock, New York to Trenton, New Jersey. Most are small. Since 1981 a major accomplishment has been the completion of sewerage and treatment facilities for Hancock, New York. Prior to the completion, raw sewage including hospital wastes were discharged untreated. In recent years new treatment facilities have also been completed for other communities including Easton, Pennsylvania and Lambertville, New Jersey. Zone One is classified as Effluent-Limited in accordance with the Federal Clean Water Act. Wastewater treatment plants are required to achieve secondary treatment levels.

The three mile reach of the Delaware in the vicinity of the Delaware Water Gap is affected by point and non-point sources originating in nearby tributaries. These sources include raw sewage discharges in the vicinity of Delaware Water Gap Borough (Cherry Creek), point and non-point sources in the Brodhead Creek watershed, and a point source discharge from a resort complex. A regional wastewater treatment and interceptor system is planned to serve the lower Brodhead Creek watershed including Stroudsburg, East Stroudsburg and Delaware Water Gap Boroughs and the above mentioned resort. Construction of the system is to begin in 1984. It is anticipated that this regional system will eliminate the major point sources of pollution in the affected watersheds as well as some of the non-point sources (malfunctioning on-lot systems) and, thus, abate the problem noted in the Delaware River.

Non-Point Sources: Sources of non-point pollution in Zone One include malfunctioning septic tanks, agricultural runoff, urban runoff and others. The impact of these sources is subtle and does not appear to result in water quality standards violation. An exception is fecal coliform levels. Fecal coliform levels in the Delaware River from Port Jervis, New York to Trenton, New Jersey may increase dramatically when it rains. National Park Service 1983 bacterial data on tributaries in the Delaware Water Gap National Recreation Area indicate that under both dry and wet conditions bacterial levels appear to be related to the degree of development found in tributary watersheds. In most cases the increased level of fecal coliform does not indicate a major health problem because the bacteria levels are low and non-human in origin. Studies have also shown the possibility that natural sources of fecal coliform may be partly involved in the bacteria increases observed during rainfall. However, anthropogenic sources of fecal bacteria exist and will be a continuing concern.

The high fecal coliform values observed at Reigellsville appear to be non-point source related. Most of the ten values obtained in the 1982-83 period were taken on or following rainy days. A visual comparison of the amounts of the recorded rainfall and the magnitude of the observed fecal coliform levels indicates that the two are related. For example, the highest fecal coliform level, 2,400/100 ml, was observed in conjunction with a rainstorm that dumped up to 2.5 inches of rain on upstream areas. This was the most rain received on any of the sampled days. Fecal coliform-fecal streptococcus ratios for some sampling dates strongly suggest possible human contamination. The fact that rainfall appears to influence the level of bacteria, however, indicates that non-point sources may be the main cause of the observed water quality standards violations. The infrequent rainfall-biased sampling does not allow conclusions to be made concerning the magnitude of water quality problems at Riegelsville, if any. Data during dry periods, when recreation use of the river is more likely, are not available for Reigellsville.

Zones 2, 3, 4 and 5

The Delaware Estuary is impacted by both point and non-point sources of pollution. All four Estuary zones are classified as "water quality-limited in accordance with the Federal Clean Water Act. This classification means that wastewater dischargers must receive greater than secondary levels of treatment (as developed by a wasteload allocation program) and that water quality management should examine the abatement of non-point sources. The Estuary is currently governed by a wasteload allocation program and an on-going study is examining both point and non-point source abatement needs for the future.

Point Sources: Much is known about point-sources since they have been the subject of water pollution abatement efforts for at least 40 years (DRBC 1982). In 1968 the Delaware River Basin Commission instituted an Estuary-wide wasteload allocation program which allocates permissible oxygen demanding waste discharges (carbonaceous biochemical oxygen demand or CBOD) in order to achieve water quality standards. Based on mathematical modeling studies the assimilative capacity in terms of pounds CBOD/day was determined for each zone. After setting aside a small reserve in each zone, allocations to individual dischargers were made based on the concept of equal waste reduction by all discharges in a zone. In 1968, allocations were issued to approximately 90 waste dischargers to the Delaware Estuary. Currently there are 77 active dischargers in the Estuary holding DRBC allocations. Five additional active dischargers have had their allocations withdrawn pending connection to regional systems not yet constructed. In addition five industrial dischargers have allocations, but recently suspended operations. The following table summarizes the DRBC wasteload allocation program. The difference between the zone assimilative capacities and the total allocated load represents the reserve set aside for future growth. As indicated Zone 2 is over allocated. This issue anf future water quality strategies are currently the subject of on-going DRBC studies described later.

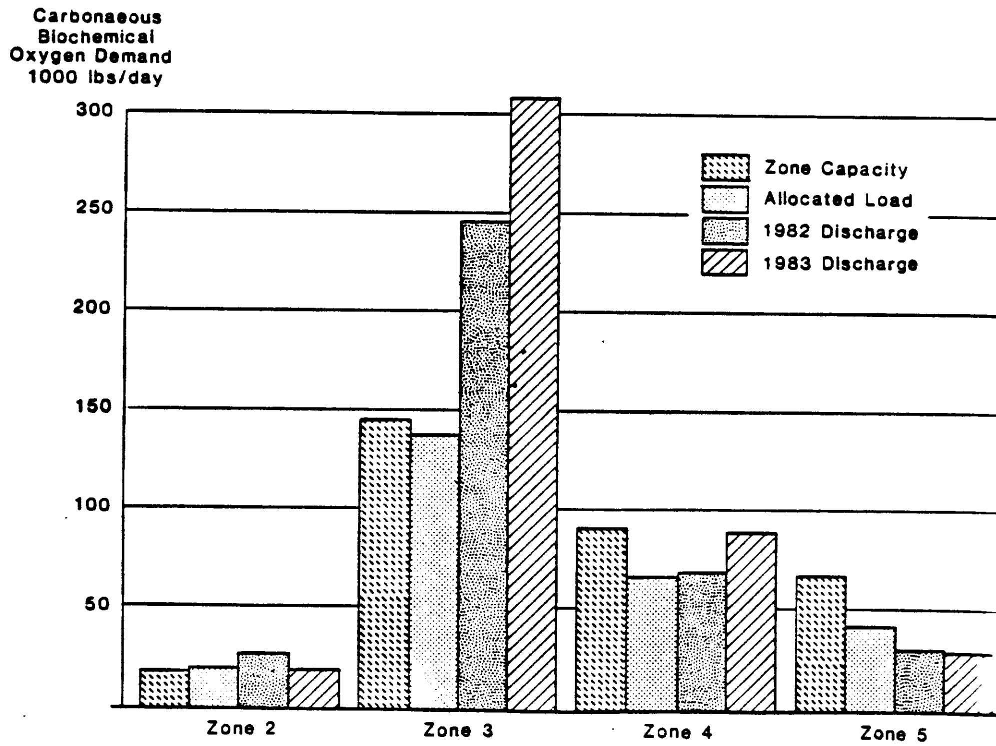
Zone	Assimilative Capacity	Allocated Load-1983	Required Zone Removal
2	18,600	19,901	88.5
3	144,800	137,542	86.0
4	91,000	67,089	89.25
5	67,600	42,574	87.5
Total	322,000 lbs/day	267,106 lbs/day	

Point sources of pollution at this time determine whether or not designated uses are being met in Zones 2-5. This is demonstrated by comparing Figure 9 which presents the exceedance of the zone allocated load by all the point sources in each zone with the previously presented water quality overviews for each zone:

A. 100% of Zone 2 is meeting designated uses. Figure 9 indicates that by mid-1983 the total charge load to the Zone about equaled the alloted discharge load. The decrease from 1982 to 1983 is largely due to the completion of the Trenton, New Jersey wastewater treatment plant upgrading project and better treatment at another plant that was discharging above its limits in 1982. There are 4 municipal wastewater treatment plants in Zone 2 that are major violators of their permitted wasteload allocations.

B. Zone 3 does not attain the Federal fishable and swimmable water quality goals and several of its designated uses. It is the most polluted section of the Delaware River. Figure 9 indicates that inadequately treated point source wastes are a major factor. The total load discharged exceeds the Zone's allocated discharge by a factor of about two. Wasteloads increased in 1983 at major municipal

Figure 9. Comparison of Wasteload Discharged with Total Load Allocated and the Zone Assimilative Capacity



wastewater treatment plants. This increase is possibly due to increased economic activity resulting from the diminution of the recent recession. The increased amount of wastes discharged to Zone 3 is reflected in the observed summer season dissolved oxygen concentrations (Figure 5). Concentrations in 1982 were better than 1983 due to the lessor amount of oxygen-demanding materials discharged.

There are 5 municipal and 2 industrial facilities considered to be major violators of their permitted discharge. Of these, two City of Philadelphia plants and two for the City of Camden, represent 96% of the allocated load to Zone 3 and 49% of the allocated load to the entire Estuary. All these plants are currently undergoing upgrading of treatment and, hopefully, will be meeting their allocations within the next two or three years. Water quality improvement should be noted if either of the two Philadelphia plants or the largest Camden plant come on-line with new facilities.

C. Most of Zone 4 also does not support several of its designated uses nor meets the Federal fishable and swimmable goals. The area of non-attainment begins at the upper (Zone 3) end of Zone 4 and extends down river. The large point source wasteload discharged in Zone 3 impacts Zone 4 water quality possibly more so than the wasteloads discharged directly into Zone 4. Also, several large dischargers in Zone 4 are not in compliance with their wasteload allocations. The increase in discharge loads from 1982 to 1983 is also attributed to increased economic activity. Major violators of permitted allocations in Zone 4 include 1 municipal and 3 industrial facilities.

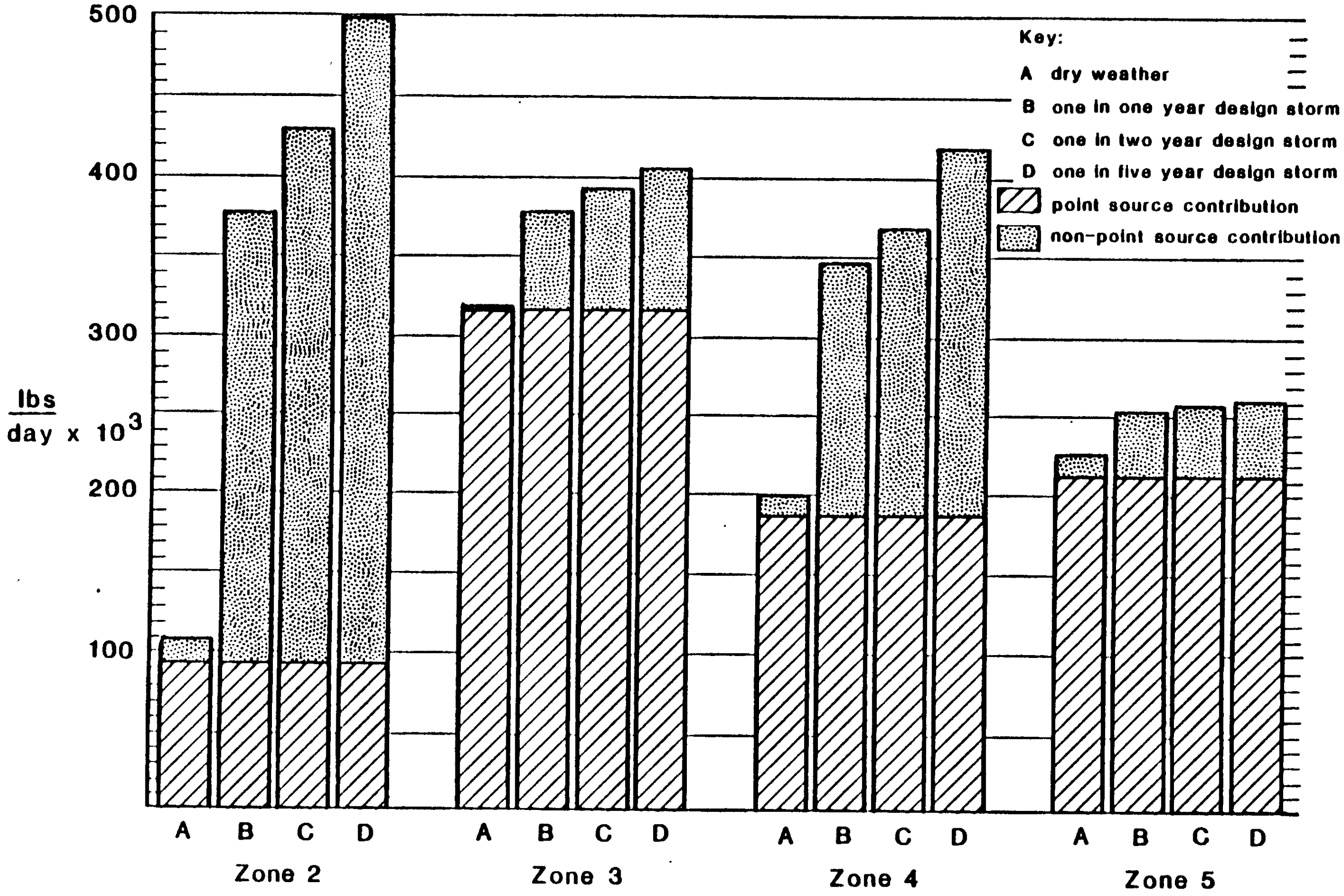
D. Zone 5 not only attains its designated uses, but the upper section attains uses that are even higher. As Figure 9 indicates one reason is that the total wasteload discharged to Zone 5 is much less than the total allocated load. Thus, the water quality attained is better than projected when standards and designated uses were originally adopted. A minor increase in actual 1983 loads is also seen in Zone 5.

Four minicipal and one industrial facility are considered major violators of their wasteload allocation permits. The largest treatment plant in Zone 5, the City of Wilmington wastewater treatment plant, discharges well below its wasteload allocation and is perhaps the most efficient large treatment plant along the Delaware River at this time.

Non-Point Sources: are a significant pollution load to tidal Delaware Estuary, Zones 2, 3, 4, and 5. These non-point sources can be divided into three categories: urban runoff, combined sewers and loads from tributaries and are primarily a wet-weather phenomenon, increasing with rainfall intensity.

The Delaware River Basin Commission is currently examining future abatement measures for the Delaware Estuary using a mathematical model developed by the U.S. EPA and others. Part of this effort involves the estimation of point versus non-point source contributions. The effort to date has yielded the load breakdown shown in Figure 10, which indicates the relative contribution

Figure 10. Relative Contributions of Point and Non-point Sources in the Delaware Estuary



of each type of pollution source to the total load (carbonaceous and nitrogenous oxygen demand) being discharged to each zone. The point sources shown assumes that all dischargers are meeting their DRBC allocation. Four conditions are presented (1) a dry weather, no-rain condition (2) a rainstorm of the size that occurs once a year (3) a once in every two year rain; and (4) a once in every five year rain. The three design rain storm differ in duration (from 13 to 27 hours) and intensity (2 to 3.3 inches). In most cases the resultant non-point source loads are discharged during the first 24-hours.

As would be expected point sources dominate during dry weather. As rainfall intensity increases the relative proportion of each zone's total load that is attributable to non-point sources also increases. In all cases the major portion of the non-point sources emanates from tributaries.

Zone 6

Point Sources: According to state 305(b) reports, the major impacts in Zone 6 from point sources are felt locally. Dischargers are scattered and small in comparison to the hugh volume of water represented by the Delaware Bay. Point sources do not appear to cause any significant harm to the attainment of designated uses in Zone 6. In past years the most significant point source impact on Zone 6 came from the high volume of oxygen demanding materials discharged above Zone 6 in Zones 3, 4 and 5.

Non-Point Sources: Specific data on non-point source impacts on Delaware Bay water quality are not available. The sources would be agricultural runoff, malfunctioning on-lot sewage disposal and the like, plus possibly non-point sources associated with commercial fishing such as oyster shucking, wastes etc..

TOXIC PARAMETERS

There are three types of toxic data depending upon where the toxic parameters are measured. These are water column data, data from bottom sediments and fish tissue data. The following discusses toxic parameters in the Delawre River and Bay for each type.

Water Column

Zone One is sampled for selected heavy metals on an occasional basis. Metals sampled include arsenic, cadmium, chromium, copper, lead, and several others. There are no adopted water quality criteria for these parameters. DRBC has adopted interpretive guidelines for eight metals and, in conjunction with the States and EPA is attempting to formulate new criteria to adopt as standards. Using the numeric guidelines (U.S. Fish and Wildlife Service 1983), potential criteria (DRBC-1983) and other information for guidance, it appears that no toxic water quality problems are evident in the water column of Zone One. Values for all samples parameters are extremely low; often less than the test sensitivity. Lead may be the exception in the lower section of Zone One, but natural sources there cannot be ruled out.

In Zones 2, 3, 4, 5 and the upper portion of Zone 6 the DRBC/Delaware DNREC boat run program samples several heavy metals that have human toxicity, such as lead, cadmium and arsenic. Metal concentrations in the water column are generally below DRBC's interpretive guidelines or criteria currently proposed. Lead and cadmium can be considered borderline cases since a small percentage of values at some locations obtained in 1982 and 1983, were above the proposed criteria or the guidelines.

Data on some trace metals have been reported for the lower Estuary (Zone 5) and Delaware Bay (Sharpe 1983). Values were below toxicity levels and it was concluded that the concentrations were not exceptionally high when compared to either the Chesapeake Bay or Hudson River estuaries. While some elevations in concentrations were attributable to human activity, there were no indications of environmental deterioration.

Data for non-metallic toxic substances in the water column are generally not available. Studies have shown (including Sharp 1983) that phytoplankton and nitrification inhibition occur in the Estuary near Philadelphia. Although the reasons for these inhibitions are not known, toxicity from industrial chemical compounds is one of several possibilities. In May 1981 a survey by the Delaware Department of Natural Resources and Environmental Control found no presence of chlorinated pesticides in the water column of the Delaware Estuary or Bay. A repeat of the survey in April 1982 tested for both PCB and chlorinated pesticides without finding either.

Bottom Sediments

During the 1982-83 period bottom sediments were sampled once in Zone One at Trenton, New Jersey, and a variety of pesticides were found. Most values were below test sensitivity and others indicated low concentrations of the organic compounds. Indirect evidence of the lack of sediment toxicity is indicated by DRBC benthic macroinvertebrate samples. Samples taken in 1982 and 1983 in the

Delaware River at various locations upstream of the Delaware Water Gap show healthy, diverse macroinvertebrate populations.

Data concerning toxic compounds in the Delaware Estuary and Bay sediments have largely been acquired in the navigation channel for dredged spoils disposal analyses. A recent report (Corps 1984) summarized the results of various tests done in the 1979-83 period. Heavy metals, low concentrations of pesticides and a variety of organic compounds were found. Higher concentrations of most of the examined parameters were found in sediments in the reach of the Delaware River from Trenton to Philadelphia (Ben Franklin Bridge) than in the reach from Philadelphia to the sea. The report concluded that no serious pollution problems existed with respect to the sediments. Unfortunately there are very few data taken in sediments in near-shore areas. Concentrations of toxics in some of these sediments are known to be elevated due to their proximity to waste sources.

Sharp et. al. (1983) examined data for trace metals in the bottom sediments of the lower portion of Zone 5 - upper Delaware Bay area. Trace metals were attributed to three sources (a) riverine, largely natural sources (iron, maganese lithium, potassium and aluminum) (b) marine sources (magnesium, strontium, calcium and sodium) and (c) pollution sources (chromium, copper, lead and mercury). As would be expected, pollution sources (i.e. human activity) increased in magnitude in an upstream direction. Pollution sources were considered a very high "factor influence" in the Bay area in the region centered around the mouth of the Cohansey River, New Jersey. That the researchers were able to differentiate trace metals in bottom sediments as to source does not mean that the metals were found at toxic levels.

A sediment sample taken by the Delaware Department of Natural Resources and Environmental Control in lower Zone 5 in 1982 showed no detectable concentrations of various pesticides and organic compounds. Metals were present in minute quantities.

Fish Tissue

Toxics in fish tissue are of concern because fish are caught and consumed by humans. Fish are the highest organisms in the Delaware River food chain and, thus, many toxic compounds are bioaccumulated. The accumulation of toxics in fish tissue can result in concentrations in the tissue that are higher than the surrounding environment.

Routine fish tissue sampling was initiated in 1979 by the four Delaware River Basin States as part of the EPA Basic Water Quality Monitoring Program. Up to ten locations are sampled each year from Port Jervis, New York in Zone One to the mouth of the Mahon River in Zone 6. Not all the data from this program are as yet available due to laboratory backlog and other problems. Limited fish tissue data are also available from a recently completed special study by the U.S. Department of the Interior, Fish and Wildlife Service (1983).

The toxics fish tissue data for Zone One locations are limited. In most cases measured parameters are not detectable. Several pesticides, herbicides and metals have been found in trace quantities; most are below applicable action levels. In 1980 and 1981 some chlordane values at Trenton were a concer Data collected since 1981 indicate lower levels. It must be emphasized tha fish tissue analysis is complex and sufficient data have not been collecte from which to draw scientifically valid conclusions.

Similar fish tissue data from the Delaware Estuary (Zones 2-5) indicat varying amounts of toxic compounds in fish flesh. Again chlordane appears t a concern. Small quantities of other parameters have also been foun including DDT, Arsenic, PCB and others although in all samples th concentrations were below action levels.

Fish and oyster samples taken in the lower Estuary and Upper Delaware Ba indicate that concentrations of most measured toxics are below detectabl limits. No potential toxic problems are evident.

Overview of the Toxics Problem

There is no doubt that toxic compounds are present in the Delaware River an Bay environment. The intense industrial activity and urbanization of th lower Delaware River Basin would suggest many potential sources of a wid variety of chemicals and chemical compounds. Even in relatively "clean areas, toxic problems may occur. For example, near Narrowsburg, New York i the Upper Delaware Scenic and Recreational River area is a landfill tha leaches toxic material. A study is underway to determine whether or not th leachate impacts Delaware River water quality. This and many other question still exist concerning the sources and fates of toxic compounds in th Delaware River system.

The available data are limited. Few samples are taken at few locations for a limited number of parameters. The data analyzed to date suggests that few, i any, problems exist. However, this conclusion is only tentative until man more samples of Delaware River water, sediments and especially fish are made.

SPECIAL CONCERNS AND REMAINING PROBLEMS

The following discusses several areas of special significance that should be considered, along with previously mentioned concerns, as remaining problems.

1. Recreational use of the Delaware River is intense and increasing particularly in the non-tidal river. The increased use makes the maintenance of the sanitary water quality a key concern. An unanswered concern is the impact of the recreational use of the river on water quality itself.

2. In Zone 2 the allowable amount of oxygen demanding wastes discharged exceeds the previously-determined assimilative capacity of the zone, althouth standards are generally being attained. The reallocation of Zone 2 or the selection of alternative pollution control strategies is being studied by DRBC as part of an Estuary-wide modeling and planning program.

3. In Zones 3 and 4 sediment oxygen demand is a special concern. DRBC modeling studies indicate that SOD deposits exert a significant oxygen demand on the overlying water column. SOD rates measured in situ in Zones 3 and 4 are unusually high at some locations (DRBC 1983).

4. In Zones 3, 4 and part of Zone 5 adopted water quality standards are less than required to meet the Federal fishable and swimmable water quality goals. In 1979 a DRBC ad hoc task force of state and federal biologists defined fishable water quality in terms of dissolved oxygen levels that are not currently attainable. The pollution controls needed to attain these levels are being determined in the above-mentioned Estuary-wide program.

5. The attainment of designated uses and water quality standards usually requires that wastewater treatment plants be upgraded and operated to meet allowable wasteloads. When the latter does not occur, the benefits of upgrading are lost. Wastewater treatment plants that have completed their upgrading, usually with state and federal grant assistance, and still do not meet their effluent limitations should be the subject of increased attention.

6. Non-point sources and toxic substances will remain special concerns for the forseeable future.

WATER QUALITY SUMMARY OF THE DELAWARE RIVER AND BAY

The following table presents a general assessment of Delaware River water quality in term of excellent, good, fair or poor. These terms are defined as follows:

Excellent - no significant pollution problems. Water quality standards are violated ver infrequently or not at all. Use of reach for effluent disposal is minimal o non-existent.

Good - Minor or localized pollution problems. Water quality standards are not violated i most samples or in major sections of the river reach. [Bacteria would be typica localized problem.] Wastewater dischargers to the reach generally meet applicabl effluent requirements.

Fair - Frequent violations of one or more water quality standards on an annual or seasona basis. Fish life limited to pollution-tolerant species or fish kills noted periodically. Bacteria levels sufficiently high to prevent safe swimming.

Poor - Regular violations of various water quality standards. Water quality unsuitabl for fish survival at least part of the year. Very high bacterial levels present.

General Assessment and Attainment of Water Quality Goals

	No. of Miles	General Water Quality	Meets Swimmable Goal	Meets Fishable Goal	Supports Designated Us-
West Branch Delaware	9	Good	yes	yes	yes
Delaware River, Zone One Hancock, N.Y. to Delaware Water Gap	118	Excellent	yes	yes	yes
Delaware Water Gap to Trenton, N.J.	79	Good	yes	yes	yes
Delaware Estuary Zone 2	25	Good to Fair	yes	yes	yes
Delaware Estuary Zone 3	13	Poor	No	No	No
Delaware Estuary Zone 4	16	Poor to Fair	No	No	No
Delaware Estuary Upper Zone 5	11	Fair	yes	No	yes
Delaware Estuary Lower Zone 5	20	Good	yes	yes	yes
Delaware Bay Zone 6	48	Excellent	yes	yes	yes

An overview of water quality by state is presented below. Total mileage includes nine miles of the West Branch, Delaware and includes the center line of the Delaware Bay.

State by State Water Quality Summary

	DE	NJ	NY	PA	Total	% of Total
Total number of miles	79	253	86	260	339	100 1/
Miles in Nat. Wild and Scenic R. Sys.	0	37	72	109	109	32
Miles supporting designated uses	79	224	86	231	310	91
Miles not supporting all designated uses	0	29	0	29	29	9 1/
Miles of fishable water quality	68	213	86	231	299	88
Miles of non-fishable water quality	11	40	0	29	40	12
Miles of swimmable water quality	79	224	86	231	310	91
Miles of non-swimmable water quality	0	29	0	29	29	9

1/ includes the interstate portion of the West Branch, Delaware River

2/ miles not supporting all designated uses are in Zones 3 and 4. Designated uses not being met fully there are maintenance of resident fish, passage of annadromous fish and secondary contact recreation.

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6. Delaware River Basin Commission "Delaware River Water Quality in the Delaware Water Gap National Recreation Area", West Trenton, N.J. (February 1983)

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8. Delaware River Basin Commission "Report of Findings, Delaware Estuary Sediment Oxygen Demand Study Fall 1983", West Trenton, N.J. (December 1983)

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13. U.S. Fish and Wildlife Service "Concentrations of Environmental Contaminants in Fish From Selected Waters in Pennsylvania", University Park, PA (1983)

STATUS REPORT ON THE INTERSTATE SANITATION DISTRICT WATERS

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MARCH 1984

EXECUTIVE SUMMARY

Interstate Sanitation District waters exhibited some improvement compared to previous years. District waters meet dissolved oxygen requirements during the winter; however, in some locations, dissolved oxygen values in the summer drop below standards for extended periods. Some waters are also high in heavy metals, oil and grease, and bacterial contamination.

New Jersey surface waters located within the New Jersey-New York Metropolitan Area form part of the jurisdiction of the Interstate Sanitation Commission.

The Commission's programs for the improvement of these waters, in cooperation with the states, include the following:

(1) to establish and attain minimum dissolved oxygen requirements for all surface waters;

(2) to establish necessary pollutant levels for discharges into District waters;

(3) to monitor surface waters by analysis of samples obtained from regularly scheduled helicopter surveys;

(4) to do routine sampling and analysis of municipal and industrial dischargers to determine whether Compact requirements are being met;

(5) to assist the states and the U. S. EPA with NPDES/SPDES compliance monitoring;

(6) to monitor surface waters for coliforms within the Interstate Sanitation District in cooperation with the U. S. EPA and the State of New Jersey, as related to New Jersey's disinfection policy; and

(7) to supply water quality data to STORET, the U. S. EPA data storage and retrieval system, and to the state and federal agencies.

The waters described in this report and their tributary treatment plants are shown in Figure 1. These waters are:

ISC Class A Waters - NJ TW 1 Waters: Sandy Hook Bay
Raritan River
Raritan Bay

ISC Class B-1 Waters - NJ TW 2 Waters:		Hudson River Upper New York Bay Arthur Kill South of the Outerbridge Crossing
ISC Class B-2 Waters - NJ TW 3 Waters:		Kill Van Kull Newark Bay Arthur Kill North of the Outerbridge Crossing

The water classes and uses described below were promulgated by the Interstate Sanitation Commission and are compatible with New Jersey's classifications and uses, namely:

Class A Waters - Suitable for primary contact recreation and in designated areas for shellfish harvesting

Class B-1 Waters - Suitable for fishing and secondary contact recreation

Class B-2 Waters - Suitable for passage of anadramous fish and for maintenance of fishlife

These water classifications are defined in the Interstate Sanitation Commission Water Quality Regulations effective October 15, 1977. The Commission's water quality and effluent regulations were revised to help achieve higher quality waters throughout the District.

Additional demographic information pertaining to the New Jersey portion of the Interstate Sanitation District is:

1983 population -	3,146,200
Total coastal miles -	93
Total estuarine waters* -	72 sq. miles
Interstate border miles -	Hudson River - 8.6 sq. miles Arthur Kill/Kill Van Kull-4.63 sq mi Raritan Bay - 38 sq. miles

* All waters in the Interstate Sanitation District will be considered estuarine.

SURFACE WATER QUALITY

Table 1 is a breakdown of water quality conditions for water year 1981. Figure 2 is a map displaying the Region's waters as a function of their attainment of designated water use classification.

Changes/Trends in Water Quality

A comparison of water quality was made for water years 1975 and 1981. The availability of extensive data at a statistical level for these years is the reason for inclusion in this report. Water years rather than calendar years were utilized because the data reflects full seasonal effects. A preliminary review of the data collected in water years 1982 and 1983, generated by the Commission's regular helicopter sampling runs, shows little variation in the District waters as compared to the 1981 assessment. Tables 2 through 5 show various presentations on water quality and use assessment.

SPECIAL CONCERNS/REMAINING PROBLEMS

Special concerns that affect the District include:

(1) Surface water quality maintenance and assurance in light of population and industrial growth.

(2) Municipal wastewater plant operation, maintenance, and rehabilitation.

(3) Toxic pollution of surface waters, due to an absence of meaningful pretreatment and raw discharges from combined sewers, presents a major problem of great importance. Identification and control of toxic pollutants from industrial and nonpoint sources has been minimal at best.

(4) Until appropriate pretreatment requirements are imposed and actually enforced, these discharges of toxics to the public sewer systems of the area will continue to result in pollution of the receiving waters. Public treatment plants do not remove enough toxic pollutants from influents to solve the problem. Furthermore, one result of current processes is to produce toxic sludges which then present their own disposal problems.

(5) Combined sewers, which are a major phenomenon in the core of the Region, contribute raw overflows which are detrimental to maintenance of quality for both conventional and toxic parameters.

(6) Shellfishing could be a greater resource in the Interstate Sanitation District than at present. In certain waters shellfishing is prohibited for direct harvesting as well as for depuration or relay. In others it is approved for direct harvesting only on a seasonal basis. Based upon a desire to increase the use of this

resource, the Commission is presently examining the possibility of requiring further disinfection of sewage effluents.

WATER POLLUTION CONTROL PROGRAM

The pollution control activities of the Interstate Sanitation Commission continue to include monitoring of effluent discharges and of receiving water quality, standards-making and review, and cooperation with the states and U. S. EPA in the NPDES/SPDES Permit Programs. The focus of the Commission's work is not only on the condition and management of the waters involved, but also on the interrelationships with conditions and developments in the waters which intermingle among the states.

The Commission inspects Publicly Owned Treatment Works (POTWs) and industrial treatment facilities on a regular basis and reports the results of these inspections to the states, the U. S. EPA, and the discharger involved. All water quality sampling data are also supplied to the states and the U. S. EPA. The Commission also conducts special samplings and analyses: e.g. for coliform conditions in connection with examination of the states' disinfection policies, with a goal of harmonizing those policies.

The Commission does studies of parameter conditions for its District which show the relationships of existing water quality conditions to applicable standards. For example, this was done for dissolved oxygen, including conditions as they would be in 1990 if all dischargers were then providing secondary treatment. On the basis of these studies and of other data, especially that obtained from its monitoring activities, the Commission reviewed 301(h) applications made by over 20 POTWs in its District. Concurrences were not granted in each case.

Enforcement

NPDES and SPDES permits for discharges within the Interstate Sanitation District carry provisions requiring effluents to meet the requirements of the Commission's Water Quality Regulations, as well as those of the individual states. Ever since the inauguration of the Section 402 Permit Program, the Commission has reviewed permits and participated in permit proceedings to assure that its requirements are included. The Commission also does compliance monitoring to determine whether ISC Compact and other permit requirements are being met.

Nonpoint Source Control Program

The contribution of nonpoint pollution sources to degraded water quality in the Interstate Sanitation District is much less than for point sources. Nevertheless, urban runoff, the underwater mining of sand and gravel, and work to maintain navigation channels do place added stress on these waters, perhaps amounting to 10% of the total pollution load. Since great progress has been made in controlling point sources (other than combined sewers) and many of the water segments are still inadequate or only partially suitable for their present and intended uses, it is important to reduce contamination from the nonpoint sources. Table 6 shows severity and extent of nonpoint source pollution in the Interstate Sanitation District.

INTERSTATE SANITATION DISTRICT WATER QUALITY

Sampling Network

The quality of the District waters is monitored and checked by conducting helicopter sampling surveys. The Commission regularly samples the effluents of municipal, privately owned, and industrial wastewater treatment plants that discharge into District waters. The samplings are conducted by the Commission's field personnel and the analyses are performed by the Interstate Sanitation Commission laboratory. The Commission also operated remote automatic water monitoring equipment until mid-1983.

Effluent Monitoring

The Commission samples municipal sewage treatment plants and a limited number of industries discharging into District waters. The results of the analyses and the records and facilities inspections are used to determine compliance with the Commission's regulations and N/SPDES permit requirements.

Sewage treatment plants and some industries are sampled for a six hour period. Other industries are sampled for twenty-four hours or a full day's production, if less than twenty-four hours. Industrial plants are sampled for a wide range of parameters, such as heavy metals, nutrients, chlorinated hydrocarbons and purgeable organic compounds. Many of the industries are sampled at the request of and in cooperation with the member states and the U. S. EPA. All data and reports are furnished to the appropriate state and federal agencies.

Remote Automatic Water Quality Monitoring

During water year 1983, a new monitoring location was established on Pier A in the Hudson River at the Battery. However, due to budgetary constraints, this new station as well as the previously operational stations have been placed on standby. This status denotes that the monitors have been left in place and can be calibrated and manually operated if a situation warrants. They also can be placed back on-line for automatic operation with minimum effort when funds become available.

During the portion of the year that the monitors were in operation, four parameters -- conductivity, dissolved oxygen, temperature, and pH -- were continuously measured at each station. These data were transmitted hourly to a central receiver at the Commission's office, summary reports were generated daily and the information was sent to the appropriate state and federal agencies. In addition, entries are made to STORET -- a national data base maintained by the U. S. EPA.

Figure 3 shows the location of the monitoring sites. Figures 4, 5, and 6 are graphs for the past five years showing the monthly maximum, minimum, and average values for each parameter at each station. The monthly maximum and minimum represent the single highest value and the single lowest value for the month, respectively. The monthly average is the average of the daily average values for the month. Dotted lines indicate a month for which less than ten days of data were available.

Water Quality Surveys

Water quality surveys in the District were conducted by helicopter during the months of March, July, August, and September. Use of a helicopter rather than boats enables a large survey area to be sampled during a single portion of a tidal cycle and also eliminates problems encountered with shipboard analyses. Figure 7 is a map of the water quality sampling areas and lists of the sampling station descriptions are shown in Tables 7 and 8.

In addition to the conventional pollutant parameters, samples were taken for nutrients, heavy metals, oil and grease, and toxic organics. These data are available at the Commission and through STORET.

FIGURE 1

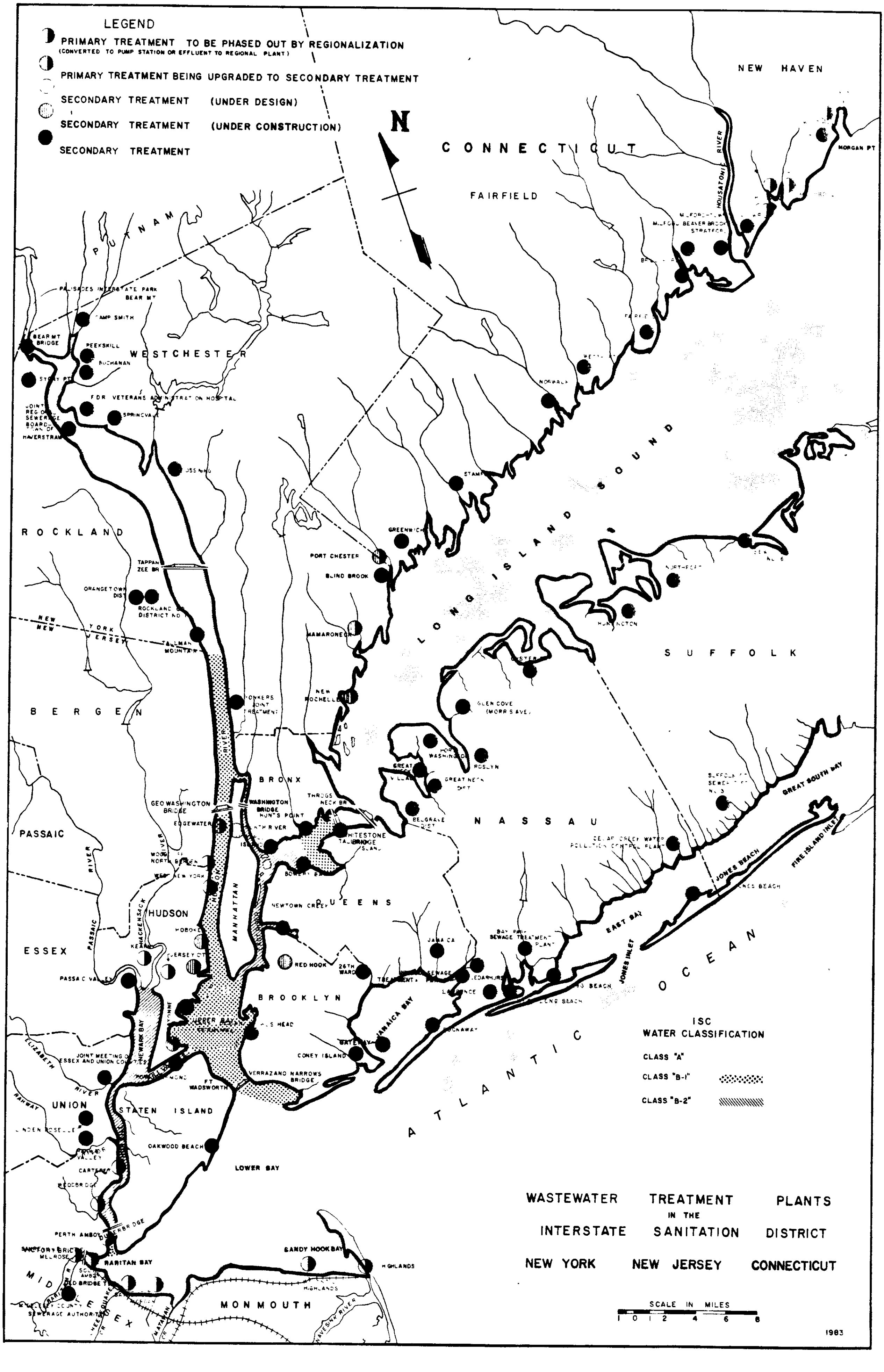
LEGEND
PRIMARY TREATMENT TO BE PHASED OUT BY REGIONALIZATION
(CONVERTED TO PUMP STATION OR EFFLUENT TO REGIONAL PLANT)
PRIMARY TREATMENT BEING UPGRADED TO SECONDARY TREATMENT
SECONDARY TREATMENT (UNDER DESIGN)
SECONDARY TREATMENT (UNDER CONSTRUCTION)
SECONDARY TREATMENT
N
CONNECTICUT
FAIRFIELD
NEW HAVEN
PUTNAM
WESTCHESTER
ROCKLAND
BERGEN
PASSAIC
HUDSON
ESSEX
UNION
BRONX
MANHATTAN
QUEENS
BROOKLYN
STATEN ISLAND
NASSAU
SUFFOLK
MONMOUTH
LONG ISLAND SOUND
ATLANTIC OCEAN
LOWER BAY
RARITAN BAY
GREAT SOUTH BAY
JAMAICA BAY
ISC
WATER CLASSIFICATION
CLASS "A"
CLASS "B-1"
CLASS "B-2"
WASTEWATER TREATMENT PLANTS
IN THE
INTERSTATE SANITATION DISTRICT
NEW YORK NEW JERSEY CONNECTICUT
SCALE IN MILES
0 1 2 4 6 8
1983

FIGURE 2

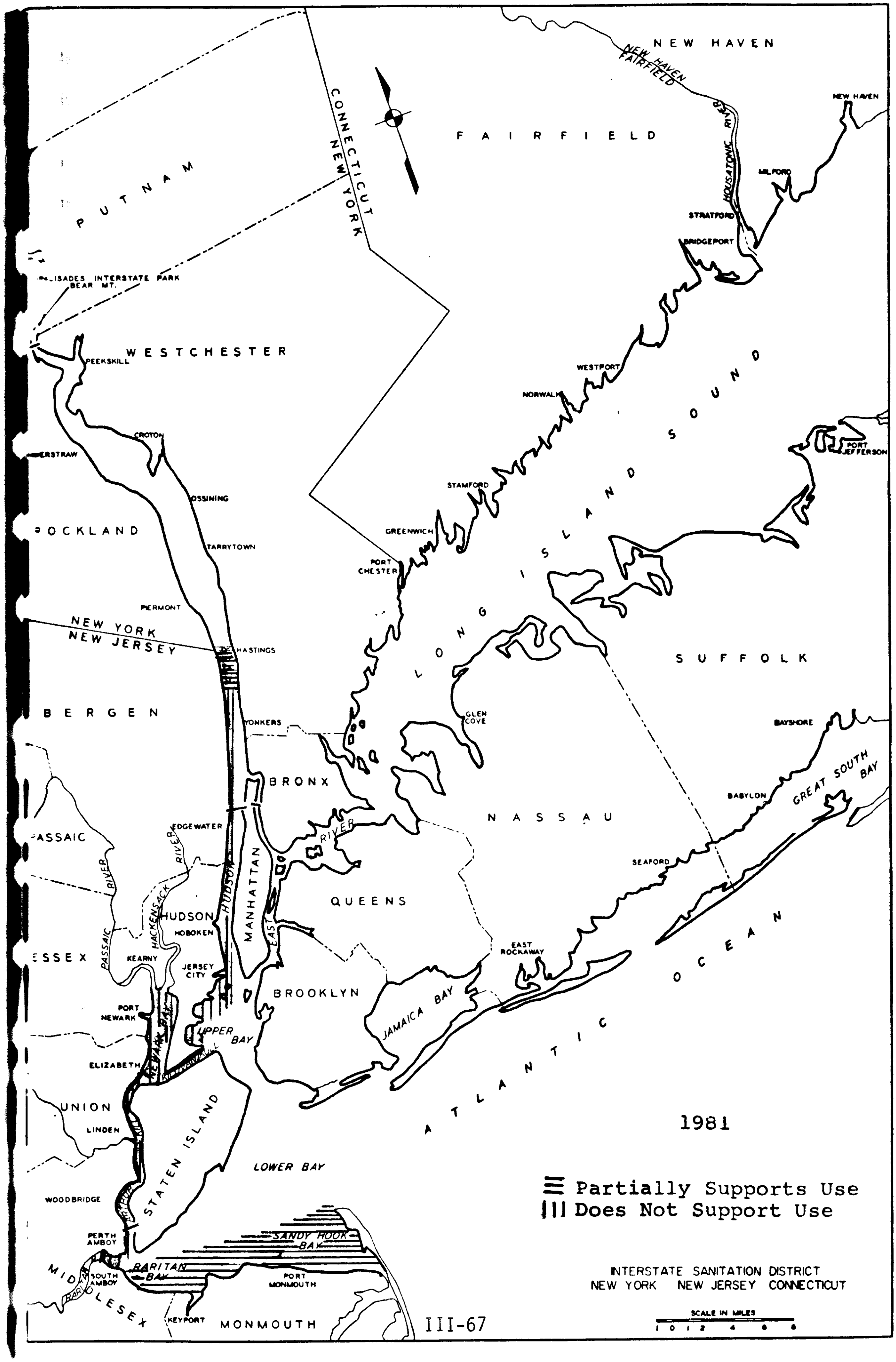
NEW HAVEN
NEW HAVEN
FAIRFIELD
FAIRFIELD
CONNECTICUT
NEW YORK
PUTNAM
HOUSATONIC RIVER
MILFORD
STRATFORD
BRIDGEPORT
PALISADES INTERSTATE PARK
BEAR MT.
WESTCHESTER
PEEKSKILL
WESTPORT
NORWALK
LONG ISLAND SOUND
PORT JEFFERSON
CROTON
HAVERSTRAW
OSSINING
STAMFORD
ROCKLAND
GREENWICH
TARRYTOWN
PORT CHESTER
PIERMONT
NEW YORK
NEW JERSEY
HASTINGS
SUFFOLK
BERGEN
YONKERS
GLEN COVE
BAYSHORE
BRONX
BABYLON
GREAT SOUTH BAY
PASSAIC
EDGEWATER
NASSAU
RIVER
PASSAIC RIVER
HACKENSACK RIVER
HUDSON RIVER
SEAFORD
MANHATTAN
QUEENS
HUDSON
HOBOKEN
EAST RIVER
ESSEX
KEARNY
JERSEY CITY
EAST ROCKAWAY
ATLANTIC OCEAN
BROOKLYN
PORT NEWARK
NEWARK BAY
UPPER BAY
JAMAICA BAY
ELIZABETH
UNION
LINDEN
STATEN ISLAND
1981
LOWER BAY
Partially Supports Use
Does Not Support Use
WOODBRIDGE
PERTH AMBOY
SANDY HOOK BAY
SOUTH AMBOY
RARITAN BAY
PORT MONMOUTH
MIDDLESEX
INTERSTATE SANITATION DISTRICT
NEW YORK NEW JERSEY CONNECTICUT
KEYPORT
MONMOUTH
SCALE IN MILES
0 1 2 4 6 8

FIGURE 3

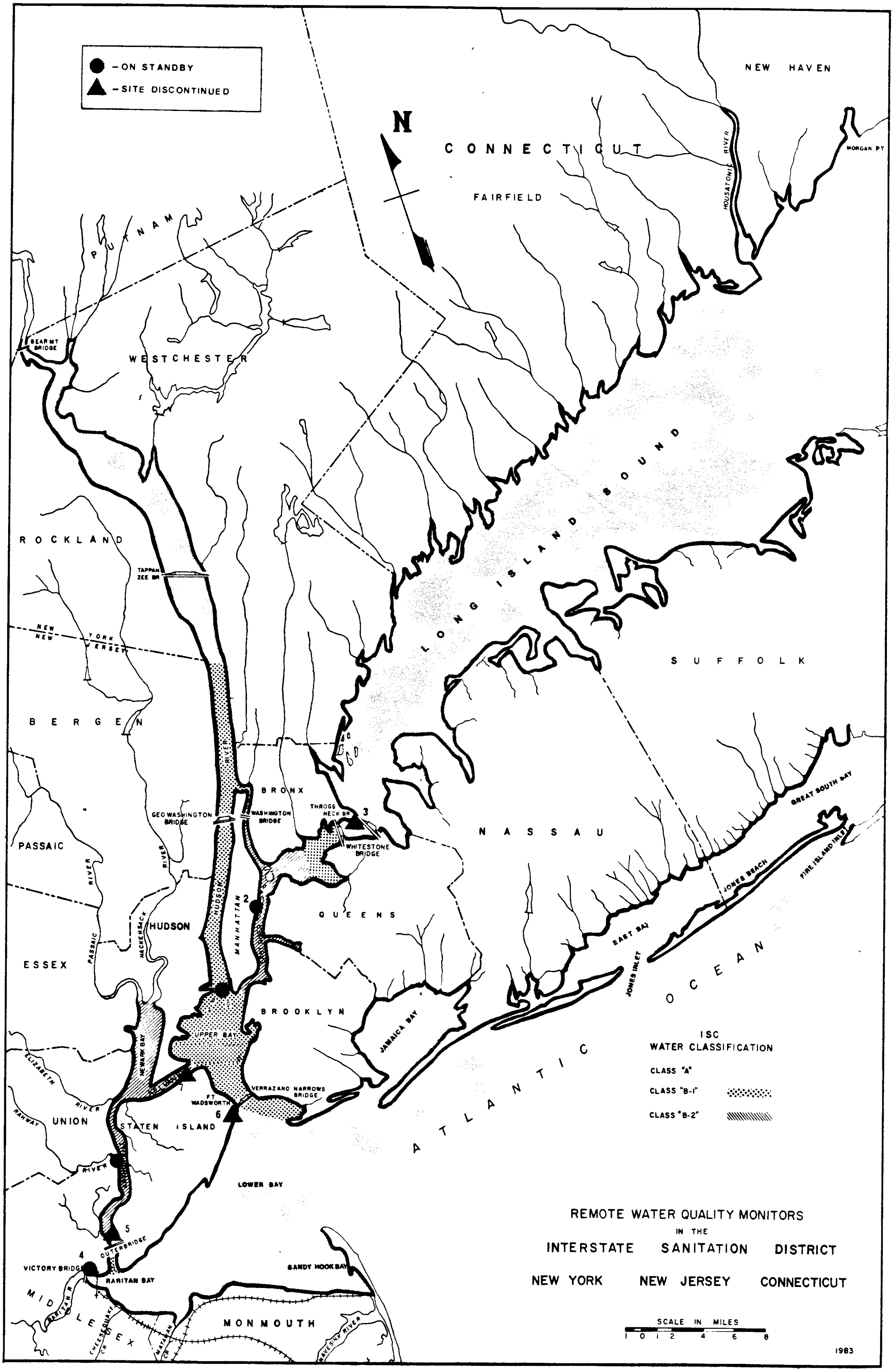
– ON STANDBY
– SITE DISCONTINUED
N
CONNECTICUT
FAIRFIELD
NEW HAVEN
HOUSATONIC RIVER
MORGAN PT
PUTNAM
WESTCHESTER
BEAR MT BRIDGE
ROCKLAND
TAPPAN ZEE BR
NEW YORK
NEW JERSEY
BERGEN
LONG ISLAND SOUND
SUFFOLK
BRONX
GEO WASHINGTON BRIDGE
WASHINGTON BRIDGE
THROGS NECK BR
WHITESTONE BRIDGE
NASSAU
PASSAIC
PASSAIC RIVER
HACKENSACK RIVER
HUDSON RIVER
HUDSON
MANHATTAN
QUEENS
ESSEX
BROOKLYN
UPPER BAY
NEWARK BAY
ELIZABETH RIVER
RAHWAY
UNION
VERRAZANO NARROWS BRIDGE
FT WADSWORTH
STATEN ISLAND
JAMAICA BAY
EAST BAY
JONES INLET
JONES BEACH
GREAT SOUTH BAY
FIRE ISLAND INLET
ATLANTIC OCEAN
LOWER BAY
OUTERBRIDGE
VICTORY BRIDGE
RARITAN BAY
SANDY HOOK BAY
MIDDLESEX
RARITAN R
MONMOUTH
1
2
3
4
5
6
7
ISC
WATER CLASSIFICATION
CLASS "A"
CLASS "B-1"
CLASS "B-2"
REMOTE WATER QUALITY MONITORS
IN THE
INTERSTATE SANITATION DISTRICT
NEW YORK NEW JERSEY CONNECTICUT
SCALE IN MILES
1 0 1 2 4 6 8
1983

FIGURE 4

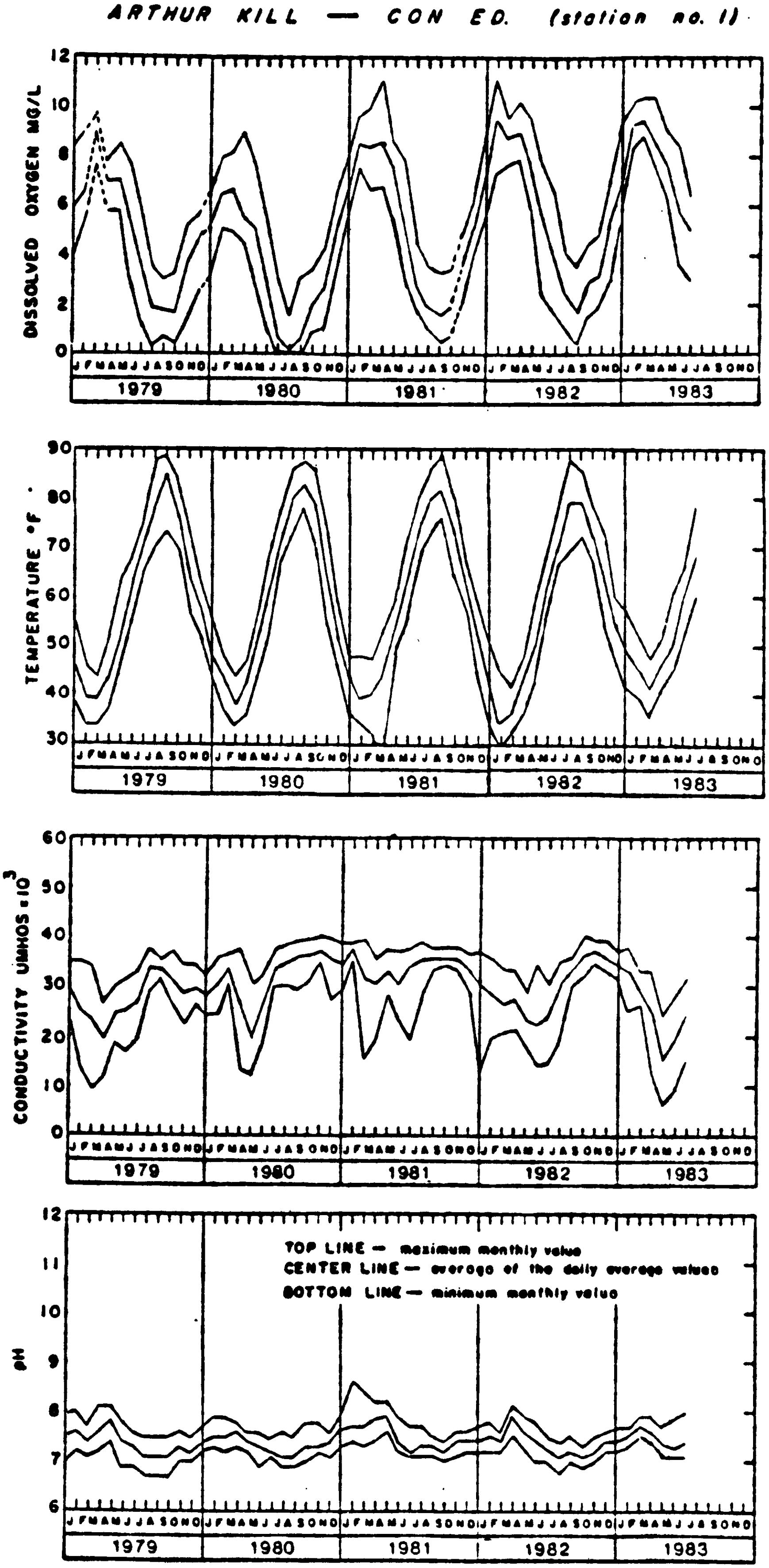
ARTHUR KILL — CON ED. (station no. 1)
DISSOLVED OXYGEN MG/L
TEMPERATURE °F
CONDUCTIVITY UMHOS x 10³
pH
J F M A M J J A S O N D
1979
1980
1981
1982
1983
TOP LINE — maximum monthly value
CENTER LINE — average of the daily average values
BOTTOM LINE — minimum monthly value

FIGURE 5

RARITAN RIVER—VICTORY BRIDGE (station no. 4)

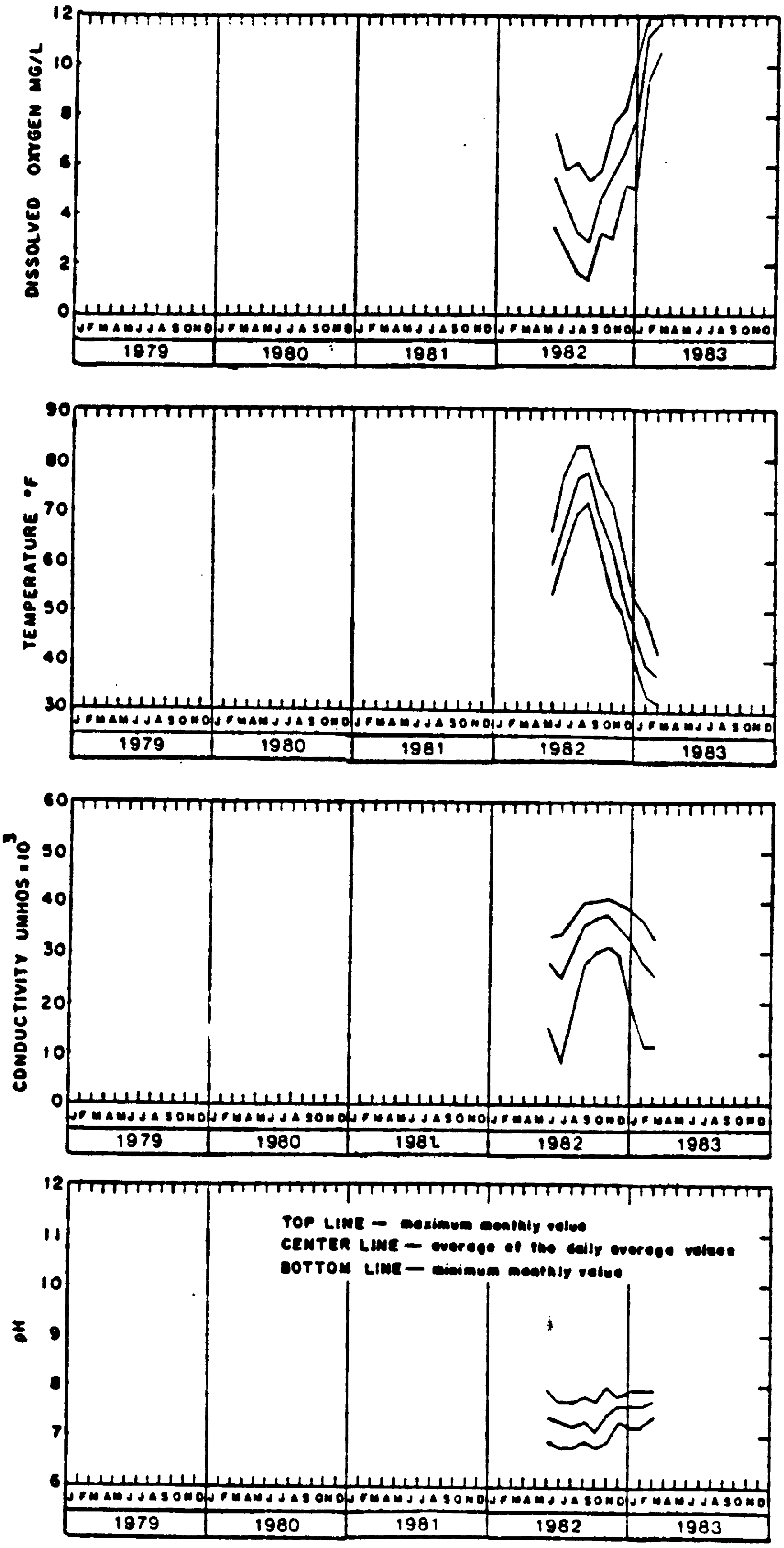

FIGURE 6

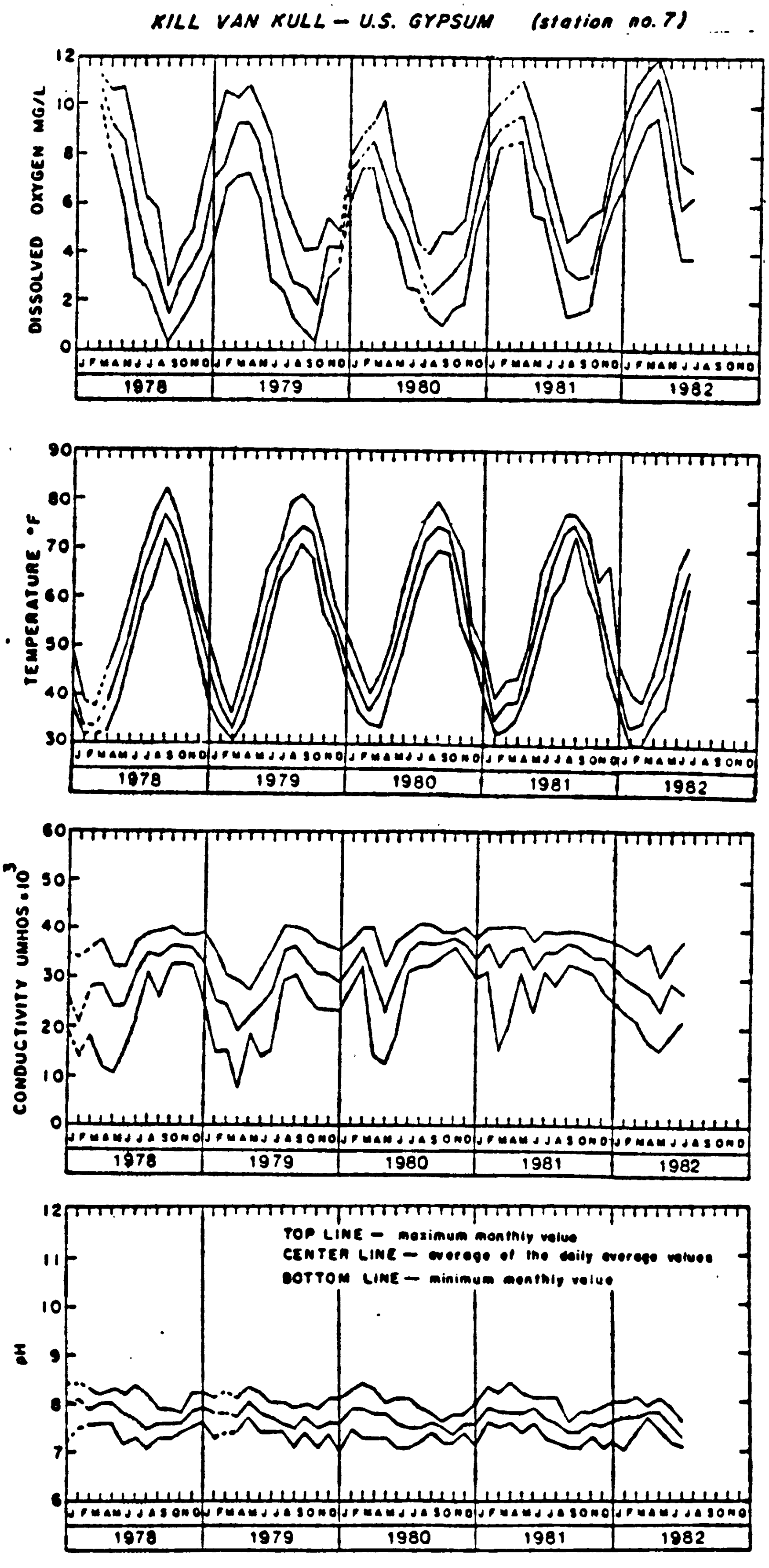
KILL VAN KULL — U.S. GYPSUM (station no. 7)
DISSOLVED OXYGEN MG/L
TEMPERATURE °F
CONDUCTIVITY UMHOS x 10^3
pH
TOP LINE — maximum monthly value
CENTER LINE — average of the daily average values
BOTTOM LINE — minimum monthly value
J F M A M J J A S O N D
1978
1979
1980
1981
1982

FIGURE 7

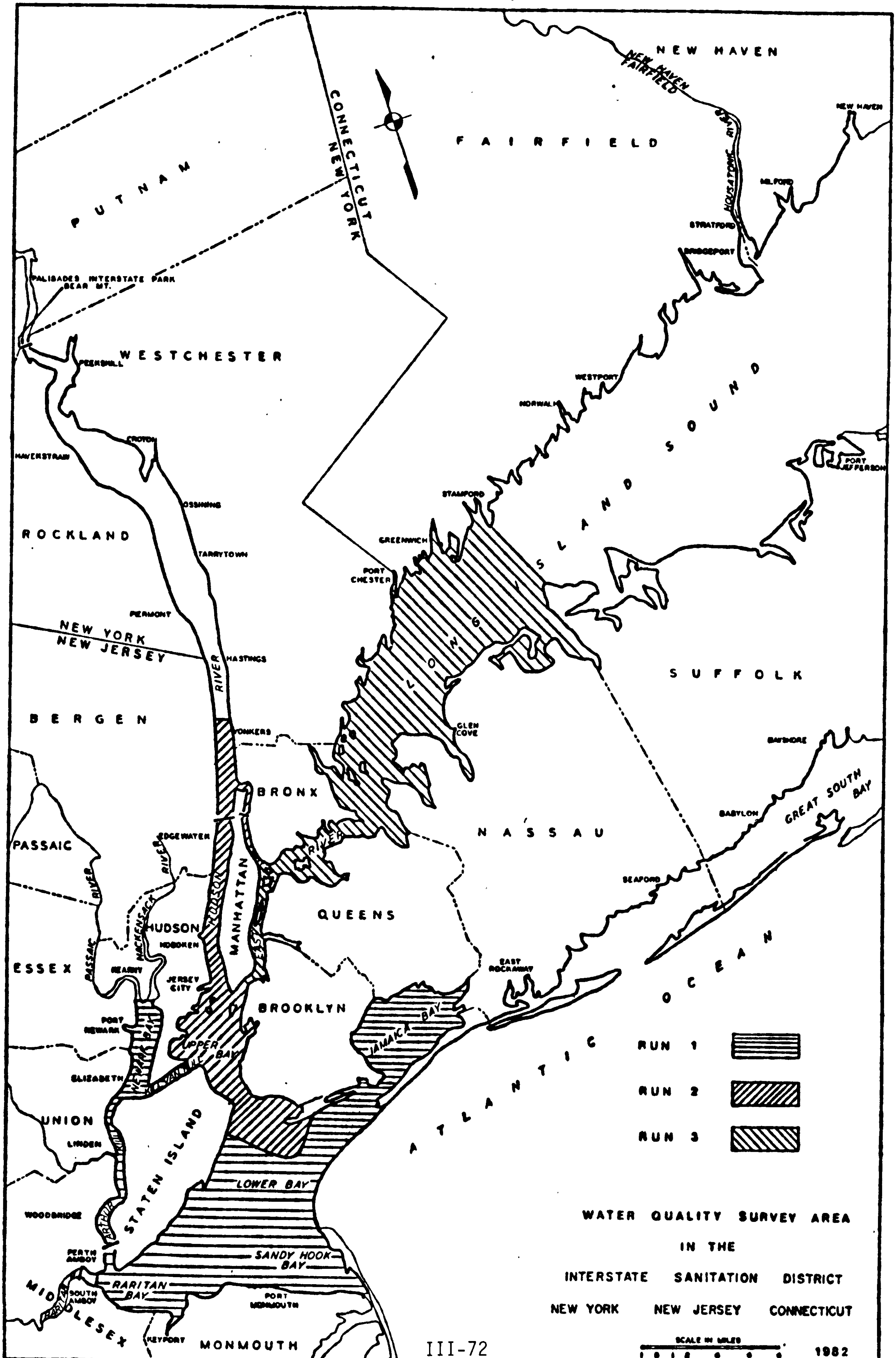
PUTNAM
CONNECTICUT
NEW YORK
FAIRFIELD
NEW HAVEN
WESTCHESTER
ROCKLAND
NEW YORK
NEW JERSEY
BERGEN
BRONX
PASSAIC
HUDSON
MANHATTAN
QUEENS
ESSEX
BROOKLYN
UNION
STATEN ISLAND
MIDDLESEX
MONMOUTH
NASSAU
SUFFOLK
LONG ISLAND SOUND
ATLANTIC OCEAN
GREAT SOUTH BAY
HUDSON RIVER
EAST RIVER
UPPER BAY
LOWER BAY
JAMAICA BAY
SANDY HOOK BAY
RARITAN BAY
NEWARK BAY
RUN 1
RUN 2
RUN 3
WATER QUALITY SURVEY AREA
IN THE
INTERSTATE SANITATION DISTRICT
NEW YORK NEW JERSEY CONNECTICUT
1982

TABLE 1

SURFACE WATER QUALITY FOR WATER YEAR* 1981

Square Miles/Square Miles Assessed	72/72
Sq. mi./square miles designated for uses more stringent than fishable/swimmable	0/0
Sq. mi./square miles designated for uses less stringent than fishable/swimmable	24/24
Sq. mi./square miles monitored	72/72

* Wateryear: October 1, 1980 to September 30, 1981, inclusive.

TABLE 2

EVALUATION OF SUPPORT OF DESIGNATED USES

Water Year	Supported	Partially Supported	Not Supported	Unknown	Total Assessed
1975	0 sq mi	0 sq mi	72 sq mi	0 sq mi	72 sq mi
	0%	0%	100 %	0%	100%
1981	0 sq mi	48 sq mi	24 sq mi	0 sq mi	72 sq mi
	0%	67%	33%	0%	100%

TABLE 3

CHANGES IN AND WITHIN USE SUPPORT BETWEEN 1975 AND 1981

	Within Category	Change in Category
Sq Mi Improved:		48 - 66%
Sq Mi Degraded:		0
Sq Mi Maintained:	24 - 34%	
Unknown:	0	

TABLE 4

CAUSES OF NONSUPPORT OF DESIGNATED USES

Municipal/Industrial	80%
Nonpoint Sources	10%
Other	10%

TABLE 5

RELATIVE ASSESSMENT OF MAJOR PARAMETERS OF CONCERN

Discharge Sources	Parameters								
	Coli	D.O.	Nut	pH	Temp	Toxics	Turb	Other	2 Most Serious
Municipal	X	X	X			X			X
Industrial		X			X	X			X
Nonpoint									
Other (including natural)									

<u>TOXIC PARAMETERS AND PUBLIC HEALTH/ACQUATIC LIFE CONCERNS</u>

Number of Estuary Square Miles Affected by Toxics: 72

TABLE 6

SEVERITY AND EXTENT OF NONPOINT SOURCE CONTRIBUTIONS

TYPE OF NPS	EXTENT	SEVERITY	PRIMARY PARAMETERS
urban			
agriculture (irrigated)			
agriculture (nonirrigated)			
animal wastes			
silviculture			
underwater mining	L	M	M/O*
construction			
hydrologic modification			
saltwater intrusion			
residual waste /landfill			

--- EXTENT ---

W = widespread (50% or more of the State's waters are affected)
M = moderate (25% to 50% of the State's waters are affected)
L = localized (less than 25% of the State's waters are affected)

-- SEVERITY --

S = severe (des. use is impaired)
M = moderate (des. use is not precluded, partial support)
I = minor (des. use is almost always supported)

-- PRIMARY PARAMETERS --

C = coliforms
LF= low flow
M = metals
N = nutrients
OD= oxygen demand
P = pesticides/herbicides
S = salinity
SS= suspended solids
T = turbidity
O = other (please specify) * Toxics

TABLE 7

INTERSTATE SANITATION COMMISSION
WATER QUALITY SAMPLING STATIONS - HELICOPTER RUN 1

STATION	LATITUDE NORTH D M S	LONGITUDE WEST D M S	DESCRIPTION
AK-03	40-38-18	74-11-45	At the center of & on the northside of the B&O R.R. Bridge
AK-07	40-35-35	74-12-22	Middle of mouth of Rahway River & in line with shoreline along Tremley Reach
AK-13	40-33-02	74-15-00	Mid-channel between Flashing Red Buoy #12 & Flashing Green, Black Buoy #1
AK-18	40-30-24	74-15-34	Mid-channel of Ward Point Bend (west) and opposite Perth Amboy Ferry Slip
AO-01	40-31-47	73-56-37	Flashing Red R "2" Gong (4 sec.)
JB-03	40-37-37	73-53-00	In channel 400 feet south of the end of Canarsie Pier
JB-05	40-35-45	73-48-40	At center pier of bridge over Beach Channel - Hammels
JB-07	40-38-52	73-49-20	At mouth of Bergen Basin, southeast of the sludge storage tank
LB-01	40-30-44	74-06-03	500 feet from Old Orchard Light in line with the beacon at Old Orchard Shore
NB-03	40-39-20	74-08-45	Northside of C.R.N.J. Bridge over the Newark Bay South Reach Channel (mid-channel)
NB-12	40-41-57	74-07-10	Newark Bay North Reach at mid channel northside of LVRR Bridge
RB-10	40-29-04	74-15-38	Qk Fl G "3" Buoy
RB-14	40-28-01	74-11-18	Buoy C "3" off Conaskonk Point at channel entrance to Keyport Harbor
RB-15	40-27-23	74-08-56	Private Fl G Buoy "1" on Belvedere Beach Point Comfort
RB-16	40-30-16	74-09-46	North side of Fl 4 sec 8M "20" Buoy located on northern boundary of Raritan Bay West Reach; off Huguenot Beach on Staten Island
RI-02	40-34-24	73-53-08	Under center of bridge from Barran Island to Rockaway
RI-03	40-33-21	73-56-51	Gong "9" Fl G 4 sec Buoy in Rockaway Inlet; northwest of Lookout Tower on Rockaway Point

TABLE 8

INTERSTATE SANITATION COMMISSION
WATER QUALITY SAMPLING STATIONS - HELICOPTER RUN 2

STATION	LATITUDE NORTH D M S	LONGITUDE WEST D M S	DESCRIPTION
HA-02	40-50-44	73-55-45	Hamilton Bridge (middle bridge of 3)
HR-01	40-42-20	74-01-36	Mid-channel of Hudson River N-S: Line of black buoys E-W: Fire Boat Pier (NY) and railroad pier (NJ)
HR-02	40-45-17	74-00-58	Mid-channel of Hudson River E-W: Heliport (NY) and Seatrain pier (NJ)
HR-03	40-47-41	73-59-09	Mid-channel of Hudson River E-W: Soldiers & Sailors Monument (NY) and circular apartment buildings (NJ)
HR-04	40-51-04	73-57-04	Mid-channel of Hudson River under George Washington Bridge
HR-05	40-52-40	73-55-02	Mid-channel of Spuyten Duyvil Creek under Henry Hudson Bridge
HR-07	40-56-51	73-54-27	Mid-channel of Hudson River E-W: Opposite Phelps Dodge (Yonkers)
LB-02	40-33-45	74-04-20	B.W. Bell off Midland Beach
LB-03	40-34-03	73-59-00	200 feet south of Steeplechase Pier at Coney Island - N "2S"
LB-04	40-35-00	74-00-51	1/4 mile northeast of Norton Point, near the White Nun Buoy
NJ-08	40-31-28	74-02-07	Buoy R "10S" Gong Fl R at northwest end of Swash Channel
UH-03	40-39-14	74-03-35	Passaic Valley Outfalls E-W: Robbins Reef Light and forward water tower on Naval Dock N-S: Statue of Liberty and Black Bell Buoy #1-G
UH-11	40-39-05	74-05-10	Located in the Kill Van Kull, in mid-channel & directly opposite Fl G & Black Buoy #3
UH-13	40-36-26	74-02-45	Middle of channel in Narrows under Verrazano Bridge
UH-21	40-40-23	74-02-28	Main ship channel 10 yards to the west of Fl R Bell Buoy #30
UH-22	40-38-25	74-02-50	In mid-channel of Bay Ridge Channel E-W: Flashing Red Beacon on 69th St. Ferry Dock (Brooklyn) N-S: Fl G Bell Buoy #3 and Fl R Gong Buoy #22
UH-29	40-42-17	73-59-54	Mid-channel of East River in line with Pier #11 (Manhattan) and Pier #1 (Brooklyn)

CHAPTER IV - A SYSTEM FOR RATING WATERBODIES AND THEIR WATER QUALITY MANAGEMENT NEEDS

Water pollution control agencies have in the past few years been making significant efforts towards setting priorities for their many activities so that positive results are maximized. These efforts at setting priorities on activities have largely been driven by reduced operational resources, as well as increased emphasis by the federal Environmental Protection Agency on the need for states to set priorities on their water quality management activities and waterbodies. The New Jersey Division of Water Resources recognizes there is a need to systematically evaluate the state's waters so that limited pollution control resources are allocated in an efficient and effective manner.

The New Jersey 1982 State Water Quality Inventory (305(b)) Report contains a "Surface Water Rating System" which assigns "Points" on the basis of water quality and water use to 29 segments (individual or grouped watersheds). The purpose of the rating system in the 1982 305(b) report is to highlight watersheds from the standpoint of degraded water quality and degree of water uses. Although the Division has developed priority systems and lists in the past for specific programs or problems, (such as Construction Grants projects, soil erosion rates by county, and enforcement actions), prior to the Surface Water Rating System, no statewide quantitative assessment had been produced which compares the relative water quality of specific streams with their water uses. Since the rating system has been developed, the Division of Water Resources (DWR) has incorporated its results into a number of programs such as strategies for correcting municipal wastewater facilities in non-compliance with their discharge permits, and in the conceptual development of a permit fee methodology for wastewater discharges.

The 1982 Surface Water Rating System has also been designed to be the basis for future rating systems because it does have certain current inherent limitations. These limitations include:

- The rating system does not fully take into account the potential for waterbodies to have certain or designated specific water uses improved or restored.

- The information used in the system was limited to quantitative data which could be easily compared and accumulated. Information used to describe certain water uses was based upon only indirect indicators of the importance of that use.

- Ratings were developed for 29 segments covering most of the state. These 29 segments, equivalent to the segments evaluated in the 305(b) report, generally encompass more than one distinct watershed. As such, actual water quality conditions and uses for areas of a watershed were often not accurately represented, especially when attempting to determine water quality management needs.

On the basis of the above restrictions a refined rating system has been developed for the 1984 305(b) report. The refined system takes into account, and attempts to correct, these limitations. This refined rating system, called a "A System for Rating Waterbodies and their Water

Quality Management Needs", is described below.

A. Description of a System for Rating Waterbodies and Water Quality Management Needs

This rating system has been devised to consist of two components - a quantitative assessment and a qualitative assessment. The quantitative assessment is based on the 1982 Surface Water Rating System and incorporates many of the same elements found in that system. The second component is new and consists of a Water Use and Resource Assessment. In addition, the system will look at the state as 148 segments versus the 29 segments reviewed in the 1982 305(b) report, (a list of these segments are found in Table IV-1). It is felt that with the Water Use and Resource Assessment, as well as the breakdown of the state into 148 segments, many of the limitations found in the 1982 305(b) system can be significantly reduced.

The 148 segments used in this rating system are based on a delineation of the state by the United States Soil Conservation Service (SCS) prepared in conjunction with the federal Water Resources Council, United States Geological Survey (USGS), and other federal and state agencies. The state has been divided into 12 hydrologic cataloging units by the Water Resources Council and USGS. From the 12 hydrologic cataloging units the SCS has delineated approximately 140 "small watersheds" for soil and agricultural management purposes (primarily for Small Watershed Projects as defined by PL-566). The DWR has modified the boundaries of a few of the small watersheds to conform with various Division activities, such as with shellfish sanitary survey boundaries. In addition, New York-New Jersey interstate waters, and the Delaware River and Bay have been delineated as segments. A statewide map identifying the 148 segments is available from the Bureau of Planning and Standards, DWR, upon request.

All streams in the state have also been arranged in a computer file by segment, through the incorporation of New Jersey's Universal Stream Numbering System (USNS). The USNS was prepared by the Bureau of Monitoring and Data Management, DWR, over the past five years as a way to catalog, number and [illegible] (by river mileage) all the state's streams and monitoring stations. Streams identified on USGS quadrangle maps are given unique streams numbers, stream level number and a river mile index. The resultant list of waterways includes nearly 1700 named streams and approximately 8900 unnamed or uncoded streams. A benefit of the USNS is that it allows various water-related factors to be added by river mile to the segment files. The location of point and non-point sources of pollution, water uses and sampling locations are expected to be added in each segment's computer file in future refinements to the system.

Quantitative Assessment - The Surface Water Rating

The Surface Water Rating or quantitative assessment is composed of many of the same parameters as was used in the rating system found in the 1982 305(b) report. Like the 1982 System, the Surface Water Rating contains a Water Quality Index and a Water Use Index, however, there are differences in the individual parameters and how they are evaluated. Ratings are given for the 148 segment discussed above compared to only 29 segments in the 1982 report. The Water Quality Index includes seven

Table IV-1 - Segmentation of the State Into Small Watersheds

Segments	Identifier Code
Wallkill River Basin	
Upper Wallkill River	02020007010
Papakating Creek	02020007020
Black Creek	02020007040
Lower Wallkill River	02020007030
Delaware River Basin	
Mill Brook	02040104090
Delaware River tributaries - Sussex County	02040104110
Little Flat Brook	02040104130
Big Flat Brook	02040104140
Flat Brook	02040104150
Vancampens Brook	02040104240
Dunfield Creek	02040104020
Swartzwood Lake	02040104030
Upper Paulins Kill	02040104040
Lower Paulins Kill	02040104050
Delawanna Creek	02040104060
Upper Pequest River	02040105070
Bear Creek	02040105080
Lower Pequest River	02040105090
Upper Musconetcong River	02040105150
Lower Musconetcong River	02040105160
Beaver Brook	02040105100
Buckhorn Creek	02040105110
Lopatcong Creek	02040105120
Pohatcong Creek	02040105140
Harihoke Creek to Warford Creek	02040105170
Locatong Creek and Wickecheoke Creek	02040105200
Alexauken Creek to Gold Run	02040105210
Upper Assunpink Creek	02040105230
Lower Assunpink Creek	02040105240
Duck Creek	02040201030
Upper Crosswicks Creek	02040201040
Lower Crosswicks Creek	02040201050
Doctors Creek	02040201060
Back Creek	02040201070
Blacks Creek	02040201080
Crafts Creek	02040201090
Assiscunk Creek	02040201100
Delaware River tributaries-Burlington County	02040201110
Upper North Branch Rancocas Creek	02040202020
Cranbury Brook	02040202030
Lower North Branch Rancocas Creek	02040202040
Upper South Branch Rancocas Creek	02040202050
Southwest Rancocas Creek	02040202060
Lower South Branch Rancocas Creek	02040202070
Rancocas Creek	02040202080
Swedes Run and Pompeston Creek	02040202090
Pennsauken Creek	02040202100
Cooper River	02040202110

Table IV - Continued

Segments	Identifier Code
Woodbury Creek and Big Timber Creek	02040202120
Mantua Creek	02040202130
Repaupo Creek	02040202140
Raccoon Creek	02040202150
Oldmans Creek	02040206010
Delaware River tributaries - Upper Salem County	02040206020
Upper Salem River	02040206030
Lower Salem River	02040206040
Delaware River tributaries - Central Salem County	02040206050
Alloways Creek	02040206060
Stow Creek	02040206070
Upper Cohansey River	02040206080
Lower Cohansey River	02040206090
Back, Cedar and Natuxent Creek	02040206100
Dividing Creek	02040206110
Still Run	02040206120
Scotland Run	02040206130
Upper Maurice River	02040206140
Muddy Run	02040206150
Union Lake	02040206160
Maurice River below Union Lake	02040206170
Manantico Creek	02040206180
Manumuskin Creek	02040206190
Lower Maurice River	02040206200
East and West Creeks	02040206210
Dennis Creek	02040206220
Delaware Bay tributaries - Cape May County	02040206230
Delaware River	
Zone 1A - State line to Delaware Water Gap	02040104001
Zone 1B - Water Gap to Riegelsville (Musconetcong River)	02040105001
Zone 1C - Riegelsville to Trenton	02040105002
Zone 2	02040201001
Zones 3 and 4	02040202001
Zone 5	02040206001
Zone 6	02040206002

<u>Atlantic Coastal Basin</u>

Navesink River	02030104070
Shrewsbury River	02030104080
Shark River	02030104090
Manasquan River	02040301010
North Branch Metedeconk River	02040301020
South Branch Metedeconk River	02040301030
Metedeconk River	02040301040
Kettle Creek and Northern Barnegat Bay	02040301050
Upper Toms River	02040301060
Union Branch	02040301070
Lower Toms River	02040301080
Cedar Creek	02040301090

Segments	Identifier Code
Central Barnegat Bay and tributaries	02040301100
Forked River	02040301110
Oyster Creek and Central Barnegat Bay	02040301120
Mill Creek, Cedar Run, Westecunk Creek and Lower Barnegat Bay	02040301130
Tuckerton Creek and Little Egg Harbor	02040301140
Batsto River	02040301150
Upper Mullica River	02040301160
Mid-Mullica River	02040301170
Oswego River	02040301180
West Branch Wading River	02040301190
Lower Mullica River	02040301200
Great Bay	02040301210
Upper Great Egg Harbor River	02040302030
Mid-Great Egg Harbor River	02040302040
Lower Great Egg Harbor River	02040302050
Patcong River and Lakes Bay	02040302060
Cape May Atlantic tributaries	02040302080
Tuckahoe River	02040302070
Doughty Creek	02040302010
Absecon Creek	02040302020
Raritan River Basin	
Lamington River	02030105050
Upper North Branch Raritan River	02030105060
Lower North Branch Raritan River	02030105070
Upper South Branch Raritan River	02030105010
Lower South Branch Raritan River	02030105020
Neshanic River	02030105030
Pleasant Run	02030105040
Stony Brook	02030105090
Upper Millstone River	02030105100
Lower Millstone River	02030105110
Lawrence Brook	02030105130
Manalapan Brook	02030105140
Matchaponix Brook	02030105150
South River	02030105160
Raritan River	02030105080
Lower Raritan River	02030105120
Raritan Bay tributaries	02030104060
Northeastern New Jersey Waters	
Elizabeth River	02030104020
Morses Creek	02030104030
Rahway River	02030104050
Bound Creek, Arthur Kill, Kill Van Kull, Newark Bay and Upper New York Bay	02030104010
Upper Passaic River - Headwaters to Livingston	02030103010
Mid-Passaic River - New River to Pompton River	02030103040
Whippany River	02030103020
Rockaway River	02030103030

Segments	Identification
Pequannock River	02030103050
Wanaque River	02030103070
Ramapo River	02030103110
Pompton River	02030103120
Mid-Passaic River - Pompton River to Garfield	02030103125
Lower Passaic River	02030103150
Saddle River	02030103140
Upper Hackensack River	02030103170
Lower Hackensack River	02030103180
Hudson River tributaries	02030101170

parameters: dissolved oxygen, total phosphorus, total dissolved solids, un-ionized ammonia, biochemical oxygen demand, fecal coliform and toxics. Besides the toxics information, all the water quality data used to develop ratings were based on results from either ambient monitoring stations or shellfish sanitary surveys. The toxics data is from the Office of Science and Research, and is equivalent to the toxics information in the 1982 305(b) report rating system.

The conventional water quality parameters evaluated were collected during the period 1977 to 1982 from all ambient fixed station monitoring locations in the state, including interstate waters. All conventional parameters are given points based on the percentage of values exceeding criteria in the State Surface Water Quality Standards or a recommended level. Recommended levels to compare measured values with were designed for biochemical oxygen demand (BOD) and fecal coliform because there is no standard for BOD and an insufficient number of fecal coliform values to allow direct comparison to standards. A value of 4.0 mg/l is used for a recommended level to evaluate BOD, (this level is used because it is roughly double the value considered equal to the natural background level of BOD). This value has been generated for this index only and is not to be confused with criteria presented in the State Surface Water Quality Standards. Fecal coliform points are given on the basis of the percentage of values exceeding a recommended level; this level varies with the waterbody being evaluated. A maximum of 100 points can be awarded for each of the 7 conventional parameters. When more than one monitoring station occurs in a segment, the violations for each station are averaged, followed by an average of all stationsin the segment.

The data utilized to assess the presence of toxic pollutants in each watershed was derived from a separate statewide survey conducted by NJDEP's Office of Science and Research in the late 1970s. Their study focused on the concentration of toxic substances in the water column, bottom sediments, and fish tissue. Point scores for toxics were based on the average levels found in sediment and water column only. The maximum "Toxics Subscore" is 100 points. This is based on the combination from a segment of a maximum 50 points for toxics in the water column and 50 points for toxics in sediments. Fish tissue values are in most instances from fish collected throughout the stream's length, and cannot be broken into values for the individual segments. Each sampling medium was evaluated separately for the levels found, and an average score given. Scores for each medium were based on non-detectable (0 points per medium), low (17 points per medium), moderate (34 points per medium) and high or excessive (50 points per medium) levels. The point scores for each of the two media are added together to get the final "Toxics Subscore". Some watersheds or segments were sampled for toxics in only one medium and therefore, their "Toxics Subscore" may not reflect actual conditions throughout the water environment. The "Toxic Subscore" is then added to the "Average Violations Subscore" to give the overall "Water Quality Index".

The Water Use Index of the quantitative assessment contains evaluations for potable water supplies, fisheries and shellfisheries resources and bathing locations. Agricultural water use, which was included in the

1982 Surface Water Rating, is not in the current Water Use Index because the information cannot divided into the 148 segments. The uses evaluated are defined below:

Potable Supply - Based upon data compiled by the Division of Water Resources on surface water diversions (million gallons per day) for the latest year with complete data.

Fisheries - Based upon data compiled by the Division of Fish, Game and Wildlife on number of fish stocked (average of last five years) and number of anadromous fish spawning runs confirmed.

Shellfish - Based upon percentage of "Approved" or "Seasonal" shellfish growing waters classified by the Division of Water Resources in each segment.

Since the importance of the four water uses varies from one section of the state to the next, or even from one watershed to the next, it was determined that equitability and objectivity would be best served by assigning to each parameter the same maximum possible point value. A maximum of 150 points was assigned to each of the four water use indices, resulting in a maximum possible "Water Use Score" of 600 points. The point value awarded to a given water use in a watershed is based on the percentage derived from the ratio of a watershed's use to the highest use watershed. Using this methodology to determine the Water Use Index enables each of the 148 segments to be assessed in relation to each other and to the state as a whole. In addition, the Fisheries index is composed of two categories, thus requiring an additional step to be performed to equally divide the point maximum parameter value, (resulting in a maximum of 75 points for each of the two categories within the parameter).

The total possible points for a Surface Water Rating, therefore, is 1300 (700 water quality points and 600 water use points).

Qualitative or Water Use and Resource Assessment

The Water Use and Resource Assessment has been designed to include in the rating system those water use and resource indices in which no quantitative data is available. Because of the lack of data, as well as the importance of these water uses, qualitative assessments are thought as the best method for considering the following variables:

- What is the quality of the existing resource base?
- How intense is the particular use? and
- What is the potential for improving a use or resource?

Answers to these questions are generated for freshwater fisheries, marine fisheries, shellfisheries and primary contact recreation for the purpose of the qualitative assessments. Table IV-2 presents how these uses will be reviewed for each segment. It is anticipated that with this type of information water quality managers will be able to select those management activities which would have a greater potential to maintain or improve water quality and uses.

Table IV-2 Water Use and Resource Assessment

Use/Resource	Existing Resource Base (Amount/Quality)			Intensity of Use[1]	Potential for Restoring Use/Improving or Resource[2]	Current Water Quality Rating to Use or Resource
	Small/Poor	Moderate	Large/Good			
1. Freshwater Fisheries						
A. Streams						
Trout						
Non-trout						
B. Lakes						
Trout						
Non-trout						
2. Marine Fisheries						
A. Anadromous Fish						
B. Nursery/Breeding						
C. Seasonal/Year-Round Use						
3. Shellfisheries						
A. Open Harvesting						
B. Seasonal Harvesting						
C. Restrictive Harvesting						
4. Primary Contact Recreation						
A. Swimming						
B. Wading						
5. Potable Water Supplies						

[1, 2] Rate Intensity/Potential by High, Moderate or Low

The information used in the qualitative assessment is based on questionnaires prepared by the DWR for completion by various state and local agencies. The NJ Division of Fish, Game and Wildlife's Bureaus of Freshwater Fisheries and Marine Fisheries will complete questionnaires for the assessment of fisheries and shellfisheries resources, respectively, and their aquatic environment throughout the state. The NJ Division of Parks and Forestry, Office of Green Acres and local health agencies will evaluate waters for suitability for contact recreation. The preparation and completion of these questionnaires with Departmental agencies addressing natural resource protection is an attempt to increase their input in water quality management programming activities so that DWR actions are coordinated to have optimum benefit. It is anticipated that the resource information gathered from these offices will be routinely updated on an annual or biennial basis. This update will likely consist of a review, and if necessary resubmittal, of a questionnaire.

B. Uses of the Waterbody Rating System

There has been an increase in interest throughout programs in the DWR for using a waterbody rating system to help determine where are the greatest water quality management needs. This interest is a result of greater emphasis towards the correction of long-term pollution problems, especially where significant water quality improvement or water use restoration may occur. The qualitative or Water Use and Resource Assessment in this rating system is expected to be an important information source to help make these decisions because it evaluates the potential for improving water quality and specific water uses in a segment. As such, the rating system is expected to be valuable to water quality program managers in two distinct ways. First, it allows direct comparisons between segments with regard to water quality and water uses when using the Surface Water Rating or quantitative assessment. The Surface Water Rating permits the use of a numerical comparison between segments, if needed, for purposes of direct ranking. Secondly, as described above, water quality planning activities will benefit from the qualitative assessment section because the intensity of uses at specific locations, and the potential of restoring or improving a use in a segment is evaluated.

The rating system and each segment's evaluation will eventually be stored on computer files. With the breakdown of all of the state's streams from the USNS into individual segment file, the location of point sources dischargers, monitoring stations, bathing beaches and other water quality variables by river mile will be available for inclusion into the system. This information will then be readily available to program planners to help determine where their respective activities may have the greatest potential benefits.

The information in the rating system can be useful for a variety of water quality management needs. As an example, the Division may want to set priorities for correcting 25 specific enforcement cases which are known pollution sources. In addition to reviewing the operational reasons for non-compliance, the impacts of the discharge on receiving waters, the quality of receiving waters and their uses, and the potential for restoring various water uses can be evaluated from the rating system. Together this information will allow rational decisions to be made so that enforcement actions may proceed by first emphasizing correction of those discharges, which when brought into compliance, will have the greatest impacts on improving water quality and in-stream uses. The rating system can also be used for the full spectrum of water quality management activities, from determining the need to conduct water quality monitoring to correction of non-point sources.

APPENDIX - Completion Guide for the Water Quality Management Progress Report

New Jersey Department of Environmental Protection
Division of Water Resources

I. Atlas

Information presented is based on readily available data.

II. Amibent Water Quality

A. Streams and Rivers (fresh waters only)

1.a. Miles Assessed: based on the estimation that general water quality conditions are known for 90% of the State's streams and rivers.

1.b. and c: Based on State Surface Water Quality Standards (same for "Lakes and Reservoirs" and "Estuaries and Oceans") below.

1.d. Miles Monitored: Figure represents the number of long-term monitoring stations in the State for which 4 or more years of water quality data are available times 5. Five is the number of stream miles each station is generally thought to represent (2.5 miles upstream and 2.5 miles downstream of station). Also includes figures presented by the Delaware River Basin Commission.

2. Evaluation of Support of Designated Uses.

For both 1972 and 1982 the figures shown are based on a statistical summary of monitoring station data for the years 1972 and 1982. The evaluation of support of designated uses follows the criteria in the STEP guidance. For each monitoring station with which data was available in 1972 and 1982 the following water quality indicators made up the evaluation: dissolved oxygen, fecal coliform, total phosphorus and unionized ammonia. Biological information assisted in the determination for 1982 only. A list of each station and the category assigned to it can be obtained from the N.J. Division of Water Resources upon request. Our evaluation generally equals "miles monitored," therefore a large percentage of stream miles fall under the "Unknown" category (i.e. there was no definitive and readily available information on the remaining miles of streams).

3. Changes in and Within Use Support.

Between 1972 and 1982: The "Miles Unknown" corresponds to the "Unknown" category in the Evaluation of Support of Designated Uses. The remaining 20% (10% improved, 7% maintained and 3% degraded) is based upon actual changes as represented by ambient monitoring station data and the overall reduction of pollutants in the State's major rivers and streams. This reduction in pollution levels is considered significant, yet many pollution indicators remain above certain quality criteria.

III.

B. Lakes and Reservoirs (Information for this section was provided by the DEP's Lake Management Program.)

2. Evaluation of Support of Designated Uses: No centralized information was available for 1972 on the quality of the State's publically owned lakes and reservoirs. 1982 figures based on information gathered through the DEP's Lakes Management Program's surveys of all publically-owned lakes (1977 to present).

3. Changes In and Within Use Support: Not available due to no information for 1972.

C. Estuaries and/or Oceans (Includes information provided by the Interstate Sanitation Commission and Delaware River Basin Commission)

1.a. Square miles assessed equals 90% of all ocean, tidal and estuarine waters of the State. This is based on fixed-station monitoring, shellfish harvesting areas monitoring, summertime ocean monitoring for dissolved oxygen, and general knowledge of the condition of remaining waters.

1.d. Square miles monitored is the amount of water for which long-term monitoring is available (most tidal, estuarine and coastal waters in State's jurisdiction are monitored for bacterial quality by DEP's Bureau of Shellfish Control).

2. Evaluation of Support of Designated Uses: Based on shellfish harvesting areas monitoring for bacteria, EPA's summertime ocean dissolved oxygen monitoring program (did not exist in 1972), and information supplied by the Interstate Sanitation Commission and Delaware River Basin Commission.

E. Causes for Less Than Full Support of Designated Uses in 1982.

1. By Pollution Sources

a. Streams and Rivers: Based on best professional judgement.
b. Lakes and Reservoirs: From a compilation of data from intensive surveys performed on the State's public lakes and reservoirs.
c. Estuaries and/or Oceans: Based on best professional judgement.

2. By Major Parameters of Concern: see footnotes for explanation of areas affected by toxics.

Point Sources

A. Municipal

1. Level of Wastewater Treatment Provided to State's Population. Was prepared as follows:

- The average yearly increase of population for New Jersey was based on the census years of 1970-1980.
- The base year of 1972 sewered population was determined by multiplying the 1972 total population by a factor of 0.77. This factor was determined by dividing the sewered population by the total population as determined from the 1978 Needs Survey.

- The base year of 1982 sewered population was determined from the 1982 Needs Survey.
- The total unsewered population was obtained by difference between total population and sewered population.
- The unsewered population requiring treatment systems was determined from the 1978 and 1982 Needs Surveys by recording the need for abandonment of septic systems and the population involved.
- The 1978 Survey sewered population flow percentages for each treatment category was determined. The 1972 sewered population was multiplied by these percentages for each category to obtain the 1972 sewered population for each category. The ratio of unsewered population requiring treatment to total unsewered population in 1978 was assumed to be the same for 1972.
- The number of people in each treatment category was shown in a bar graph for the base years 1972 and 1978.

2. Annual population equivalents of BOD loads generated vs loads discharged by municipal treatment facilities compared to 1982 load projections. Information for this was gathered from EPA's computerized data base (based on Discharge Monitoring Reports - DMRs). Flow and loading data for municipal facilities were obtained for three years (1982, 1979, and 1977), plotted and extrapolated to 1972. The information is only for facilities that fall under the S.I.C. catagory 4952 (Municipal). The following calculations developed the information shown in the graph:

BOD Loading	1982	1979	1977	1972(2)
Number of Plants Reporting	257	278	279(1)	---
Influent Loading (#BOD/day)	1,911,237	2,383,461	2,328,424	3,000,000
Number of Plants Reporting	260	279	280	260
Effluent Loading (#BOD/day)	457,895	1,211,754	1,456,728	2,700,000
% Removal	76%	49%	37%	10 - 30%(3)
Population Equivalents (#Loading/.2)				
(Influent)	9,600,000	---	---	15,000,000
(Effluent)	2,300,000			12,000,000(4)
(Projected)	8,600,000			

(1) A total of 279 plants for which BOD loading was obtained are compared to 256 plants for which flow data is available.

(2) Extrapolated values.
(3) Range is due to difference in extrapolated and best professional judgment values.
(4) Based on 20% removal.

It should be pointed out that the reduction in total BOD influent loading between 1972 and 1982 is due to reduced industrial contributions.

3. Significant Municipal Facility Compliance.

NOTE: Figures represent all municipal facilities with a S.I.C. number of 4952, and significant facilities only. Of the 298 facilities under the S.I.C. catagory 4952, 257 reported flow in the year 1982. The Division of Water Resources Violation Scoring System for permitted facilities identified 68 (23%) plants with significant violations. Of the plants reporting flow, 60% (578 mgd) of their total flow were in non-compliance. Information to differentiate between interim and final permits for was not readily available. The extrapolated information generated for 1972 did not appear to reasonably approximate conditions in that year, and therefore, year 1972 was listed as "NOT AVAILABLE." The number of facilities needing upgrading/regionalization is based on the 1982 New Jersey Needs Survey.

B. Non-Municipal Facility Compliance.

NOTE: Number of facilities equals all industrial and other non-municipal facilities for which fees are being assessed through the NJPDES permit program (1,018 facilities). Information for 1972 and interim 1982 permitted facilities was not readily available. Of the 1,018 facilities, 804 (79%) are in compliance with permit requirements. Since industrial permittees do not ordinarily report flow on their DMR's, it was decided to draw information on flow for these discharges from the only organized computer package presently available, namely the Division's permittee fee schedule. By taking those permittees reporting flow and comparing the list with the Division's Violation Scoring System for 1982, a total amount of significant violating flow (for permittees with annual violation points greater than 50) was determined. Of 1,018 permittees, 460 reported flow; of these 460, 252 were industrial discharges other than thermal and 208 were thermal. Determination of percentage of flow meeting requirements was made in the following manner:

1982 DATA (INDUSTRIAL) (From Fees)

No. of Permittees 604 Industrial
414 Thermal
1018 Total

No. of Permittees Reporting Flow	Gallonage (MGD) (Average Flow)
252 Industrial	5,931.1359
208 Thermal	16,843.1494
460 Total	22,774.2853 MGD Total

No. of Permittees Reporting Flow (With Annual Violations Scores Greater than 50) for 1982	Gallonage (MGD) (Average Flow)
89 Industrial	4,124.9423
48 Thermal	3,908.4045
137 Total	8,033.3468

RATIOS

	Number	Flow
Industrial Violators	89 / 252 = 35.3%	4,127.9423 / 5,931.1359 = 69.5%

	Number		Flow	
Thermal Violators	48 / 208	= 23.1%	3,908.4045 / 16,843.1494	= 23.2%
Total Violators	137 / 460	= 29.8%	8,033.3468 / 22,774.2853	= 35.3%

IV. Non-Point Source Pollution Control

Provided as requested.

V. Water Quality Management Program Elements

A.2. Enforcement. Number of facilities from the Division of Water Resources Enforcement Element. Enforcement actions include those from all facilities, not just in significant non-compliance.

B. Municipal Facility Investment. Information for this section was obtained in the following manner:

- EPA and other federal funds were obtained from GICS (Grants Information Control System)
- State funds were obtained from State funding records
- Local match funds were obtained from the difference between project eligible costs and the sum of federal EPA and State funds expended
- Other local funds were obtained from records of non-funded project costs for the years 1979 through 1982. The average amount expended by 10 and added to the ineligible project costs.
- Ineligible project costs were determined by studying the average ratio of eligible costs to total capital construction costs in eight facility plans from various parts of the State.

VI-IX. These sections contain the information as described in the section title.