

# **New Jersey's Watershed Health Report Card: The Case for a Stronger State Clean Water Program**

A Report

By

The New Jersey Public Interest Research Group Law and Policy Center

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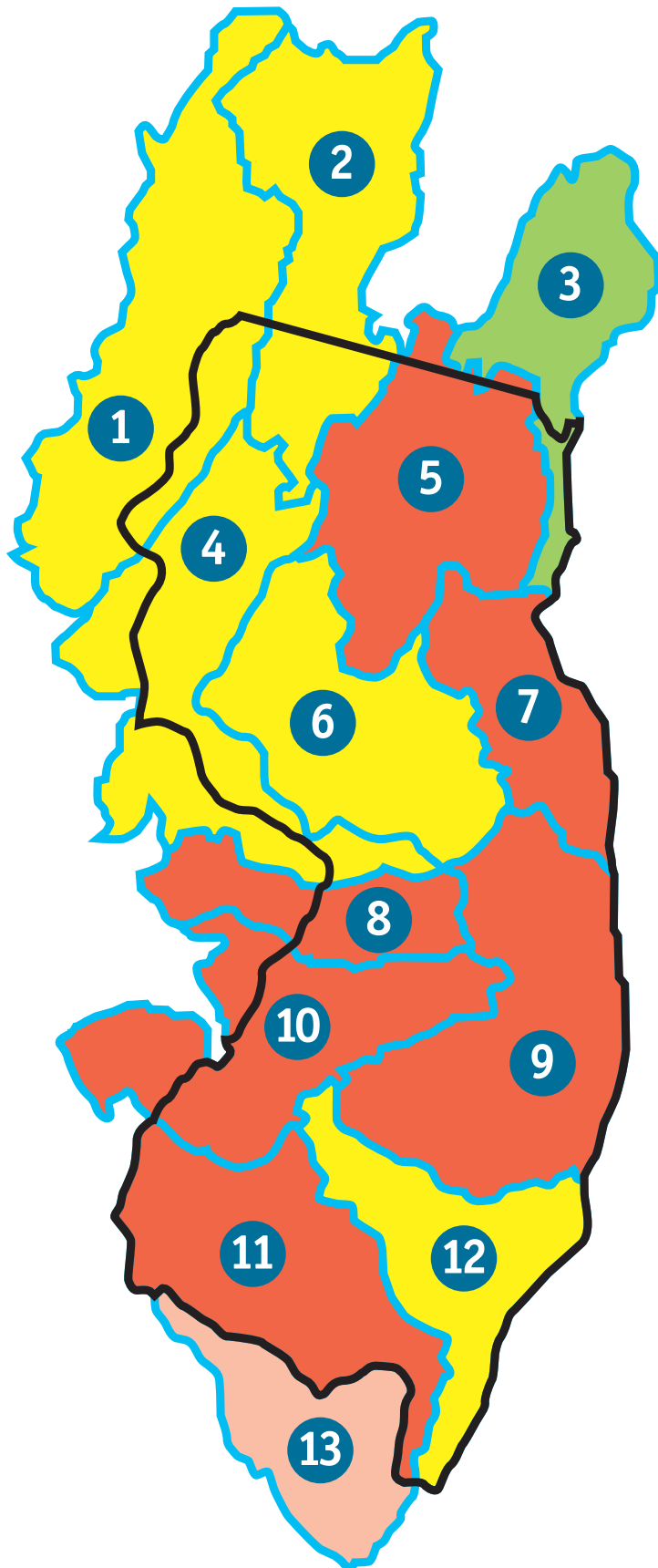
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# New Jersey WATERSHED HEALTH MAP



**KEY:**

- More Serious Water Quality Problems (High Risk in the Future)
- Serious Water Quality Problems (High Risk In the Future)
- Serious Water Quality Problems (Less Risk in the Future)
- Better Water Quality (High Risk in the Future)

## New Jersey's Watersheds:

1. Middle Delaware-Mongaup-Broadhead
2. Rondout
3. Lower Hudson
4. Middle Delaware-Musconetcong
5. Hackensack-Passaic
6. Raritan
7. Sandy Hook-Staten Island
8. Crosswicks-Neshaminy
9. Mullica-Toms
10. Lower Delaware
11. Cohansey-Maurice
12. Great Egg Harbor
13. Delaware Bay

## **Executive Summary**

NJPIRG Law and Policy Center's report *New Jersey's Watershed Health Report Card: The Case for a Stronger Clean Water Program*, written by Clean Water Advocate Dena Mottola, presents data from the United States Environmental Protection Agency (EPA) documenting that New Jersey has failed to restore and protect the health of its rivers and streams. As a result, New Jersey's watersheds (the land area that drains all local waterbodies, affecting their flow, water level, and pollution level) are the most unhealthy and most threatened watersheds in the nation.

Clearly, the condition of New Jersey's watersheds is not surprising, given that the state is the most densely populated and most industrialized in the nation. The challenges that New Jersey faces to protecting our waterways only serves to underscore the need for a stronger clean water program. In response to these challenges, this report concludes that New Jersey's clean water program must be the strongest in the nation, and act as a model for other states.

About five million New Jersey residents drink water drawn from the surface waters of the state. Failure to protect our watersheds has real consequences, putting New Jerseyans' public health at risk from unsafe drinking water, and unsafe recreational use of waterways for fishing and swimming. This report makes the urgent case that significant improvements to New Jersey's clean water program must be made immediately.

The report's major findings include:

- 42.9% of New Jersey's watersheds, the greatest percentage in the nation, have received the EPA's worst possible watershed health score, compared with only 1.7% of the nation's watersheds.

Six New Jersey watersheds received the lowest score. They are: the Cohansey – Maurice (DE/NJ), the Crosswicks-Neshaminy (NJ/PA), the Hackensack-Passaic (NJ/NY), the Lower Delaware (NJ/PA), the Mullica-Toms (NJ), and the Sandy Hook-Staten Island (NJ/NY) watersheds. These watersheds not only have serious water quality problems, but are also considered by the EPA to be highly vulnerable to even further declines in water quality.

- 92.9% of New Jersey's watersheds are highly vulnerable to further declines in water quality, compared with 5.6% nationally.

Only one New Jersey watershed, the Delaware Bay (DE/NJ/PA), is not highly vulnerable to a decline in water quality.

- The watershed health scores for 57.1 % of New Jersey's watersheds have declined from 1997 – 1999, compared to only 10 % – 13% nationally. Only 14.3% have improved (the remainder stayed constant).

Eight New Jersey Watersheds declined in water quality from 1997 - 1999. They are the Delaware Bay (DE/NJ/PA), the Hackensack-Passaic (NJ/NY), Lehigh (NJ/PA), the Lower Delaware (NJ/PA), the Middle Delaware-Mongaup-Brodhead (NJ/NY/PA), the Middle Delaware-Musconetcong (NJ/PA), Roundout (NJ/NY), and Sandy Hook-Staten Island (NJ/NY).

The report addresses five points. First, this report presents the EPA 'health' scores for each of New Jersey's fourteen watersheds. The scores are based on the latest and most comprehensive data available about both the current quality of New Jersey's waterways and the factors that threaten to put our watersheds at risk of even further health declines in the future. Secondly, the report provides a comparison of New Jersey's scores with the scores of all the watersheds in the nation. Third, it includes a comparison of New Jersey's scores with the scores of other states that, like New Jersey, face serious water quality problems. Next, the report presents both the current and past scores for each New Jersey watershed, in order to show trends, either towards improved, sustained or declined watershed health. Finally, the report presents recommendations for policies that would strengthen New Jersey's clean water program.

The NJPIRG Law and Policy Center recommends these policy changes to address water pollution in New Jersey:

- Strengthen protections for drinking water supplies and other key waters -- Provide these waters with the same level of protection (classification upgrades) current New Jersey regulations only afford to trout streams;
- Stop overdevelopment from threatening our water -- Ban new or expanded wastewater systems in areas that are both major water supply watersheds and of natural significance that contain endangered/threatened species or exceptional scenic value;
- Clean up the State's most polluted waterways -- Set water quality based standards (WQBEL's) on dischargers, and implement clean-up plans (TMDL's), within 5 years;
- Force sewer plants to reduce water pollution -- Apply comprehensive environmental (anti-degradation) reviews to existing, and new, sewer plants and lines; and
- Ensure adequate water supply -- Review the adequacy of the local water supply for all proposed development in areas with low water supply, including a study in the State's Atlantic coastal counties on depletive/consumption uses and shifting

away from current practices that fail to adequately recharge local waterways and aquifers

These recommendations, if adopted by the Administration, would place the State back on a course toward meeting the Clean Water Act's mandate to "enhance, maintain, and restore the physical, chemical and biological integrity of the nation's waters".

## **Introduction**

The USEPA has posted a website, [www.epa.gov/surf](http://www.epa.gov/surf) that characterizes or scores all watersheds <sup>1</sup> in the nation on a scale of 1 to 6 for overall health. A watershed is broadly defined as the land area that drains to a waterbody and affects its flow, water level, loadings or pollutants. For the purposes of this report, watershed boundaries are defined by the EPA, and do not correspond with the New Jersey Department of Environmental Protection's watershed boundaries. (See Appendix A for a complete list of New Jersey watersheds and the counties they are located within.)

The scores, 1 – 6, are based on the EPA's Index of Watershed Indicators, (The IWI or Index) which includes a variety of indicators that point to whether rivers, lakes, streams, wetlands, and coastal areas are “well” or “ailing” and whether activities on the surrounding lands that affect our waters are placing them at risk.<sup>2</sup> (A complete description of these indicators can be found in Appendix B.)

The Index of Watershed Indicators characterizes both the condition and vulnerability of waterways in 1667 of the 2262 watersheds in the 50 states and Puerto Rico for which sufficient data exists. (Nationally, 595 watersheds or 26% of watersheds were not characterized for condition or vulnerability because insufficient data exists from those watersheds.)

- First, indicators of the conditions of the watershed are scored and watersheds are assigned to one of three categories: better water quality, water quality with less serious problems, and water quality with more serious problems.
- Second, indicators of vulnerability of the watershed are scored and the watershed is characterized: high or low vulnerability.
- These two sets of indicators are then combined.
- Each watershed gets a score based on the combination of scores.

### **Condition and Vulnerability Scores**

**1** – Better Water Quality / Low Vulnerability

**2** – Better Water Quality / High Vulnerability

**3** - Less Serious Problems / Low Vulnerability

**4** - Less Serious Problems / High Vulnerability

**5** – More Serious Problems / Low Vulnerability

**6** – More Serious Problems / High Vulnerability

#### *Watersheds with Better Water Quality*

Watersheds where data are sufficient to assert that the State or Tribal designated uses are largely met and other indicators of watershed condition show few problems.

#### *Watersheds with Less Serious Water Quality Problems*

Watersheds with aquatic conditions below State or Tribal water quality goals that have problems revealed by condition indicators.

*Watersheds with More Serious Water Quality Problems*

Watersheds with aquatic conditions well below State or Tribal water quality goals that have serious problems exposed by condition indicators.

*Watersheds with High Vulnerability to Stressors*

Watersheds where data suggest significant pollution and other stressors and, therefore, a higher vulnerability to declines in aquatic health. These watersheds have the greatest need for actions to protect quality and prevent decline.

*Watersheds with Low Vulnerability to Stressors*

Watersheds where data suggest pollutants or other stressors are low, and, therefore there exists a lower potential for future declines in aquatic health. Actions to prevent declines in aquatic conditions in these watersheds are appropriate but at a lower priority than in watersheds with higher vulnerability.

## New Jersey Watershed Health Scores

### Key findings:

- 92.9% of New Jersey watersheds are ‘highly vulnerable’ to further declines in water quality.
- 50% of New Jersey watersheds have ‘more serious water quality problems’.<sup>3</sup>
- 42.9% of New Jersey watersheds received the lowest score, 6, for ‘more serious water quality problems’ and ‘highly vulnerable’ to further declines in water quality.<sup>4</sup>

	<b>Ranking</b>	<b>Number of Watersheds</b>	<b>Percentage</b>	<b>Watersheds</b>
Better Water Quality / Low Vulnerability	1	0	0 %	N/a
Better Water Quality / High Vulnerability	2	2	14.3 %	Lehigh (NJ/PA) Lower Hudson (CT/NJ/NY)
Less Serious Water Quality Problems / Low Vulnerability	3	0	0 %	N/a
Less Serious Water Quality Problems / High Vulnerability	4	5	35.7 %	Great Egg Harbor (NJ) Middle Delaware-Mongaup-Brodhead (NJ/NY/PA) Middle Delaware –Musconetcong (NJ/PA) Raritan (NJ) Roundout (NJ/NY)
More Serious Water Quality Problems / Low Vulnerability	5	1	7.1 %	Delaware Bay (DE/NJ/PA)
More Serious Water Quality Problems / High Vulnerability	6	6	42.9 %	Cohansey-Maurice (DE/NJ) Crosswicks-Neshaminy (NJ/PA) Hackensack-Passaic (NJ/NY) Lower Delaware (NJ/PA) Mullica-Toms (NJ) Sandy Hook - Staten Island (NJ/NY)
Data Sufficiency Threshold Not Met		0	0%	N/a

## **Comparison of New Jersey and National Watershed Health Scores**

### **Summary Findings:**

- 92.9% of New Jersey watersheds are highly vulnerable to further declines in water quality, compared with 5.6% nationally.
- 42.9% of New Jersey watersheds are scored “6”, having serious water quality problems and highly vulnerable to further declines, compared with 1.7% nationally.
- 50% of New Jersey watersheds compared to 32.1% of watersheds nationally have serious water quality problems.

<b>Ranking</b>	<b>New Jersey</b>	<b>National</b>
Better Water Quality / Low Vulnerability	0%	13.7 %
Better Water Quality / High Vulnerability	14.3%	1.3 %
Less Serious Water Quality Problems / Low Vulnerability	0%	32.5 %
Less Serious Water Quality Problems / High Vulnerability	35.7%	2.6 %
More Serious Water Quality Problems / Low Vulnerability	7.1%	21.9 %
More Serious Water Quality Problems / High Vulnerability	42.9%	1.7 %
Data Sufficiency Threshold Not Met	0%	26.3 %

## **Comparison of States With the Worst Watershed Health Score (6) More Serious Water Quality Problems – High Vulnerability**

### **Key Findings**

- New Jersey has the greatest percentage of watersheds scored 6 in the nation.<sup>5</sup>

<b>State</b>	<b>Percent of Watersheds Scored 6</b>
New Jersey	42.9 %
Delaware	30 %
Massachusetts	15 %
Indiana	12.2 %
Kentucky	10.4 %
Louisiana	8.3 %
Pennsylvania	6.9 %
Mississippi	6.8 %
Ohio	6.7 %
Maryland	4.2 %
Florida	3.7 %
Wisconsin	3.6 %
Minnesota	3.5 %
New York	3.5 %
Tennessee	3.3 %
Missouri	3 %
National	2.3 %
Kansas	2.2 %
California	2 %
Alabama	1.9 %
Georgia	1.9 %
Michigan	1.5 %

## New Jersey Watershed Health Score Trends 1997 – 1999

**Key Findings:**

- The scores for 57.1 % of NJ watersheds have declined from 1997 – 1999.
- The scores for 28.6% of NJ watersheds remained the same from 1997 – 1999.
- The scores for 14.3% of NJ watersheds improved from 1997 – 1999.

<b>NJ Watershed</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>Change</b>
Cohansey – Maurice (DE/NJ)	6	6	6	No change
Crosswicks – Neshaminy (NJ / PA)	6	6	6	No change
Delaware Bay (DE/NJ/PA)	3	3	5	-
Great Egg Harbor (NJ)	4	4	4	No change
Hackensack – Passaic (NJ/NJ)	5	5	6	-
Lehigh (NJ/PA)	1	1	2	-
Lower Delaware (NJ/PA)	4	4	6	-
Lower Hudson (CT/NJ/NY)	4	4	2	+
Middle Delaware – Mongaup – Brodhead (NJ/NY/PA)	1	1	4	-
Middle Delaware – Musconetcong (NJ/PA)	2	4	4	-
Mullica – Toms (NJ)	6	6	6	No change
Raritan (NJ)	6	4	4	+
Rondout (NJ/NY)	3	3	4	-
Sandy Hook –Staten Island (NJ/NY)	5	5	6	-

## National Watershed Health Score Trends

### Key Findings

- Most watershed scores in the nation have remained the same from 1997 - 1999.
- Slightly more watersheds in the nation have declined than improved from 1997 - 1999.

### October 1997 – October 1998

Category	Number of Watersheds
Improvement	244
No Difference	1119
Decline	210

### April 1999 – September 1999

Category	Number of watersheds
Improvement	157
No Difference	1280
Decline	169

## **Policy Recommendations**

These policy recommendations are a package. They are intended to be implemented together, as a comprehensive approach to limiting the amount of water pollution from the largest sources in New Jersey: overdevelopment, sewer plants and other industrial dischargers.

### **Strengthen Protections for Drinking Water Sources**

- DEP should upgrade the protective status of all drinking water reservoirs, reservoir feeder streams, and water upstream of water supply intakes.

Provide for a higher level of protection for the state's waterways that serve as major drinking water supplies by upgrading all drinking water reservoirs, reservoir feeder streams, and water upstream of water supply intakes to DEP's C1 stream classification. Currently, waterways used for trout maintenance have more protection under the DEP stream classification system, than most surface waters used to supply drinking water to the residents of New Jersey. Waterways protected by C1 status cannot be significantly degraded unless there is a pressing social or economic need.

### **Clean Up the State's Most Polluted Waterways**

- Set water-quality based standards (WQBELs) to protect our public health within five years.

Implement stricter, more protective water quality based standards by shifting from a technology based pollution control approach to a water quality based pollution control approach, as required under the federal Clean Water Act of 1972. The extensive list of seriously polluted New Jersey waterways documented by the DEP in the Section 305(b) and 303(d) reports is evidence that the pollution control technology approach fails to reduce pollution and protect public health. The Clean Water Act mandates that more stringent protections be implemented and enforced when the use of technology based pollution control requirements fail to protect the water quality in the receiving river or stream.

- Implement cleanup plans for all New Jersey's 1,042 impaired water segments within five years.

Conduct TMDL (Total Maximum Daily Loads) clean ups of the 1,042 water segments (948 river and stream sections and 94 polluted lakes) listed on the New Jersey 1998 impaired list, the 303(d) list. Section 303 (d) of the Clean Water Act requires New Jersey to list all waterways that do not meet water quality standards (based on 'fishability and swimmability'). Congress mandated that for waterways that do not meet the "fishable and swimmable" standards of the Clean Water Act, states were required to impose a clean-up plan in order to achieve water quality goals. TMDLs are the basis for establishing water quality based effluent levels (WQBELs) that determine pollution permit levels equal to the amount of pollution that a water body can carry without

becoming impaired. Despite federal mandates and citizen suits, the DEP has failed to complete a single clean-up.

### **Force Sewer Plants to Reduce Pollution**

- The DEP should require sewer treatment plants to conduct a comprehensive environmental analysis, to reduce pollution, from existing and new sewer treatment plants and lines.

The Clean Water Act mandated the implementation of an anti-degradation policy in order to maintain and protect high quality and pristine rivers, lakes, and streams. The DEP has recognized that anti-degradation policies apply to all surface waters of the state, but has not implemented them in New Jersey's pollution control permit program. These policies strictly limit the lowering of water quality. Existing uses must either be maintained or protected, and no irreversible changes to water quality are allowed that would impair or preclude attainment of designated uses. Waters classified as non-degradation waters must be maintained in their natural state, and are not to be subjected to any manmade wastewater dischargers. In instances where DEP actions or decisions would lower water quality, state and federal mandates require a water quality analysis and public review of the impact that the increased pollution would have on the receiving water body. Further, justification for the lowering of water quality in a given river, lake or stream must be made to support important social and economic objectives. Under state and federal regulations, DEP is required to conduct anti-degradation reviews before pollution discharge permits are issued.

### **Stop Overdevelopment from Threatening Our Water**

- Ban new or expanded sewer service in environmentally sensitive areas.

Ban all new and expanded sewer lines in environmentally sensitive areas. These areas would include all C (1) watersheds and areas which are both 1) potable water supply areas and 2) areas of natural significance that contain endangered species or exceptional scenic value.

- Designate buffer zones around reservoirs and water supply sources.

Designates buffer zones, or no-development zones, around reservoirs and other water supply sources. "The Public Surface Water Supply Act", Assembly Bill No. 371 (Assemblyman Rooney and Assemblywoman Rose Marie Heck), has been introduced. The bill would provide that no person may engage in any of the following activities in a watershed management area: remove or dredge of material of any kind; drain or disturb water; dump, discharge or fill with any material; drive pilings, place obstructions, destroy plant life, construct any building or structure; pave any road or other impervious surface; apply or dispose of pesticides; and any other activity deemed by the DEP to be harmful to the public water supply. Bill allows for limited exemptions.

- Prohibit highway building along rivers.

Prohibit the building of highways and roads along rivers. Legislation will be introduced this spring.

**Ensure Adequate Water Supply**

- Require sewer treatment plants to return treated water to the natural water cycle.

Make state funding available for a pilot project in Ocean, Cape May, Monmouth, Atlantic to study how sewer plants can shift from current practice of discharging into oceans to instead recharge local waterways and aquifers.

- Ensure development doesn't outpace water supply.

The DEP should review the adequacy of the local water supply for all proposed development in areas with low water supply and implement policies to ensure development does not outpace water supply.

## **Conclusion**

Most people are not surprised by the poor quality of New Jersey's watersheds, given that the state is the most densely populated and most industrialized in the nation. The challenges that New Jersey faces to protecting our waterways only serves to underscore the urgent need for a stronger clean water program. In response to these challenges, this report concludes that New Jersey's clean water program must be the strongest in the nation, and act as a model for other states.

## Notes

<sup>1</sup>Watershed in this case is defined by USGS 8 digit huc (hydrologic unit code) codes, the smallest nationally consistent set of watersheds in the huc system. Hucs are watershed boundaries based on surface hydrological features. These boundaries do not correspond with NJDEP watershed management areas, and some span more than one state. New Jersey spans 14 watersheds, as defined by the 8 digit huc code system.

<sup>2</sup> EPA “Surf Your Watershed” website.

<sup>3</sup> 50% is a conservative calculation, based on a total of 14 watersheds that are at all located in New Jersey. Two of the 14 watersheds, the Lehigh and the Lower Hudson, which received an EPA watershed health score of “2” for Better Water Quality, Highly Vulnerable to further declines in water quality, are primarily located in bordering states.

<sup>4</sup> 42.9% is a conservative calculation, based on a total of 14 watersheds that are at all located in New Jersey. Two of the 14 watersheds, the Lehigh and the Lower Hudson, which received an EPA watershed health score of “2” for Better Water Quality, Highly Vulnerable to further declines in water quality, are primarily located in bordering states.

<sup>5</sup> NJPIRG compiled this data from the EPA’s Surf Your Watershed website. Many states listed here had a number of watersheds that could not be scored due to lack of sufficient data.

## **Appendix A: New Jersey Counties\* / Watershed Locator**

### **More Serious Water Quality Problems High Vulnerability**

#### *Cohansey – Maurice Watershed*

Atlantic County  
Camden County  
Cape May County  
Cumberland County  
Gloucester County  
Salem County

#### *Crosswicks / Neshaminy Watershed*

Burlington County  
Mercer County  
Monmouth County  
Ocean County

#### *Hackensack – Passaic Watershed*

Bergen County  
Essex County  
Hudson County  
Morris County  
Passaic County  
Somerset County  
Sussex County  
Union County

#### *Lower Delaware Watershed*

Burlington County  
Camden County  
Gloucester County  
Ocean County

#### *Mullica – Toms Watershed*

Atlantic County  
Burlington County  
Camden County  
Monmouth County  
Ocean County

#### *Sandy Hook – Staten Island Watershed*

Essex County  
Hudson County  
Middlesex County  
Monmouth County  
Union County

### **More Serious Water Quality Problems Low Vulnerability**

#### *Delaware Bay Watershed*

Cape May County  
Cumberland County  
Gloucester County  
Salem County  
Sussex County

### **Less Serious Water Quality Problems High Vulnerability**

#### *Raritan Watershed*

Hunterdon County  
Mercer County  
Middlesex County  
Monmouth County  
Morris County  
Somerset County  
Union County

#### *Great Egg Harbor Watershed*

Atlantic County  
Camden County  
Cape May County  
Cumberland County  
Gloucester County

#### *Roundout Watershed*

Passaic County  
Sussex County

#### *Middle Delaware – Mongaup Watershed*

Sussex County  
Warren County

#### *Middle Delaware – Muscongecong Watershed*

Hunterdon County  
Mercer County  
Monmouth County  
Morris County  
Sussex County  
Warren County

### **Better Water Quality High Vulnerability**

#### *Lehigh Watershed*

Warren County

#### *Lower Hudson Watershed*

Bergen County

- Most counties span more than one watershed.

## **Appendix B: The EPA Index of Watershed Indicators**

The EPA collaborated with states, tribes, private organizations and other federal agencies to choose the original 15 condition and vulnerability indicators, or data layers, used to rate the overall “health” of our waters. Since the original Index was released in October of 1997, one additional indicator has been added, making a total of 16 indicators.

Seven of the indicators are related to the condition of the waterways and nine are related to vulnerability. Condition indicators are designed to show existing watershed health across the country. These indicators include such things as waters meeting state or tribal designated uses, contaminated sediments, ambient water quality, and wetlands loss. Vulnerability Indicators are designed to indicate where pollution discharges and other activities put pressure on the watershed. These could cause future problems to occur. Activities in this category include such things as pollutant loads discharged in excess of permitted levels pollution potential from urban and agricultural lands, and changes in human population levels.

The EPA has also been compiling existing data for four additional indicators that are, at this time, candidates for inclusion in the Index of Watershed Indicators. They are also working to add indicators that describe the actions that agencies and individuals are taking to improve the condition of water resources.

In addition to adding new indicators or data sets, every year the EPA updates the Index with the most recent data from each of the 16 data sets as it becomes available. As a result, scores for watersheds change, and past scores are available for each watershed.

In aggregating the 16 Indicators into the overall Index, Indicator #1, Assessed Rivers Meeting All Designated Use, is weighted more heavily than other Indicators because it is a comprehensive assessment of waterway quality in the state. All other condition and vulnerability indicators are weighted equally. At least 10 of the 16 data layers must be present to calculate the overall index for any given watershed. If sufficient data for Indicator #1 was not available, the values of the other indicators of condition were multiplied by three to derive an Index score.

### **The Condition Indicators**

The seven indicators below are condition indicators.

#### **1) Assessed Rivers Meeting All Designated Uses**

Information reported by Tribes and States on the percentage of waters within the watershed that meet all uses established for those waters as reported in 1994, 1996 and 1998 reports to EPA under the Clean Water Act section 305(b).

Source: The 1998 National Water Quality Inventory Report (305(b))

## **2) Fish and Wildlife Consumption Advisories**

Recommendations by Tribes or States to restrict consumption of locally harvested fish or game due to the presence of contaminants.

Source: The 1998 National Listing of Fish and Wildlife Consumption Advisories

## **3) Indicators of Source Water Quality for Drinking Water Systems**

Three data (1990 – 1998) sets combined to provide a partial picture of the condition of rivers, lakes/reservoirs, and ground waters used by public drinking water systems: a) New Jersey's assessment of surface waters meeting "water supply" designated use (305(b)); b) water system treatment and violation data appropriate to use as surrogates of source water condition (SDWIS); and c) occurrence at significant levels in source water of chemicals regulated under the Safe Drinking Water Act.

Sources: The 1998 National Water Quality Inventory Report (305(b)) and the EPA STORET database

## **4) Contaminated Sediments**

The level of potential risk to human health and the environment from sediment chemical analysis, sediment toxicity data, and fish tissue residue data.

Source: National Sediment Inventory (1980 – 1993)

## **5) Ambient Water Quality – (Four Toxic Pollutants)**

Ambient water quality data showing percent exceedences of national criteria levels, over an eight year period (1990-1998) of copper, chromium (hexavalent), nickel, and zinc.

Source: EPA STORET database

## **6) Ambient Water Quality (Four Conventional Pollutants)**

Ambient water quality data showing percent exceedences of national reference levels, over eight years (1990-1998) of ammonia, dissolved oxygen, phosphorous, and pH.

Source: EPA STORET database

## **7) Wetland Loss Index**

Percentage of wetlands lost over an historic period and a more recent period.

Sources: US Fish and Wildlife Service National Wetland Inventory (1982-1992) and the Natural Resources Conservation Service National Resource Inventory (1780-1980)

## **The Vulnerability Indicators**

The nine indicators below are vulnerability indicators.

### **8) Aquatic/Wetland Species at Risk**

Assessing the conservation of plants and animals at the greatest risk of extinction.

Source: The Nature Conservancy/State Heritage Database (1996)

### **9) Toxic Pollution Loads Over Permit Limits**

Discharges over a one year period for toxic pollutants are combined and expressed as a percentage above or below the total discharges allowed under the National Pollutant Discharge Elimination System (NPDES) permitted amount.

Source: EPA's Permit Compliance System (1999)

### **10) Conventional Pollutant Loads Over Permit Limits**

Discharges over a one year period for conventional pollutants are combined and expressed as a percentage above or below the total discharges allowed under the National Pollutant Discharge Elimination System (NPDES) permitted amount.

Source: EPA's Permit Compliance System (1999)

### **11) Urban Runoff Potential**

The potential for urban runoff impacts is estimated based on the percentage of impervious surface in the watershed (roads, paved parking, roofs, etc.)

Source: EPA calculations based on US Census Bureau data and US Geological Survey land use data and estimated population growth from 1978 – 1990.

### **12) Index of Agricultural Runoff Potential**

A composite index comprised of a) potential index calculating nitrogen runoff from farm fields, b) model calculating delivery of sediment to rivers and streams from cropland and pastureland, and c) potential index calculating for pesticide runoff from farm fields.

Source: Natural Resources Conservation Service and National Resources Inventory (1990 – 1995)

### **13) Population Change**

Population growth rate as a surrogate of many stress-producing activities from urbanization

Source: Census Bureau (1980 – 1990)

#### **14) Hydrologic Modification – Dams**

This index shows relative reservoir impoundment volume in the watershed. The process of impounding streams changes their characteristics and the reservoirs and lakes formed in the process can be more susceptible to pollution stress.

Source: US Army Corps of Engineers (1995 - 1996)

#### **15) Estuarine Pollution Susceptibility Index**

This measures an estuary's susceptibility to pollution based on its physical characteristics and the propensity to concentrate pollutants.

Source: National Oceanic and Atmospheric Administration (1989 – 1991)

#### **16) Atmospheric Deposition**

Information from the National Atmospheric Deposition Program / National Trends depicts nitrogen (NO<sub>3</sub> and NH<sub>4</sub>) deposition in the water from the air. (1996)