# The Lower Hudson River Basin

## Basin Description

The Lower Hudson River Basin makes up about forty percent of the larger Hudson/Mohawk River Basin, which also includes the Upper Hudson and Mohawk River Basins and is one of the largest drainage areas on the eastern seaboard of the United States. Taken together, these three basins drain over 12,800 square miles (including one-quarter of New York State), covering much of eastern New York State and small portions of New Jersey, Connecticut, Massachusetts and Vermont. The Lower Hudson River Drainage Basin, which includes all the waters that drain into the Hudson below the Federal Dam in Troy, covers 4,982 square miles. The main stem of the Lower Hudson River is not actually a river, but rather a tidal estuary for its entire 153 mile length from the Battery at the southern tip of Manhattan to the Troy Dam. The drainage area of the of the Lower Hudson includes much of Westchester, Putnam, Orange, Dutchess, Ulster, Columbia, Greene, Albany and Rensselaer Counties; and parts of New York (Manhattan), Bronx, Rockland, Sullivan, Schoharie and Schenectady Counties.

The Lower Hudson River Basin is arguably the most diverse of any major drainage basin in the state. It encompasses portions of New York City as well as other urban centers, highly populated and developed suburbs, rural and agricultural areas, and largely unpopulated forested lands including much of the 700,000 acre Catskill Park. The economy of the basin is equally diverse with virtually every economic sector – including service, financial, manufacturing, agricultural, tourism/recreational – well represented. The majority of the total basin population of 3,887,321 (2000) is concentrated in the southern portion of the basin in New York City and surrounding suburbs, and in other urban/suburban areas located along the river. In addition to portions of the New York City boroughs of Manhattan (1,437,195, total) and the Bronx (1,332,650, total), other population centers include Yonkers (190,086), Albany (95,658, portion), Troy (49,170, portion) Poughkeepsie (29,871), Newburgh (28,259), Middletown (25,388) Ossining (24,010), Kingston (23,456) and Peekskill (22,441).

There are about 8,861 miles of rivers and streams in the basin and over 1,400 lakes and ponds. Many of the ponds are too small to be individually assessed, but 324 significant* lake, pond and reservoir waterbody segments (covering 37,676 acres) are included in the Lower Hudson Basin Waterbody Inventory. In addition the Hudson River accounts for 78,322 acres of estuary waters in the basin. The largest river watershed in the basin is the Rondout River Watershed with about 1,584 miles of streams or 18% of the basin total; this watershed includes 976 miles of stream in the Wallkill River drainage. Other large tributary watersheds in the basin include the Stockport/Kinderhook Creek Watershed (1,077 miles of stream, 12%), the Catskill Creek Watershed (927 miles, 10%), the Esopus Creek Watershed (631 miles, 7%) and the Croton River Watershed (607 miles, 7%). Of the lakes/reservoirs, the largest are Ashokan Reservoir (8,060 acres, or 21% of the basin lake acres), Rondout Reservoir (2,024 acres, 5%), New Croton Reservoir (1,949 acres, 5%), Alcove Reservoir (1,363 acres, 4%), Cross River Reservoir (899 acres, 2%) and Muscoot/Upper New Croton Reservoir (770 acres, 6%). Five of these six reservoirs (as well as ten of the sixteen largest lakes/reservoirs in the state) are part of the New York City Water Supply System. The reservoirs of the New York City system make up 46% of the lake reservoir acres in the state.

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* *Significant Lakes* are lakes of 6.4 acres (0.01 square miles) or larger and are included the New York State Lakes Gazeteer.

## Water Quality Issues and Problems

The sources of water quality impacts in the Lower Hudson River are as diverse as the watershed area. Municipal wastewater, urban runoff, contaminated sediments from past industrial activities, agricultural impacts, inadequate on-site septic system treatment and streambank erosion are just some of contributors to basin waters quality issues. Many of these sources are fairly common concerns in watersheds that are highly populated. Beyond the urban areas, increasing development and urban sprawl create additional stresses. Even in more rural parts of the basin, lakes and streams experience impacts from agricultural activity and atmospheric deposition.

In addition to addressing existing sources and restoring impacted waters, there is also widespread interest and support for protecting the highly valued water resources of the Lower Hudson Basin. The Hudson River itself is the focus of considerable attention not only due to its water resource value, but its uniqueness as an estuary, the fishery and wildlife it supports, and its historical and cultural significance. Similar protections are supported for upland waters that flow through wilderness and recreational areas like the Catskill Park and that feed the numerous drinking water supply reservoirs in the basin.

### *Hudson River PCBs/Other Fish Consumption Advisories*

Fish consumption in a number notable waters in the Lower Hudson Basin is impaired due to various toxic pollutants that result in NYS Department of Health fish consumption health advisories. The most significant of these advisories are those that apply to the main stem of the Hudson River itself. These advisories recommend limiting consumption of many species (and eating none of other species) because of elevated levels of PCBs and other contaminants. The contamination is considered to be the result of past industrial discharges, particularly PCB discharges in the Upper Hudson River (for more information, see the Upper Hudson River WI/PWL Report). These restrictions have severely affected what had at one time been thriving commercial fishing industries.

Significant past industrial contamination has also resulted in advisories for Nassau (Rensselaer County) and Kinderhook (Columbia County) Lakes. Consumption of American eel from the Saw Mill River (Westchester County) is restricted due to contamination by past use of the pesticide chlordane. A number of other lakes and reservoirs have advisories in place due to atmospheric deposition of mercury, which has become a regional issue among northeastern states.

### *Declining Hudson River Fisheries*

New York fisheries biologists have documented that American shad spawning stock have become smaller and younger and mortality has increased to excessive and unacceptable levels. Declines in American eel, smelt and blueback herring have also been reported. Throughout the Atlantic Coast waters, shad stocks are at historic lows and, along with several other important marine species, are in need of dedicated restoration efforts. The suspected causes of this decline include over-fishing, habitat loss, entrainment/impingement at power generating plants on the river, increased populations of predatory species and increased competition for food sources. NYSDEC recently announced a new set of initiatives aimed a developing a better understanding of the Hudson estuary ecosystem and restoring the threatened fisheries. This effort will focus on continuation of American shad monitoring programs, reduction of shad mortality at water intakes, control of by-catch of shad during commercial fishing for other species, identification and restoration of critical spawning and nursery habitats, and continued ecosystem studies to understand the effects of predators and invasive species.

### *Urban/Industrial/CSO Runoff*

Various recreational uses, aquatic life use support, and aesthetics in stretches of the urban waterways throughout the basin are significantly restricted by pollutants from various industrial, municipal, and commercial sources. The most significantly affected of these waterbodies are located in the New York City metropolitan area and the Albany Pool at the head of the estuary. Urban storm runoff transports a variety of pollutants and debris into the waterways. In addition, combined sewer overflows (CSOs) convey pollutants to the Hudson River and its urban tributaries during wet-weather periods. Contaminated sediments, inactive hazardous waste sites and other impacts attributed to past/historic discharges also limit waterbody uses.

### *Swimmable Hudson River*

In spite of continuing water quality issues, improvement in Hudson River water quality since the 1970s has been significant. In response, there has been a rise in recreational use and growing public interest for increased swimming opportunities. Currently swimming occurs in popular anchoring spots along the shore, including areas not designated for swimming. However, in spite of growing use, publicly available swimming areas in the Hudson remain limited. To reach the goal of a swimmable Hudson River, NYSDEC Hudson River Estuary Program and Division of Water are focusing on four primary areas of water quality impact: 1) the need for seasonal disinfection of municipal and other wastewater discharges, 2) the reduction of CSO impacts through appropriate control strategies, 3) implementation and compliance with the Phase II Stormwater permit program, and 4) continued support of a vessel No Discharge Zone in the Hudson.

### *Commercial Development/Suburban Sprawl*

Impacts on aquatic life and other uses due to increasing commercial and suburban residential development is of particular concern in the Lower Hudson Basin. Such development and the accompanying expansion of impervious surfaces results in more nonpoint runoff and increasing loadings of silt, nutrients and chlorides and increases stream flows and velocities, leading to unstable stream channels, erosion and degraded habitat. The cumulative effect of additional residential wastewater impacts – be they individual on-site systems, cluster systems or smaller municipal facilities – also contribute to minor impacts where previously there were none. A recent study of water quality trends over a thirty-year period found that nearly two-thirds of the locations in New York State where water quality measurably declined are attributable to previously non-impacted sites that now exhibit minor impacts (NYSDEC, Bode et al., 2004). In three-quarters of those instances the impact was due to nonpoint source nutrient enrichment of the stream.

A typical example of this water quality decline has occurred in Woodbury Creek in Orange County. Biological surveys of the creek were conducted in 1987, 2004 and 2005. Survey results show declines in water quality at multiple sites between previous and more recent sampling. The sampling indicated two causes of impacts: increased nutrient enrichment and an abundance of algae, most pronounced downstream of wastewater treatment facilities serving new residential developments; and significantly increased chloride levels attributable to runoff from shopping malls in the drainage headwaters.

### *Lake Eutrophication and Recreational Use Impacts*

Eutrophication is a natural process that occurs as a lake ages and is not necessarily indicative of man-made pollution. However when human activities (e.g., shoreline erosion, urban/agricultrual runoff, wastewater discharges or septic seepage) accelerate this process, it is known as cultural eutrophication. Such accelerated changes can alter plant and animal life within the lake, shoreline and surrounding watershed, and decrease the water quality and recreational value of a lake. The population growth and preponderance of small lakes in the Lower Hudson Basin result in the frequent occurrence of such impacts on recreational uses of basin lakes.

### *Protection of New York City Water Supply Reservoirs*

New York City maintains a system of reservoirs in the Hudson and Delaware Basins to provide drinking water to the millions of people who live and work in the city. The Ashokan and Rondout Reservoirs are the two Lower Hudson Basin reservoirs in the Catskill/Delaware System, which provides 90% of the New York City water supply. The Croton System, which provides the other 10%, is a cascading system of twelve reservoirs and three controlled lakes in northern Westchester and Putnam Counties. In order to protect the New York City water supply, a comprehensive long-range watershed protection program is in place. These protections enable the city to receive a series of waivers from a federal requirement to filter water from the Catskill/Delaware supply. Although New York City has committed through a Consent Decree to construct a water filtration plant for the Croton supply, the City has considerable interest in efforts to protect the water quality in the Croton and Catskill/Delaware Systems. To that end a Watershed Agreement is in place between New York City Department of Environmental Protection (NYCDEP) and the watershed communities which sets forth programs and funding for watershed protection. These efforts focus on the specific water quality concerns such as increased nutrient loadings to reservoirs, risk of spill-related problems and pollution from stormwater runoff. The designation of the Croton Watershed as an MS4 municipal stormwater area - and the subsequent development of Stormwater Management Programs - will also reduce pollutant loadings.

### *Hudson River Estuary Program*

To further restore and protect the waters of the Hudson River, NYSDEC established the Hudson River Estuary Program in 1987 to provide a holistic (watershed) approach to management of the ecosystem. The Hudson River Estuary Program leads a unique regional partnership of agencies, organizations and the public to restore the Hudson in ways that support the quality of life so valued by Hudson Valley residents. The program focuses on conservation of natural resources, promotion of full public use and enjoyment of the river; and reducing pollution that affects the ability to use and enjoy the river. The Estuary Program implements the Hudson River Estuary Action Agenda through numerous partners in government, non-profit and business sectors, and concerned citizens. The program is built on sound science and principles of ecosystem-based management. It is guided by the Hudson River Estuary Advisory Committee, which includes representatives of the commercial fishing industry, recreational anglers, utility companies, local government, educators, researchers, conservationists and other river users. This facilitates working with many representatives of the public toward common goals.

### *Groundwater Resources*

Although groundwater resources are not specifically tracked through the WI/PWL, they are considered *Priority Waters* nonetheless. Groundwater provides drinking water for about one-third of the population of New York State and is the source of base flow for most rivers and streams in the state. Management and protection of both the quantity and quality of this resource is critical for protecting public health and is also a key element of surface water quality and wetland management efforts. In the Lower Hudson River Basin, the more significant threats to groundwater resources include inactive hazardous waste sites and industrial discharges, pesticide application, chemical spills, animal feeding operations and inadequate on-site wastewater treatment systems. The impact of increasing groundwater withdrawals in order to support growing development and population and resulting discharges and higher stream flow is an emerging issue that merits additional investigation.

## Lower Hudson River Basin Water Quality Assessment

The series of charts presented on the following pages provides an overall assessment of water quality conditions in the entire Lower Hudson River Basin. For each waterbody type (rivers/streams, lakes/reservoirs and estuary waters) the first chart shows the percentage of the miles/acres of waters in the basin that fall into the various water quality assessment categories. The **red** portion of the first pie indicates the percentage of waters characterized as *Not Supporting Uses*. The **purple** portion represents segments with *Minor Impacts/Threats*. Taken together, these categories of waters comprise the *Priority Waterbodies* for that waterbody type. The percentage of miles/acres for the other water quality assessment categories – waterbodies having *No Known Impacts*, *UnAssessed Waters*, and waterbodies with *Impacts Needing Verification* – are shown in **blue**, **light blue**, and **green** respectively.

The second pie chart shows the severity of the most significant use impact or restriction for waters in the two categories that comprise the Priority Waterbodies. The levels of severity are:

*Precluded*: waters do not support appropriate uses;
*Impaired*: waters frequently do not support appropriate uses;
*Stressed*: waters support appropriate uses, but other water quality impacts are apparent; and
*Threatened*: waters support uses and have no impacts, but activities threaten future use support.

More detailed descriptions of these levels of severity are outlined in *Appendix A - Assessment Methodology*.

The bar charts indicate the pollutant sources that are most frequently cited as major contributors to the water quality impacts for Priority Waterbodies in the Lower Hudson River Basin. The charts reflect the percentage of miles/acres of the total waterbody area on the Priority Waterbodies List where a particular source is listed as a major contributor to the water quality impact. For each source, the color shading of the bar indicates the severity level (*Precluded*, *Impaired*, *Stressed*, *Threatened*) of the most significant water use impact to the waterbody.

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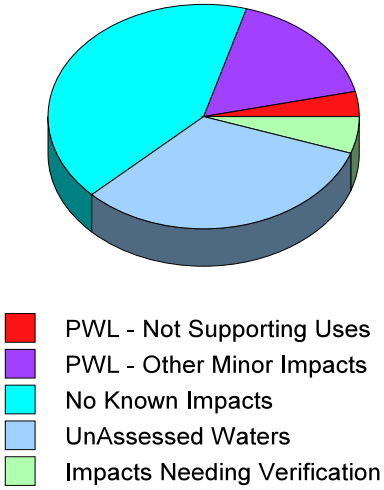
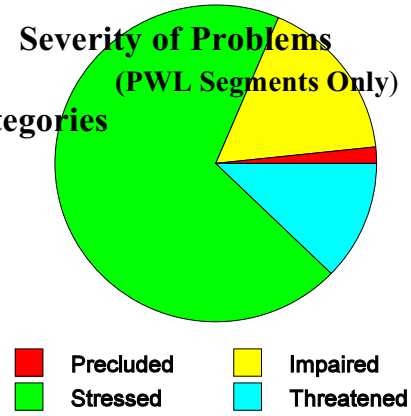
# Rivers/Streams

### Water Quality Assessment Categories
**(for ALL Waters in the Basin)**



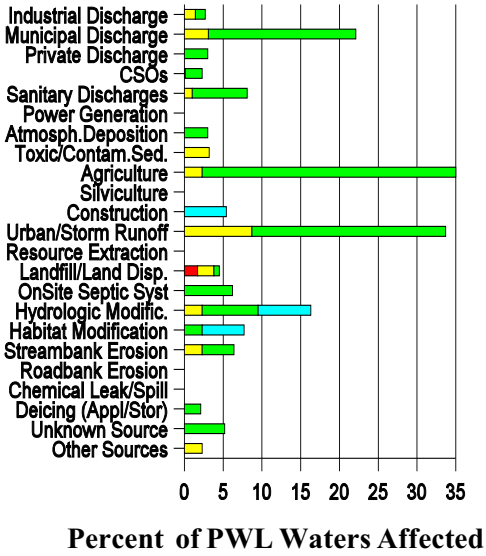

### Severity of Problems
**(PWL Segments Only)**




**Lower Hudson Basin**

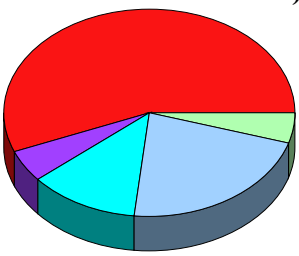
| | |
|---|---|
| Total River Miles: | 8,861 |
| Total PWL Miles: | 1,820 |

### Major Sources of Impact
**(PWL Segments Only)**



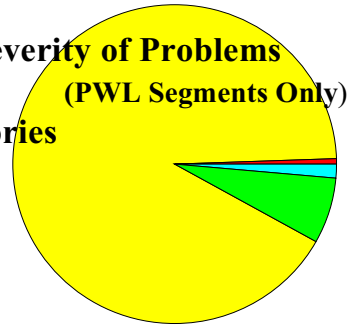
# Lakes/Reservoirs

### Water Quality Assessment Categories
**(for ALL Waters in the Basin)**



- PWL - Not Supporting Uses
- PWL - Other Minor Impacts
- No Known Impacts
- UnAssessed Waters
- Impacts Needing Verification

### Severity of Problems
**(PWL Segments Only)**

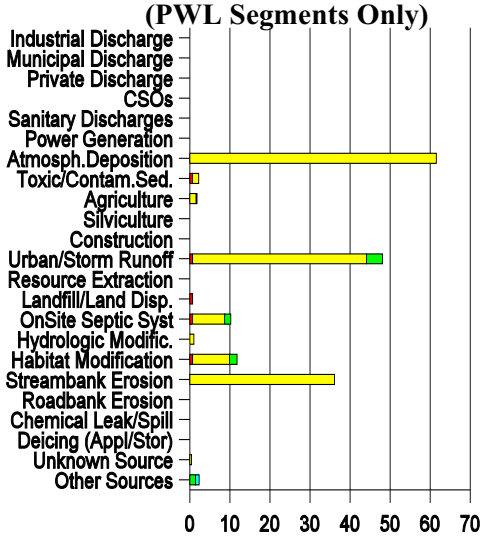


- Precluded
- Impaired
- Stressed
- Threatened

**Lower Hudson Basin**

| | |
|---|---|
| Total Lake Acres: | 37,676 |
| Total PWL Acres: | 23,027 |

### Major Sources of Impact
**(PWL Segments Only)**




**Percent of PWL Waters Affected**

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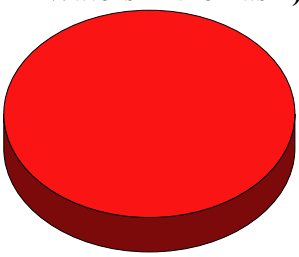
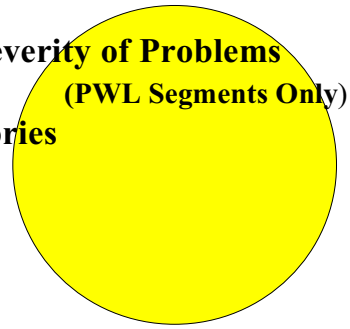
# Estuary Waters

### Water Quality Assessment Categories
**(for ALL Waters in the Basin)**



- PWL - Not Supporting Uses
- PWL - Other Minor Impacts
- No Known Impacts
- UnAssessed Waters
- Impacts Needing Verification

### Severity of Problems
**(PWL Segments Only)**

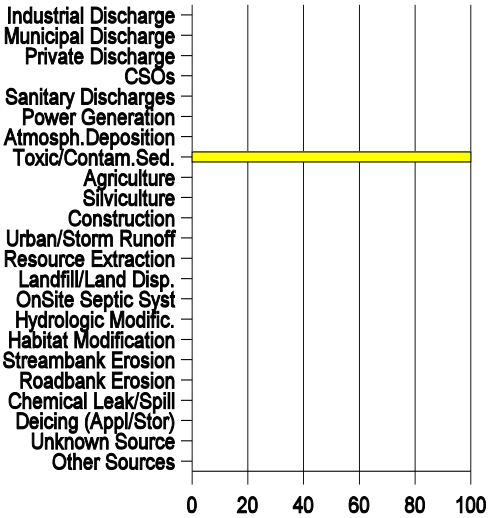


- Precluded
- Impaired
- Stressed
- Threatened

**Lower Hudson Basin**

| | |
|---|---|
| Total Estuary Acres: | 78,322 |
| Total PWL Acres: | 78,322 |

### Major Sources of Impact
**(PWL Segments Only)**




**Percent of PWL Waters Affected**

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## Basin Water Quality Summary

About twenty percent (21%, or 1,890 miles) of the 8,861 river miles in the Lower Hudson River Basin are included on the Priority Waterbodies List as either not supporting uses or having minor impacts or threats to water quality. The large majority (82%) of these Priority Waterbody Listed river miles are considered *Stressed* or *Threatened* waters that fully support appropriate uses but have minor impacts/threats to uses. Only about four percent (4%) of all basin river miles are *Impaired* and do not fully support appropriate uses.

Fifty-six (56) of the 324 separate lake segments in the basin are included on the PWL as having either impaired uses or minor impacts/threats to uses. However these 56 impaired/impacted lakes include a number of larger lakes and represent over sixty percent (61%) of the total lake acres in the basin. For 39 of these lakes (totaling 21,192 acres, or 56% of basin lake acres) the impacts are such that fish consumption, recreational uses and/or aquatic life support are not fully supported. Over two-thirds (70%) of the impaired lake acres are the result of fish consumption advisories, primarily due to the atmospheric deposition of mercury.

All of the estuary waters of the Hudson River are impaired due to fish consumption advisories that extend from the Battery at the southern tip of Manhattan to the Troy Dam. These advisories are the result of past industrial discharges, particularly PCB discharges in the Upper Hudson River.

In addition to atmospheric deposition and toxic/contaminated sediments related to past industrial discharges (noted above), the most frequently cited sources affecting water quality in the basin are urban/stormwater runoff, agricultural activity and municipal wastewater discharges. These sources reflect the diverse character of the basin which has densely populated urban centers, sprawling suburban developments and considerable rural agricultural areas. The multiple sources of impact to rivers in the stream also highlight the variety of water quality issues in the basin.

Insert Figure 2 - Water Quality Assessment Map

# The Lower Hudson River Basin Waterbody Inventory/Priority Waterbodies List

This compilation of water quality information includes individual waterbody *Data Sheets* describing the water quality conditions in the Lower Hudson River Basin of New York State. Causes (pollutants) and sources of water quality problems for those waterbodies with known or suspected impacts are also outlined.

The data sheets are presented in hydrologic order, beginning with the most downstream waters and continuing upstream through the basin. Waterbody data sheets are grouped by US Geological Survey Hydrologic Unit Code (HUC) basin and presented as separate sections of this report (see Figure 3). A Waterbody Inventory of the specific waterbody segments in each watershed is included at the beginning of each watershed section.

Data sheets are included for each waterbody that has been assessed; i.e., waterbodies listed as *Impaired Waters* (Not Supporting Uses), Waters with *Minor Impacts*, *Threatened Waters,* waters with water quality impacts ***Need Verification***, or waterbodies with *No Known Impact*. *UnAssessed* waterbodies are included in the Waterbody Inventory for each watershed, but because they have not been assessed data sheets for these waters have not been included.

The information outlined on the data sheets includes *Waterbody Location Information*, *Water Quality Problem/Issue Information*, *Resolution/Management Information* and *Further Details*. See *Appendix B – Waterbody Inventory Data Sheet Background Information* for more details about the data sheets.

Note that the assessments in this report reflect the best available water quality information at the time of publication. Water quality information may be added or modified subsequent to the preparation of this edition of the Waterbody Inventory and Priority Waterbodies List. When information is updated, the data sheet for the corresponding waterbody segment is issued with the date of revision. More recently revised data sheets supercede the corresponding waterbody information in this listing.

Following the individual waterbody data sheets in the watershed sections, a *Summary Listing of Priority Waters* provides a brief overview of all *Priority Waterbodies*, i.e., waterbodies listed as *Impaired Waters* (Not Supporting Uses), Waters with *Minor Impacts* and *Threatened Waters*.

Indices of waterbody data sheets by both county and alphabetically by segment name are included as Appendix C and D, respectively.

Insert Figure 3 - Watershed Map