Chapter 5

# *Watershed-Based Needs Accounting*

## How can watershed-based needs accounting enhance water quality-based planning and priority setting?

The reporting of needs in previous surveys had limited geographic focus because data were reported as an aggregation of individual facility information by State. Many States are now moving toward developing and enhancing their environmental protection programs with a different geographic focus—the watershed. The watershed protection approach to environmental management is a strategy that focuses on hydrology, sound science, and stakeholder/partner participation.

A watershed is a geographic area in which water, sediments, and dissolved materials drain to a common outlet such as a point on a larger stream, a lake, an underlying aquifer, an estuary, or an ocean. Because watersheds are defined by natural hydrology, not artificial political boundaries, they represent the most logical basis for managing water resources. A watershed-based management approach allows an agency to consider not only the water resource itself but also the land from which the water drains and the activities undertaken on that land. This type of planning helps agencies target the principal water quality problems regardless of their source. As a result, many water quality and ecosystem problems can be solved more effectively at the watershed level than at the individual waterbody or discharger level.

The watershed approach benefits the economy, the environment, and communities. It facilitates program integration, promotes public participation, and focuses energy on environmental results. Coordinating efforts across traditional program areas (for example, drinking water protection, pollution control, fish and wildlife habitat protection, transportation, and power generation) allows managers to look at *all* the issues in watersheds. The result is a better understanding of the cumulative impact of many different human activities.

Users of the CWNS 2000 might want to obtain needs information on a watershed basis for several reasons. Setting water quality guidelines or standards at the watershed level allows States to assess both the point and nonpoint pollution sources in watersheds, track funding requirements over time, conduct project-specific analyses, and address problems in the most cost-effective manner. With limited resources at all levels of government, watershed-based planning and assessment allows States to focus on their highest environmental priorities. Using the CWNS database to download data can facilitate this process.

Figure 5-1 shows the documented needs in the CWNS 2000 according to watershed boundaries at the subregion level. The CWNS 2000 results indicate that most of the needs are in a small number of watersheds: 90 percent of documented needs are in 24 percent of the Nation's watersheds.

Because the CWNS now has coordinate information as well as watershed references, locations can be overlaid on any scale of watershed. This flexibility allows people at the Federal, State, and local levels to obtain information in a usable format. For example, CWNS data can be integrated with other EPA systems such as Envirofacts, Enviromapper, Surf Your Watershed, and water quality modeling systems like EPA's BASINS (Better Assessment Science Integrating Point and Nonpoint Source). CWNS data can also assist with

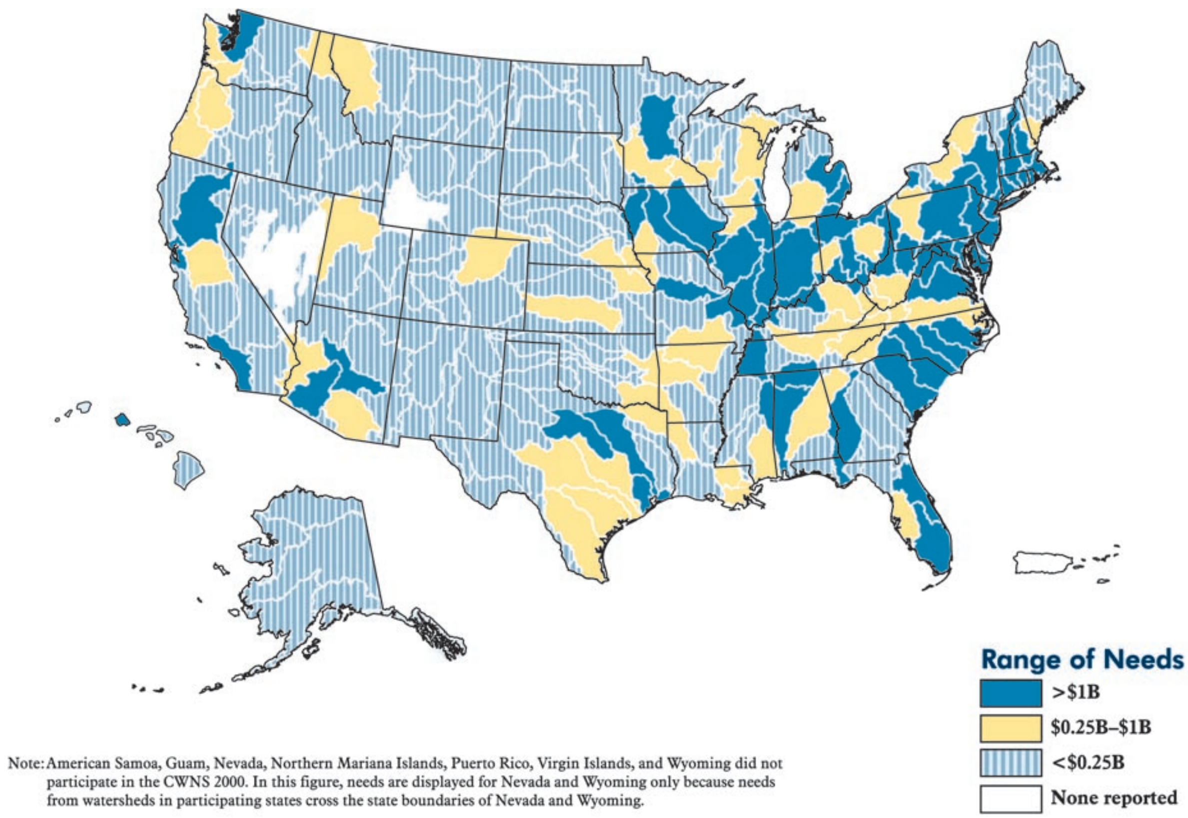



**Figure 5-1. Geographic distribution of total documented needs by 4-digit watershed (January 2000 dollars in billions).**

the development of environmental indicators (e.g., pounds of pollutants removed from the environment) and priority setting using other watershed-referenced information, such as data on 303(d) impaired waterbodies, and subsequent TMDL development.

The CWNS 2000 takes a geography-centered approach because location provides essential information for solving water quality problems. The ability to see on a map the spatial relationships of factors that contribute to priority issues and the management actions designed to address those issues can be powerful. Once those spatial relationships are established, questions about the effectiveness of management actions arise.

The following coastal analysis and case study on Long Island Sound show the benefits of accounting for needs on a watershed basis. Watershed-based needs accounting links the land uses in the watershed to all the potential sources of pollution in the watershed and to the eligible needs from the CWNS 2000 for the waterbody. All of the tables and figures in this section present cost estimates or technical data from the CWNS 2000. With this information, a State can determine the total effort required to meet water quality standards for a particular waterbody, assuming all needs are addressed. Watershed management can offer a strong foundation for uncovering the many stressors that affect a watershed. The result is information better suited for helping managers to determine what actions are needed to protect or restore the resource.

## How do coastal needs differ from inland needs?

The georeferencing of needs data to the watershed level permits various types of spatial analyses, one of which examines coastal needs. Coastal areas are economically and ecologically productive and diverse, yet they face increasing pressure to produce a high-quality environment for commerce, industry, tourism, and development. Coastal land is the most developed in the Nation, supporting more than 53 percent of the population. The coastal population is expected to grow at a slightly faster pace and account for more people than the rest of the Nation over the next 20 years. Between 1994 and 2015, the coastal population is projected to increase by 28 million people (20 percent), compared to a 22 million (18 percent) increase in inland areas (Culliton, 1998).

The *National Coastal Condition Report* (USEPA, 2001b) describes environmental conditions in coastal areas using information from 1990 to 2000. The report presents summaries of data from monitoring, assessment, and advisory programs to create a benchmark of coastal conditions from which future progress can be measured. Indicators were calculated for water clarity, dissolved oxygen, coastal wetland loss, eutrophic condition, sediment contamination, benthic index, and fish tissue contamination. The needs surveys can provide data with a level of detail similar to that of the coastal condition report, such that those indicators can be used in conjunction with needs survey data to prioritize projects or track progress as needs are addressed.

Figure 5-2 shows coastal watersheds, as defined by the National Oceanic and Atmospheric Administration (NOAA), in the United States. The CWNS 2000 data for these coastal watersheds were compared with the inland watershed data. Coastal watersheds have a higher proportion of needs in Categories I, III-B, VI, and VII (Figure 5-3). Although coastal watersheds take up only 11 percent of the land area in the contiguous United States (252 million acres of the 2.4 billion acres of land area), they account for almost 50 percent of total needs. Based on 2000 U.S. Census figures, per capita needs are $685 and $565 for coastal and inland populations.

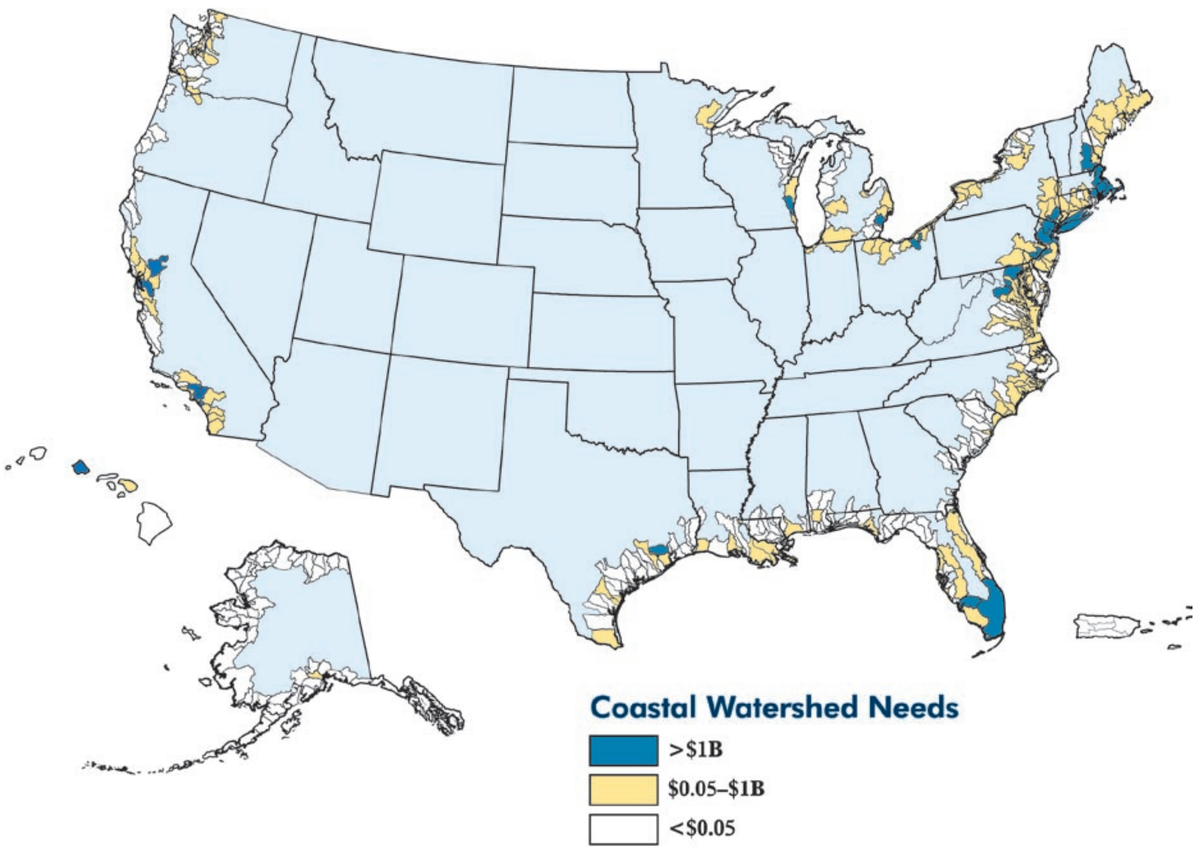



**Figure 5-2.** **Watersheds in United States classified as coastal by NOAA (January 2000 dollars in billions).**

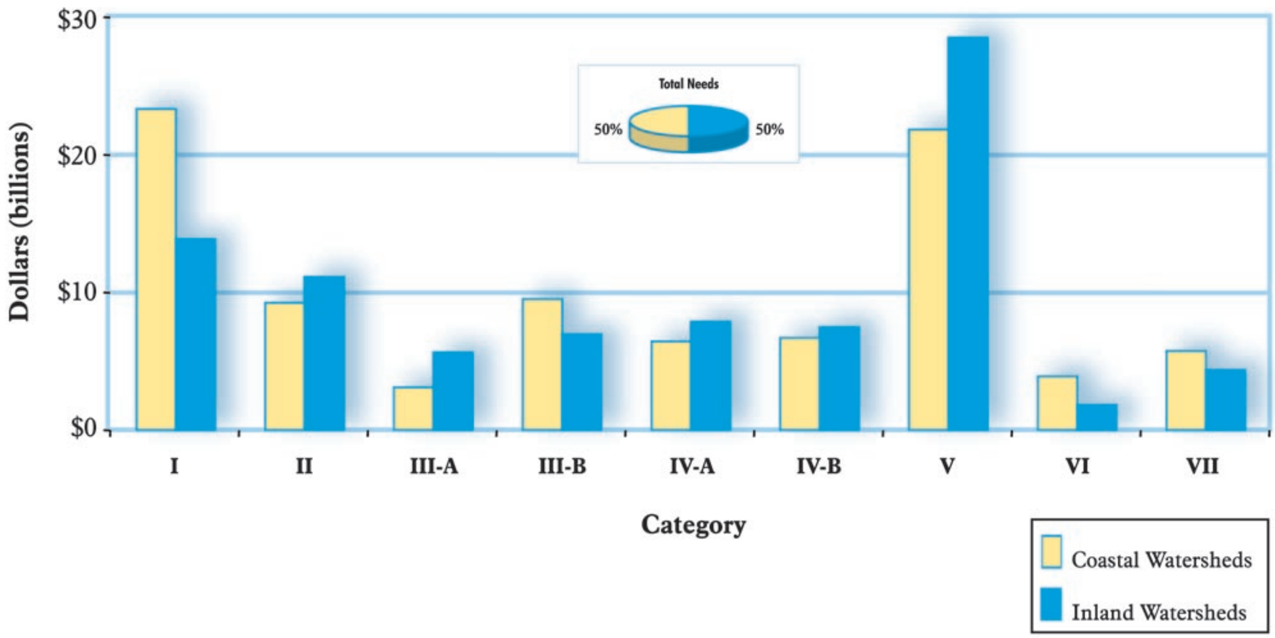



**Figure 5-3. Total documented needs in coastal and inland watersheds (January 2000 dollars in billions).**

Technical data can also be analyzed by watershed. Figure 5-4 displays the population receiving five levels of wastewater treatment, distinguished according to location in either coastal or inland watersheds. Less-than-secondary treatment is more prevalent in coastal watersheds (5 percent of the total coastal population of 104.9 million receiving treatment) than in inland watersheds (less than 1 percent of the total inland population of 102.5 million receiving treatment) because the CWA section 301(h) program grants waivers from the act's secondary treatment requirements to facilities whose discharge to marine waters will not adversely affect the environment. Forty-six percent of the 104.9 million coastal residents are served by secondary treatment, while 37 percent of the 102.5 million inland residents are served by secondary treatment. Fifteen percent more people in inland watersheds receive advanced treatment: 56 percent of the inland population receives treatment at an advanced level, and 41 percent of the coastal population receives advanced treatment. No discharge, a level of treatment used to identify evaporative facilities, is slightly less prevalent in inland watersheds (5 percent) compared to coastal watersheds (6 percent). Partial treatment, in which wastewater is sent to another facility for further treatment, is also approximately the same in both coastal watersheds (1 percent) and inland watersheds (2 percent).

Figure 5-5 shows the geographic distribution of watersheds that have populations receiving greater than secondary treatment. Populations of more than 100,000 people receiving advanced wastewater treatment appear clustered around major metropolitan areas.

The design capacity for treatment facilities in 2000 is displayed by watershed in Figure 5-6. Again, the higher range for design capacity is clustered around major metropolitan areas. Inland watersheds provide a total design capacity of 23,640 million gallons per day for 154 million people, while coastal watersheds provide a total design capacity of 19,914 mgd for 130 million people.

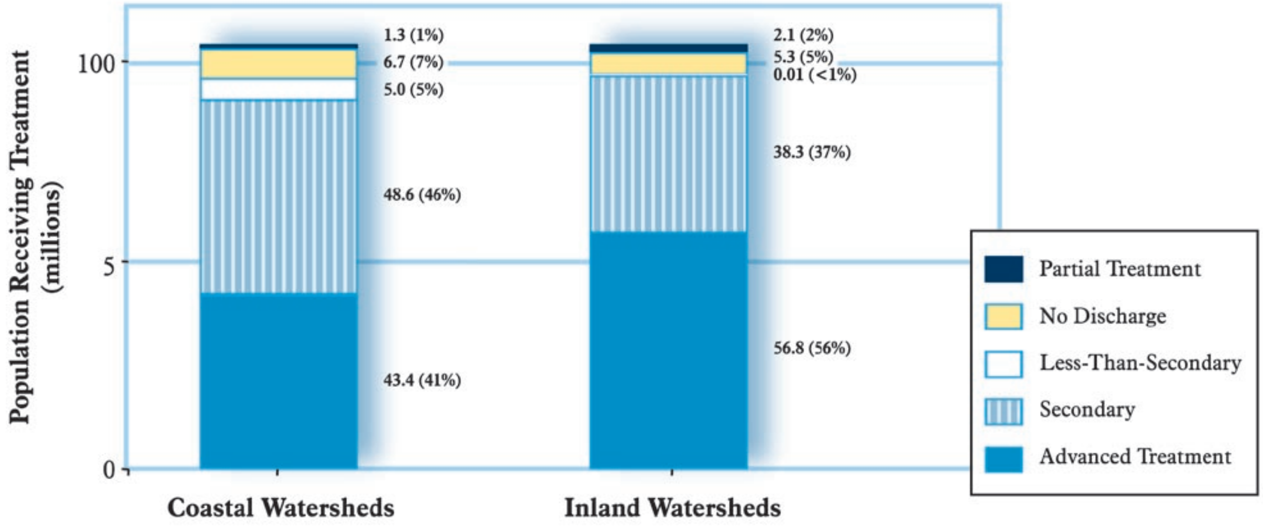
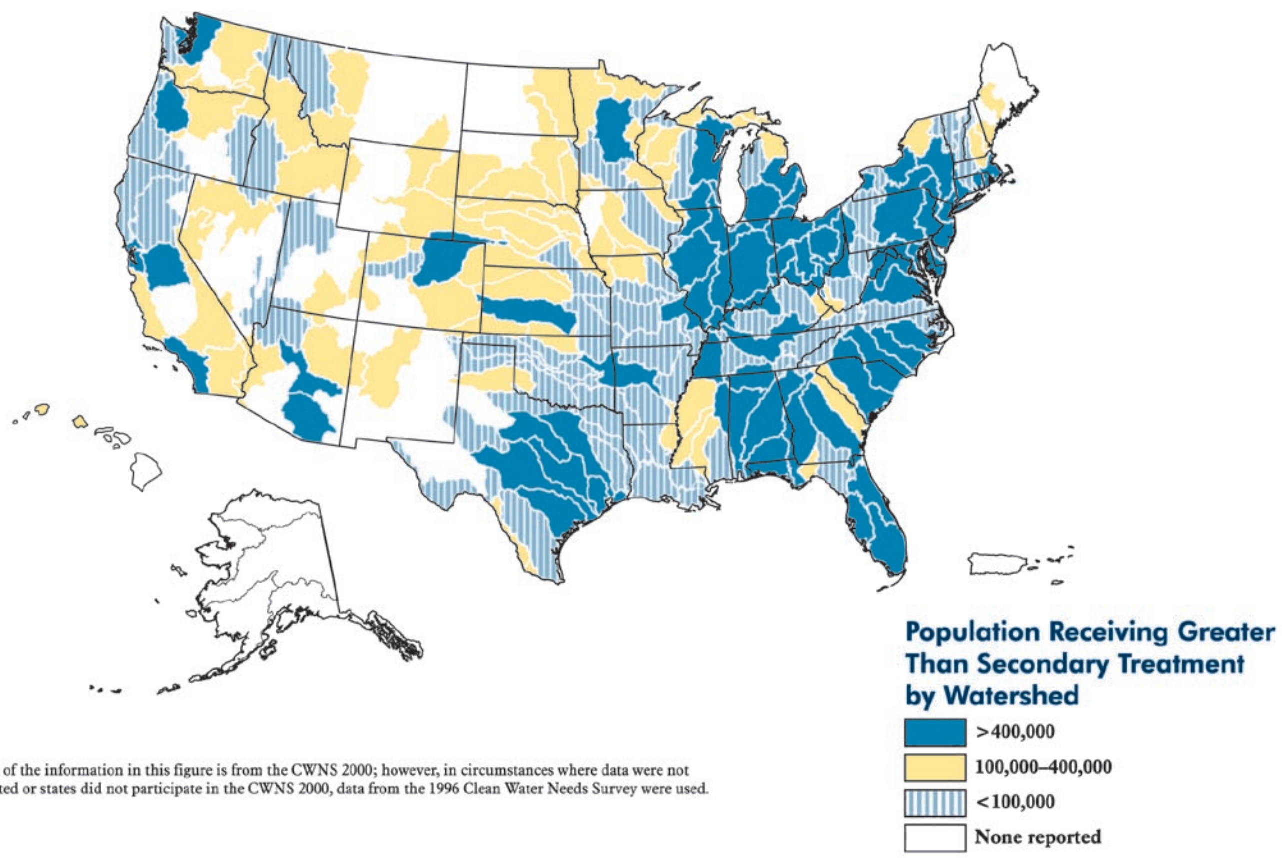



**Figure 5-4.** Percentage of the population receiving various forms of wastewater treatment.




Most of the information in this figure is from the CWNS 2000; however, in circumstances where data were not updated or states did not participate in the CWNS 2000, data from the 1996 Clean Water Needs Survey were used.

**Figure 5-5.** Geographic distribution of watersheds classified by population receiving greater than secondary treatment.

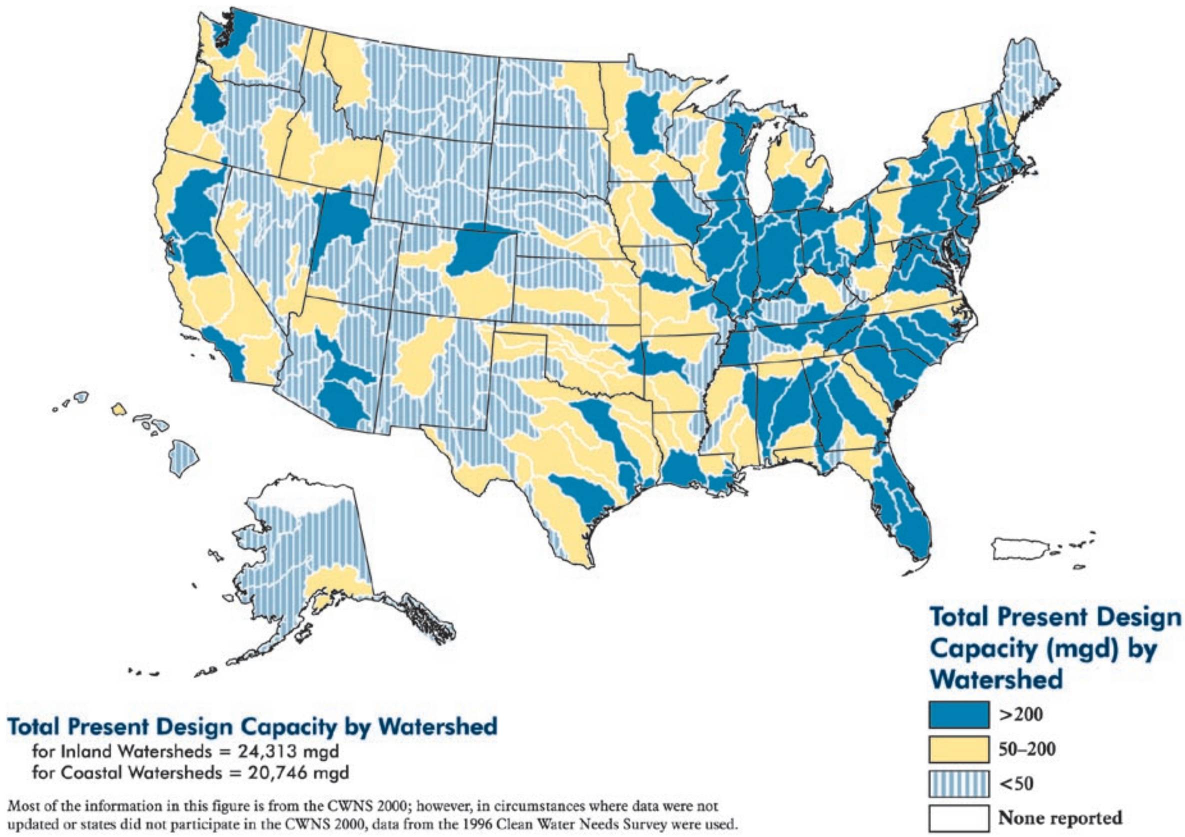



**Figure 5-6. Geographic distribution of watersheds classified by total present design capacity for treatment facilities in operation in 2000.**

## Case Study: Long Island Sound drainage basin

The Long Island Sound exemplifies the broad-scale influence of multiple watersheds on a single waterbody. In 1987 the Long Island Sound was designated an "Estuary of National Significance." The estuary provides the regional economy more than $5 billion a year while also offering feeding, breeding, nesting, and nursery areas for animals and plants. More than 8 million people live in the Long Island Sound area. Associated development has increased some types of pollution, altered land surfaces, reduced open spaces, and restricted access to the Sound. The Long Island Sound is an estuary that receives 90 percent of its fresh water from three major rivers—the Thames, the Housatonic, and the Connecticut. The Sound's watershed extends into Canada and covers an area of about 16,000 square miles (Figure 5-7). Despite significant improvements in water quality and coastal zone management, the Sound continues to have serious problems, particularly hypoxia (oxygen deficiency), which is caused by excessive nitrogen loading from sewage treatment plants and polluted runoff into the Sound (LISS, 2001).

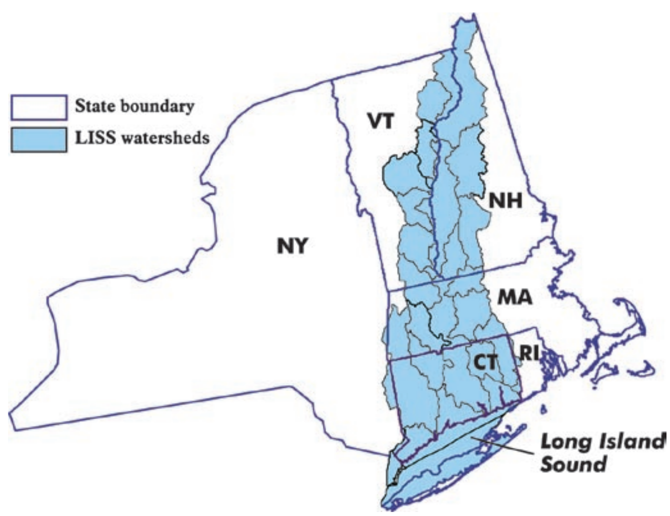
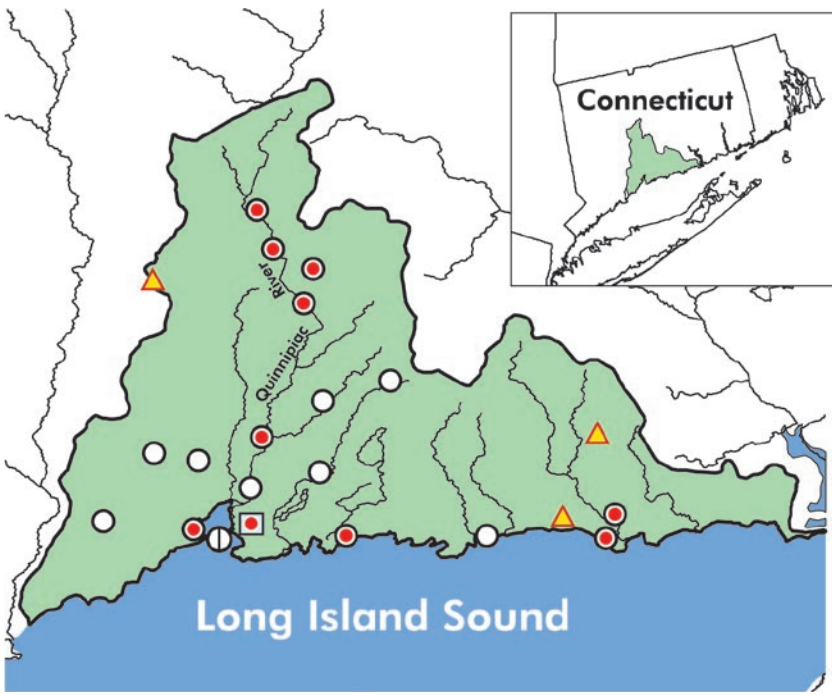



**Figure 5-7. Long Island Sound watersheds.**

The Long Island Sound Study (LISS) is a research and management project begun in 1985 by the Federal government, Connecticut, and New York. The National Estuary Program, under the Clean Water Act, now funds the LISS. The study is a cooperative effort involving researchers, regulators, user groups, and other concerned organizations and individuals working to protect and improve the health of the Sound by implementing a CCMP. The CCMP prescribed dividing the Long Island Sound drainage basins into zones for total nitrogen load management. One of these zones encompasses the Quinnipiac River watershed, which has a drainage area of 327,900 acres. The location of the Quinnipiac River watershed and costs to meet needs identified for it are shown in Figure 5-8.

In 1999 EPA began coordinating with the Connecticut, Housatonic, and Thames River Basins; Block Island Sound; and the New York Harbor States to identify nitrogen sources, evaluate the impact of the nitrogen loads on dissolved oxygen concentrations in the Long Island Sound, and establish a nitrogen reduction program and schedule. Managing needs on a watershed basis will allow for prioritization and allocation of efforts for implementing nitrogen load reduction. Figure 5-9 shows the multiple watersheds that affect the Sound and associated costs for projects to control point and nonpoint source pollution. Table 5-1 draws on data from the CWNS 2000 to show the level of wastewater treatment for facilities draining to the Long Island Sound.




| Legend | CWNS Need Categories | Needs ($ Millions) |
|---|---|---|
| Rivers | Secondary treatment | $137 |
| Quinnipiac River watershed | Advanced treatment | $174 |
| | Infiltration/inflow correction | $7 |
| *Facility Nature* | Sewer replacement/rehabilitation | $0 |
| Combined sewer | New collectors and appurtenances | $14 |
| Separate sewer | New interceptors and appurtances | $19 |
| Individual on-site system area | CSO control | $289 |
| Treatment plant | Storm water management programs | $0 |
| Nonpoint source discharge location | Nonpoint source pollution control | $16 |
| | **Total needs** | **$656** |

**Figure 5-8. Location of Quinnipiac River watershed, facility locations, and watershed's needs (January 2000 dollars in millions).**

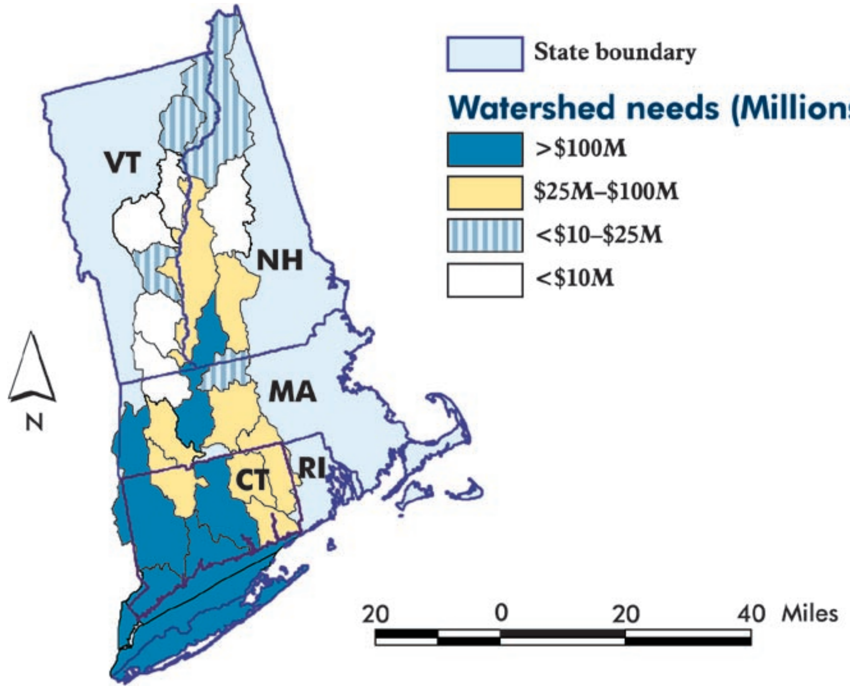



**Figure 5-9. Total documented needs in Long Island Sound watersheds (January 2000 dollars in millions).**

**Table 5-1.** Level of Wastewater Treatment for Facilities Draining to Long Island Sound

| Level of Treatment | Less Than Secondary | Secondary | Advanced Treatment | No Discharge | Partial Treatment | Total |
|---|---|---|---|---|---|---|
| **Existing** | | | | | | |
| Number of facilities | - | 184 | 57 | 95 | 85 | 421 |
| Design capacity (mgd) | - | 2,217 | 354 | 6 | 3 | 2,579 |
| Number of people served | - | 8,784,320 | 2,045,961 | 98,236 | — | 10,928,517 |
| **Projected** | | | | | | |
| Number of facilities | - | 145 | 100 | 89 | 122 | 456 |
| Design capacity (mgd) | - | 1,981 | 561 | 21 | 0 | 2,563 |
| Number of people served | - | 7,123,036 | 3,900,688 | 257,483 | — | 11,281,207 |

## What are some other benefits of taking a watershed approach to needs accounting?

By taking a watershed approach to needs accounting, greater attention is placed on protecting or restoring the resource and on achieving real ecological results than on meeting administrative requirements. A more thorough understanding of threats and conditions in watersheds provides a stronger basis for targeting priority concerns. The CWNS 2000 provides financial and technical data useful for planning and priority setting at a variety of geographic scales. These data can be used to generate maps from the CWNS 2000, such as Figures 5-5 and 5-6, to which maps generated with data from future surveys can be compared to visualize how wastewater trends in watersheds have changed since the CWNS 2000. CWNS watershed data can also help in developing program and technical tools such as how-to guides, models, case studies, and environmental indicators.