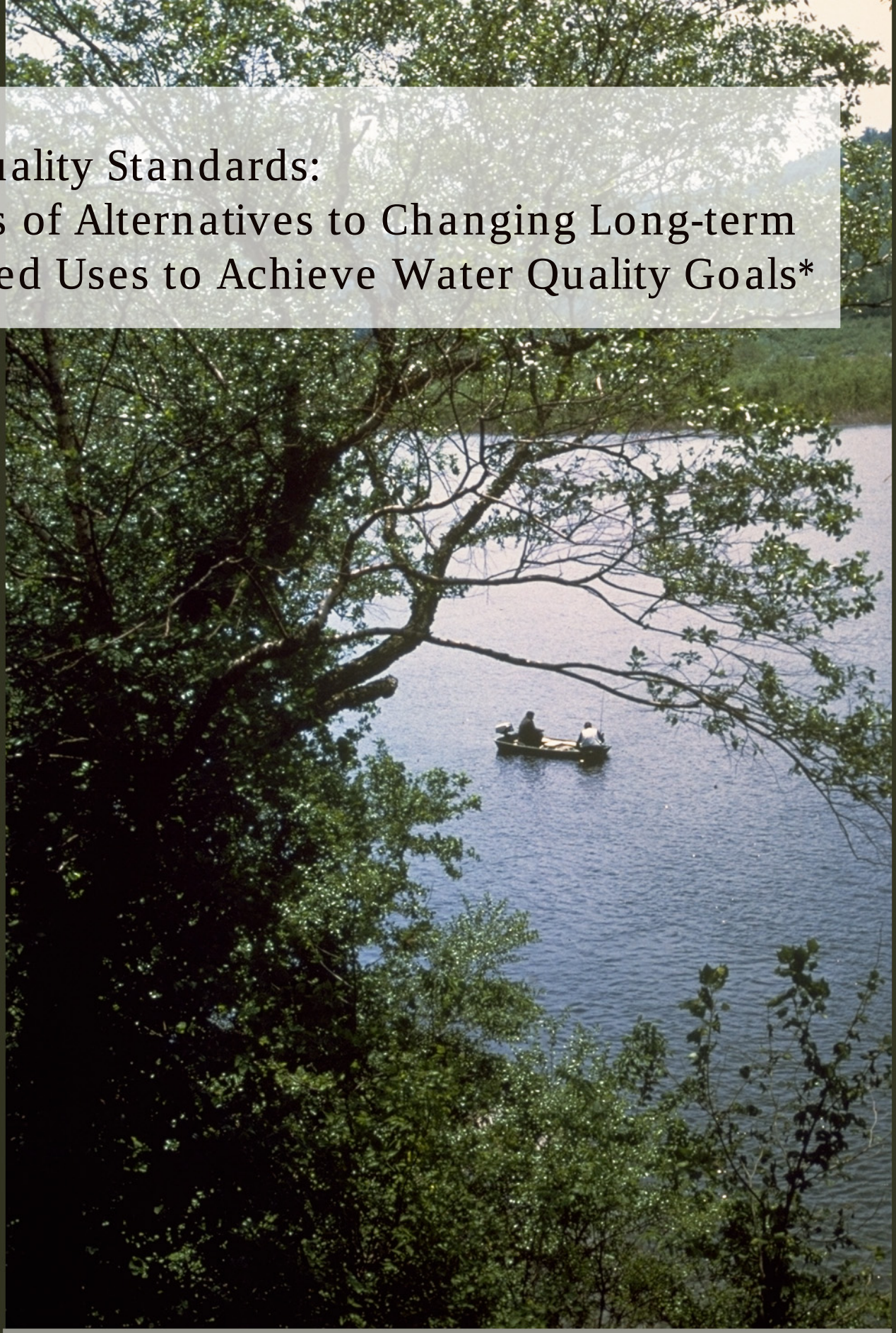
Water Quality Standards: Examples of Alternatives to Changing Long-term Designated Uses to Achieve Water Quality Goals*



*Case study examples developed by States and EPA

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FOREWORD

States, Tribes, and Regions need to share information about regulatory tools for facilitating progress towards meeting Clean Water Act goals, particularly in impaired waterbodies. Attainment of water quality standards may, in some instances, require relatively long time frames (e.g., greater than five years) to achieve the State's designated use. For example, this situation may occur with the following types of sources throughout the United States:

- Combined sewer overflows (CSOs)
- Pollution by legacy contaminants (e.g., PCBs, dioxins, some metals)
- Abandoned mines
- Urban and agricultural land use impacts (e.g., nonpoint sources)
- Nutrient enrichment
- Some industrial and POTW discharges of toxic pollutants

Some of these types of sources, such as periodic discharges from CSOs or nonpoint sources, may cause temporary non-attainment of specified designated uses. For some pollutants, a relatively long time frame may be required to alleviate the impairments, such as PCB contamination or nutrient enrichment in bays, estuaries, lakes, and reservoirs. In some cases, there may not be sufficient scientific basis for determining what uses can be attained. There also may be cases where there is a common desire to improve conditions in the near term, even though the achievability, or time frame of achievability, of the water quality standards in the longer term is unknown or in question. In all of these cases, short-term mechanisms may provide a useful incentive to make environmental improvements over current conditions. When stakeholders believe they cannot achieve a long-term goal, some may resist the initiation of any improvements.

Water quality standards must include designated uses consistent with the Clean Water Act goal of "protection and propagation of fish, shellfish, and wildlife and recreation in and on the water" unless there is an analysis supporting the assertion that it is not feasible to attain such a use. Water quality standards must also include specific criteria to protect the designated uses. Implementation of these water quality standards, through establishing permit limits on point source dischargers or developing "Total Maximum Daily Loads" (TMDLs) for point and nonpoint sources, must be aimed at the applicable water quality standard. TMDLs are plans to achieve the applicable water quality standard and cannot authorize a delay in meeting otherwise applicable regulatory requirements in and of themselves. However, mechanisms that do modify the regulatory requirements can be used in conjunction with a TMDL.

There are several ways of adjusting aspects of a water quality-based program to facilitate implementation of water quality standards without removing the long-term designated use. Sometimes, these mechanisms are used in conjunction with one another to tailor a specific approach. First, States may revise their criteria to better reflect specific protection needs. States

may also adjust the wasteload and load allocation portions of their TMDL to obtain an achievable balance among sources. The next level is to examine use of schedules of compliance. These are addressed in the Clean Water Act and in U.S. EPA's permitting regulations. They can apply to individual dischargers and, in more recent examples, to multiple sources. Ideally, schedules of compliance are authorized within the applicable water quality standards. States have also used authorizing state legislation and general permits to help establish and implement schedules of compliance. Finally, States can establish short-term goals, or variances, within their applicable water quality standards. These are facilitated by the same water quality standards regulatory requirements that allow removal of the long-term designated use, but are typically of reduced scope in terms of pollutants addressed, affected sources, and time of applicability.

The tools presented here for use in attaining water quality standards can serve as alternatives to changing long-term underlying designated uses and criteria. The following case studies, developed by the States and EPA, provide initial examples of some approaches and tools that have been used or are proposed for use. These particular examples focus on approaches that combine schedules of compliance with adjustments to criteria. EPA will continue to work with States to prepare case studies that illuminate the spectrum of approaches that utilize the flexibility built into the water program to achieve important objectives.

Santa Monica Bay Bacteria

Background Information

Santa Monica Bay lies offshore of Los Angeles County, California. The Los Angeles Regional Water Quality Control Board developed a TMDL to address documented bacterial water quality impairments at 44 beaches located along the coast from just south of Palos Verdes Peninsula north to the Los Angeles/Ventura County line. The Santa Monica Bay Beaches Wet-weather Bacteria TMDL was designed to preserve and enhance the water quality at Santa Monica Bay beaches during wet-weather conditions, which are defined as days with 0.1 inch or greater rainfall and the three days following the rainfall event. A separate TMDL was developed for dry weather conditions.

An estimated 55 million people visit the Santa Monica Bay beaches each year. The primary issues associated with bacterial contamination of the beaches include the health of swimmers and surfers who use the beaches for recreation, the cost of health care associated with illness originating from use of the water, and economic impacts to local economies when beachgoers go elsewhere. For example, visitors to the beaches spent an estimated $1.7 billion locally in 2002.

Many of the beaches along Santa Monica Bay were listed on California's 1998 section 303(d) list because elevated levels of coliform or beach closures associated with bacteria prevented the full support of the beaches' designated use for water contact recreation. A consent decree between the U.S. Environmental Protection Agency (EPA), Heal the Bay, Inc., and BayKeeper, Inc. was approved on March 22, 1999. As a part of the court order, EPA established a schedule to complete a TMDL to reduce bacteria at Santa Monica Bay beaches. Water quality standards, which are the basis for the targeted reduction in bacteria from dischargers identified in the TMDL, are set at a level to ensure that the risk of illness to the public from swimming at Santa Monica Bay beaches will be less than 19 illnesses per 1000 swimmers. This level of risk is consistent with EPA recommended acceptable health risk levels for marine waters.

Runoff from storm drain systems was determined to be the primary source of bacterial contamination leading to bacterial water quality impairments at the Santa Monica beaches. Elevated levels of bacterial indicators in stormwater runoff from the storm drain system has been linked to sanitary sewer leaks and spills, runoff from homeless encampments, pet waste, illegal discharges from recreational vehicle holding tanks, and malfunctioning septic tanks and urban runoff. Additional sources of elevated bacteria to marine waters could also include direct illegal discharges from boats, malfunctioning septic tanks, illicit discharges from private drains, and swimmer wash-off. It is also important to note that the bacteria indicators that are used to assess water quality are not specific to human sewage. Other possible sources that can contribute to the elevated bacterial indicator levels are fecal matter from animals and birds, vegetation, and food waste.

Treating elevated bacteria concentrations in stormwater runoff from semi-arid urban areas poses significant challenges because of the ubiquitous nature of bacteria in the urban environment coupled with the nature of storms and stormwater runoff in the semi-arid Los Angeles Region. Local wet weather characterizations have shown elevated concentrations of bacteria from every type of land use, making it difficult to prioritize and focus implementation measures in specific geographic areas. Additionally, short, intense storms that create large peak flows and volumes characterize the semi-arid Los Angeles Region. These large flows and volumes are difficult to capture and treat at one point. The Los Angeles Regional Board recognized this challenge and the need to implement stormwater capture-and-treat measures at multiple points throughout the watershed to meet TMDL requirements. Given the lengthy and complex planning process that would be required to implement a multi-benefit, watershed approach, the Regional Board proposed a unique "reference system/antidegradation" (using their terminology) approach combined with a relatively long implementation schedule, described below.

Approach

California establishes water quality standards, in part, through amendments to Regional Board "Basin Plans". In this case, two amendments served as the water quality standards mechanisms that facilitated this approach: one was a general authorizing provision for schedules of compliance and the other was a specific procedure to adjust an aspect of a water quality criterion. On February 10, 2004, EPA approved an amendment to the "Basin Plan" for the coastal watersheds of Los Angeles and Ventura Counties, which authorized inclusion of compliance schedules in NPDES permits. Although adoption of such policies is optional for a state, such implementation policies are subject to EPA review and approval under Clean Water Act (CWA) section 303(c). The amendment specifies that where the Regional Board determines it is infeasible for an existing discharger to achieve immediate compliance with an effluent limit specified to implement a new, revised or newly interpreted water quality standard, the Regional Board may establish a compliance schedule to implement a TMDL. An authorized compliance schedule must include a time schedule for completing specific actions and be based on the shortest time possible to achieve compliance.

For the Santa Monica beaches, the Regional Board proposed a wet weather TMDL to be implemented over a period of 10 to 18 years. The relatively long implementation schedule allows the use of an integrated water resources approach that takes a holistic view of regional water resources management by integrating planning for future wastewater, storm water, recycled water, and potable water needs and systems; focuses on beneficial re-use of storm water, including groundwater infiltration, at multiple points throughout a watershed; and addresses multiple pollutants that impair the Santa Monica Bay or its watershed. Although the general authorizing provision for schedules of compliance is an approved water quality standard, the specific implementation schedule for this TMDL was not subject to a specific water quality standards review action.

A unique aspect of the wet-weather TMDL is the "reference system/antidegradation approach"

adopted as a water quality standard. On June 19, 2003, EPA approved the "reference system/antidegradation approach" and "natural sources exclusion approach," included as amendments to the Basin Plan, as implementation procedures for the single sample bacteriological objectives. A certain number of daily exceedances of the single sample bacteria objectives is allowed based on historical exceedance levels at existing shoreline monitoring locations, including a local reference beach within Santa Monica Bay. This approach recognizes natural sources of bacteria that may cause or contribute to exceedances of the single sample bacteria objectives. The Regional Board did not intend to require treatment or diversion of natural creeks or treatment of natural sources of bacteria from undeveloped areas. This reference system/anti-degradation approach is designed to ensure that human-generated sources of bacteria and natural bacteria conveyed by human activities (e.g., storm water conveyances) do not cause or contribute to an exceedance of water quality standards. Additional data collection will allow the Regional Board to better understand the contribution of naturally occurring bacteria and refine the numeric target to address the natural sources or to adjust the objectives to recognize naturally occurring exceedances. Arroyo Sequit Canyon, which drains to Leo Carrillo Beach was proposed as the initial reference system. Arroyo Sequit Canyon is largely undeveloped with about 98% open space and little evidence of human impact. The reference beach approach ensures that water quality is at least as good as that of the reference beach.

Although not subject to formal EPA review under CWA Sections 303(c) or 303(d), the Regional Board formally adopted a TMDL implementation schedule within a package of amendments to their "Basin Plan". The implementation schedule contains the following flexibility:

- The use of the reference approach that allows a number of exceedance days based on exceedances in an undeveloped reference watershed
- A re-opener in 4 years that allows for additional science to modify the implementation plan
- Allowance for a longer implementation plan (up to 18 years) if the cities utilize an integrated resource approach that involves watershed-wide storage and re-use and onsite treatments instead of traditional engineering approaches of capture, treatment, and discharge

Boundaries of Application

The California approach relies on the use of reference conditions to distinguish between natural and human-caused bacterial contamination of Santa Monica Beaches. Long-term implementation is required to allow time for the incorporation of changes using a multi-benefit watershed based approach. The watershed approach will strive to incorporate groundwater recharge, water re-use throughout the watershed, and integrate wastewater, storm water, recycled water, and potable water needs throughout the basin feeding Santa Monica Bay.

This application required multiple levels of approval since it was adopted as a water quality standards action. This entails multiple reviews, citizen and stakeholder input, public meetings, and formal Regional and State Board meetings. It is important to note that the "reference system/antidegradation approach" was formally adopted in the California Water Quality Standards. In this case, the adoption of the approach mostly occurred prior and/or concurrently with the adoption of the TMDL. The selection of the reference locations is critical and should reflect waters with no or virtually no anthropogenic impact. In using this approach, care must be taken in selecting the reference location. They should not be selected solely because they are the best, but degraded, conditions present in human-influenced systems.

Resources/References

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Long Island Sound Dissolved Oxygen

Background Information

The Connecticut Department of Environmental Protection (CTDEP), the New York State Department of Environmental Conservation, and the U.S. Environmental Protection Agency (EPA) have identified nitrogen as the primary pollutant leading to summertime hypoxia (low dissolved oxygen) in Long Island Sound bottom waters. While nitrogen is essential to a productive ecosystem, too much nitrogen fuels the excessive growth of algae. When the algae die, they sink to the bottom, where they are consumed by bacteria. The microbial decay of algae and the respiration of oxygen-breathing organisms use up the available oxygen in the lower water column and in the bottom sediments, gradually reducing the dissolved oxygen concentration to unhealthy levels. Dense algal blooms also can inhibit light penetration, preventing sufficient light from reaching the bottom in shallow areas to support the growth of submerged aquatic vegetation, an important habitat for shellfish and juvenile fish. Consequently, excessive nitrogen impairs the function and health of Long Island Sound.

Dissolved oxygen levels in the deep waters of Long Island Sound below the seasonal pycnocline routinely fall below 2 mg/L in the summer months. These levels are too low to sustain important fish and shellfish populations in the sound. State water quality standards for dissolved oxygen were 6.0 mg/L for Connecticut waters and 5.0 mg/L in the New York portion. Connecticut and New York developed the Long Island Sound nitrogen TMDL to address the hypoxia problem.

The baseline nitrogen load delivered to Long Island Sound from New York and Connecticut was estimated to be about 48,000 tons of nitrogen per year. The TMDL, which was jointly established by Connecticut and New York in December 2000 and approved by the EPA in April 2001, specifies that almost 24,000 tons of the nitrogen originating in New York and Connecticut from human sources and delivered to the sound in the baseline year be reduced by 2014. This translates into a reduction of 58.5% from the human-caused sources of nitrogen from New York and Connecticut.

The TMDL specifies that point and non-point source discharges in New York must remove about 17,150 tons per year by 2014. In Connecticut, point source dischargers will be required to remove about 6,670 tons of nitrogen annually from their effluent streams prior to discharge to Long Island Sound or its tributaries. About 400 tons of nitrogen are targeted to be removed from non-point sources, primarily urban stormwater runoff. To meet the Wasteload Allocation established in the TMDL for Publicly Owned Treatment Works (POTWs) in Connecticut, 79 POTWs will have to upgrade facilities such that the group will collectively meet the nitrogen reduction requirements.

Approach

Connecticut used a three-pronged approach to improve the hypoxic conditions in Long Island

Sound to meet water quality standards for aquatic life support uses:

- Adopting appropriate dissolved oxygen criteria for bottom waters
- Establishing a TMDL that incorporates a phased implementation plan
- Implementing a nitrogen trading program to facilitate load reductions

Connecticut recognized that their existing general water quality criteria for dissolved oxygen, which was 6.0 mg/L at any time, was not appropriate for application to deep waters of the sound below the seasonal pycnocline during the summer months. Due to natural circulation patterns and the large (>16,000 sq. mi.) watershed draining into the sound, dissolved oxygen levels below 6 mg/L in bottom waters are an expected natural occurrence when the sound stratifies during the summer months. This condition would exist even in the total absence of human derived nitrogen. Federal guidance (*Ambient Aquatic Life Water Quality Criteria for Dissolved Oxygen (Saltwater): Cape Cod to Cape Hatteras* (USEPA, 2000) provided a comprehensive evaluation of the effects of dissolved oxygen on aquatic life along the Atlantic coast that was necessary to support the State's adoption of a dissolved oxygen criteria that more closely reflects natural conditions and protects the biological integrity of the sound. Connecticut's criteria was approved by EPA in May 2001.

Both New York and Connecticut have committed to a phased implementation of the TMDL that will be accomplished in three steps with 5-year incremental reduction targets. Beginning in 1999, the two states are required to reduce their annual nitrogen discharges to the Sound toward a goal of 58.5% of baseline or about 24,000 tons at the end of 15 years. The phased implementation requires implementing controls to achieve:

- 23.4% reduction (40% of goal or about 9,534 tons) by August 2004
- 43.9% reduction (75% of goal or about 17,876 tons) by August 2009
- 58.5% reduction (100% of goal or about 23,834 tons) by August 2014

Recognizing that the total nitrogen load entering the Sound from human sources is dominated by point source discharges and that point sources also hold the greatest management potential, Connecticut set a goal to meet the overall reduction by implementing technologies and strategies to sewage treatment facilities with an aggressive cumulative goal of 64% nitrogen reduction from municipal POTWs. Connecticut evaluated traditional approaches to facilitating the nitrogen reductions at POTWs that require specific waste load allocations to be applied to individual facilities. The traditional approach would require facility upgrades at all POTWs to meet the reduced nitrogen loads specified in the waste load allocation in accordance with the NPDES regulations governing issuance of individual permits to each facility. Connecticut's assessment found that regulatory costs would be significant (due primarily to the need to negotiate and reissue 79 individual permits to include nitrogen reduction requirements and compliance schedules), overall capital improvement costs would be prohibitive (since the cost-effectiveness of individual upgrades and local concerns regarding financing could not be considered), and that there is not sufficient building capacity to make the simultaneous improvements across all 79

plants in time to meet the TMDL schedule.

The CTDEP asked the state legislature to approve a unique Nitrogen Credit Exchange Program. Nitrogen trading was proposed as an innovative and cost effective method to meet the necessary reductions identified in the TMDL. Public Act 01-180 was passed in 2001 and codified in the Connecticut General Statutes, Sections 22a-521 through 527. These statutes authorized DEP to issue a General Permit for Nitrogen Discharges and establish a Nitrogen Credit Exchange. The statute also established authority to convene a Nitrogen Credit Advisory Board composed of State Agency representatives (Treasury, Policy and Management, DEP) and appointed members representing municipalities involved in the program.

The Nitrogen Credit Exchange provides DEP with the flexibility it needs to minimize the costs associated with implementing the TMDL and meeting the water quality goals for Long Island Sound. The credit exchange program encourages municipal dischargers to maximize nitrogen removal using their existing facilities and provides an incentive for municipalities to implement cost-effective “retrofits” or design and build complete facility upgrades to enhance nitrogen removal. Under the terms of the General Permit for Nitrogen Discharges that regulates the 79 municipal facilities covered by the Exchange Program, each facility is assigned an annual allocation based on a percentage reduction from their baseline load. The annual allocation decreases each year reflecting anticipated cumulative progress towards meeting the 2014 TMDL goal expected as new facilities for nitrogen removal come on-line at various locations around the state. Each facility’s annual allocation is thereby linked to the performance of all other plants in the State. Facilities that remove more than their annual allocation receive credits that are sold to the State. Facilities that discharge more nitrogen than their allocation must purchase credits from the State to remain in compliance with the General Permit.

The value of a credit is established each year based on the capital and operation and maintenance costs for nitrogen treatment at facilities that have completed nitrogen removal projects financed by the State Clean Water Fund relative to the load of nitrogen removed by those projects. Because the annual allocations to each facility decreases each year and the value of a credit increases (as more expensive projects are completed and more facilities incur operational expenses) the incentive to implement additional projects grows with the need to implement more costly projects to achieve the TMDL goal. The exchange program also accounts for geographical differences in the impact of nitrogen discharged by POTWs within the watershed (e.g., nitrogen discharged in New London in the eastern sound has about 18% of the impact to dissolved oxygen that nitrogen from Norwalk which is located near to the area of hypoxia). The end-of-pipe nitrogen loads at each facility is equalized using trading rations that reflect the relative impact on dissolved oxygen noted above to produce “equivalent nitrogen credits.” All trades are based on equivalent credits to ensure progress is measured against improvements in Long Island Sound. Potential local impacts from nitrogen are evaluated when the individual NPDES permits are reissued and compliance with limits to protect local water quality cannot be met through trading.

The EPA Approval Process and State Implementation included the following steps:

- CTDEP and NYDEC jointly established the TMDL in December 2000
- CTDEP adopted dissolved oxygen criteria for offshore coastal waters on February 21, 2001
- EPA approved Connecticut's dissolved oxygen criteria for offshore coastal waters on May 10, 2001
- EPA approved the TMDL approved in May 2001.
- The Connecticut legislature adopted Legislation authorizing the General Permit and Nitrogen Exchange Program on July 6, 2001
- CTDEP issued the General Permit for Nitrogen Discharges in January 2002

The Nitrogen Credit Exchanges have been successfully executed for 2002 and 2003 trading years.

Boundaries of Application

Connecticut's approach, which centers on the Nitrogen Credit Exchange Program, required considerable public, municipal government and legislative buy-in prior to implementation. Frequent consultation and close coordination with EPA Region 1 was also critical to implementing the approach. The key to the program was the State legislation that authorized the creation of the Nitrogen Credit Exchange and creation of the Nitrogen Credit Advisory Board.

The operation of the credit exchange also requires the state to provide funds to purchase excess credits if Connecticut facilities collectively reduce greater amounts of nitrogen than the General Permit requires in a given year. For example, in the first year of trading, statewide facility structural and operational improvements resulted in removal of greater than 400 tons of nitrogen (equalized credits to the hypoxic area) less than projected when the annual allocations for 2002 were established in the General Permit. As a result, the State was required to disburse nearly 1.3 million dollars to purchase the excess credits generated. In 2003, loads were closer to projected expectations and approximately $300,000 was expended to purchase excess credits. In the event that the annual target is not met, funds from the sale of credits will exceed funds disbursed to buy credits and the Nitrogen Credit Advisory Board is empowered to use this money to fund research or other activities to promote nitrogen reduction efforts.

Changes to the Connecticut water quality criteria were possible because sound scientific studies were available to support this effort. State and federal partnerships that supported the scientific research on dissolved oxygen needs to support aquatic life in salt water led to EPA issuing the revised aquatic life criteria guidance upon which Connecticut's criteria are based. Studies, such as the National Estuary Program's Long Island Sound Study, contributed to a better understanding of the impacts of continuous and cyclic changes in dissolved oxygen to salt water aquatic life. Without this scientific support, the TMDL assumptions would change dramatically.

The CTDEP is experiencing faster than anticipated implementation of changes by facilities. Municipalities often appear motivated as much by the stigma attached to credit purchases as by the financial incentives incorporated into the program. This has resulted in more staff time to review design plans and process applications for facility modifications to improve nitrogen removal efficiency. Connecticut is also experiencing difficulties securing sufficient funding to meet the needs of all the facilities requesting capital through the State Revolving Fund to improve their processes to remove nitrogen. Although trading encourages implementing the most cost-effective measures first, achieving the TMDL goal will still require a significant public investment in treatment infrastructure. Nitrogen removal upgrade projects must compete with CSO remediation projects and other wastewater treatment infrastructure needs for a limited annual allocation of State Revolving Fund financing. The continued success of the program will depend in large part on maintaining a steady supply of financial support to municipalities to upgrade nitrogen treatment.

Resources/References

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For additional information on Connecticut's Water Quality Standards, Total Maximum Daily Load, and Nitrogen Credit Exchange Program, visit the DEP web site at http://www.dep.state.ct.us/wtr or contact us at (860) 424-3704.