Clean Water Act and Pollutant Total Maximum Daily Loads (TMDLs)

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Summary

Section 303(d) of the Clean Water Act (CWA) requires states to identify waters that are impaired by pollution, even after application of pollution controls. For those waters, states must establish a total maximum daily load (TMDL) of pollutants to ensure that water quality standards can be attained. A TMDL is both a quantitative assessment of pollution sources and pollutant reductions needed to restore and protect U.S. waters and a planning process for attaining water quality standards. Implementation of Section 303(d) was dormant until states and the Environmental Protection Agency (EPA) were prodded by lawsuits. The program has been controversial, in part because of requirements and costs faced by states to implement this 40-year-old provision of the law, as well as industries, cities, farmers, and others who may be required to use new pollution controls to meet TMDL requirements.

Despite controversies, the TMDL program has become a core element of overall efforts to protect and restore water quality. States and EPA develop several thousand TMDLs annually, but many more need to be completed. The most recent information indicates that over 41,000 waterbodies do not meet water quality standards and need a TMDL to initiate corrective measures. The 303(d) program has evolved, and especially during the last decade, EPA and states have addressed more complex issues, including TMDLs involving both point (direct discharges) and nonpoint sources (diffuse discharges) such as stormwater; TMDLs for less-traditional causes of impairment such as ocean acidification and climate change; TMDLs for pollutants such as mercury that involve coordination among water, air, and other environmental programs; and multi-jurisdictional TMDLs.

The largest multi-jurisdictional TMDL, for the Chesapeake Bay watershed, has drawn considerable attention. It was developed by EPA and was necessitated because previous largely voluntary restoration efforts by the Bay jurisdictions were insufficient to attain water quality standards. It addresses all segments of the Bay and its tidal tributaries that are impaired from discharges of nitrogen, phosphorus, and sediment, with a goal of having TMDL implementation measures in place by 2025. The Chesapeake Bay TMDL has a number of novel elements, including Watershed Implementation Plans in which the jurisdictions identify specific measures to achieve needed pollutant reductions, and biennial reports to the public on progress in implementation. The Bay TMDL has been controversial with a number of groups concerned about the costs of implementation and the likely mandatory nature of many of EPA's and states' actions. EPA's authority to develop the TMDL has been challenged in a lawsuit.

When a TMDL is developed, implementation is a major uncertainty. First, Section 303(d) does not require implementation, and states' strategies for implementation vary widely. Only a few have laws requiring implementation plans, while many others rely on less structured policies. Second, a number of barriers to implementation can be identified. The most prominent is insufficient funding, but technical impediments such as insufficient scientific data also are a challenge. At the same time, factors that may aid effective implementation can be identified, including active involvement of stakeholders and governments, and adequate resources.

The TMDL program is in a period of transition and increasingly is addressing new challenges—more complex TMDLs, larger scale impairments, and nonpoint sources. Other than recent oversight hearings on the Chesapeake Bay TMDL, Congress has not shown active interest in the TMDL program for more than a decade. Some stakeholders, especially states, believe that several issues present Congress with an opportunity to examine the TMDL provisions of the CWA.

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Background

The Clean Water Act (CWA) contains a number of complex and interrelated elements of overall water quality management. Foremost is the requirement in Section 303 that states establish ambient water quality standards for water bodies, consisting of the designated use or uses of a water body (e.g., recreational, public water supply, or industrial water supply) and the water quality criteria which are necessary to protect the use or uses. Standards are then used to determine which waters must be cleaned up, how much effluent may be discharged, and what is needed for protection. Through permitting, states or the Environmental Protection Agency (EPA) impose wastewater discharge limits on individual industrial and municipal facilities to ensure that water quality standards are attained. However, Congress recognized in the act that, in many cases, pollution controls implemented by industry and cities would be insufficient to attain and maintain water quality standards, due to pollutant contributions from other unregulated sources.

Under CWA Section 303(d), states must identify waters for which discharge limits specified in permits are not stringent enough to achieve established water quality standards, after implementation of technology-based controls by industrial and municipal dischargers. For each waterbody or segment, states[1] are required to set a total maximum daily load (TMDL) of pollutants at a level that ensures that applicable water quality standards can be attained and maintained. A TMDL is essentially a pollution budget, a quantitative estimate of what it takes to achieve state water quality goals, setting the maximum amount of pollution a waterbody can receive without violating water quality standards, including a margin of safety to account for seasonal variations and uncertainty between pollutant loads and the quality of receiving waters. As such, TMDLs provide a scientific calculation of how much pollutant loads need to be reduced to meet those standards.

A TMDL is both a planning process for attaining water quality standards and a quantitative assessment of problems, pollution sources, and pollutant reductions needed to restore and protect a river, stream, or lake. TMDLs may address all pollution sources and allocate needed pollutant reductions among categories of sources that contribute to the water quality impairment, including point sources, such as municipal sewage treatment or industrial plant discharges (wasteload allocation or WLA); and nonpoint sources (load allocation or LA), such as runoff from roads, farm fields, and forests, atmospheric deposition, naturally occurring sources, and background sources of the pollutant.

The goal of the TMDL is to eliminate an impairment, not meet a pollutant limit for its own sake. The TMDL itself does not establish new regulatory controls on sources of pollution, and it does not set discharge limits. Nor is it self-implementing. However, when TMDLs are established, municipal and industrial wastewater treatment plants may be required to install new or improved pollution control technology. For waters impaired by point source discharges, TMDLs are enforced through revisions to existing CWA permits, which include the pollutant limits and a schedule for compliance. For waters impaired by nonpoint source runoff, because there are no federal controls over these sources (there is no CWA permit requirement as there is for point sources), the primary implementation tools are state-run nonpoint source management programs, coupled with state, local, and federal land management programs and authorities, and financial

[1] Reference throughout this report to states includes states, U.S. territories, and Tribes authorized by EPA to administer water quality standards on tribal lands.

assistance and incentive programs. States can but are not required to regulate nonpoint sources to achieve goals set out in a TMDL. For example, farmers or ranchers may be asked by states to use alternative methods in their operations to prevent fertilizers and pesticides from reaching streams, and they may receive funds to help them install on-farm pollution management systems or practices.

EPA has specific responsibilities under Section 303(d). First, EPA is required to review and approve a state's list of impaired waters and TMDLs. Second, if a state fails to identify impaired waters and develop a TMDL where one is needed, the CWA requires EPA to develop an impaired waters list for the state and make its own TMDL determination. EPA is not authorized to implement a TMDL.

Implementation of Section 303(d)

EPA acknowledges that a vigorous TMDL program is needed because significant water quality problems persist in the nation's waters, nearly 40 years after enactment of the CWA. An estimated 40% of the nation's waters assessed by states do not meet water quality standards.[2] TMDLs are one element of state water quality management programs. Other activities include standard setting, monitoring, permitting, and enforcement, and all must be integrated with the TMDL program. Most states have lacked the resources to do TMDL analyses, which involve complex assessment in order to ascribe and quantify environmental effects from particular discharge sources. Baseline water quality monitoring data for the analyses (to identify impaired waters and pollution sources) have been limited. EPA has both been reluctant to intervene in the states and also lacked resources to do so itself. Thus, there was little initial implementation of the provision enacted in 1972. Only in 1992 did EPA issue regulations requiring states, every two years, to list waters that do not attain water quality standards and establish TMDLs to restore water quality.

Responding to the failure of states and EPA to meet these requirements, however, environmental groups filed lawsuits in more than three dozen states to compel compliance with the law's requirements. Environmentalists see implementation of Section 303(d) as important both to achieving the overall goals and objectives of the act and to pressuring EPA and states to address nonpoint and other sources that are responsible for many water quality impairments nationwide but have not been well controlled. Of the suits tried or settled, nearly two dozen resulted in court orders requiring expeditious TMDL development by states or EPA.

The TMDL litigation falls into three general categories: (1) challenges intended to compel EPA to step in to fulfill TMDL requirements where a state has failed partially or completely to do so; (2) challenges to EPA's listing of impaired waters, TMDL approval decisions, or EPA's promulgation of TMDLs; and (3) challenges to the substance or content of TMDLs.[3]

Because of the lawsuits and existing requirements of the law, in 1997, EPA issued interpretive guidance which for the first time called on states to develop long-term schedules for implementing TMDLs. There is neither a CWA nor a regulatory deadline for states to develop

[2] U.S. Environmental Protection Agency, *National Water Quality Inventory: Report to Congress, 2004 Reporting Cycle*, EPA 841-R-08-001, January 2009, http://water.epa.gov/lawsregs/guidance/cwa/305b/2004report_index.cfm.

[3] For information on TMDL litigation by state, see http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/lawsuit.cfm. However, this information is a partial list that is not comprehensive or current.

TMDLs. Under the 1997 guidance, EPA recommends that states establish TMDLs in order to meet water quality standards within 8 to 13 years of listing the water as impaired.[4] Development of TMDLs has increased (since 1996, states and EPA have established more than 48,000), but many more remain to be completed. The most recent state 303(d) lists, most of them submitted in 2008 and 2010, identified over 41,000 waterbodies as not meeting water quality standards and in need of a TMDL, affecting more than 300,000 miles of rivers and shorelines and 5 million acres of lakes and resulting from nearly 72,000 causes of impairment.[5] Nationwide, more than 50% of all impairments are caused by nutrients and sediment, metals including mercury, and pathogens (e.g., fecal coliform, *E. coli*, enterococcus bacteria, and other). Pathogens are the largest single cause of impairments.[6]

Development of TMDLs does not equate automatically with restoration that attains water quality standards. Implementation is complex and highly dependent on state and local stakeholders. It takes time, as does demonstrating results. EPA has adopted a goal of having 3,360 waters (8.2% of all impaired waters identified in 2002) in attainment with applicable water quality standards by 2015.[7]

Revising the TMDL Rules

In 1999, EPA proposed revisions to the 1992 TMDL regulations to clarify and strengthen the program. The key proposed changes included a new requirement for a more comprehensive list of impaired and threatened waterbodies; a new requirement that states, territories and authorized Indian tribes establish and submit schedules for establishing TMDLs; a new requirement that the listing methodologies be more specific, subject to public review, and submitted to EPA; clarification that TMDLs include 10 specific elements; a new requirement for a TMDL implementation plan (Section 303(d) does not mandate implementation, a widely acknowledged gap; see "Factors Affecting Implementation," below); and new public participation requirements.

EPA's proposal had few strong supporters, for varying reasons. States, which would be directly affected by the proposal, criticized the burdens that new requirements would place on them. They were concerned that they lack the resources to meet tight deadlines for developing and implementing TMDLs. Further, states said that TMDLs should not necessarily be prioritized over and should be integrated with other elements of existing water quality management programs. Industry groups were greatly concerned about impacts of new pollution control requirements that result from TMDLs. But, municipal and industrial point source groups urged states and EPA to ensure that TMDL requirements do not fall disproportionately on their discharges, while possibly failing to address nonpoint source contributions to impaired waters. Farm groups and others with nonpoint discharges questioned EPA's authority to include nonpoint source pollution in the TMDL program. The forestry industry vigorously criticized potential impacts of the proposal. Environmentalists, who support the need for a stronger and more comprehensive TMDL program,

[4] This is a longer time frame than has been mandated as a result of some of the TMDL litigation. The schedules for TMDLs in lawsuits concluded by consent decrees and settlement agreements range from 4 years to 20 years; most call for a 10-year development schedule.

[5] Many waters are impaired by more than one pollutant or other cause.

[6] For information, see http://ofmpub.epa.gov/tmdl_waters10/attains_nation_cy.control?p_report_type=T#status_of_data.

[7] U.S. Environmental Protection Agency, Office of Water, *National Water Program Guidance, Fiscal Year 2013*, April 2012, p. 32. In 2002, states identified 39,503 specific waterbodies as impaired.

objected to the lengthy time periods in the proposal before water quality improvements are likely to occur. They have criticized the lack of aggressive implementation of a program that has existed in the law since 1972.

Congressional interest was high: by the time the final rule was signed in July 2000, 13 congressional hearings had been held, and a number of legislative proposals to modify the Clean Water Act or delay the rule had been introduced.[8] EPA attempted to respond to the criticism with flexibility on some of the most contentious points. While the revised rule was undergoing final review, Congress adopted a provision in the FY2001 Military Constructions/FY2000 Urgent Supplemental Appropriations Bill (P.L. 106-246), stating that no funds could be used in FY2000 or FY2001 to "make a final determination on or implement any new rule relative to" the 1999 proposal. Because President Clinton intended to sign the bill into law but opposed the TMDL limitation, the Administration accelerated its review, allowing the EPA Administrator to sign it before President Clinton signed the appropriations bill. In the final rule, EPA acknowledged Congress's action in the legislation and delayed the effective date of the rule's changes until October 31, 2001. The text of the final rule was published on July 13, 2000.[9]

The final rule built on the existing regulatory program and added details, specific requirements, and deadlines requiring states to implement plans to clean up polluted waters. It retained key elements of the 1999 proposal for more comprehensive identification of impaired waters, schedules and minimum elements for TMDLs, and new public participation requirements. For some interested parties, what was most of interest was what was not included in the final rule. In efforts to respond to criticism, EPA dropped several provisions that were most controversial, including some potentially affecting agriculture and forestry.[10]

The Bush Administration announced in October 2001 that it would delay the effective date of the rule until May 2003, to allow for further review, but in March 2003, EPA withdrew the 2000 rule in order to consider initiating an entirely new rule or other options. Officials said that additional time was needed to decide whether and how to revise the program and that allowing the rule to take effect in May 2003 would disrupt the ongoing review. No further timetable was announced.

One EPA view, widely reported at the time, was that a new rule is not essential, because states are improving and will continue to improve the pace at which TMDLs are established, even under existing rules. Many environmentalists have said that, short of retaining the 2000 rule, the best action would be to leave the 1992 rules in place, because, although flawed, those rules are preferable to a new rule that might weaken the program. Other stakeholders have urged EPA to adopt different strategies. Many states and industries favor a rule with more flexibility than either the 2000 rule or existing regulations. In mid-2002, EPA developed a draft revised rule which it informally circulated among interest groups and federal agencies for many months, but it did not propose a new rule. In early 2009, there were some reports of discussion among EPA officials of

[8] During the 106th Congress, hearings were held by the House Agriculture Committee; House Transportation and Infrastructure Committee; Senate Agriculture, Nutrition and Forestry Committee; and Senate Environment and Public Works Committee.

[9] U.S. Environmental Protection Agency, "Revisions to the Water Quality Planning and Management Regulation and Revisions to the National Pollutant Discharge Elimination System Program in Support of Revisions to the Water Quality Planning and Management Regulation; Final Rules," 65 *Federal Register* No. 135, July 13, 2000, pp. 43586-43670.

[10] See CRS Report RL30611, *EPA's Total Maximum Daily Load (TMDL) Program: Highlights of the Final Revised Rule*, by Claudia Copeland.

reviving review of the 2000 rule, but the Obama Administration has not come forward with proposed regulatory changes.

As a result, program requirements under the 1992 regulations and court-sanctioned TMDL schedules remain in place and are the drivers for much of the current TMDL activity.

Recent Developments and Challenges

The earliest TMDLs developed by EPA and states often addressed impairments resulting from single pollutants and a limited number of sources. Developing even these relatively straightforward TMDLs presented substantial technical and scientific challenges, but the national program has by now become a core element of overall efforts to protect and restore water quality. States and EPA develop several thousand TMDLs annually (e.g., EPA approved 2,566 in 2010 and 2,820 in 2011). At the same time, the 303(d) program has evolved, and especially during the last decade, EPA and states have addressed more complex issues, including TMDLs for less-traditional causes of impairment, TMDLs involving both point and nonpoint sources, and multi-jurisdictional TMDLs. Legal challenges continue to influence implementation of the program.

Administrative Developments

Several provisions of the CWA direct states to report periodically to EPA on water quality conditions and trends. The 303(d) requirement to identify impaired waters is one of these provisions. Others are found in CWA Section 305(b), which calls for a biennial assessment of all navigable waters in the state, and Section 314, which requires a biennial report on water quality conditions of lakes. Since 2001, EPA has taken steps to minimize the administrative burden on the states of implementing these overlapping provisions by integrating the requirements into a single submission that enables a broad-scale, national inventory of water quality conditions. These Integrated Report (IR) requirements are detailed in guidance memoranda; the most recent was issued in March 2011.[11] The IR format uses a five-part categorization approach for classifying the status for each water segment, ranging from Category 1 (all designated uses are supported, and no use is threatened) to Category 5 (at least one designated use is not supported or is threatened, and a TMDL is needed—these are the waters that comprise 303(d) lists).

EPA has issued a number of guidance and other documents to support states as they address emerging TMDL issues and concerns, which are discussed next.

Addressing Nonpoint Sources in TMDLs

The traditional focus of the CWA has been on controlling direct pollutant discharges to surface waters from municipal and industrial point sources, through regulations and permits. Over time, as these sources have abated pollution, uncontrolled nonpoint sources have become a larger relative portion of remaining water quality problems. Nonpoint source pollution results from indirect discharges to surface waters from diffuse sources such as land runoff, precipitation, atmospheric deposition, drainage, seepage, or hydrologic modification. Nonpoint sources (both

[11] See "Information Concerning 2012 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions," http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/ir_memo_2012.cfm.

urban and rural) are known to cause or contribute to water quality impairments throughout the United States.

Whether and how to address nonpoint sources has been a key issue in the TMDL program. As previously described, when states or EPA develop a TMDL, they have flexibility in making use of available water quality management tools to allocate pollutant reductions. They can, for example, tighten discharge limits on point sources through enforceable permits. But municipalities and industries contend that limiting TMDLs only to point sources imposes disproportionate requirements on their operations, especially in waters that are impaired both by point and nonpoint sources.

Farming and forestry groups have long been concerned about how their activities might be addressed in TMDLs and whether they might be subject to CWA regulation of some sort, even though the act does not provide EPA with regulatory authority over nonpoint sources. EPA only can influence activities of nonpoint sources through use of grants and funding, such as CWA Section 319, which addresses nonpoint source pollution through state-run nonpoint pollution management programs.[12] CWA Section 303(d) does not specify whether TMDLs should cover nonpoint sources, but EPA's long-standing interpretation has been that nonpoint sources of polluted runoff should be addressed, along with point sources, where they contribute to water quality impairment. That interpretation was upheld in a key court case in 2002.[13]

Because their pollutant contributions are intermittent and because the principal policy tools available to government are voluntary or incentive-based programs, not regulatory programs, addressing nonpoint pollution sources in TMDLs is more challenging than is addressing point sources. A TMDL must include a "reasonable assurance" component that needed load reductions can be attained, but making this demonstration can be problematic when nonpoint sources are a significant source of impairment, since there is no permit or similar enforcement mechanism to provide accountability. Tracking implementation of practices to manage nonpoint pollution and verifying results are difficult, especially practices that are done voluntarily and without federal or state cost-share assistance. Some state officials contend that TDMLs for restoring impaired waters are ineffective when nonpoint sources with few or no controls are the main sources of impairment.[14] One observer, however, has suggested that states avoid allocating reductions to point sources "by relying on rather fanciful reductions from nonpoint dischargers (which, because they have no permits, can be as fanciful as one wishes)."[15]

Stormwater

Throughout the United States, stormwater discharges are responsible for thousands of water quality impairments. Stormwater is generated when precipitation from rain and snowmelt events flows over land or impervious surfaces (paved streets, parking lots, and building rooftops) and does not percolate into the ground. It may be conveyed through pipes or ditches, or it may flow

[12] While the 319 program is voluntary at the federal level, states may include regulatory components in their 319 programs.

[13] Pronsolino v. Marcus, 91 F.Supp.2d 1337 (N.D.Cal 2000) aff'd, Pronsolino v. Nastri, 291 F.3d 1123 (CA9 2002).

[14] Amena H. Saiyid, "TMDLs Ineffective for Waters Impaired by Nonpoint Sources, State Officials Tell GAO," *Daily Environment Report*, vol. 141 (July 24, 2012), p. A-8.

[15] Oliver A. Houck, "The Clean Water Act Returns (Again): Part 1, TMDLs and the Chesapeake Bay," *Environmental Law Reporter*, vol. 41, no. 3 (2011), pp. 10208-10228, 10211.

over land and discharge directly into a waterbody. As the runoff flows over the land or impervious surfaces, it accumulates debris, chemicals, sediment, or other pollutants that could harm water quality if the runoff is discharged without treatment. The most common pollutants coming from stormwater are nutrients, pathogens, sediment, and metals, according to EPA.

Most stormwater sources are point sources, which are regulated under the federal stormwater regulatory program and thus are subject to CWA permit requirements. This program applies to stormwater discharges from several broad categories: municipal separate storm sewer systems (MS4s) that serve populations greater than 100,000 and smaller MS4s in Census-defined urbanized areas; construction activity one acre and larger; and specified categories of industrial activity.[16]

Other stormwater sources are nonpoint sources and thus are nonregulated by the CWA. Sources include runoff from residential and commercial application of fertilizer and manure, land disturbance and erosion, and atmospheric deposition.

Many impairments result from point source and nonpoint source stormwater discharges, and TMDLs can address both. In developing these TMDLs, data needed to characterize loads from regulated stormwater activities are generally available from CWA permitting programs. Assigning wasteload allocations to these sources is done by adjusting their permit requirements. Data to characterize loads from unregulated stormwater sources can be more difficult to obtain, and assigning cleanup obligations to them presents the types of allocation and implementation challenges previously discussed concerning nonpoint sources generally. The TMDL also must recognize that stormwater may not be the only source of pollutants such as nutrients or metals in an impaired waterbody.[17]

Mercury

Mercury is the cause of more than 4,700 impairments in thousands of 303(d) listed waterbodies; more than 60% of these impairments are indicated by high mercury levels in fish. Mercury accumulates in fish tissue as methylmercury, the form that presents the greatest risk to human health through consumption of contaminated fish.

In many waterbodies, mercury originates largely from air sources, such as coal-fired power plants, municipal waste combustors, and medical waste incinerators that deposit mercury in waters or on adjacent lands that then wash into nearby waters. Contributions may come from a combination of local, regional, and international sources. In some cases, the presence of mercury results from past practices, such as legacy gold mining, or from geologic deposits. Some mercury may be discharged to water from existing industrial point sources, although in many waterbodies, the amounts are very small compared to other sources, according to EPA.

Since 1996, states and EPA have developed nearly 7,000 mercury TMDLs. Given the variety of potential mercury sources, developing and implementing TMDLs for mercury-impaired waters

[16] For information, see CRS Report 97-290, *Stormwater Permits: Status of EPA's Regulatory Program*, by Claudia Copeland.

[17] Pathogens, metals, nutrients, and sediments are the cause of nearly 57% of impairments in 303(d) listed waters. See http://ofmpub.epa.gov/tmdl_waters10/attains_nation_cy.control?p_report_type=T#status_of_data. How many of those impairments are from stormwater sources is unknown.

often involves coordination among multiple programs—water, air, waste, and toxics programs—and multiple stakeholders. Technical and organizational challenges can be significant, particularly where mercury is predominantly from atmospheric sources. Water management programs generally do not control sources of air emissions, and controlling deposition that originates outside a single jurisdiction is difficult.

Two TMDLs that notably have addressed these types of challenges are a statewide mercury TMDL developed in Minnesota, consisting of two regional TMDLs in the state that cover 998 waterbody/pollutant combinations, and a regional mercury TMDL developed by seven northeast states (Connecticut, Maine, Massachusetts, New York, New Hampshire, Vermont, and Rhode Island).[18] These and many other mercury TMDLs expect to be accomplished over time through existing and future regulatory controls outside of the CWA (such as Clean Air Act regulation of mercury emissions from coal-fired powerplants and other sources), making it difficult to estimate with confidence the effectiveness of mercury reduction strategies. Thus, most anticipate periodic reevaluation by the seven participating states to determine progress and the need for additional or revised reductions to meet water quality standards.

Ocean Acidification

Oceans naturally absorb carbon dioxide (CO_2) from the atmosphere, but too much CO_2 can cause them to become overly acidic. Scientists believe that ocean acidification (OA) is primarily caused by increasing CO_2 concentrations in the atmosphere. In a 2010 report, the National Research Council of the National Academies of Sciences concluded that ocean chemistry is changing at an unprecedented rate and magnitude due to anthropogenic CO_2 emissions and that "there is a risk of ecosystem changes that threaten coral reefs, fisheries, protected species, and other natural resources of value to society."[19]

Activists have been pressing EPA on a variety of fronts to address the role of increasing emissions of CO_2, a greenhouse gas, on climate change, including under the TMDL program. In 2009, the Center for Biological Diversity (CBD) sued EPA in a challenge to the agency's approval of Washington's 303(d) list, because the state's list failed to include coastal waters as impaired for marine pH due to CO_2.[20] CBD also sought to force EPA to revise and strengthen its existing water quality criterion for pH in marine waters, issued in 1976. Under the CWA, EPA issues water quality criteria, which are scientific information regarding concentrations of specific chemicals in water which protect aquatic life or human health. States, in turn, use these EPA-recommended criteria as a basis for developing water quality standards. CBD argued to EPA that the existing marine pH criterion is not protective enough to address decreasing pH levels due to increased CO_2 emissions. The group contended that if states adopted more stringent marine pH criteria in their water quality standards, more waters likely would be identified as impaired, thus requiring TMDLs to achieve reduction in CO_2 emissions that are responsible for the standards violations. EPA has said that it has insufficient data to revise the national marine pH criterion at this time.

[18] U.S. Environmental Protection Agency, "Examples of Approved Mercury TMDLs," http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/mercury.cfm.

[19] National Research Council, National Academies of Science, *Ocean Acidification: A National Strategy to Meet the Challenges of a Changing Ocean*, National Academies Press, 2010, p. 15. For additional information, see CRS Report R40143, *Ocean Acidification*, by Eugene H. Buck and Peter Folger.

[20] In chemistry, pH (potential (of) hydrogen) is a measure of the concentration of hydrogen ions in a solution, hence, its acidity or alkalinity.

To settle the CBD lawsuit, EPA agreed to look for opportunities to use the CWA to address OA (it did not commit to revising the existing marine pH water quality criterion). In 2010, EPA published a Federal Register Notice seeking public comment on what considerations it should take into account when deciding how to address the listing of waters as threatened or impaired by OA under the TMDL program, including how to develop TMDLs for such listed waters.[21] Also as part of the settlement, EPA subsequently issued a memorandum that advised coastal states to list waters that do not meet standards for marine pH when data are available, but the memo did not elevate in priority the assessment and listing of waters for OA. The memo said, "EPA recognizes that information is absent or limited for OA parameters and impacts at this point in time and, therefore, listing for OA may be absent or limited in many States."[22] The agency expects to provide additional guidance to states when future OA research provides improved monitoring and assessment methods.

Climate Change

Even for relatively straightforward impairments (e.g., a single pollutant such as a heavy metal discharged from known sources), TMDL development is complex and resource-intensive. The process requires extensive data on current water quality conditions, pollutants and sources causing impairments, and modeling to analyze effects of load and wasteload allocations that will attain water quality standards with a margin of safety. Climate change considerations add even greater complexity to the analyses, including the need to assess future conditions that are themselves uncertain and sources that can be both domestic and global. Nevertheless, a 2011 EPA draft report notes that climate change may alter attainability of some designated uses and parameters related to water quality standards (e.g., lower streamflow may increase stream temperature) and recommends that "TMDLs and water quality standards should be examined to ensure that these remain protective of aquatic life uses under changing climatic conditions."[23]

The number of future TMDLs that could or should include potential climate change effects is unknown. According to EPA, "It is probable that most existing TMDLs do not take climate change considerations into account, and due to the number of TMDLs in existence (~40,000) it is not feasible to re-open each TMDL with the sole purpose of incorporating climate change considerations." In the future, however, EPA will encourage development of TMDLs that incorporate projected climate impacts and uncertainty, as appropriate.[24]

Consideration of climate change currently is occurring in a few TMDLs, including Vermont's phosphorus TMDL for Lake Champlain. A TMDL is required for Lake Champlain because phosphorus concentrations in many segments of the lake are higher than levels allowed in Vermont water quality standards. The states of Vermont and New York jointly developed a

[21] U.S. Environmental Protection Agency, "Clean Water Act Section 303(d): Notice of Call for Public Comment on 303(d) Program and Ocean Acidification," 75 *Federal Register* 13537-13540, March 22, 2010.

[22] Denise Keehner, Director, EPA Office of Wetlands, Oceans and Watersheds, memorandum, "Integrated Reporting and Listing Decisions Related to Ocean Acidification," November 15, 2010, p. 4.

[23] U.S. Environmental Protection Agency, Global Change Research Program, National Center for Environmental Assessment, *Implications of Climate Change for Bioassessment Programs and Approaches to Account for Effects*, Preliminary Draft, EPA/600/R-11/036A, March 2011, p. 7-1, http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=233810. EPA expected to issue a final report in mid-2011 but has not done so.

[24] U.S. Environmental Protection Agency, *National Water Program 2012 Strategy: Response to Climate Change, Public Comment Draft*, March 2012, p. 51, http://water.epa.gov/scitech/climatechange/upload/NWP_Draft_Strategy_03-27-2012.pdf.

phosphorus TMDL, which EPA approved in 2002. However, EPA's approval of the TMDL was challenged in a federal lawsuit, which asserted a variety of flaws, including insufficiently stringent wasteload allocations of pollutants for point sources coupled with a lack of reasonable assurances that nonpoint source reductions would occur; an inadequate margin of safety; inadequate specificity of the stormwater component of the wasteload allocations; and failure to consider water resource effects associated with documented and predicted climate change.[25]

In April 2010, EPA signed a settlement agreement with the environmental plaintiffs, and in January 2011, the agency reconsidered its previous approval of the Lake Champlain TMDL and disapproved the Vermont portion. After re-reviewing the 2002 TMDL, EPA concluded that two of the four contested elements are not consistent with EPA regulations and guidance available at the time of TMDL approval: margin of safety, and reasonable assurance. EPA found the two other elements of the complaint—the stormwater component, and climate change considerations—to be consistent with then-current rules and guidance.

Under Section 303(d)(2) of the CWA, upon disapproval of a TMDL, EPA must establish a new TMDL to implement applicable water quality standards, and EPA has begun a new phosphorus TMDL for the impaired Vermont segments in Lake Champlain. EPA informed the state of Vermont that, in doing so, it may refine several aspects of the TMDL, not just the components that were determined to be inadequate. Although EPA did not reject the challenged climate change considerations in the 2002 TMDL, apparently they are being addressed now: one component of preparing the TMDL is a study of potential effects of climate change and phosphorus loads to Lake Champlain. EPA expects to prepare the TMDL for public comment in late 2012 or early 2013.[26]

Multi-Jurisdiction TMDLs

For some time, EPA has encouraged states to develop TMDLs using a watershed approach, recognizing that, where multiple impaired segments are clustered within a watershed, it frequently is more efficient to organize restoration activities across the watershed, instead of doing TMDLs for individual stream segments. One of the first states where this approach was used is Montana, but it is also reflected in other locations. In cases where the watershed spans more than one state, TMDLs have been developed jointly or in coordination by several states. Beyond the expected challenges of TMDL development in a single stream segment (e.g., data, resources, scientific uncertainties), these multi-jurisdiction TMDLs present additional challenges (e.g., differing priorities, institutional coordination).

- Several states have developed statewide TMDLs for a single pollutant, such as Minnesota's mercury TMDL (described above). Other states (e.g., Florida and North Carolina) are developing statewide TMDLs for mercury-impaired waters. Several states also have developed statewide bacteria TMDLs (Rhode Island, Connecticut, New Hampshire, and Vermont). New Hampshire has developed a statewide chloride TMDL.
- Because air deposition from outside a single region is a prominent source of mercury impairments, many mercury TMDLs are being developed on a multi-

[25] Conservation Law Foundation v. U.S. Environmental Protection Agency, No. 2:08-cv-00238wks (D. Vt. 2008).

[26] http://www.epa.gov/region1/eco/tmdl/pdfs/vt/LakeChamplainTMDLDevelpmtProcess.pdf.

jurisdiction basis, including the six-state Northeast Regional Mercury TMDL discussed above.

- New York and Connecticut developed TMDLs with measures needed to attain water quality standards for dissolved oxygen in Long Island Sound. The TMDLs require wastewater treatment plants and other point sources in both states to reduce nitrogen discharges that contribute to the Sound's water quality impairment.
- Water quality monitoring data show that approximately half of the length of the Ohio River (475 miles) is now listed as impaired for contact recreational use. As a result, a bacteria TMDL is now under development for the entire river due to the diverse sources that contribute to impairments, including municipal sewer overflows, animal feedlots, and textile and pulp mills, as well as nonpoint sources such as leaking septic systems and land application of manure. Two EPA regions, the six states along the river, and the Ohio River Valley Water Sanitation Commission (ORSANCO) are participating in the TMDL.
- In 2010, EPA approved a TMDL developed by the Washington Department of Ecology to address nutrient enrichment problems which have caused algae blooms and low dissolved oxygen levels in Lake Spokane. The TMDL applies to a 63-mile stretch of the Spokane River from the Idaho-Washington border to the lake. It is one of the first TMDLs to coordinate point source reductions across state boundaries; it includes cross-boundary wastewater and stormwater sources in Idaho, because the Spokane River originates in that state, and modeling determined that those point sources contribute to water quality impairments in the watershed in Washington. Among the challenges for Washington and EPA was developing a TMDL with equitable allocations for dischargers in Washington and Idaho, one that would not call for disproportionate pollutant reductions in either state.[27]

The largest multi-jurisdictional TMDL, for the Chesapeake Bay watershed, is discussed next.

Chesapeake Bay TMDL

One TMDL that touches on several of the issues discussed above and that has drawn considerable attention and controversy, including from Members of Congress, was developed by EPA for the 64,000-square-mile Chesapeake Bay watershed.

Despite several decades of activity by governments, the private sector, and the general public, efforts to improve and protect the Chesapeake Bay watershed have been insufficient to meet restoration goals. Although some specific indicators of Bay health have improved slightly or remained steady recently (such as blue crabs and underwater bay grasses), others remain at low levels of improvement, especially water quality. Overall, the Bay and its tributaries remain in poor health, with polluted water, reduced populations of fish and shellfish, and degraded habitat and resources. The primary pollutants causing impairments are nutrients (nitrogen and

[27] Michael A. Bussell, Director, Office of Water & Watersheds, U.S. EPA Region 10, letter to Kelly Susewind, Washington Department of Ecology, "Approval of the Spokane River Dissolved Oxygen TMDLs." May 10, 2010, p. 19, http://www.epa.gov/region10/pdf/tmdl/spokane_tmdl_approval_may2010.pdf.

phosphorus) and sediment discharged from multiple urban, suburban, and rural sources around the Bay.

In May 2009, President Obama issued an executive order that declared the Bay a "national treasure" and charged the federal government with assuming a strong leadership role in restoring the Bay.[28] The executive order established a Federal Leadership Committee for the Chesapeake Bay to develop and implement a new strategy for protecting and restoring the Chesapeake region. The resulting strategy, which was released in May 2010, launched major specific environmental initiatives to establish new clean water regulations on stormwater discharges and pollution discharges from animal feedlots in the Bay watershed, put new agricultural conservation practices on farms in the region, and restore land and water habitat.[29]

A central feature of the overall strategy is EPA's establishment of a TMDL for Chesapeake Bay, which was necessitated because the Bay states' previous restoration efforts were insufficient to attain water quality standards. Under a consent decree resolving litigation over impairment of Bay waters, EPA was required to establish a Chesapeake Bay TMDL no later than May 1, 2011.[30] EPA issued the TMDL on December 29, 2010.

The Chesapeake Bay TMDL—which is actually divided into three separate TMDLs—is the largest single TMDL developed to date. It addresses all segments of the Bay and its tidal tributaries that are impaired from discharges of nitrogen, phosphorus, and sediment, with a goal of having TMDL implementation measures in place by 2025. Nitrogen and phosphorus are considered the main contributors to poor Bay water quality because, in excess amounts, they spur algae blooms, which block sunlight critical to underwater grasses that support crabs, fish, and waterfowl. When the algae die, they sink to the bottom and decompose in a process that depletes the water of oxygen, creating so-called dead zones. Sediment also depletes water of oxygen. To meet the TMDL goals, the amount of nitrogen entering the Bay needs to be reduced by 75.39 million pounds a year, phosphorus needs to be cut by 14.55 million pounds, and sediment needs to be reduced by 3.7 million tons from 2009 levels. The TMDL allocates needed reductions of these pollutants to all jurisdictions in the watershed. Detailed plans identifying specific reductions are to be developed by the seven jurisdictions located in the Chesapeake Bay watershed in Watershed Implementation Plans (WIPs).[31]

As part of the TMDL process, states are to prepare WIPs in three phases identifying specific reductions and control measures to achieve needed pollutant reductions from point sources (i.e., industrial and municipal facilities and large animal feeding operations) and nonpoint sources (i.e., farms and forests). The WIPs are part of the accountability framework for the Bay TMDL. Phase I WIPs were developed in December 2010. They generally outlined the types of controls and best management practices (BMPs) that will be utilized to meet the first major goals of the TMDL: that 60% of needed practices to achieve water quality standards will be in place by 2017. Each of the states' plans is different and reflects the states' choices regarding localized identification of needed controls and BMPs. EPA is now reviewing the Phase II WIPs, which describe how the jurisdictions will work with specific localities over the next five years to reduce sources of

[28] Executive Order 13508, "Chesapeake Bay Protection and Restoration," 74 *Federal Register* 23099-23104, May 15, 2009.

[29] For information, see http://www.chesapeakebay.net/news_federalstrategy.aspx?menuitem=51207.

[30] Fowler v. U.S. EPA, Case No. 1:09-CV-00005-CKK (D.D.C.), May 10, 2010.

[31] New York, Pennsylvania, Maryland, Delaware, Virginia, West Virginia, and the District of Columbia.

impairment. The Bay jurisdictions are to submit Phase III WIPs by 2017, including any modifications needed to meet the 2025 goal of having in place 100% of practices needed to achieve the nutrient reduction targets.

The use of WIPs as part of the restoration strategy provides states flexibility to determine the mix of specific controls they deem appropriate to meet the overall reduction goals. EPA fully expects that the jurisdictions will meet commitments in the WIPs, but the agency also identified a number of potential "backstop" actions available to it under the CWA if a state fails to do so, including expanding permit coverage to currently unregulated sources, requiring net improvement offsets, conditioning EPA grants, or increasing federal enforcement in the watershed. These CWA backstop authorities are always available to EPA, but EPA's use of them in the Chesapeake Bay TMDL has been very controversial. It also marks a change from the historic nature of Bay restoration, which was based primarily on stakeholder agreements.[32] EPA's review of the WIPs has led to discussions with each jurisdiction to resolve certain issues, such as providing reasonable assurance that allocation targets will be achieved. EPA's approval of the Phase I WIPs included certain backstops for New York, Pennsylvania, and West Virginia.[33]

The Chesapeake Bay TMDL has a number of novel elements. For example, building on a 2009 voluntary agreement by the Bay states, the TMDL requires the jurisdictions to commit to and report on short-term milestones every two years to help government and the public assess progress in implementing cleanup plans. Federal and state officials evaluated progress under the first two-year milestone goals, which were to be reached by the end of 2011, and concluded that in general, states have made significant overall progress and accelerated nutrient reduction efforts, but that improvements are still needed in many areas. The mixed findings were not unexpected. A review by environmental groups for a subset of important pollution controls found that each state was ahead of schedule in implementing some actions, such as nutrient reduction from wastewater treatment plants, but behind in others, such as implementing agriculture conservation management plans.[34] The first milestones under the TMDL were submitted by states in January 2012, and they must be attained by the end of 2013.

The TMDL also reflects the view that nutrient trading can be a promising strategy for meeting nutrient load limits in a cost-effective way. Under this market-based strategy, sources such as municipal wastewater and industrial facilities achieve their individual load limits by purchasing load reductions from other sources such as farmers for a lower cost than if the point source were to install technology on-site. Three states in the Bay watershed (and a number of other states outside the region) have initiated nutrient trading programs, but little implementation has occurred. In the Bay TMDL, EPA supports (but does not mandate) trading to meet the plan's nutrient reduction targets and to account for and manage new or increased loadings in the future, and each of the Bay jurisdictions included nutrient trading in its Phase II WIP.

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[32] U.S. Government Accountability Office, *Chesapeake Bay Restoration Effort Needs Common Federal and State Goals and Assessment Approach*, GAO-11-802, August 2011, p. 10.

[33] In New York, EPA required installation of biological nutrient removal at all wastewater treatment plants in the Bay watershed. In Pennsylvania, EPA moved 50% of the state's stormwater allocation into wasteload allocation, meaning that the state likely will have to regulate those stormwater sources through MS4 permits. In West Virginia, EPA shifted 75% of the state's animal feeding operation (AFO) load into wasteload allocation, meaning that sources could potentially be subject to state or federal CWA permits as necessary to protect water quality if West Virginia does not achieve reductions in agricultural loads from nonpoint sources, as identified in the WIP.

[34] Chesapeake Bay Foundation and Choose Clean Water, "2011 Milestone Analysis Shows Progress," July 9, 2012, http://www.cbf.org/page.aspx?pid-3815.

Many supporters believe that trading has the potential to result in substantial overall cost savings, but actual predictions depend on numerous considerations and uncertainty (e.g., required trading ratios, potential tradeable loads, geographic scope of trading, transaction costs). Trading is also seen as a means of encouraging agriculture's participation in Bay restoration, since it has the potential of generating new revenue for the agricultural sector (since a point source may pay a farmer to reduce pollutants that the point source would otherwise have to control). It is generally believed that installing measures to control agricultural sources of nutrients is more cost-effective than, for example, urban nonpoint source practices such as street sweeping or installing urban forest buffers.[35] To support these types of efforts, USDA awarded $2.35 million to five projects in FY2012 to promote water quality trading in the Chesapeake Bay watershed. The supported projects are intended to help completion of state water quality market rules and organizations needed to carry out trading between point sources and farmers and ranchers. At the same time, some observers are cautious about the role of water quality trading in restoring impaired waters. One recent assessment of nutrient trading in the Bay watershed summarized both positive aspects of nutrient trading—such as potential to use market forces and increase stakeholder support—and negative aspects—trading to reduce water pollutants is technically complicated, interstate trading is hindered by differing state requirements, and verifying results is difficult.[36]

EPA's TMDL and the overall federal Bay restoration strategy under the executive order are controversial with a number of groups that are concerned about the likely mandatory nature of many of EPA's and states' upcoming actions. A major concern is that the strategy will be very costly to implement and will hamper the region's economic recovery. Critics point out that EPA has not prepared a cost-benefit analysis of restoring the watershed. EPA is now preparing such an analysis, based on the Phase I WIPs, and expects to complete it by the end of 2012. Estimating benefits is more complicated than estimating costs because of the difficulty of monitoring and verifying results, according to EPA.

Implicit in much of the criticism of the Chesapeake Bay TMDL is concern that EPA will use it as a model for developing similar large-scale TMDLs in other locations. As previously described, EPA has developed and approved a number of multi-state TMDLs (e.g., the Northeast Regional Mercury TMDL), but some observers worry that what they view as an aggressive and inflexible TMDL strategy for the Chesapeake Bay will be replicated for other waterbodies.

Legal challenges were brought by agricultural and home builder groups, who argue that EPA has exceeded its CWA authority (for example, by imposing detailed pollutant allocations and using backup authority to strengthen WIPs) and impinged on the responsibilities of states to assign pollution reductions to individual sources.[37] They also question the science and accuracy of computer models that EPA used in setting overall pollution limits. EPA contends that development of the TMDL was well within its authority under the CWA, and the agency disputes that it overrode state authority, noting that states were fully involved in the TMDL development process. Several environmental groups and municipal water utility groups have intervened on EPA's side in the litigation.

[35] RTI International, *Nutrient Credit Trading for the Chesapeake Bay, An Economic Study*, prepared for the Chesapeake Bay Commission, May 2012.

[36] Willamette Partnership, Pinchot Institute for Conservation, and World Resources Institute*, In it Together: A How-To Reference for Building Point-Nonpoint Water Quality Trading Programs, Case Studies (Part 3 of 3),* July 2012, pp. 32-44.

[37] American Farm Bureau Federation and Pennsylvania Farm Bureau v. U.S. EPA, Case No. 11-cv-0067 (M.D. Pa.).

Environmental activists have expressed support that the federal government is finally asserting a leadership role to restore the Bay and have endorsed legislation that would codify requirements of the Bay TMDL in the Clean Water Act, while authorizing grants and other assistance for implementing required measures. Companion bills to do so were introduced in the 111th Congress (S. 1816 and H.R. 3852), but no legislation was enacted. The House Agriculture Committee also approved separate legislation in the 111th Congress (H.R. 5509) that would have authorized an expanded role for the Department of Agriculture in Chesapeake Bay restoration, to counter EPA's role in the TMDL. Legislation similar to H.R. 5509 has been introduced in the 112th Congress (H.R. 4153). Congress has shown interest in the impact of the plan on agriculture through oversight hearings by the House Agriculture Subcommittee on Conservation, Energy, and Forestry (on March 16 and November 3, 2011).

Outside Assessments of the TMDL Program

Over the last decade, several assessments have recommended ways to strengthen the TMDL program. One Government Accountability Office (GAO) report examined whether available water quality data are sufficient to allow state officials to make key decisions about activities such as identifying waters that do not meet water quality standards and developing strategies to address those waters. Water quality data are so limited, particularly data for nonpoint sources, that many fear that TMDL decisions will be based on unsound information and will impose unneeded or inappropriate control mandates, according to GAO. Inconsistent monitoring, data collection, and listing procedures used by states to identify impaired waters have hindered efforts to develop effective TMDL programs, GAO found.[38]

In 2002, GAO issued a related report that examined the different approaches used by states to identify impaired waters. Some of the approaches have no appropriate scientific basis, GAO said, and states apply a range of quality assurance procedures to ensure the quality of data used to make impairment decisions. GAO concluded that, because of inconsistencies in states' approaches to identifying impaired waters, the information in EPA's database of impaired waters is of questionable reliability, and EPA cannot reliably tally the number of TMDLs that must be completed nationwide.[39]

EPA's responses to both reports are reflected in the Integrated Report guidance in place since 2004 (see "Administrative Developments"). It provides guidance on how states can document the scientific and technical rationale for categorizing their waters, and it lists key elements that must be included in states' descriptions of their methodologies. In addition, in order to encourage a long-term process of incremental improvement in state water monitoring programs, EPA published a document recommending the basic elements of such a program.[40]

Following EPA's controversial revisions of the TMDL program regulations in 2000 (which were subsequently withdrawn in 2003), the agency's FY2001 appropriation bill, P.L. 106-377, required a study by the National Academies of Sciences (NAS) on the scientific basis of the program. The

[38] U.S. General Accounting Office, *Key EPA and State Decisions Limited by Inconsistent and Incomplete Data*, RCED-00-54, March 14, 2000.

[39] U.S. General Accounting Office, *Inconsistent State Approaches Complicate Nation's Efforts to Identify Its Most Polluted Waters*, GAO-02-186, January 11, 2002.

[40] U.S. Environmental Protection Agency, *Elements of a State Water Monitoring and Assessment Program*, EPA 841-B-03-003, March 2003.

NAS report, issued in 2001, concluded that scientific knowledge exists to move forward with the program but recommended certain types of changes, such as utilizing iterative, adaptive implementation and revision, as scientific data and information improve.[41] EPA's review of the 2000 rule after 2001 was at least partly to consider how to respond to those recommendations, and many of the more recent TMDLs explicitly allow for and anticipate use of adaptive management techniques.

In 2007, EPA's Inspector General (IG) reported on TMDL implementation, particularly EPA's attention to information and systems to track and evaluate implementation. The IG found that a lack of information prevents EPA from determining if TMDL implementation activities are occurring in a timely manner, and the extent to which TMDLs are restoring impaired waters. EPA tracks specific outcomes—for example, numbers of TMDLs developed—but not functional results of water quality improvement. The report noted that EPA has recently taken steps to measure results and improve program data, including sponsoring studies of TMDL implementation and evaluating additional results measures. These tasks are challenging, the IG acknowledged, but the report urged EPA to provide more management direction to improve its ability to assess how well the program is functioning.

EPA concurred with many of the IG's conclusions, but responded in part that the agency has only limited authority to require new post-TMDL monitoring, data tracking, and reporting. The IG had recommended that EPA report annually on nationwide implementation activities, such as BMPs completed and inclusion of wasteload allocations in point source discharge permits. EPA said that "there are substantial cost and logistical implications of reporting annually and nationally on TMDL implementation and TMDL environmental outcomes. After a point, tradeoffs between level of effort invested in reporting and actually restoring impaired waters must be made by EPA and the States."[42]

Factors Affecting Implementation

EPA and other stakeholders frequently point out that TMDLs are not the only approach to restoring water quality and that TMDLs are sometimes inseparable from the combined effect of multiple surface water protection program activities. TMDL implementation is only one of several factors contributing to water quality improvements, and it is likely to be a small percentage, the agency says. Other factors besides TMDL implementation could influence whether a waterbody is in attainment with water quality standards, including new monitoring data or a change in water quality standards, with data showing that the waterbody meets the new standards.

Further, states point out that there can be advantages and disadvantages of using TMDLs to address impairments. Some say, for example, that relying on TMDLs is the right approach when the problem and the source of impairment are unknown, and more scientific evidence is needed to allocate pollutant reductions. Others say that doing TMDLs for some types of sources (e.g., agriculture) provides transparency and assurance to the public about what the state is doing to

[41] National Research Council of the National Academies of Science, Water Science and Technology Board, *Assessing the TMDL Approach to Water Quality Management*, June 2001.

[42] Office of Inspector General of the U.S. Environmental Protection Agency, *Total Maximum Daily Load Program Needs Better Data and Measures to Demonstrate Environmental Results*, Report No. 2007-P-00036, September 19, 2007, p. 17.

improve water quality. But in view of the technical and resource challenges of doing TMDLs, in some cases, alternative approaches may also be appropriate. For example, a state may lawfully avoid listing an impaired water as needing a TMDL if it can demonstrate to EPA that other pollution control programs provide reasonable assurance that water quality standards will be met, such as imposition of point source permit limits, or state regulations and local ordinances for nonpoint sources. However, this use of non-TMDL options is a relatively new idea and has been little used. Some think that alternative approaches are more difficult to achieve than a TMDL. One approach, in the state of Washington, is called "straight to implementation." It involves working directly with landowners, which enables actions to prevent pollution without first developing a TMDL, especially when the state has clear enforcement authority over all types of sources, including nonpoint. Also, a TMDL may not be necessary in cases where the source of impairment is clearly known and control measures and funding are known and available.[43]

That said, when a TMDL is developed, implementation is a huge gap in the program for several reasons. First, as noted previously, CWA Section 303(d) requires development of a TMDL for impaired waters but does not require implementation. States' strategies for implementation vary widely. A recent survey determined that five states have laws requiring TMDL implementation plans, either separately after the TMDL is approved or during development of the TMDL. In five other states, formal implementation plans are not required, but are completed pursuant to state guidance. In a third category are 15 states that develop implementation plans based on an unwritten state initiative or rely on federal guidance. And finally, another 15 states have less intensively developed implementation plans, which generally are a brief section in the TMDL report. No information was found for nine states. The survey also examined how states implement nonpoint source pollutant reductions. It found that 10 states have regulations to address some or all types of nonpoint source pollution, while most states use incentive-based and voluntary programs instead of a regulatory approach.[44]

Second, a number of barriers to TMDL implementation can be identified.[45] The most prominent hindrance is funding. The CWA provides no dedicated funding for TMDL development or for implementation. Inadequate resources are cited as a problem for BMP implementation for nonpoint sources, for point source upgrades such as wastewater treatment plants, for abandoned mine land restoration, for staffing and technical expertise, and for data collection, modeling, and follow-up monitoring. Technical impediments are a related challenge, such as insufficient scientific data on the pollutant removal performance of BMPs for nonpoint sources, or inability to link water quality impacts to sources or causes due to lack of data and understanding of pollutant fate and transport.

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[43] See Environmental Law Institute, *National Workshop to Advance State TMDL Programs*, Final Project Report & Workshop Proceedings, November 2008, http://www.eli.org/pdf/tmdl/TMDL.FinalReport.pdf. Hereafter, *National Workshop*.

[44] Virginia Tech University, Biological Systems Engineering Department and the Center for TMDL and Watershed Studies, *State-Specific TMDL Implementation Information*, September 2008, http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/upload/2009_09_09_tmdl_results_27_st_imp_info_va_tech.pdf.

[45] See, for example, Brian Benham, Rebecca Zeckoski, and Gene Yagow, "TMDL Implementation: Lessons Learned," *Proceedings: Water Environment Federation TMDL 2007 Conference*, pp. 428-442, http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/upload/2009_09_09_tmdl_results_27_st_imp_info_va_tech.pdf; Environmental Law Institute, State TMDL Program Resource Center, "State TMDL Program Snapshots," http://www.eli.org/program_areas/Events/StateTMDLProgramSnapshots.cfm; and *National Workshop*.

At the same time, several factors that seem to aid effective implementation also can be identified. These include active involvement of stakeholders and local and state governments; using a diversity of approaches to address sources; existence of a watershed plan that is focused on issues in the watershed and achievable through corrective actions; targeted or phased implementation; and adequate resources to implement corrective measures, monitor progress, and provide technical assistance.

Conclusion

After nearly 40 years of implementing the CWA, EPA and states acknowledge that a substantial portion of the nation's waters still are impaired or threatened by pollution. The most recent national inventory of water quality reported that nearly 40% of surveyed water bodies remain too polluted for fishing, swimming, and other designated uses. Yet those numbers only represent rivers, streams, and lakes actually surveyed by state monitoring programs—typically about one-third of all waters. The TMDL assessments developed by states yield more precise water quality information and identify large numbers of waters requiring additional measures before water quality standards are attained.

The TMDL program is in a period of transition. Many states are emerging from earlier consent decree mandates and are increasingly addressing new challenges—for example, more complex and resource-intensive TMDLs, larger scale impairments, and nonpoint sources. Whether the program as it now exists is well suited to address some of these problems, such as ocean acidification or climate change, is debatable. In August 2011, EPA and state program managers launched discussions of developing new goals for the program. One year later, these discussions produced a draft "long-term vision" for reforming the process, including allowing states the option to consider protecting healthy waters, using alternative approaches that incorporate adaptive management, and integrating TMDLs with other CWA and Safe Drinking Water Act programs.[46]

Other than recent oversight hearings on the Chesapeake Bay TMDL, Congress has not shown active interest in the TMDL program for more than a decade. Some stakeholders, especially states, believe that several issues present Congress with an opportunity to examine the TMDL provisions of the CWA. Issues could include integrating TMDLs into a larger clean water program that considers all steps—from designation of uses to implementation—in order to meet water quality standards, recognizing and striking a balance between water quality restoration and pollution prevention, changing focus from point sources to nonpoint sources, and addressing resource and funding needs.

[46] Amena H. Saiyid, "Draft TMDL Plan Focuses on Protecting Waters, Not Just Restoring Impaired Ones," *Daily Environment Report*, August 20, 2012, http://www.bna.com/draft-tmdl-plan-n12884911304/.

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