Massachusetts Institute of Technology

Distributing Responsibility for Clean Water: The Total Maximum Daily Load (TMDL) Program

Water and Wastewater Engineering
Department of Civil and Environmental Engineering

By Katherine Lin

Cambridge, Massachusetts
April 28, 2005

Ignored for nearly two decades, the Total Maximum Daily Load (TMDL) program required by Section 303(d) of the 1972 Clean Water Act (CWA) has gained prominence in recent years. While federal technology controls reinforced by water quality-based limitations for point source dischargers serve as the primary management tool of the CWA, the Act seeks a safety net through the TMDL program. If effluent streams, even after implementation of effluent limitations, still prevent the receiving water body from meeting state water quality standards (WQS), the states, territories, and tribes[1] may require both point and non-point sources to reduce pollutant loads. In aggregate, these loads may not exceed the state-defined TMDL, which is the maximum amount of pollutant a water body may receive daily and still meet WQS.

What has caused the TMDL program's rise in favor after years of neglect? From the perspective of dischargers as well as federal and state regulators, effluent limitations are convenient. All parties involved need only be concerned with a single wastewater stream at a time—it is not necessary to work on the watershed scale. Yet, effluent limitations are restricted by this seemingly beneficial characteristic. Non-point sources contribute heavily to water quality deterioration. The EPA (2005) reports that 43% of the 1998 303(d) list cited non-point contributors as the only source of pollution; in contrast, 10% identified only point sources. The time to embrace a systems approach like TMDLs has come. However, if effluent limitations are more easily regulated and have successfully reduced point source loadings, what party is willing to call for TMDLs?

The catalyst bringing recognition of 303(d) came from the private sector in the form of citizen lawsuits beginning in the 1980s. Unhappy with the condition of local waters obtained through effluent limitations, citizens groups demanded action from both

[1] "States, territories, and tribes" will henceforth be referred to as "states" for convenience.

the U.S. EPA and the states. A barrage of court orders compelled the EPA to move forward with TMDLs (EPA 2005; Houck 1999, 51-56).

An overview of the TMDL process quickly demonstrates the benefit and appeal to both citizens and the states. First, the states must identify a primary purpose or designated use for each water body and define the WQS necessary for this use. Examples of use might include recreation, industry, public water supply, agriculture, or support of wildlife (40 C.F.R. §130.3). This step is crucial because it establishes the standards that 303(d) references as measures of effluent limitation success.

This first step is also advantageous in two ways: (1) Determining the designated use of each water body optimizes the management process by identifying both necessary and excessive treatment of discharges unique to the water of interest, and (2) Leaving the determination to the states localizes water quality management and, therefore, increases the incentive of citizens to involve themselves in the management process.

Next, the states must identify, prioritize, and list all impaired water bodies, which are those that do not meet the WQS. For each impaired body, the states must develop a TMDL for each violating pollutant and pollution. The goal of the TMDL is to ensure that the receiving water body does not exceed the WQS, and must account for seasonal variations and a margin of safety. After EPA approval of the list and the TMDLs, the states then allocate each TMDL amongst all contributing point and non-point sources (33 U.S.C. §1313(d)-(e)). The final step, of course, is implementation.

Again, the TMDL process has multiple advantages. The development of TMDLs individual to each water body reemphasizes management optimization. The allocation of the TMDL amongst various sources clearly trumps effluent limitation; the latter only

allows for point source control, while the former accommodates all dischargers. The superiority of TMDLs in this case is evident.

Furthermore, a focus on wastewater effluent ignores the physical and biological conditions in the receiving water body and places disproportionate emphasis upon chemical parameters (NRC 2001, 13). With such a narrow approach, it is no surprise that the U.S. has yet to achieve "swimmable and fishable" waters.

Finally, Oliver A. Houck (1999, 167) summarizes the TMDL process as logical and flexible. The process makes sense; states attribute designated uses to water bodies, identify the necessary standards for these uses, and allocate pollutant loading over all sources. The very nature of this process is flexible, because it is, to an extent, subjective. When combined with the advantages described above, the question of embracing an ambient water-quality approach really becomes not why, but why not?

Yet, one must acknowledge that an ambient water quality-based approach has been tried without success in the past. Why should the TMDL process succeed where its predecessor, the 1965 Water Quality Act, failed? One difference between the WQA and TMDLs is that the CWA clearly outlines a process of implementation. On the contrary, the WQA called only for interstate standards and offered no further guidelines (Houck 1999, 13). This foresight in the drafting of 303(d) indicates that Congress learned a lesson from the WQA. TMDLs may succeed because U.S. water quality management has already observed the failure of ambient water quality standards once.

Perhaps the greatest potential contributor to TMDL success, however, may come from the citizenry. After all, one must recall that citizen lawsuits prompted the rise of TMDLs. The public demands clean water. TMDLs are by nature local, and therefore

encourage citizen involvement. In summary, TMDLs seem a viable path towards clean water not only because they account for all pollutant sources, but also because the federal and state governments and their constituents can learn from past mistakes.

The greatest flaws of the previous attempt at water quality standards were the lack of guidelines for implementation as well as comprehensive technical information. The success of the TMDL process relies on rectifying these problems with the most efficient combination of public and private sector cooperation.

As discussed earlier, 303(d) explicitly addresses the implementation problem. Congress has made a good start, but interpretation and enforcement are what give significance to the text of the law. Regarding the interpretation issue, EPA regulations released in 1985, 1992, and 1999 provide detailed regulatory guidance. Congress has prevented EPA from implementing the 1999 rule, however, and the states continue to operate under the 1992 regulations.

The regulations cumulative to 1992 describe which waters must be listed and the prioritization necessary, what documentation must be submitted as support for lists, how TMDLs should be developed and allocated, and what timeline must be followed for list development and submission. Given the dragging record of previous U.S. water quality management initiatives, the timeline is quite significant. The 1992 regulations require biennial list submissions, and the EPA must review the lists within 30 days. In the event of disapproval, the EPA must provide an updated list for public comment within 30 days (40 CFR §130.7).

While the 1992 regulations provide a basic framework for implementation, the text still lacks a comprehensive description of the data necessary for TMDL

development. This generality could be interpreted as recognition of scientific uncertainty, yet the text could also explicitly acknowledge this uncertainty rather than avoiding discussion. The EPA issued the Consolidated Assessment and Listing Methodology (CALM) report in 2002 as an attempt to provide guidance for monitoring and assessment. Freedman et al. (2003, 24) view the CALM report as a good first step, but see room for further improvement. Other considerations include the age, source, and robustness of data as well as the use of statistical analyses.

The allocation of TMDLs amongst point and non-point sources calls for an understanding of the entire watershed. This understanding usually comes from models, which by their predictive nature always include a degree of uncertainty. While it would be inappropriate for the regulations to specify one blanket model for all watersheds, it is absolutely appropriate to define a model selection process. In a 2001 report contracted by the EPA, the National Research Council (NRC) developed eight criteria for model selection (72). The NRC (ibid, 81-82) report also discusses the various data required, such as flow, ambient water quality, land use, point and non-point source, atmospheric deposition, upstream, and best management practices, that should be considered in a thorough development of TMDLs. While proclaiming all of these data compulsory to TMDL establishment would be prohibitive and inefficient, a discussion of these categories in the regulations could prove helpful to water quality managers. Thus, the EPA should review the data requirements discussed in the regulations.

The 1992 regulations address the interpretation of 303(d). Yet, the regulations cannot force enforcement. Regardless of the strength of language, law and regulations require action to become reality. The proposed 1999 revisions call for more public

participation (Houck 1999, 201), which is a wise step towards catalyzing consistent action. The public brought TMDLs to life with lawsuits in the 1980s, and its continued inclusion is logical; those who use water the most care the most about its condition.

Indeed, Mel Vargas and Randy Palachek (2003) suggest a third party approach to TMDLs. While the state and federal governments will still supervise the overall process, private stakeholders manage the local details. Again, this approach simply makes sense. By virtue of volunteering to manage the TMDL process for a water body, third party stakeholders reveal the personal value attached to this local resource. Pragmatic advantages of the third party approach are also significant. Unlike the states or the EPA, these stakeholders may focus all attention on a single water body. Consequently, time and funding constraints may become less of a problem. Local groups can also more accurately assess the designated use of the body. Thus, the EPA should consider encouraging the public to become proactive in the TMDL process.

Even in an imperfect form, the TMDL program is the future of U.S. water quality management. That the EPA, states, and private sector are working to identify and solve problems of the program bodes well for the future. Mistakes of the past are often realized in retrospect, after all hope has been lost. Mistakes of the present can be rectified, programs refined, and eventually, water quality improved. The TMDL program is a work in progress that can gain much from past lessons learned. With a return to ambient water quality-based standards as well as recognition of the benefits of third party involvement and specific data guidelines, TMDLs could succeed where predecessors failed.

References

Federal Water Pollution Control Act. U.S. Code. 1972. Vol. 33, §1313(d)-(e).

Freedman, Paul L., David W. Dilks, and Wendy M. Larson, 2003. "Improving TMDLs," *Water Environment & Technology*, Vol. 15, No. 6, Pgs. 22-26. June 2003

Houck, Oliver A, 1999. *The Clean Water Act TMDL Program: Law, Policy, and Implementation*. Environmental Law Institute, Washington, D.C.

National Research Council, 2001. *Assessing the TMDL Approach to Water Quality Management*, by the Committee to Assess the Scientific Basis of the Total Maximum Daily Load Approach to Water Pollution Reduction. National Academy of Sciences, Washington, D.C. September 2001.

Total maximum daily loads (TMDL) and individual water quality-based effluent limitations. Code of Federal Regulations. July 1, 2004 Edition. Title 40, §130.7.

U.S. EPA, 2005. *Overview of the Total Maximum Daily Load Program*. Powerpoint presentation, accessed 15 April 2005.

Vargas, Mel and Randy Palachek, 2003. "Third Party TMDLs," *Water Environment & Technology*, Vol. 15, No. 6, Pgs. 32-36. June 2003.

Water quality standards. Code of Federal Regulations. July 1, 2004 Edition. Title 40, §130.3.