THE NEW FACE OF THE CLEAN WATER ACT: A CRITICAL REVIEW OF THE EPA'S NEW TMDL RULES

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I. INTRODUCTION

The United States is on the brink of a new era in water quality regulation. Newly-finalized total maximum daily load (TMDL) rules are bringing to life a long-dormant approach to the identification, prioritization, and repair of the nation's polluted waters that promises to expand the gains in water quality secured by the Clean Water Act's first twenty-five years.[1] Despite progress under the Clean Water Act (CWA), pollution or some form of habitat degradation continues to afflict thirty-six percent of surveyed river miles.[2] Moreover, of the nation's impaired rivers and streams, less than ten percent are impaired primarily or secondarily by industrial point sources – the Act's principal early target for pollution reductions along with municipal sewage treatment.[3] These stark realities – along with an abundance of litigation directed at the agency – have prompted the U.S. Environmental Protection Agency (EPA) to explore the potential of the Clean Water Act's section 303(d) to promote a wide variety of new actions to protect the nation's waters.

A long-neglected part of the Clean Water Act (CWA), section 303(d) requires states to identify waters that are not in compliance with water quality standards, establish priorities, and implement improvements. Based in part upon the recommendations of a Federal

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1. *See* 33 U.S.C. §§ 1251-1387 (1994). For 1977 amendments to the Act, see Clean Water Act of 1977, Pub. L. No. 95-217, 91 Stat. 1566 (1977).

2. *See* OFFICE OF WATER, U.S. EPA, EPA 841-F-97-003, REPORT BROCHURE: NATIONAL WATER QUALITY INVENTORY: 1996 REPORT TO CONGRESS 2 (1998) (according to states' 1996 reporting under section 305(b) of the Clean Water Act); *see also* OFFICE OF WATER, U.S. EPA, THE QUALITY OF OUR NATION'S WATER <http:www.epa.gov/305b> (last modified July 16, 1998) (providing a summary of the 1996 Report to Congress).

3. *See* NATIONAL WATER QUALITY INVENTORY, *supra* note 2, at 2.

Advisory Committee convened in 1996, the EPA issued proposed rules for implementation of the TMDL program in 1999.[4] Amid substantial controversy the final rule was published in July, 2000.[5]

The TMDL rule explains that "[t]he TMDL specifies the amount of a particular pollutant that may be present in a waterbody, allocates allowable pollutant loads among sources, and provides the basis for attaining or maintaining water quality standards."[6] Within this description lies a significant shift in the way water quality is regulated. Instead of the technology-based, end-of-pipe approach to point sources that has characterized CWA enforcement to date, the TMDL program promises an "ambient" approach to water monitoring and standards. That is, instead of a focus on releases from known sources of water pollution (i.e., monitoring discharges from discrete, identifiable pollution sources), regulation and reporting will increasingly be concerned with the *in situ* quality of waterbodies themselves. While this sounds like simple common sense, an ambient approach to water quality enforcement is largely untried.[7] For a variety of mostly pragmatic reasons, federal and state programs have focused on the regula-

4. *See* U.S. EPA, EPA 100-R-98-006, REPORT OF THE FEDERAL ADVISORY COMMITTEE ON THE TOTAL MAXIMUM DAILY LOAD (TMDL) PROGRAM 25-43 (1998) [hereinafter FAC]; Proposed Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. 46,012 (1999) (to be codified at 40 C.F.R. pt. 130) (proposed Aug. 23 1999); Revisions to the National Pollutant Discharge Elimination System Program and Federal Antidegradation Policy In Support of Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. 46,058 (1999) (to be codified at 40 C.F.R. pt. 122, 123, 124, 131) (proposed Aug. 23, 1999).

5. *See* 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, 65 Fed. Reg. 43,586 (2000) (to be codified at 40 C.F.R. pts. 9, 122, 123, 124, and 130) (Jul. 13 2000). The rule's introduction has been controversial, not only because of its significant implications for a broad range of potentially regulated entities, but for procedural reasons as well. In June, Congress passed an emergency spending bill with a rider that would have blocked EPA actions necessary to finalize the rule. In response, EPA published the final rule only a few hours before the spending bill was signed by the President, thus thwarting the Congressional maneuver. *See* Cheryl Hogue, *Muddied Waters: EPA Issues Controversial Rule, But Will Congress Stop Implementation?*, CHEM. & ENG. NEWS, August 28, 2000, at 19-20; Susan Bruninga*, TMDL Rulemaking Would be Thwarted Under Special Funding Bill OK'd by Congress*, 31 Env't Rep. (BNA) No. 27, at 1427.

6. Proposed Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. at 46,013.

7. Interestingly, statutory approaches that pre-date the Clean Water Act, such as the Water Quality Act of 1965, called for ambient water quality standards and state-driven implementation plans. For an overview of this early history, see ALLEN KNEESE & CHARLES SCHULTZE, POLLUTION, PRICES, AND PUBLIC POLICY, 30-50 (1975). The failure of these earlier approaches to water quality regulation are a cautionary tale. *See* EPA v. California ex rel. State Water Resources Control Board, 426 U.S. 200 (1976) (addressing the difficulty of translating ambient water quality standards into standards that can control the conduct of specific polluters).

tion of point sources via technology-based standards to secure effluent reductions. But the low-hanging fruit of low-cost, high-volume point source reductions has largely been harvested. Today, significant water quality improvement requires the expansion of controls to nonpoint sources of pollution.

While the rules have significant implications for point sources, the TMDL program's impact on nonpoint source regulation is its most important characteristic. Because ambient monitoring will find a large number of the nation's waterbodies to be impaired, and because nonpoint sources are a primary cause of that impairment, TMDLs will change the politics, economics, and implementation of water quality regulation.

This article provides a description and critical review of the EPA's TMDL rules. The analysis is not critical of the overall movement toward this type of regulatory approach. In fact, TMDL-based rules should be thought of as an inevitable step toward a mature phase of regulation in which all sources of water quality degradation are addressed. However, the review is critical in the sense that it takes a sober view of the significant challenges facing regulators. After all, there is a reason nonpoint sources have largely escaped regulation over the last twenty-five years. Federal authority to mandate nonpoint source controls remains weak. Implementation of the analytic tools required by the TMDL process will be costly and difficult. And conflicts are almost certain to arise due to the geographically interrelated nature of pollution sources and legal jurisdictions. Also, the new rules explicitly create incentives for pollutant trading across point sources and nonpoint sources. According to the new rules, "EPA is seeking to establish a market for pollutant trading, in the hopes of creating more effective and efficient mechanisms for restoring water quality."[8] While laudable as a means to promote flexible, cost-effective discharge controls, water quality trading should be recognized as a tall order with numerous barriers to implementation.

This article does not address the debate over the CWA's net social benefits.[9] Rather, it takes the CWA's legal requirements as given

8. Revisions to the National Pollutant Discharge Elimination System Program and Federal Antidegradation Policy In Support of Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. at 46,068.

9. This issue has received significant attention from economists and from the EPA. Many studies find that the incremental costs of CWA rules exceed their benefits, as measured by willingness to pay for improved water quality. For an analysis of this issue, see Randolph Lyon & Scott Farrow, *An Economic Analysis of Clean Water Act Issues*, 31 WATER RESOURCES RES. 213 (1995). *See also* OFF. OF WATER, U.S. EPA, EPA 800-R-94-002, PRESIDENT CLINTON'S

and considers the economic implications of movement toward a TMDL-driven regulatory system. Part II provides an overview of current water quality conditions, the history of the TMDL Program's development, and a brief description of the rules. Part III turns to a detailed description of completed TMDLs. Part IV explores a set of legal and economic challenges presented by the program's future implementation and makes recommendations for the ways in which the program can be made most effective. Part V considers the difficulties associated with water quality trading. The article concludes with a summary of the challenges facing the TMDL program.

II. TMDL PROGRAM BACKGROUND

The procedure by which water quality priorities are identified, the process that assigns responsibility for improvements, and the economic, political, and practical challenges of implementation, are all changing. The history of Clean Water Act implementation – both its successes and failures – helps to explain why the TMDL Program's time has come.

A. *The Clean Water Act's Successes and Failures*

Within ten years of the CWA's passage, water scientists and regulators reported significant improvements in water quality. An analysis of changes in water quality over the period 1974 to 1981 documented widespread reductions in lead and fecal bacteria concentrations, a reduction in industrial and municipal biological oxygen demand loads of seventy-one percent and forty-six percent, respectively, and some localized improvements in measures of dissolved oxygen deficit.[10] To put the accomplishment in better perspective, these gains were achieved during a period when inflation-adjusted GNP increased twenty-five percent. The gains were largely due to CWA-related expenditures for the improvement of municipal sewage treatment. Between 1970 and 1985 the fraction of the U.S. population served by wastewater treatment jumped from forty-two percent to seventy-four percent.[11]

In addition to improvements in municipal wastewater treatment, technology-based standards for industrial point sources began to yield

CLEAN WATER INITIATIVE: ANALYSIS OF BENEFITS AND COSTS (1994).

10. *See* Richard A. Smith et al., *Water Quality Trends in the Nation's Rivers*, 235 SCIENCE 1607, 1607-11 (1987).

11. *See* WORLD RESOURCES INST., WORLD RESOURCES 1992-1993, at 167 (1992).

large improvements. Starting in the early-1980s, point sources have had to meet effluent limits consistent with a variety of technology-based standards such as "best available technology economically achievable."[12] Establishment of the National Pollution Discharge Elimination System (NPDES) permitting system has brought reporting, penalty, and anti-backsliding provisions to the regulatory scheme. Complementing this federal permit authority, section 505 of the CWA enables citizens to file suit for compliance with NPDES permits or EPA orders.[13] Together, these enforcement tools have precipitated significant reductions in industrial point source releases. For instance, between 1987 and 1990 toxic discharges to surface water fell from 417 to 197 million pounds per year, according to Toxics Release Inventory data.[14] By setting limits on the discharge of more than sixty pollutants, including organic pollutants and heavy metals, the EPA Office of Water currently estimates that the program reduces conventional pollutant discharges by 108 million pounds and toxic discharges by twenty-four million pounds annually.[15] A rough, but illustrative, benchmark of these collective improvements is offered by the EPA: "[i]n 1972, most estimates were that only thirty to forty percent of assessed waters met water quality goals such as being safe for fishing and swimming. Today, state monitoring data indicate that between sixty to seventy percent of assessed waters meet state water quality goals."[16]

There is at least an academic consensus that the CWA is one of the environmental movement's success stories, due to its success in motivating point sources controls.[17] But to say that the CWA has im-

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12. Compliance was phased in over a period of years, with the timing depending on the source category and effluent classification. *See* 42 U.S.C. § 1311(b)(2)(A).

13. *See* 33 U.S.C. § 1365 (1998). The CWA's citizen suit provisions are thought to have been particularly effective, at least relative to their use under other statutes. *See* Charles S. Abell, *Ignoring the Trees for the Forest: How the Citizen Suit Provision of the Clean Water Act Violates the Constitution's Separation of Powers Principle*, 81 VA. L. REV. 1957, 1960 (1995). For a more critical view of penalties under the CWA, see ROBERT ADLER ET AL., THE CLEAN WATER ACT 20 YEARS LATER 166-170 (1993). For an analysis of whether citizen suits are available in the context of water quality-based CWA violations, rather than permitting violations, see Michael P. Healy, *Still Dirty After Twenty-Five Years: Water Quality Standard Enforcement and the Availability of Citizen Suits*, 24 ECOLOGY L.Q. 393, 433-442 (1997).

14. However, the study in which these figures are cited is highly critical of the implementation of point source regulations under the CWA. *See* ADLER ET AL., *supra* note 13, at 18.

15. *See* OFF. OF WATER, U.S. EPA, CLEAN WATER SUCCESSES AND CHALLENGES <http://www.cleanwater.gov/action/c1a.html> (last modified Aug. 10, 1998).

16. *Id.*

17. *See* Drew Caputo, *A Job half Finished: The Clean Water Act After 25 Years*, 27 ENVTL. L. REP. 10574, 10,575-578 (1997); *see also* ROBERT V. PERCIVAL ET AL, ENVIRONMENTAL

proved water quality is not to say that further efforts are not indicated. In fact, the nation's waters remain significantly polluted.[18]

Despite the CWA's achievements, a sobering implication of the above figures is that, while sixty to seventy percent of waters now meet state standards, thirty to forty percent still fall short. More specifically, according to the latest National Water Quality Inventory, thirty-six percent of the rivers and streams surveyed were partially or fully impaired, and water quality is "threatened" in an additional eight percent.[19] Of the surveyed lakes, thirty-nine percent were partially or fully impaired, with water quality threatened in an additional ten percent.[20] For surveyed estuaries, thirty-eight percent are reported to be partially or fully impaired, with water quality threatened in an additional four percent.[21] Casting the data somewhat differently, the States have identified more than 20,000 individual river segments, lakes, and estuaries as polluted. This amounts to 300,000 miles of river and five million acres of lakes classified as polluted.[22]

Rank	**Rivers**	**Lakes**	**Estuaries**
1	Agriculture	Agriculture	Industrial discharges
2	Municipal Point Sources	Unspecified Nonpoint Sources	Urban Runoff/ Storm Sewers
3	Hydrologic Modification	Atmospheric Deposition	Municipal Point Sources
4	Habitat Modification	Urban Runoff/ Storm Sewers	Upstream Sources
5	Resource Extraction	Municipal Point Sources	Agriculture

REGULATION: LAW, SCIENCE, AND POLICY 873-876 (1996).

18. When it comes to overall water quality and the water quality-based regulations in the CWA, critics can be quite blunt. *See, e.g.*, Healy, *supra* note 13, at 395 ("[E]valuated from a variety of perspectives, the enforcement of the water quality-based system of pollution control must be viewed as a failure.").

19. *See id.*

20. *See id.*

21. *See* REPORT BROCHURE: NATIONAL WATER QUALITY INVENTORY 1996 REPORT TO CONGRESS, *supra* note 2, at 6. The surveys covered nineteen percent of all stream miles, forty percent of all lake acres, and seventy-two percent of all estuarine waters.

22. *See* OFFICE OF WATER, U.S. EPA, TOTAL MAXIMUM DAILY LOAD (TMDL) PROGRAM (Aug. 1999) <www.epa.gov/OWOW/tmdl/tmdlfs.html> (last modified Aug. 13 1999).

The data strongly suggest that improvements in water quality were disproportionately due to regulation of point sources.[23] There is now widespread recognition that nonpoint sources are of principal concern.[24] Consider the EPA's most recent ranking of sources contributing to water quality impairment;[25] industrial sources, while present on this list, clearly do not predominate. Instead, a host of nonpoint sources, particularly from urban and agricultural runoff, loom large.[26]

Pesticide, fertilizer, and animal waste runoff from agriculture is the single largest contributor to the impairment of rivers and lakes. The private incentive of agriculture to ensure the largest yields via perhaps excessive application of pesticides and fertilizers is a classic example of an environmental externality, since much of the application inevitably migrates into common resource waterbodies.[27] Logging and construction activities, many of them on federal lands, are a significant source of sediment contamination, as runoff carries fine-grained soils from roads and construction sites into lakes and streams.[28] In urban and suburban areas, watershed degradation is closely tied to increased population density and residential and commercial development.[29] In such areas the relatively impermeable nature of groundcover leads to rapid, unfiltered runoff from roadways and parking lots, chemically treated lawns, and commercial establishments.[30] Increased attention is also being given to atmospheric

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23. *See generally* U.S. EPA, THE QUALITY OF OUR NATION'S WATER, OVERVIEW OF STATES § 305(B) WATER QUALITY REPORTING FOR THE YEAR 1996 (1996) [herinafter THE QUALITY OF OUR NATION'S WATER].

24. This is not only clear from water quality data, but in the pronounced shift in legal and regulatory attention toward nonpoint sources. Section IV describes these changes in more detail.

25. *See* THE QUALITY OF OUR NATION'S WATER, *supra* note 23, at 13.

26. In common parlance, pollution from nonpoint sources is "runoff caused primarily by rainfall around activities that employ or cause pollutants." *United States v. Earth Sciences, Inc.,* 599 F.2d 368, 373 (10th Cir. 1979).

27. *See generally* ARUN MALIK ET AL., U.S. DEP'T OF AGRICULTURE, AGRICULTURAL NONPOINT SOURCE POLLUTION AND ECONOMIC INCENTIVE POLICIES: ISSUES IN THE REAUTHORIZATION OF THE CLEAN WATER ACT (1992).

28. *See* J. Lynch & E. Corbett, *Evaluation of Best Management Practices for Controlling Nonpoint Pollution from Silvicultural Operations*, 26 WATER RESOURCES BULLETIN 41, 41-52 (1990).

29. *See generally* WATER ENV'T FED'N AND THE AMERICAN SOC'Y OF CIVIL ENG'RS, URBAN RUNOFF QUALITY MANAGEMENT (1998).

30. Compare the "rainfall allocation" for natural and urban groundcover. With natural groundcover, approximately forty percent evaporates, fifty percent infiltrates the soil, and ten percent runs off. In an urban setting thirty percent evaporates, fifteen percent infiltrates, and fifty-five percent runs off. *See* NORTHEASTERN ILL. PLANNING COMM'N, URBAN

deposition, where pollutants from airborne dust and industrial and commercial air emissions are absorbed by surface waters or precipitated via rainfall.[31] In the Northwest, elevated water temperatures are having a negative impact on cold water salmon habitat.[32] Finally, legacy pollution (i.e., pollution no longer being discharged) collected in sediments is a significant source of ongoing waterbody impairment.[33]

One of the reasons these sources are such a significant problem is that they present serious implementation, monitoring, and enforcement challenges.[34] But the water quality problems they cause can no longer be ignored, particularly given the significant reductions already secured from point sources.[35] In this context, it is not surprising that political and legal pressure is being applied to the EPA, and in turn to the states, to make something of the regulatory potential contained in the CWA's TMDL provisions.

B. *The Changing Politics of Water Quality*

The seeds of this shift in regulatory emphasis have been in place since the Act's passage in 1972. Within section 303 lay provisions that called for an ambient water-quality driven (rather than end-of-pipe) approach to enforcement. The section calls upon the states to identify waters for which the point source controls elsewhere in the Act "are not stringent enough to implement any water quality standard applicable to such waters."[36] States must prioritize any waters so

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STORMWATER BEST MANAGEMENT PRACTICES FOR NORTHEASTERN ILLINOIS 5 (1993).

31. The rules "explicitly include atmospheric deposition as a nonpoint source of pollutants." Proposed Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. at 46,016.

32. Water temperature is viewed as a component of overall water quality. *See* Tom Alkire, *Temperature Becoming Larger Issue for Northwest Dischargers, Official Says*, 30 Env't Rep. (BNA) 795 (Aug. 20, 1999).

33. EPA estimates that 10 percent of the nation's lakes, rivers, and bays have sediment contaminated with toxic chemicals that can kill fish living in those waters or impair the health of people and wildlife who eat contaminated fish. *See EPA's Contaminated Sediment Management Strategy*, (visited October 10, 2000) <http://www.epa.gov/ostwater/cs/stratefs.html>, *citing* U.S. EPA, EPA 823-C-97-004 LISTING OF FISH AND WILDLIFE CONSUMPTION ADVISORIES (1997); U.S. EPA, EPA 823-R-97-006–008 THE INCIDENCE AND SEVERITY OF SEDIMENT CONTAMINATION IN SURFACE WATER OF THE UNITED STATES (1998).

34. For a broad overview of policies to control nonpoint sources, see Marc Ribaudo et al., *Economics of Water Quality Protection From Nonpoint Sources: Theory and Practice*, *in* U.S. DEP'T OF AGRICULTURE, ECONOMIC RESEARCH SERVICE REP'T 782 (1999).

35. In the words of one observer, "unless TMDLs include quantified restrictions on nonpoint sources, they are wasting everyone's time." Oliver A. Houck, *TMDLs, Are We There Yet: The Long Road Toward Water Quality-Based Regulation Under the Clean Water Act*, 27 Envtl. L. Rep. (Envtl. L. Inst.) 10,391, 10,401 (Aug. 1997).

36. 33 U.S.C. § 1313(d) (1998).

identified, based on analysis of use and severity of degradation, and establish TMDLs sufficient to bring the waters into compliance.

Section 303 provisions were largely ignored by states and the federal government during the first two decades of CWA enforcement.[37] But nonattainment of water quality goals and the desire to bring more sources into the regulated sphere has led to a reexamination of the latent enforcement power contained in section 303.[38] The importance of the section is, first, that it requires state-wide assessments and public documentation of water quality problems. As the public becomes aware of the "impaired" nature of the waters around their communities, this reporting alone will provide motivation for state regulatory efforts. Second, the TMDLs themselves appear, at least in principle, to imply that states must allocate pollutant load reductions to sources not currently covered by load restrictions. Since load reductions have been wrung from point sources over a period of twenty five years, and since the bulk of current impairment is due to nonpoint sources, any state seeking further load reductions – at least on a cost-benefit basis – will be led directly to nonpoint sources. In this way, the shift to ambient monitoring and standards almost necessarily leads to a greater emphasis on nonpoint sources.

Enforcement of section 303 clearly alters the politics of load reduction. The need to meet *in situ* water quality standards sets up a state-by-state confrontation between well-organized industrial interests—which can claim to have already paid their pollution control dues—and organized agricultural, silvicultural, and municipal interests that resist the "expansion" of CWA-driven requirements to their hard-to-solve nonpoint problems. An industrial and municipal constituency for nonpoint source controls can already be detected. According to the Director of the Association of Metropolitan Sewerage Agencies, "In the absence of nonpoint source controls, all these criteria drive tighter standards. All that's left is tighter limits on permits."[39] This scenario is obviously of great concern to current point source permit holders. A minority (dissenting) contribution to the

37. For a detailed analysis of the history of section 303 provisions in the context of the CWA's overall implementation, see Houck, *supra* note 35, at 10,391; Oliver A. Houck, *TMDLs: The Resurrection of Water Quality Standards-Based Regulation Under the Clean Water Act*, [27 News and Analysis] Envtl. L. Rep. (Envtl. L. Inst.) 10,329 (July 1997).

38. *See* WILLIAM H. RODGERS, JR., ENVIRONMENTAL LAW 252, 259-262 (2d ed. 1994) for a description of the important differences between technology-based, point source CWA enforcement and water quality-driven CWA enforcement.

39. Susan Bruninga, *Clean Water Act: Chances for Clean Water Bill Dim; EPA to Use Existing Authorities on Nonpoint Sources*, 29 Env't Rep. (BNA) No. 37, at S-18-19 (1999).

Federal Advisory Committee Report by a municipality representative and industrial source representative echoed the worry saying, "[i]t is patently unfair to encourage states to impose further burdens on point sources merely because of the absence of federal enforcement authority over nonpoint sources."[40]

The EPA's authority to implement the new TMDL rules is not accepted by all parties. Even if the new rules are successfully promulgated, many opponents have not accepted the changes quietly. Following publication of the proposed rule, members of a House subcommittee criticized the EPA for not requesting Congress to enact authorizing legislation in support of the TMDL program.[41] Some agricultural interests argue that the proposed TMDL rules "illegally link nonpoint source runoff to the federally dictated and enforceable TMDL program" by reading the CWA to cover only waters impaired by point sources.[42] The EPA's position is that the CWA provides ample authority for the TMDL rules.[43] In the Proposed Rule, the EPA directly addresses the argument that they have no authority to regulate nonpoint sources. "Section 319, a section that exclusively addresses nonpoint sources, provides clear evidence that Congress did not intend to limit the term 'pollutant' to point sources."[44] If a state fails to impose controls over an operation that is the source of an ongoing water impairment, the agency contends that the CWA provides it with authority to step in and issue Best Management Practices (BMPs) or other controls to reduce nonpoint pollution.[45]

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40. FAC, *supra* note 4, at I-5.

41. *See* Susan Bruninga, *House Panel Members Question EPA Authority to Issue TMDL Proposal*, 30 Env't Rep. (BNA) 1241 (Nov. 5, 1999).

42. Susan Bruninga, *Waters Impaired By Nonpoint Sources Would Be Listed, Draft TMDL Rule Says*, 30 Env't. Rep. (BNA) 519, 520 (July 16, 1999) (reporting argument presented in a memorandum to the Office of Management and Budget from the National Pork Producers Council, the National Cattlemen's Beef Association, and the American Crop Protection Association).

43. According to a recent federal district court ruling, non-point sources are covered under the TMDL provisions of the CWA. *See* Pronsolino v. Marcus, No. C 99-01828 WHA 1, 28 (N.D. Cal., March 30, 2000) <http://www.epa.gov/owow/tmdl/pronsdecision.pdf> (stating that "as to whether TMDLs were authorized in the first place for all substandard rivers and waters, there is no doubt. They plainly were and remain so today – without regard to the sources of pollution.").

44. Proposed Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. at 46,021. For a more detailed analysis of federal authority over nonpoint sources, see discussion *infra* Section IV.1.

45. *See* Bruninga, *supra* note 39, at 1241 (testimony of Chuck Fox, EPA assistant administrator for water); *see also* Houck, *supra* note 35, at 10,401.

C. *Litigation*

The direct impetus for the new focus on section 303 was a series of court cases beginning in the late 1980s that challenged the EPA's oversight of the states' responsibilities. Until very recently, most states had failed to submit their assessments of polluted waters (if those assessments even existed at all), and had therefore failed to engage in the prioritization of waters for cleanup, promulgation of TMDLs, and implementation of associated discharge controls called for under section 303. The history of this litigation has been usefully summarized by the EPA and others.[46] As of late 1999, the EPA is under court order in seventeen states to establish TMDLS if the states fail to do so. In fourteen other states, claims have been filed (or notice has been given of intent to file) seeking to compel the EPA to establish TMDLs.[47]

The Federal Advisory Committee and the new rules are a direct outgrowth of this litigation.[48] The litigation has also had an immediate effect on the states' assessment and reporting of impaired waters. *Idaho Sportsmen's Coalition v. Browner* is illustrative.[49] As of 1989, Idaho had submitted no list of "water quality limited segments" (WQLSs). As of 1992 the state had a list, but one with only thirty-six listed WQLSs. Using a "constructive submission" theory, the court found the EPA's approval of Idaho's compliance with section 303 to be arbitrary and contrary to law. Under court order, the EPA has since approved a list identifying 962 Idaho WQLSs. All states and territories have now at least submitted a list, with full EPA approval secured by thirty-eight states.[50]

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46. *See* OFF. OF WATER, U.S. EPA, TMDL LITIGATION BY STATE (Sept. 1, 1999) <www.epa.gov/OWOW/tmdl/lawsuit1.html> (last modified Sept. 8, 1999); *see also* Houck, *supra* note 37, at 10,344 ("By and large, they [the states] did not do anything called for under § 303(d) . . . . They did not do it in the 1970s. They did not do it in the 1980s. They did not do it at the outset of the 1990s, nor did EPA—until a series of citizen suits rocked EPA and the states into a hasty rereading of § 303(d) and the current scramble to comply.").

47. For cases establishing the failure of a state to meaningfully or fully submit the required section 303(d) lists and need to develop TMDLs, see Alaska Ctr for the Env't v. Browner, 20 F.3d 981 (9th Cir. 1994); Sierra Club v. Hankinson, 939 F. Supp 865 (N.D. Ga. 1996). For consent decrees or settlement agreements, see American Littoral Socy. v. EPA, 943 F. Supp 548 (E.D. Pa. 1996)); Defenders of Wildlife v. Browner, 909 F. Supp 1342 (D. Ariz. 1995).

48. *See* FAC, *supra* note 4; Proposed Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. at 46,012; Revisions to the National Pollutant Discharge Elimination System Program and Federal Antidegradation Policy In Support of Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. at 46,058.

49. *See* Idaho Sportsmen's Coalition v. Browner, 951 F. Supp. 962, 964 (W.D. Wash. 1996) (describing the case's procedural history).

50. It is important to note that these are lists of impaired waters, not the states' final

D. *Brief Overview of the Enacted Rules*

The revisions to the EPA's TMDL rules provide more specificity and structure to the operation of the program. The rules lay out a basic set of requirements for the states, including:

• *Which waters are listed.* While it is largely up to an individual state to determine which waters are impaired, relative to its own water quality standards, the rules require public review of the procedures by which a state generates its list.[51] And EPA has final approval authority over listings and the methodologies used to derive them. According to the rules, the EPA's view is that "the section 303(d) list should serve as a comprehensive public accounting of all waterbodies impaired or threatened by pollution and pollutants, irrespective of the tool or mechanism being used to achieve standards."[52]

• *A format for listing and the assignment of priorities.* The states are required to rank waters by their degree of impairment, assign waters on the list to categories that reflect their priority and progress toward meeting standards, and develop a "prioritized schedule" for attainment.[53] Impaired waterbodies designated as public drinking water supplies and those whose water quality poses a threat to species listed under the Endangered Species Act, must be designated as high priority.[54] Apart from that, the states are allowed discretion, subject to federal oversight. A range of factors may be considered in the development of the priority rankings. "These factors include immediate programmatic needs, vulnerability of particular waterbodies as aquatic habitats, recreational, economic and aesthetic importance of particular waterbodies, degree of public interest and support, and State, Territorial, authorized Tribal, or national policies and priorities."[55]

TMDL plans.

51. *See* 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, 65 Fed. Reg. at 43,603.

52. Proposed Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. at 46,025. States have latitude to determine the geographic scope of a waterbody or segment that is listed. Listing can relate to an entire basin or individual stream segments. There is a tradeoff here. Too large an area may overwhelm the regulator's ability to monitor, evaluate, and implement a plan effectively. Too small an area may fail to account for all of the sources contributing to a problem.

53. 40 C.F.R. § 130.27 (2000).

54. *See* Proposed Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. at 46,026.

55. *Id*. at 46,025.

• *Timelines.* States are required to establish TMDLs for all waterbodies within ten years.[56] TMDLs for waterbodies listed as "high priority" should be established first.[57]

• *The implementation of TMDLs themselves.* All TMDLs must identify the pollutants contributing to impairment, and establish the load reductions, including a margin of safety, necessary to bring the water into compliance. The TMDL must also identify pollutant sources, including nonpoint sources. In addition, the TMDL must feature an implementation plan, with a list and timeline for actions, including monitoring and verification of compliance. The implementation plan also includes an "allocation" of load reductions to different sources.[58] Local conditions – ecological, political, and economic – will be allowed to determine the nature of the allocation. According to the rule, TMDLs "provide for tradeoffs between alternative point and nonpoint source control options so that cost effectiveness, technical effectiveness, and the social and economic benefits of different allocations can be considered by decision-makers."[59]

State-level TMDL development, particularly the allocation of load reductions, is likely to spur a host of innovative approaches to pollutant load reductions by drawing new sources and trading mechanisms into new control systems. But, to complement this many-flowers-will-bloom flexibility, the new rules codify a set of requirements meant to guarantee meaningful and comparable state initiatives.

The rules are analyzed in more detail below.[60] While still subject to significant implementation questions, the rules should nevertheless

56. *See* 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, 65 Fed. Reg. at 43,591. The final regulations require TMDLs to be established by July 2010. An additional five years will be granted if a state can show the ten year deadline is "not practicable."

57. Proposed Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. at 46,050.

58. *See* 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, 65 Fed. Reg. at 43,597-600.

59. Proposed Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. at 46,030.

60. The proposed TMDL rules were accompanied by proposed changes to the NPDES permitting system for point sources. These rules, which were dropped in the final version, included new point source offset requirements and re-classification of certain large animal feeding, aquatic animal production, and certain forestry operations as point sources. For discussion of these rules, and reasons for their exclusion, see Revisions to the Water Quality Planning and Management Regulation and Revisions to the National Pollutant Discharge Elimination System

be recognized as a significant new development in the nation's approach to water quality improvement.

III. COMPLETED TMDLS: AN ILLUSTRATION

In response to the threat of litigation, or under court order, a number of states have moved forward with the development of loading standards for priority impaired water segments.[61] We now describe Oregon's Columbia Slough TMDLs in order to concretely illustrate the components and practical implications of a TMDL analysis and plan.[62] The Columbia Slough TMDLs should not necessarily be viewed as representative of TMDLs generally, since the problems and solutions identified in TMDL planning are highly idiosyncratic to their location. The case has been selected because it involves a complex set of impairments and includes detailed analysis and concrete implementation plans by the state. In fact, the Columbia Slough TMDLs are notably specific in their description of the enforcement and implementation tools that will be employed to achieve water quality improvements.

A. *Columbia Slough TMDLs*

Once impairments are identified through the listing process, TMDL planning focuses on the identification of pollutant sources, the allocation of responsibility for source reductions, and implementation and enforcement of the allocations. These steps are illustrated in the following case description.

Columbia Slough is a roughly nineteen mile long collection of mostly shallow water channels located on the Columbia River's floodplain near Portland. A variety of land uses – industrial, residential, and agricultural – occurs in the 40,000 acre area that drains into the Slough.[63] The geographic scope of the TMDL was determined largely by hydrological characteristics such as drainage areas and tidal

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Program in Support of Revisions to the Water Quality Planning and Management Regulation, 65 Fed. Reg. at 43,639-52.

61. Among others, California, Maryland, Pennsylvania, West Virginia, North Carolina, Delaware, and Oregon have completed EPA-approved TMDLs for some of their state's impaired water segments. *See Total Maximum Daily Load Program,* (visited October 11, 2000) <http://www.epa.gov/owow/tmdl/>.

62. *See* OREGON DEP'T OF ENVTL. QUALITY, COLUMBIA SLOUGH TMDLS (1998) (visited Mar. 21, 2000) <http://waterquality.deq.state.or.us/wq/TMDLs/TMDLs.htm.> [hereinafter CSTMDL].

63. *See id*. at 4.

flows. The TMDLs for Columbia Slough were approved by the EPA in November, 1998.[64]

1. How Are Water Quality Problems Identified?

The first step in the TMDL process is the listing of a waterbody as impaired. This process identifies the category of impairment (e.g., excessive algae or lead) and compares existing conditions to the relevant water quality standard. Impairment is determined according to criteria established and documented by the state.[65] These criteria describe the standards for each category of impairment, the data required for analysis, and guidelines to ensure the quality of data analysis.[66]

As an example, consider the state's framework for determining chlorophyll *a* impairment. The beneficial uses affected by impairment include water contact recreation, aesthetics, fishing, water supply, and livestock watering. The standards are expressed as numeric concentrations (e.g., mg/l).[67] Water quality is considered limited, and thus subject to listing, if the 3-month average exceeds the numeric standard.[68] Data used for the 1998 listing of waterbodies come from a variety of sources, including Oregon DEQ itself, as well as contractors and federal agencies. Standards and data vary by pollutant. For example, fish or shellfish consumption advisories issued by the Oregon State Health Division indicate impairment from toxic pollutants.[69]

The Columbia Slough was placed on the Oregon Department of Environmental Quality's section 303(d) list due to a variety of impairments. The Slough was found to be in violation of standards for chlorophyll *a*, dissolved oxygen, pH, phosphorus, bacteria, and a range of toxic pollutants, including lead, dioxin, and PCBs. These pollutants individually threaten one or more beneficial uses of the waterbody including recreational fishing, boating, swimming, or support of aquatic life. Water column, fish tissue, and sediment data were

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64. *See* STATE OF OR. DEP'T OF ENVTL. QUALITY, TOTAL MAXIMUM DAILY LOAD DOCUMENTS, (visited September 24, 2000) <http://waterquality.deq.state.or.us/wq/TMDLs/TMDLs.htm> [hereinafter OR. TMDL DOCUMENTS].

65. *See* OREGON DEP'T OF ENVTL. QUALITY, LISTING CRITERIA FOR OREGON'S 1998 303(D) LIST OF WATER QUALITY LIMITED WATER BODIES (1998).

66. *See* Oregon Water Quality Standards, *described in* OR. ADMIN. R. 340-41 (2000).

67. *See* OR. ADMIN. R. 340-41, *supra* note 66 (specifying such standards for individual basins in the state).

68. *See id*. There is a required minimum of 5 representative data points per sampling site, collected on separate days during the peak algal growing season.

69. *See* OR. ADMIN. R. 340-41-445(2)(p).

used to identify the Slough as impaired. This data came from a variety of sources, including metropolitan agencies, the City of Portland Bureau of Environmental Services, Portland State University, and the U.S. Environmental Protection Agency (EPA). Historically, monitoring of the waterbody has been conducted only "sporadically," according to the DEQ.[70]

The Columbia Slough case highlights the value of the listing process. As of 1998, Portland residents can refer to a readily available state analysis of a local waterbody that provides a range of recreational, aesthetic, and commercial values. That the waterbody suffers from ten distinct forms of impairment is an easily comprehended and presumably politically salient piece of information.[71] Moreover, the listing process also promotes higher quality and more consistent data collection and analysis.

2. How are Sources and Their Contributions to Impairment Identified?

With knowledge of impairment, states must design TMDLs that provide a defensible plan for source reductions to bring the waterbody into attainment.[72] This requires knowledge of sources and the pathways by which pollutants are transported and deposited into the waterbody. Identification of sources and pathways requires a kind of holistic accounting exercise. To construct a source inventory, states will typically survey permitted sources (industrial and municipal point sources) and inventory land uses in the water body's drainage area to identify nonpoint sources, such as agricultural and urban runoff. In some cases, source identification requires the equivalent of detective work to connect ambient conditions with specific sources. For example, severe oxygen depletion was detected in the Slough following a large winter storm. This suggested that a source of impairment was airplane de-icing chemicals that ran into the Slough from Portland International Airport. In another case, elevated bacteria levels "substantially higher than those predicted via modeling" have directed attention toward the detection of illicit discharges.[73]

70. *See* CSTMDL, *supra* note 62, at 5.

71. *See* OR. TMDL DOCUMENTS, *supra* note 64. Like the Toxics Release Inventory, the provision of information relating to pollutant discharges alone may yield environmental benefits. Local political pressure on pollutant sources may be provoked by such listing. At a national level, this kind of reporting also gives environmental advocates a useful way to compare and judge the performance of regulators and source categories.

72. *See supra* Part I.D.

73. CSTMDL, *supra* note 62, at 28.

In addition to source identification, the TMDL must estimate the effect of source reductions and other control activities on the Slough's water quality. In some cases, this process is straightforward. For example, an already permitted point source may discharge directly into the waterbody. If so, the source, transport and deposition mechanism and contribution to loadings in the receiving waterbody are already known. In general, however, TMDLs will be geared toward waterbodies with multiple sources that migrate and enter the waterbody via a diverse set of pathways. Understanding the contribution of a particular source to loadings in this more general set of cases is a significant technical challenge.

Sources of impairment in Columbia Slough include a complex mix of sewer overflows, urban runoff, landfill leachate, industrial discharges, sediments, and agricultural runoff.[74] The complexity of making source determinations is compounded by a variety of interactions between ground and surface water, weather events, temperature, and water quality.[75] For this reason, source contributions are rarely known with certainty. Instead, the regulator must rely on models that attempt to capture the factors that affect the transport, deposition, and ultimate fate of pollutants in the waterbody.

The models used are determined by the type of data available and the nature of the system being described. For instance, stormwater discharges can be monitored for lead. This provides a rough gauge of the amount of lead deposition due to urban runoff. In turn, contributions to urban runoff by categories of sources can be estimated by modeling. Concretely, the land area in the drainage area occupied by industrial facilities or roadways can be used to estimate the fraction of lead runoff from those sources. The Columbia Slough TMDL includes a particularly detailed analysis of lead loadings. Individual industrial, stormwater, and sewer point source permit holders have been identified and their lead discharges assessed. In addition, an analysis was performed to determine lead contributions by land use category. For each category, including residential, industrial, commercial, parks, and traffic corridor, the land area was calculated and the lead load (in pounds per year) was estimated.[76] Consider the model used to calculate these loads for a single land use category:

> The contribution of lead from permitted industrial sites is calculated using the following equation: (Area x Annual Rainfall x Run-

74. *See id.* at 4.
75. *See generally* STEVEN CHAPRA, SURFACE WATER QUALITY MODELING (1997).
76. *See* CSTMDL, *supra* note 62, app. A, at A-15.

> off Coefficient x Pollutant Concentration = Annual Pollutant Load). The annual rainfall for the watershed is given in Table 3-12 of the Portland MS4 permit application as 34.3 inches per year, and the runoff coefficient for industrial areas is given in Table 3-13 as 0.68.[77]

This example highlights the data requirements and assumptions that go into calculating a single number in a single analysis that is a component of a much larger evaluation of sources and relative pollutant contributions.

The modeling techniques and data required for TMDL implementation pose a significant challenge. Accordingly, they also contribute significantly to the costs of implementation.[78] Some simplicity and cost savings will undoubtedly be possible as states become more practiced in TMDL development – and as more resources are devoted to the development of data and models for use in this kind of program. However, the degree to which data sources and modeling techniques can be standardized is limited. Each listed water segment is unique in its hydrology, transport pathways, pollutant sources, etc. TMDL development will invariably involve some site-specific analysis (even if the point of the analysis is simply to show that some set of standard data and techniques is applicable to the waterbody).

As an example of the site-specific nature of this analysis, consider the Columbia Slough TMDL approach to excessive nutrient loadings. Because "point source loads are minor,"[79] the search for source reductions involves groundwater controls, such as the installation of sanitary sewers. However, because the effect of these reductions is extremely delayed and "uncertain,"[80] the plan calls for changes in channel and stream flow. The recommended changes are based on a site-specific analysis of natural flows, temperature, time of year, expected algae growth and flow management techniques available in the drainage area. The applicability of general modeling techniques to this kind of problem is limited.

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77. *Id.*

78. An EPA study of TMDL costs identified modeling and data collection (monitoring) costs as the most significant contributors to the costs of TMDL implementation. The study of fourteen completed TMDLs found that development costs ranged from 4,000 to more than a million dollars. Eight of the fourteen cost more than $100,000. *See* OFF. OF WATER, U.S. EPA, EPA 841-R-96-001, TMDL DEVELOPMENT COST ESTIMATES: CASE STUDIES OF 14 TMDLS (1996).

79. *See* CSTMDL, *supra* note 62, at 14.

80. *See id.* at 24. The report suggests that it will take thirty years to achieve a forty percent reduction in groundwater nitrogen. *See id.*

For Columbia Slough, the extent of documentation related to data, analysis, and methods is exemplary, as is the sophistication of the analysis itself. However, the volume and complexity of the modeling techniques imply an equally complex array of simplifying assumptions and potential shortcomings. In general, the TMDL process highlights data limitations and our ignorance of the physical, chemical, and ecological factors that determine the fate of pollutants.

3. How Is Responsibility for Reductions Determined?

Having determined the contribution of source categories to impairment, the TMDL must assign load "allocations" (divisions of responsibility for reductions) that are expected to bring the waterbody into compliance.[81] In the case of some, though not necessarily all sources, these allocations will require reductions in current discharges. Thus, the allocations determine responsibility for the technological or land management changes that will lead to improvements in water quality. For example, a currently discharging source, if allocated a zero wasteload, must totally eliminate its discharges.

In some cases, the allocation is assigned to specific sources, in others, to general categories such as a type of land use. Not surprisingly, allocations to specific sources tend be directed at point sources and general allocations directed toward to nonpoint sources. As in the determination of sources, the allocation process often involves a quantitative modeling exercise. Modeling is used to estimate the impact of a load reduction from a particular source on the receiving waterbody. Models may also be used to predict how changes in land use due to economic growth will add to the waste load.[82]

Consider the allocations used to reduce Biochemical Oxygen Demand (BOD) in the Slough. Recall that the two primary sources contributing to the oxygen deficit are Portland International Airport and urban runoff. Oregon allocated responsibility for reductions by considering the relative baseline contributions to the oxygen deficit. These relative contributions were determined, via modeling, to be 3.8 lbs. of BOD airport load for every pound of urban runoff load. This ratio provided the basis for the allocation of reductions. Within these broad categories further divisions were made. For de-icing, eighty-nine percent was assigned to the airport and the remaining eleven percent to the Oregon National Guard. For urban runoff, forty-six

81. *See supra* Part II.D.

82. If growth is expected, the TMDL must explicitly consider that as a source category and provide an allocation for land use changes.

percent was assigned to permitted stormwater dischargers and the remainder to future growth and non-permitted sources.[83] In the course of the public comment process the allocation was explained as follows: "DEQ . . . feels that allocations based on the relative contributions of the pollutant is appropriate for a situation in which one source causes most of the water quality impairment."[84] Note that the rationale for the allocation makes no reference to the costs of discharge controls. Instead, equity seems the underlying motivation. No explicit rationale need be, or is, given.

Allocations are also motivated by pragmatism. In several cases, the permitted allocation is equal to the baseline contribution of a source, implying no need for source reductions. These examples include upstream sources of bacteria (which, because they are upstream are not controllable via this particular TMDL)[85] and atmospheric deposition of lead (uncontrollable for similar reasons).[86] Interestingly, specific point sources are in some cases also exempt from load reductions. This is true presumably because point sources are already subject to "best available" controls on releases. For example, a landfill generating lead-contaminated leachate was not required to achieve reductions in excess of its baseline allocation.[87]

Discharge reductions in Columbia Slough are to come from a variety of sources. For bacteria, reductions are achieved by eliminating combined sewer overflow (CSO) discharges[88] and eliminating illegal raw sewage sources. Both received a load allocation of zero.[89] The primary reductions in lead loadings are allocated to sources of urban runoff. These reductions are to come from changes in industrial stormwater permits and implementation of BMPs applied to commercial, industrial, and traffic corridor land uses.[90] For nutrients, reductions from a single agricultural point source and drainage district water flow management changes are required. Direct reduction in organic contaminants, such as DDT and dioxin are not possible since the release of these pollutants is now prohibited. Instead, the TMDL

83. *See* CSTMDL, supra note 62, at 12-14.

84. *Id*. at E-14.

85. *See id*. at 30.

86. *See id.* at 36.

87. *See id.* at 38.

88. *See id*. at 28. The City has been ordered to eliminate all untreated CSO discharges to the Columbia Slough. *See* Amended and Stipulated Consent Order, WQ-NWR-91-75, *cited in* CSTMDL, *supra* note 62 app. E at E-21.

89. *See id*. at 30.

90. BMPs are discussed in more detail in Part IV *infra*.

focuses on erosion in the drainage area. Stormwater transport of contaminated sediment is the primary transport and deposition mechanism. The stormwater allocation is reduced. Moreover, of the total organic allocation, thirty-three percent is devoted to future growth, since construction promotes erosion and is expected to increase loads. Reductions are to be achieved by implementation of erosion control BMPs.

4. How Will Implementation and Enforcement of the TMDL Be Achieved?

With the allocation of loads, and the reductions in discharges they imply, TMDLs must then specify the policies that will be used to achieve those allocations.[91] How are allocations to be monitored? What enforcement tools can be brought to bear to ensure compliance? Is private or public funding available for the technological and management changes implied by the allocations? The more specific and helpful a TMDL is in response to these questions, the more likely are its load reductions to be translated from aspirations into reality.

The Columbia Slough TMDL is noteworthy in that it provides particularly detailed descriptions of implementation activities. Implementation takes a variety of forms, including monitoring, revisions to NPDES permits, public capital projects, and the use of BMPs. Monitoring requirements include an ongoing study of airport-related BOD, a survey of area septic systems to identify sources of bacteria, and monitoring of toxic runoff associated with environmental cleanup sites. Revision of the airport's NPDES permit is identified as a way to promote more effective treatment of de-icing runoff.[92] Public capital projects that will lead to reductions include the construction of sanitary sewers, removal of cesspools, construction of treatment facilities for CSOs, and separation of sewers from stormwater systems.[93] Both private landowners and local government entities are required to use a variety of BMPs, including redesign of roof drains to avoid bacteria discharges from septic systems, techniques to control erosion

91. *See* Proposed Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. at 46,033. "The implementation plan must contain reasonable assurance that the implementation activities will occur." *See id*. "Without implementation, TMDLs are merely paper plans to attain water quality standards." 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, 65 Fed. Reg. at 43,625.

92. *See* CSTMDL, supra note 62, at 15.

93. *See id.* at 25.

and the transport of contaminated sediment, and changes in flow management by the area drainage district.[94] Renewal of stormwater permits will also be contingent on evidence of BMP compliance.[95]

The plans are also explicit in their assignment of responsibility for monitoring activities and BMP implementation among government entities. Memorandums of agreement between designated management agencies form the basis for this division of authority.[96] Responsibility is divided between the DEQ, a collection of municipal governments, county government, and the state Departments of Agriculture and Transportation.[97] In addition, DEQ lists a set of possible funding sources for TMDL-related attainment projects, available to both private and public entities.[98]

On paper, the Columbia Slough TMDL illustrates the promise of an ambient water quality-driven regulatory approach. The TMDL identifies impairments and their sources, allocates responsibility for source reductions and management improvements, and offers a detailed plan for monitoring and implementing improvements. This marks an ambitious expansion of efforts relative to conventional water quality regulation. The TMDL expands waterbody and source monitoring and the techniques used to analyze pollutant transport and deposition. The plan also imposes regulatory requirements on previously unregulated sources and mandates changes in land and water management practices throughout the drainage area. Finally, the TMDL notifies the source of those problems and identifies the private and public parties responsible for improvements.

B. *Other Examples*

One of the distinguishing features of Columbia Slough is that agricultural nonpoint sources are not a significant source of impairment. As previously noted, agricultural nonpoint sources will be featured in

94. *See id.* at 25.

95. *See id.* at 16. For more discussion of BMPs, see Part IV.B, *infra*.

96. *See* CSTMDL, *supra* note 62, at 3.

97. *See id*. at 45.

98. *See id*. app. E at E-3. According to DEQ, "several sources of funding are currently available, either through federal programs administered by the Natural Resource Conservation Service or a local soil and water conservation district (SWCD). There are also state cost sharing dollars which may be available through the SWCD or through a local watershed council. The state also has funding under the Oregon Plan for Salmon and Watersheds that landowners, associations, or commodity groups can apply for directly. Finally, Oregon is applying to the U.S. Department of Agriculture for additional funding under the Conservation Reserve Enhancement Program." *See id*.

many TMDLs, due to the prevalence of excessive nutrient loadings in many of the nation's waterways. A brief description of nutrient TMDLs is therefore instructive. Like the Columbia Slough analyses, TMDLs for nutrients involve modeling exercises to determine source contributions from agriculture, urban nonpoint sources, and point sources — all of which can contribute to nitrogen and phosphorus loads.

North Carolina's plan for nitrogen reduction in the Neuse River basin is illustrative.[99] The TMDL estimates the relative contributions of point and nonpoint sources and calls for thirty percent reductions in nitrogen loads from both point and nonpoint sources.[100] For agricultural nonpoint sources, the TMDL proposes to achieve reductions through farmer participation in local planning exercises or compliance with BMPs (specifically, installation of forested riparian areas or vegetative filter strips). Other initiatives included in the TMDL are a requirement that those applying fertilizer to areas of more than fifty acres receive training in nutrient management.[101]

A characteristic of several nutrient TMDLs is that reductions are sought from both point sources and from nonpoint sources. Maryland requires NPDES permitting changes for sewage treatment in the Port Tobacco watershed.[102] California calls for revision of NPDES permits to meet nutrient reductions in San Diego Creek and Newport Bay.[103] Delaware's Nanticoke River TMDL requires nutrient removal at three wastewater treatment plants,[104] and Delaware's Indian River TMDL calls for the total elimination of point source discharges.[105] In-

99. *See* NORTH CAROLINA DEP'T OF ENV'T AND NAT. RESOURCES, TOTAL MAXIMUM DAILY LOAD FOR TOTAL NITROGEN TO THE NEUSE RIVER ESTUARY, NORTH CAROLINA (1999) <http://h2o.enr.state.nc.us/TMDL/Neuse_TMDL.PDF>, [hereinafter Neuse River TMDL].

100. *See id*. at 37, 38.

101. *See id*. at 39.

102. *See* MARYLAND DEP'T OF THE ENV'T, TOTAL MAXIMUM DAILY LOADS OF NITROGEN AND PHOSPHORUS FOR THE PORT TOBACCO RIVER (1999) (visited October 12, 2000) <http://www.epa.gov/reg3wapd/tmdl/tmdl.htm> [hereinafter Port Tobacco TMDL].

103. *See* U.S. EPA REGION 9, TOTAL MAXIMUM DAILY LOADS FOR NUTRIENTS, SAN DIEGO CREEK AND NEWPORT BAY, CALIFORNIA (visited October 12, 2000) <http://www.epa.gov/region09/water/tmdl/final.html> [hereinafter San Diego Creek TMDL].

104. *See* DELAWARE DEP'T OF NAT. RESOURCES AND ENVTL. CONTROL, TOTAL MAXIMUM DAILY LOAD ANALYSIS FOR NANTICOKE RIVER AND BROAD CREEK, DELAWARE viii (1998) <http://www.dnrec.state.de.us/DNREC2000/Library/Misc/Unorg/nbrtmdla.pdf> [hereinafter Nanticoke River TMDL].

105. *See* DELAWARE DEP'T OF NAT. RESOURCES AND ENVTL. CONTROL, TOTAL MAXIMUM DAILY LOAD ANALYSIS FOR INDIAN RIVER, INDIAN RIVER BAY, AND REHOBOTH BAY, DELAWARE (1998), <http://www.dnrec.state.de.us/newpages/pdf/ibfinaltmdl.pdf> [herein-

terestingly, several TMDLs are also counting on reductions in atmospheric deposition due to more stringent CAA controls on emissions of nitrogen oxides in order to meet nitrogen load reduction goals.[106]

In all of these cases, however, the net is also cast toward currently un-regulated sources, including agricultural nonpoint sources. All of the aforementioned TMDLs set nonpoint allocations. The San Diego Creek TMDL proposes to extend discharge requirements to small, unregulated nurseries.[107] It also requires the development of nutrient management plans for all agricultural operations not regulated by waste discharge requirements.[108] The Maryland Port Tobacco TMDL's nonpoint allocation assumes no additional requirements beyond existing BMP practices.[109] It does suggest that existing state programs will support the implementation of future nonpoint source controls, however.[110] Delaware's Nanticoke River and Indian River TMDLs require plans to institute agricultural BMPs in order to achieve those TMDLs' nonpoint allocations.[111] And as noted above, North Carolina's Neuse River TMDL explicitly requires expanded use of agricultural BMPs.[112]

The problems associated with translating nonpoint allocations into concrete improvements are explored below.[113] Completed TMDLs do indicate that a set of previously unregulated, unmanaged sources is experiencing, at the very least, heightened regulatory scrutiny.

IV. LONG-RUN IMPLEMENTATION OF THE PROGRAM

Having described the scope and promise of the new TMDL rules, we now turn to issues raised by the long-run implementation of the program. The federal government and states have broad, if somewhat untested, legal authority for expansion of controls to previously unregulated sources. After a description of their respective authority we turn to an exploration of policy tools available to promote source reductions and beneficial land and water management practices.

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after Indian River TMDL].

106. *See* Neuse River TMDL, *supra* note 99, at 40.

107. *See* San Diego Creek TMDL, *supra* note 101, at 21.

108. *See id.*

109. *See* Port Tobacco TMDL, *supra* note 102, at 25.

110. *See id*.

111. *See* Nanticoke River TMDL, *supra* note 104, at 4-3 ; Indian River TMDL, *supra* note 105, at 3-10.

112. *See* Neuse River TMDL, *supra* note 99, at 9.

113. *See infra* Part IV.

Then, we describe a set of scientific, legal, and practical challenges that will be faced by states as they seek approval for and implementation of their TMDL programs.

A. *Federal Authority and Nonpoint Sources*

The Clean Water Act prohibits discharge of a pollutant without a permit.[114] This broad prohibition is subject to a very important limitation, however. It applies in a legal sense only to discharges from point sources.[115] One way to expand federal legal authority is the semantic strategy of simply relabeling nonpoint sources as point sources.[116] In fact, the EPA proposed (but withdrew) an expansion of the definition of point sources to large-scale feeding operations and certain aquaculture and silviculture practices as part of its 1999 proposals.[117] In some cases, even smaller agricultural operations may be reclassified as sources subject to NPDES permitting, or threatened with such reclassification as an incentive to improve management practices.[118] But despite efforts to expand the universe of sources subject to the CWA's permitting, there remains a large universe of sources that resist simple reclassification.

As a result, the CWA's powerful, permit-driven mode of regulation does not apply to the primary cause of current water degradation. Some federal leverage exists, but it is more indirect than that provided for by the CWA's point source provisions. For example, section 319 of the Act addresses waters impaired by nonpoint sources. The section requires states to submit reports of such impairment, identify broad categories of sources, and identify BMPs and other measures to control "to the maximum extent practicable" pollution from those sources.[119] States are left with the discretion to determine whether control efforts are to be regulatory or nonregulatory, compelled or voluntary. Nowhere in the section is an explicit enforcement authority granted to the federal government. In principle, the federal government could withhold a state's NPDES permitting authority if the state fails to follow through on section 319's require-

114. *See* 33 U.S.C. § 1311(a) (1994).

115. *See* 33 U.S.C. § 1362(12) (1994).

116. The authority to reclassify pollution sources under the CWA resides with the EPA. This was affirmed by the D.C. Circuit in *NRDC v. Costle*, 568 F.2d 1369, 1377 (D.C. Cir. 1977).

117. *See supra* note 60 and accompanying text.

118. *See Dairy Farmer Required to Obtain NPDES Permit for Manure*, U.S. WATER NEWS, October 1999, at 15. The case involved a small dairy operation with significant manure management problems.

119. *See* 33 U.S.C. § 1329(a)(1) (1994).

ments.[120] But this extreme measure is not a substitute for a more explicit, practical federal ability to compel nonpoint reductions.[121]

More subtle forms of federal influence are available. Appropriations are available to states under section 319 and section 208. The threat of funding withdrawals, while a relatively weak incentive given the limited nature of funds at stake, is available to the EPA.[122] Section 208 instructs states, among other things, to develop a process to identify agricultural and forestry nonpoint sources. These sources include return flows from irrigated agriculture, runoff from manure disposal areas, and land used for livestock and crop production. The section sets forth procedures and methods (including land use requirements) to control such sources to the extent feasible [123] and provides revocable funding for the process.[124] EPA efforts to motivate state nonpoint initiatives are illustrated by an EPA memo to regional administrators, calling on them to "focus substantial grant dollars . . . toward those states that are providing reasonable assurances that nonpoint source load allocations established in TMDLs will in fact be achieved."[125] The memo also suggests that the administrators may "deny or revoke a state's enhanced benefits status under the new section 319 nonpoint source guidance."[126] These types of funding incentives indicate the EPA's concern with state nonpoint program development. They also signal the lack of more substantive authority on the part of the EPA to motivate that development.

Federal authority over the management of federal lands can be used to promote nonpoint source improvements. The Forest Service and the Bureau of Land Management, in principle, can use their authority to ensure adequate water monitoring and the implementa-

120. *See* 33 U.S.C. § 1313(e)(2)-(3) (1994) (authorizing the withdrawal of NPDES permitting authority from the delegated state).

121. For criticisms of section 319's weakness see David Zaring, *Agriculture, Nonpoint Source Pollution, and Regulatory Control: The Clean Water Act's Bleak Present and Future,* 20 HARV. ENVTL. L. REV. 515 (1996), and Houck, *supra* note 33, at 10,391.

122. The EPA received a $100 million increase in appropriations for fiscal year 1999 to deal with nonpoint source problems and considered making awards contingent on state adoption of improved nonpoint source initiatives. *See generally* Susan Bruninga, *EPA Eyes Change to Funding Formula To Maintain Levels for Some States*, 29 Envtl. L. Rep. (Envtl. L. Inst.) 1844 (1999).

123. Section 208 calls for the development of area-wide waste treatment plans by states. *See* 33 U.S.C. § 1288(b)(2)(F) (1998).

124. *See* 33 U.S.C. § 1288(d) (1998).

125. MEMORANDUM FROM THE U.S. EPA OFFICE OF WATER ON NEW POLICIES FOR ESTABLISHING AND IMPLEMENTING TOTAL MAXIMUM DAILY LOAD*S* (last modified August 8, 1997) <http://www.epa.gov/OWOW/tmdl/ratepace.html>.

126. *See id*.

tion of BMPs for grazing, logging, and road construction activities. In fact, both agencies have mandates to manage public lands for multiple uses, including recreation, fish and wildlife, and watershed uses.[127] Also, section 401 of the CWA empowers the States to review facilities or activities that require a federal permit.[128] Thus, states can compel federal agencies to manage lands in a manner compatible with water quality maintenance and improvement.[129]

Finally, the Department of Agriculture's Conservation Reserve and Wetland Reserve Programs in principle could be harnessed to promote BMPs on agricultural land. Access to agricultural price support and land retirement programs could be made conditional on the adoption of pesticide and fertilizer reductions, though this is not current practice.[130]

Regarding the TMDL program itself, it is clear that primary authority for policies to implement TMDLs resides with the states. States have primary responsibility for developing their own lists of impaired waters and they are granted wide latitude to determine their own priorities and implementation plans.[131] However, recent litigation and the EPA's own posture suggest that there must, and will, be a strong federal oversight of these state programs.[132] The proposed rules outline the agency's vision of its own authority. According to the rules, "EPA has strong and diverse authorities to implement controls over nonpoint sources in the event that EPA were to disapprove a TMDL submitted by a State and to develop a TMDL for the impaired water."[133] This assertion sounds somewhat defensive, and should, since as previously argued federal authority to compel nonpoint controls is limited. However, the rule identifies section 504 as one particular source of federal authority. Under section 504, the administrator can compel action when there is an "imminent or sub-

127. *See* 16 U.S.C. §§ 528-529 (1994); 43 U.S.C. § 1701 (1994).

128. *See* 33 U.S.C. § 1341 (1998).

129. *See* Debra Donahue, *The Untapped Power of Clean Water Act Section 401*, 23 ECOLOGY L.Q. 201, 251 (1996).

130. Acceptance into the Conservation Reserve Program is currently sensitive to some environmental considerations, including proximity to waterbodies. For an analysis of the benefits of this kind of environmental targeting, see PETER FEATHER ET AL., U.S. DEPT. OF AG., AER-778, ECONOMIC VALUATION OF ENVIRONMENTAL BENEFITS AND THE TARGETING OF CONSERVATION PROGRAMS (1999).

131. *See* 33 U.S.C. § 1313(d)(1)(A) (1998); 40 C.F.R. § 130.7(b) (1999).

132. See section II.C *supra*, for a description of this litigation. Also, see discussion of Pronsolino v. Marcus, *supra* note 43.

133. Proposed Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. at 46,034.

stantial endangerment to health or welfare of persons."[134] As an example of such an endangerment, the rule suggests a community's inability to market contaminated shellfish.

But in general, the federal TMDL program is not self-implementing. As the proposed rule acknowledges, load allocations for nonpoint sources are not directly enforceable under the CWA. "With respect to nonpoint sources the load allocations in a TMDL are only 'enforceable' to the extend they are made so by state laws and regulations."[135] Despite the federal government's clear role in prompting and overseeing state action under section 303, state law will ultimately determine the effectiveness of the TMDL program's long-run implementation.

B. *State Authority and Nonpoint Sources*

The litmus test of the TMDL program's success will be its ability to promote more effective nonpoint controls at the state level.[136] Nonpoint sources will increasingly occupy the attention of States as they identify impairments and sources and develop plans for water quality improvement.[137] But as argued above, nonpoint sources historically have not been the prime target of regulation. Moreover, there is likely to be political pressure at the state level to avoid an expansion of controls to this category of sources. To date, state initiatives have relied heavily on voluntary, unenforceable measures, particularly with regard to agricultural runoff.[138] Taken together, these factors raise concern regarding the states' willingness to meaningfully compel reductions in nonpoint loads. The EPA's proposed TMDL rule anticipates this concern by requiring "reasonable assurance" of implementation. These reasonable assurances require states to spec-

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134. *See* 33 U.S.C. § 1364 (2000).

135. *See* Proposed Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. at 46,042.

136. There is some skepticism regarding the federal government's ability to force improvements in nonpoint policy. In the words of an official at the Chesapeake Bay Foundation, "there is nothing in [the new rules] that addresses the issue of ensuring that the reductions that are supposed to be achieved from nonpoint sources are real, and measurable, and enforceable." BAY JOURNAL, Oct. 1999 at 10.

137. *See* J.B. Ruhl, *Farms, Their Environmental Harms, and Environmental Law*, 27 ECOLOGY L.Q. 263 (2000).

138. According to a detailed survey of State nonpoint pollution enforcement mechanisms, "[a]griculture is the most problematic area for enforceable mechanisms. Where state laws exist, they often defer to incentives, cost-sharing, and voluntary programs." ENVTL. LAW INST., ENFORCEABLE STATE MECHANISMS FOR THE CONTROL OF NONPOINT SOURCE WATER POLLUTION (1997) iii.

ify implementation policies, the timing of controls or incentives, analysis of the likely effectiveness of policies, and funding sources.[139]

For point sources, consistency with NPDES permits is considered a valid "assurance" of implementation. For nonpoint sources, the most direct assurance of implementation is the availability of state laws to compel nonpoint controls, and the willingness to enforce those laws. There are in fact a large number of state statutory provisions that could be called into service. These laws include general prohibitions against pollution discharges, enforcement actions triggered by fish kills or threats to public health, sedimentation and erosion laws, and laws designed to protect specific areas for conservation.[140] Most states have access to such statutory levers, which can be directly cited as a form of reasonable assurance. In addition, regulations governing stormwater runoff, zoning, and other land use ordinances would likely qualify. Assurance could also be demonstrated by management contracts between government agencies and land users, memoranda of understanding between government entities, and bonding requirements to ensure appropriate land management practices. A variety of approaches will arise as state regulators seek innovative ways to motivate quality improvements. As an example, there are proposals in Washington State to limit irrigation water allocations to farmers who fail to take precautions against sediment runoff.[141] In Iowa, a pilot crop yield insurance plan reduces the risk to farmers of under-performing crop yields when they decrease fertilizer applications.[142] These examples are indicative of the kind of policy innova-

139. This includes analysis of the "anticipated or past effectiveness of the best management practices and/or controls that are expected to meet the wasteload and load allocations." Proposed Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. at 46,033. For a detailed definition of what constitutes "reasonable assurance" see 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, 65 Fed. Reg. at 43,598-600.

140. *See* ENVTL. LAW INST., ALMANAC OF ENFORCEABLE STATE LAWS TO CONTROL NONPOINT SOURCE WATER POLLUTION (1998). According to the study, which reviews applicable laws in all 50 States, Puerto Rico, and the District of Columbia, "most states have a number of enforceable authorities that can be used to address various nonpoint source discharges." ELI's earlier study also showed, however, that many of these legal mechanisms contain exemptions and may not always be effectively enforced. ENVTL. LAW INST, *supra* note 138, at i-v.

141. *See Irrigators Warned to Clean Farm Runoff to Protect Fish Habitat*, U.S. WATER NEWS, March 1998, at 14.

142. *See Crop Insurance Plan Helps Farmers Reduce Nitrogen Use*, U.S. WATER NEWS, March 1999, at 1. Over-fertilization is common since it builds in a margin of safety (for the farmer) against fertilizer losses due to heavy rain-related runoff.

tions that can be harnessed by states to compel or otherwise promote nonpoint load reductions.

On one hand, the long list of existing state enforcement tools is reassuring. On the other hand, that long list has thus far failed to yield adequate water quality in many of the nation's streams, lakes, and estuaries. In some cases, the failure is due to explicit exemptions for certain nonpoint sources. In other cases, the law may simply be unenforced. Many of the states with general discharge provisions explicitly exempt agriculture.[143] Massachusetts prohibits the discharge of any pollutant without a permit, but agricultural nonpoint discharges are exempted.[144] Exemptions are also found in more targeted regulations. In Ohio, land development that disturbs the soil cannot occur without state approval.[145] But, this requirement does not extend to agricultural operations. The TMDL-driven need for load reductions may erode some of these statutory exemptions as point sources permitees exert political pressure of their own to avoid further, costly point source reductions, and environmental interests focus greater attention on impairments.[146] Dormant provisions may also be called into more active service by state program administrators who must ultimately demonstrate real pollution reductions under section 303.

C. *Best Management Practices as Enforceable Standards*

Best Management Practices are a central feature of most nonpoint source control programs. BMPs are management standards that guide forest, agriculture, construction, and other activities in order to reduce nonpoint runoff. BMPs are based on the practical experience of land managers and improvements in the scientific and technical understanding of the relationship between land management practices and environmental impacts. In agriculture, examples include the installation of buffer strips along stream beds, adequate fencing to keep livestock from directly soiling surface water, placing sheds over manure piles to minimize runoff, and low chemical intensity pest control techniques. Forestry BMPs include harvest and road

143. *See* ENVTL. LAW INST., *supra* note 138, at 11.

144. *See* MASS. REGS. CODE. tit. 314, § 3.05 (2000).

145. *See* OHIO REV. CODE ANN. § 1511.02(E) (1998).

146. The State of Maryland recently imposed new rules on the ability of poultry slaughterhouses to spread sludge on fields beyond the fields' capacity to absorb it. The rules will be added as a condition of state permits governing slaughterhouse operations. *See* Peter S. Goodman, *Md. Poultry Firms to Face Strict Rules on Sludge Use*, WASH POST, March 30, 1999, at A6. The rules call for fines of up to $10,000 a day if slaughterhouse is found to be noncompliant. *See id*.

construction planning to avoid soil erosion from trails, roads, and stream crossings. Construction BMPs have a similar focus on techniques to minimize sedimentation due to erosion caused by soil disturbance. BMPs for municipalities include procedures to minimize the impact of road salting on urban runoff.

Depending on their application, BMPs can represent informal rules of thumb or be subject to approval by a government entity, such as a conservation district, state, or the U.S. Forest Service. As an illustration, Florida employs BMPs approved by a variety of organizations, including the U.S. Department of Agriculture Natural Resources Conservation Service and the Florida Department of Agriculture and Consumer Services (FDAC). FDAC has issued specific conservation practices for the purpose of protecting Florida's water resources (including streams, lakes and wetlands) from pollution associated with forestry operations.[147] These BMPs were originally designed in the mid-1970s in response to the CWA, but were revised in 1993 with the assistance of representatives from state and federal government, universities, the forest industry, and environmental groups. The recommended practices are detailed and depend on the size and type of waterbody involved, the local soil type, and the general potential of the site for erosion and sedimentation. A BMP Technical Advisory Committee meets biennially to evaluate the status and progress of BMP implementation and effectiveness.[148]

Section 208 of the CWA, which mandates state water quality plans, calls on states to describe in its plans the BMPS "which the [state] agency has selected as the means to control nonpoint source pollution where necessary to protect or achieve approved water uses."[149] The section outlines the desired characteristics of BMPs for a variety of nonpoint source categories.[150]

BMPs represent the nonpoint analog to end-of-pipe controls on point sources. They identify the technologies and techniques that

147. *See generally* FLA. DEP'T OF AGRIC. AND CONSUMER SERVICES, SILVICULTURE BEST MANAGEMENT PRACTICES (1993).

148. The Bureau of Water Analysis of the Florida Department of Environmental Regulation issued BMPs for Agriculture in 1978 pursuant to statutory requirements of the Clean Water Act. *See* NONPOINT SOURCE MANAGEMENT SECTION, FLA. DEP'T OF ENVTL. REGULATION, A MANUAL OF REFERENCE MANAGEMENT PRACTICES FOR AGRICULTURAL ACTIVITIES (1978). Unlike the specific conservation practices for forestry operations, these BMPs are general practices or categories of practices required to achieve the abatement of nonpoint source pollution. The manual refers to the U.S. Department of Agriculture for specific BMPs that are applicable in Florida.

149. *Supra* note 123, and associated text.

150. *See* 40 C.F.R. § 130.6(c)(4)(iii)(A)-(G) (1998).

lead to pollutant reductions. In some cases, states use BMPs as an aspirational goal or background threat, rather than as an enforceable standard. Colorado law calls for the development and approval of BMPs by the state department of agriculture, but defines BMPs as "any voluntary activity, procedure, or practice."[151] Thus, BMPs are not directly enforceable. Colorado does encourage their use to avoid the possibility of future regulation if "continued monitoring reveals that rules and regulations . . . are not preventing or mitigating the presence of the subject agricultural chemical to the extent necessary."[152] But, reliance on voluntary efforts should be viewed with skepticism.[153]

In other cases, BMPs are directly enforceable. Oregon law requires the State Forestry Board to develop and require the use of BMPs "as necessary to insure that to the maximum extent practicable nonpoint source discharges of pollutants resulting from forest operations on forestlands do not impair the achievement and maintenance of water quality standards . . . for the waters of the state," and criminal and civil penalties can be levied for failure to use these BMPs.[154] This regulatory "stick" is complemented by a significant "carrot," however. Forest operations conducted in accordance with BMPs can use such management as a defense against claims of water quality standard violations.[155] In Maryland, agricultural operations must employ BMPs under soil conservation district plans to protect nontidal wetlands.[156] Similar requirements are imposed on agriculture in the Chesapeake Bay watershed.[157] Federal law can compel the implementation of BMPs, particularly on federal lands.[158] In addition, states can independently force the federal government to make its financial as-

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151. COLO. REV. STAT. §25-8-103(1.3) (1999).

152. COLO. REV. STAT. §25-8-205.5(6)-(7) (1999). According to a state soil conservation district BMP guide for farmers, "if the voluntary approach is successful, further mandatory controls . . .will not need to be implemented." SHAVANO SOIL CONSERVATION DISTRICT, BEST MANAGEMENT PRACTICES FOR AGRICULTURE IN THE UNCOMPAHGRE VALLEY 7 (1997).

153. A study of barriers to BMP adoption found, not surprisingly, that the barriers were largely economic. "Many landowners noted the environmental benefits of the selected BMPs, but were reluctant to adopt them due to the direct costs involved." Eric Palas & Jeff Tisl, *The Implementation of Innovative Best Management Practices in the Sny Magill Watershed* (visited October 12, 2000) <http://www.igsb.uiowa.edu/inforsch/sny/implemen.htm>.

154. OR. REV. STAT. § 527.765(1) (1997).

155. *See* OR. REV. STAT. § 527.765(3) (1997).

156. *See* MD. CODE ANN., NAT. RES. § 8-1205 (1998).

157. *See* MD. CODE ANN., NAT. RES. § 8-1808(c)(6) (1998).

158. *See* Richard Whitman, *Clean Water or Multiple Use? Best Management Practices For Water Quality Control in the National Forests*, 16 ECOLOGY L.Q. 909 (1989).

sistance programs, permits, licenses, and development projects conform with state nonpoint control programs, which may feature BMPs.[159]

Recent cases illustrate a growing judicial awareness of the importance of BMPs. In *Sierra Club v. Martin*,[160] the U.S. Forest Service's adherence to BMPs was at issue. In *Blue Mountains Biodiversity Project v. Blackwood*,[161] BMPs associated with a site assessment were found to be inadequate given the characteristics of the site. *Idaho Sporting Congress v. Jemmet*,[162] tested the compliance of a National Forest timber sale contract with applicable BMPs. These cases suggest that BMPs increasingly can, and will, be examined to determine compliance with statutory land management requirements.

D. *The Technical Basis for Listing Criteria and Load Modeling*

The TMDL program requires states to develop scientifically and legally defensible data collection procedures, listing criteria, and watershed modeling tools.[163] TMDLs may be challenged if the implementing state agency fails to adequately define and employ these technical duties. In terms of listing waters as impaired, the proposed rule requires states to include with their section 303(d) lists a description of the methodology and factors used to prioritize and list waters as impaired.[164] As an example, the methodology description can explain how the number and severity of "exceedences" of a numeric chemical criteria translate into an impairment. Similar requirements are applied to TMDL load reduction plans. Implementation plans are required to contain monitoring and modeling procedures that will be used to gauge the effectiveness of load reduction actions. States are also required to explain their approach to "assessing the effectiveness of best management practices and control actions for non-

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159. *See* 33 U.S.C. § 1329 (b)(2)(F) (1999). *See also supra* note 129, and associated text.

160. *See* 992 F.Supp. 1448 (N.D. Ga. 1998) (holding that the Forest Service had not failed to implement BMPs as required by federal law).

161. *See* 161 F.3d 1208, 1214 (9th Cir. 1998) (finding the BMPs employed in an environmental assessment were inappropriate since the area had suffered fire burn and increased levels of erosion).

162. *See* 1997 WL 855506 (D. Idaho 1997) (determining that road construction in a Nez Perce National Forest timber sale had complied with all relevant BMPs).

163. *See* 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, 65 Fed. Reg. at 43,602-10.

164. *See* Proposed Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. at 46,019.

point sources."[165] These requirements may slow the process of TMDL implementation since they require the adoption of what may, for some states, be new techniques. Pollutant sources, dissatisfied with their designation, may also seek relief from TMDL load reductions by challenging a state's modeling tools, water quality criteria, and data collection procedures.[166]

Recent litigation has focused on one state agency's inability to promulgate lawful section 303(d) listing criteria and TMDLs associated with nutrient water quality standards.[167] In the case, the South Carolina Department of Health and Environmental Control's (DHEC) listing standards and associated TMDLs were voided by an administrative law judge. The agency was found to have violated proper public notice and other procedural safeguards designed to subject its standards and models to technical and legal scrutiny. According to the court, "DHEC has pursued its mission with unpromulgated regulations that should have been, but were not, subject to the scrutiny of DHEC's Board, the South Carolina General Assembly, and the public."[168]

While federal water quality standards are available, they are published by the EPA only as non-regulatory guidance.[169] The promulgation of water quality standards lies squarely within the jurisdic-

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165. *Id*. at 46,035.

166. The Indian River TMDL process is illustrative. *See* Indian River TMDL, *supra* note 105. Comments by a group representing agricultural interests called for peer review of data and modeling procedures "by a wide range of experts in the field of science" before the TMDL was implemented. The implementing agency's response pointed to use of a "state of the art" modeling tool developed by the U.S. Army Corps of Engineers, and extensive peer review of data and technical assumptions by several interagency workgroups and technical advisory committees. *Response to Public Comments, Indian River TMDL* (visited October 10, 2000) <http://www.dnrec.state.de.us/>.

167. *See* Western Carolina Regional Sewer Authority v. South Carolina Dep't of Health and Envtl. Control, No. 98-ALJ-07-0267-CC & 98-ALJ-07-0585-CC, 1999 WL 1016064 (S.C.Admin.Law.Judge.Div.) *1, 2 (consolidating two previous cases and concluding that "[a]t a fundamental level these contested cases are about relationships. The first is the relationship in science that links phosphorus, an essential nutrient in the aquatic food chain, to the production of the second link in that food chain, algae. The second relationship is between law and science.").

168. *Id.*

169. *See* U.S. EPA, EPA-440/5-86-001, EPA'S QUALITY CRITERIA FOR WATER 1986 (1986). The proposed TMDL rule points to federal Safe Drinking Water Act standards (which are controlling for drinking water) as a possible reference point for states against which they "can compare water quality monitoring data, or . . . use to add or revise water quality criteria to support public water supply use, in the absence of more stringent criteria that support more sensitive ecological uses." Proposed Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. at 46,017.

tion of state law. Moreover, the CWA requires that criteria adopted by states must be consistent with their own laws governing how regulations become law.[170] DHEC's failure was in inadequately translating narrative state water quality criteria into numeric standards for phosphorus, inorganic nitrogen, and chlorophyll *a*. Narrative standards are common in state statutes and, as the term suggests, are general, verbal descriptions of required water quality. In South Carolina, one such narrative standard reads that waters shall be free from "waste in concentrations or combinations which interfere with classified water uses. . ., existing water uses, or which are harmful to human, animal, plant, or aquatic life."[171] The court explained that the state must "for both practical and regulatory reasons, 'translate' its narrative water quality criteria into numerical values when making Section 303(d) listing determinations."[172] The court's ruling found that the state failed to make this translation in a way that satisfied procedural requirements. The standards being used by DHEC failed to have "clear bounds and a rational basis for their implementation."[173] The agency cannot relist the waters under section 303(d) until the U.S. EPA approves the "translation procedure" for converting South Carolina's narrative criteria into numeric criteria.

Perhaps more significantly, the judge's ruling also requires the agency to conduct a case-specific assessment of the waterbodies and sources in question. Assessment of the waterbodies is essentially a data collection and evaluation exercise. The analysis of sources is typically more complicated. Specifically, the agency must conduct an evaluation "of the point and nonpoint source nutrient loadings, of other possible causes or contributors to water quality impairment, and of whether Section 303(d) listing can be avoided by DHEC's full implementation of existing point and nonpoint source controls, including full implementation of BMPs at nonpoint sources."[174] This kind of exercise is fraught with technical difficulties. Analysis of loadings and the effect of load reductions requires a watershed model that captures transport process (such as infiltration and runoff), ground water and surface water interactions, pollutant accumulation and decay, and instream mixing. In the case of nonpoint source loads,

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170. *See* 40 C.F.R. § 25.10(b) (1998).

171. 61 S.C. CODE ANN. REGS. § 68(E)(4)(d).

172. Western Carolina Regional Sewer Authority v. South Carolina Dep't of Health and Envtl. Control, *supra* note 167 at *35.

173. *Id.* at *36.

174. *Id.* at *40.

the science is relatively undeveloped due to the complexity of interacting systems involved.[175] Knowledge of the relationship between control practices and loadings is particularly poor. According to an EPA supporting document for TMDL development, a key challenge facing agencies is "the lack of highly developed, scientifically sound approaches to identify problems in watersheds and to predict the results of potential control actions on water quality. While a wide variety of models are available, each come with limitations on its use, applicability, and predictive capabilities."[176]

Consider one particular, and relatively narrow technical issue: the interaction between ground water and surface water quality. The "flows" of groundwater into surface water (or vice versa) are themselves highly uncertain and may occur over a period of decades. This makes cause and effect determinations nearly impossible. The long time lag also limits the ability of researchers to measure the effect of control actions on receiving water quality. Moreover, the conditions under which surface and ground water interact have a crucial effect on water chemistry (acidity, oxygen content, temperature) and biological conditions that ultimately affect water quality.[177] Unfortunately, according to the U.S. Geological Survey, "research on the interface between groundwater and surface water has increased in recent years but only a few stream environments have been studied, and the transferrability of the research results is limited and uncertain."[178]

A lack of scientific certainty will in and of itself not legally hobble TMDL plans, since certainty is not a prerequisite for program implementation.[179] Uncertainty does place a premium, however, on administrative procedures that provide the greatest possible level of scientific credibility to standards, models, and data collection. Accordingly, the technical details of state TMDL programs will need to engage in ongoing notice and comment procedures and evaluation by

175. *See generally* David Zaring, *Federal Legislative Solutions to Agricultural Nonpoint Source Pollution*, 26 Envtl. L. Rep. (Envtl. L. Inst.) 10,128 (1996) (discussing problems associated with tying specific nonpoint practices with specific waterbody impairments).

176. U.S. EPA, EPA 841-R-94-002, COMPENDIUM OF WATERSHED-SCALE MODELS FOR TMDL DEVELOPMENT 4 (1992).

177. *See generally* U.S. GEOLOGICAL SURVEY, USGS Circular 1139, GROUND WATER AND SURFACE WATER: A SINGLE RESOURCE (1998).

178. *Id*. at 77.

179. *See* 33 U.S.C. § 1313(d)(1)(C) (1999). In fact, section 303(d) explicitly requires TMDLs to seek load reductions with a margin of safety that takes into account lack of knowledge concerning the relationship between effluent limitations and water quality. *See id*.

expert panels. This is likely to be a source of both significant upfront and long-run program costs.

E. *Jurisdictional Conflicts*

Section 303 provides a great deal of state discretion to determine standards and implementation strategies. This latitude, together with the lack of correspondence between state boundaries and watershed boundaries, raises the possibility of jurisdictional conflict over TMDLs. Most obviously, downstream water segments may inherit water quality problems from upstream sources in other states. Standards differ across states, sometimes to a significant degree.[180] Less stringent water quality standards and less effective implementation upstream can alone create impairments in a downstream state with stricter quality standards. For this reason, the proposed rules require states to identify a process for resolving disagreements with other jurisdictions.[181] The rules also state that the EPA may establish TMDLs "when interstate or international issues and coordination needs require EPA to assume a leadership role."[182] This will be particularly true in the case of large rivers or boundary waters. The agency also sees a role for itself in determining "equitable upstream / downstream allocations . . . that account for loadings to downstream waterbodies like the Chesapeake Bay from far away upstream sources."[183]

The need for a federal coordinating presence is likely to be particularly acute when conflicts arise due to atmospheric deposition. Atmospheric deposition occurs when airborne pollution is deposited directly onto the surface of the waterbody, or indirectly onto land and waters within the watershed. Because atmospheric deposition is a major source of water impairment, section 303(d) inextricably links state compliance with controls mandated by the Clean Air Act. According to the EPA, eighty percent of the Delaware Bay's mercury load, forty-six percent of Tampa Bay's cadmium load, and twenty-seven percent of the Chesapeake Bay's nitrogen load are due to airborne sources.[184] The significance of these atmospheric loadings is

180. *See* Oliver Houck, *The Regulation of Toxic Substances Under the Clean Water Act*, 21 Envtl. L. Rep. (Envtl. L. Inst.) 10,528 (1991) (showing that permitted concentrations of certain chemicals may be 10,000 times more protective in some states than in others).

181. *See* Proposed Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. at 46,019.

182. *Id*. at 46,037.

183. *Id*.

184. *See* U.S. EPA, EPA-453/R-97-011, DEPOSITION OF AIR POLLUTANTS TO THE GREAT WATERS: SECOND REPORT TO CONGRESS 179-181 (1997) (noting that atmospheric nitrogen

that they implicate sources over a huge geographic area. Deposition in the Chesapeake Bay is a particularly pertinent example. Studies based on data from the National Acid Deposition Assessment Program suggest that only twenty-five percent of air deposition in the Chesapeake watershed originates from sources within the watershed (which contains areas in six states).[185] The Chesapeake NOx "airshed" which defines the geographic range of airborne nitrogen sources to the Bay, covers areas in thirteen states plus the District of Columbia. Given the significance of air deposition in that watershed, and the broad geographic range of sources, there is the distinct possibility of jurisdictional conflict that necessitates federal intervention.

F. *TMDLs and Water Quantity Law*

As they move toward implementation, TMDL rules will increasingly highlight the artificial distinction between water quality and quantity issues, particularly in the West. Water quantity decisions, which are controlled primarily by state law, often have a direct impact on water quality. For instance, changes in stream flow affect the transport of pollutants through a waterbody. Also, the amount of water taken or returned to a waterbody may significantly affect the dilution of pollutants in that system. Finally, water supply often determines the suitability of a waterbody as habitat for fish or other species. In fact, reduced stream flows can constitute "water pollution" under the CWA.[186] At a practical level, TMDLs will often have to account for seasonal changes in flow in order to set appropriate loadings consistent with states' water quality standards.[187] Because of these interactions, water quantity decisions – relating to irrigation, damming, reservoir management, basin-to-basin trades, etc. – may re-

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loadings to coastal estuaries other than the Chesapeake range from twelve to forty-four percent of the total).

185. *See* Karl Blakenship, *Chesapeake Bay Watershed and NOx Airshed*, ALLIANCE FOR THE CHESAPEAKE BAY J., Sept. 1997, at 7.

186. *See* PUD No. 1 of Jefferson County v. Washington Department of Ecology, 511 U.S. 700, 721 (1994) (limiting the Federal Energy Regulatory Commission's authority to supplant state water quality standards in dam licensing proceedings).

187. *See* Proposed Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. at 46,016 (stating that "[changes in flow] may require that, for some pollutants, different TMDLs are established for different levels of instream flow, based on variations in flow over the course of the year"). *See also* 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, 65 Fed. Reg. at 43,624 (discussing the relationship of flow levels to seasonal variation) (stating "EPA believes that TMDLs must be established so that water quality standards are attained and maintained in all seasons and all flows.").

sult in changes in the waters' section 303(d) status. Correspondingly, TMDLs will in some cases constrain water transfers involving impaired waterbodies.

As argued above, a wide variety of unresolved legal issues impact the implementation of the TMDL program. The interrelationship between water quantity decisions and water quality conditions will present particularly challenging issues. Water quantity law has a well-deserved reputation for complexity. Water rights have both public and private characteristics, water law is largely state-determined, different laws govern groundwater and surface water (even though they are physically interdependent), and entirely different systems for establishing rights are used in different regions of the country.[188] In terms of interjurisdictional conflict, states have a long history of conflict over water quantity apportionment.[189] This type of conflict will likely increase under the TMDL program as water quality impairments become binding enforcement problems.

One consequence of quality concerns may be an increasing reliance on water quantity acquisitions to preserve stream flows, an approach endorsed by the TMDL federal advisory committee.[190] Federal acquisitions have already occurred due to concerns over species habitat.[191] Many states already have in place the legal foundations necessary to allow purchase and trade of water rights to preserve instream flow.[192]

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188. Generally speaking, Eastern states rely on a "riparian" foundation for water rights, while a "prior appropriation" system is used in the West. *See* JOSEPH SAX & ROBERT ABRAMS, LEGAL CONTROL OF WATER RESOURCES: CASES AND MATERIALS xvii (1986) (noting that "[w]ater law is different, and in that difference lies the charm, the interest, the fascination and the complexity of water law . . ."). *Id.* *See also* 33 U.S.C. § 1251(g) (1998) (specifically preserving state jurisdiction over water quantity allocations).

189. *See generally* Texas v. New Mexico, 482 U.S. 124 (1987); Kansas v. Colorado, 514 U.S. 673 (1995). To avoid conflict, there are several interstate river compacts, one example of which is the Arkansas River Compact, ch. 155, 63 Stat. 145 (1949); 1949 COLO. SESS. LAWS 485 §1, COLO. REV. STAT. ANN. §37-69-101(West 1973); KAN. STAT. ANN. §82a-520 (1999). A similar compact is currently being negotiated by Alabama, Georgia, and Florida over the waters in the Apalachicola-Chattahoochee-Flint and Alabama-Coosa-Tallapoosa basins. *See* Southern Envtl. Law Center, *Interstate Water Wars* (visited October 19, 2000) <http://www.selcnc.org/originals/water_wars/water_wars.html>.

190. *See* FAC, *supra* note 4, at 51.

191. *See generally* Benjamin Simon, *Federal Acquisitions of Water Through Voluntary Transactions for Environmental Purposes*, 16 CONTEMP. ECON. POL'Y 422 (1998) (describing federal acquisitions in the Snake and Yakima basins, California's Central Valley, and the Truckee-Carson basin in Nevada).

192. *See generally* INSTREAM FLOW PROTECTION IN THE WEST (Lawrence MacDonnell et al. eds., 1989); SAVING OUR STREAMS THROUGH WATER MARKETS: A PRACTICAL GUIDE (Political Economy Research Center 1998) (describing state laws to allow for instream flow

G. *The Location of Sources*

TMDLs will raise the costs of, and in extreme cases create a prohibition against, source development in watersheds suffering from impairment. New source restrictions, or any other policy creating barriers to new sources, is a necessary element of any policy geared toward water quality improvements.[193] However, an unintended consequence of TMDLs is that they may encourage the migration of point and nonpoint sources to areas that are not currently associated with water impairment. In fact, the more successful policies are in limiting loadings in impaired areas, the greater will be the incentive of dischargers to relocate to areas where TMDL-driven restrictions are not as binding or where control costs are not as high.[194]

V. ECONOMIC CONSIDERATIONS AND POLLUTANT TRADING

A distinctive feature of the EPA's approach to TMDL rules, and its watershed policy more generally, is an emphasis on trading to achieve "common-sense, cost-effective solutions for water quality problems."[195] In principle, trading is highly desirable. Trading allows sources with responsibility for discharge reductions the flexibility to determine where those reductions will occur. The financial incentives built into a trading scheme lead naturally to a situation in which the costs of pollution control are minimized.[196] Pollution permit markets, in a decentralized manner, assign control activities to the parties whose control costs are least. This is economically efficient. It is also politically attractive, since it minimizes compliance costs for a given pollutant reduction goal. In terms of water quality regulation, trading's desirability arises due to a vast disparity in pollutant control costs across sources. This is particularly true when nonpoint sources

markets and transfers).

193. *See* 40 C.F.R.§ 122.4(I) (1999). There is already a new source restriction under the CWA. ("No new permit may be issued to a new source or a new discharger, if the discharge from its construction or operation will cause or contribute to the violation of water quality standards"). *See id.*

194. Members of the TMDL federal advisory committee expressed this concern with regard to the point source offset proposal (which was dropped from the final rule). "Some committee members are concerned that enforcing the discharge restriction may in fact encourage development to spread to less-polluted areas with fewer restrictions on land or water use." FAC, *supra* note 4, at 17.

195. U.S. EPA, EPA 800-R-96-001, DRAFT FRAMEWORK FOR WATERSHED-BASED TRADING ix (1996) [hereafter Watershed Framework].

196. *See generally* J.H. DALES, POLLUTION, PROPERTY, AND PRICES (1968); T.H. TIETENBERG, EMISSIONS TRADING (1985).

are considered.[197] Nonpoint source BMPs are thought to be a particularly cost-effective means to achieve water quality improvements.[198] For example, if point sources with high control costs can purchase cheaper controls from nonpoint sources, the control cost savings may be significant.

A wide variety of trading possibilities is contemplated by the EPA. A justification for the proposed new source offset rule was that "EPA believes this proposed requirement will serve as a catalyst for the establishment of a trading market between large new dischargers and existing dischargers undergoing a significant expansion, and existing point source dischargers or nonpoint sources."[199] Point-point, point-nonpoint, and nonpoint-nonpoint trades are all envisioned.[200] The cost savings and flexibility provided by trading are the principal motivations.[201] Potential savings from point-point trading alone are estimated to be as high as $1.9 billion per year.[202]

The theoretical desirability of pollution trading is accompanied by a host of sobering practical challenges, however,[203] and the history of actual point-point trading to date under the CWA is very limited. More limited still is persuasive evidence that trading implementation can result in significant cost savings.

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197. *See* Lyon & Farrow, *supra* note 9, at 219. They find that the net benefits of nonpoint controls, while negative, are significantly larger than a variety of point source controls. Analysis of the possible cost savings from one particular trading program found a $70 million cost of point source-only controls, but an $11 million cost if reductions were achieved from nonpoint controls. *See* John Hall & C.M. Howett, *Trading in the Tar-Pamlico*, WATER ENV'T & TECH 58 (1994).

198. *See* Kurt Stephenson et al., *Watershed-Based Effluent Trading: The Nonpoint Source Challenge*, 16 CONTEMP. ECON. POL'Y 412, 413 (1998).

199. Revisions to the National Pollutant Discharge Elimination System Program and Federal Antidegradation Policy In Support of Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. at 46,058.

200. *See* Watershed Framework, *supra* note 195, at xi-xiv.

201. The EPA's proposed rule is designed to "provide for tradeoffs between alternative point and nonpoint source control options so that cost effectiveness, technical effectiveness, and the social and economic benefits of different allocations can be considered by decision-makers." Proposed Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. at 46,030. (As noted earlier, however, the offset proposal was withdrawn in the final rule. *See supra* note 60).

202. *See* OFFICE OF WATER, U.S. EPA, EPA 800-R-002, PRESIDENT CLINTON'S CLEAN WATER INITIATIVE: ANALYSIS OF BENEFITS AND COSTS 16 (1994).

203. *See generally* Robert W. Hahn & Gordon L. Hester, *Marketable Permits: Lessons for Theory and Practice*, 16 ECOLOGY L.Q. 361 (1989); James T. B. Tripp & Daniel J. Dudek, *Institutional Guidelines for Designing Successful Transferable Rights Programs*, 6 YALE J. REG. 369 (1989).

A. *Trading under the Clean Water Act*

The history of water quality trading can be summarized relatively briefly. A recent summary of trading and offset programs lists thirty-seven such programs at various stages of development, the majority of which (twenty-six) have not actually resulted in trades.[204] Notable trading experiments include the now-defunct Fox River BOD trading program in Wisconsin. Preliminary estimates of the savings from this point-point trading program were $7 million a year for the participating firms.[205] Unfortunately, and in stark contrast to the prediction of cost savings, the program only produced a single trade. In Colorado, the Dillon Reservoir trading system allows trade between point sources and nonpoint sources to reduce phosphorus loadings in the reservoir. Point-nonpoint trading activity has not actually materialized. However, two trades between nonpoint sources have occurred as nonpoint sources have become the primary remaining source of discharges.[206] The Minnesota Pollution Control Agency has approved a single trade which substitutes nonpoint phosphorus source reductions for a point source reduction on the Minnesota River.[207] In North Carolina, the Tar-Pamlico plan calls for point source nutrient reductions. Point sources must meet a cap on discharges or make a mandatory financial contribution to a nonpoint source reduction fund used to implement agricultural BMPs. To date, the point sources have met the annually decreasing cap, primarily through improvements to treatment facilities.[208] These and other trading programs indicate state and EPA willingness to experiment with the trading approach. However, they are not particularly inspiring examples of trading's ability to achieve significant cost reductions, or enthusiasm from the regulated community. What is remarkable is how little actual trading has arisen from these programs.

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204. *See generally* 61 Fed. Reg. 4994 (1999); ENVIRONOMICS, A SUMMARY OF U.S. EFFLUENT TRADING AND OFFSET PROJECTS (1996) (draft consultant report on file with author).

205. *See* WILLIAM B. O'NEILL, *The Regulation of Water Pollution Permit Trading under Conditions of Varying Streamflow and Temperature*, in BUYING A BETTER ENVIRONMENT 219, 225 (Erhard F. Joeres and Martin H. David eds., 1983).

206. *See* Watershed Framework, *supra* note 195, at 8-1.

207. *See generally* Minnesota Pollution Control Agency, *Case Study: Minnesota - Pollutant Trading at Rahr Malting Co*. (visited October 19, 2000) <http://www.pca.state.mn.us/hot/es-mn-r.html>.

208. *See generally* N.C. Dept. Env't, & Nat. Res., *Tar-Pamlico Nutrient Trading Program* (visited October 19, 2000) <http://h20.enr.state.nc.us/nps/tarp.htm>.

B. *The Barriers to Water Quality Trading*

An effective trading system requires several fundamental ingredients. Among them are: first, a sound means of enforcement to ensure that commitments (load reductions) are adhered to; second, a legal foundation that allows control flexibility sufficient to generate financial gains to participation; and third, an administratively straightforward process for participating in the market.[209] In the case of water quality trading, many of these ingredients currently are missing.

Perhaps the greatest barrier to water quality trading is the sheer complexity of factors that determine watershed loadings. Even if a source's releases are perfectly known—a tall order in itself, particularly for nonpoint sources—the transport and deposition of releases are subject to numerous uncertainties relating to geography, hydrography, and weather conditions.[210] Once present in a waterbody, a pollutant's contribution to impairment is often a function of the waterbody's assimilative capacity (which is itself a function of rainfall), temperature, salinity, acidity, and other localized chemical characteristics.[211] This produces several problems for a trading program because it makes it difficult to draw causal relationships between specific sources and water quality problems. This causation problem creates an obvious monitoring problem, unless releases can be monitored at each potential source. It also makes it nearly impossible to quantitatively relate control practices (e.g., a reduction in fertilizer application) to loadings.[212] Establishing those relationships is necessary to establish appropriate trading ratios. Trading ratios account for differences in the way control practices affect loadings. For instance, a pound of phosphorus applied to land far from a waterbody will tend to contribute less to loadings than one applied close to the waterbody. If trading is allowed to occur between these two landowners, an appropriate trading ratio must be established to ensure that the loading goal is met. Specifically, if the landowner near the waterbody is to increase its phosphorus applications, it must purchase

209. *See generally* Tripp & Dudek, *supra* note 203.

210. *See generally* Stephenson et al., *supra* note 198 at 413. Nonpoint source load measurement is considered by some to be a surmountable, and somewhat overblown, problem despite these uncertainties. Air emissions trading programs that face many similar challenges have had a relatively successful history.

211. *See* U.S. GEOLOGICAL SURVEY, *supra* note 177.

212. *See* Stephen R. Crutchfield et al., *Feasibility of Point-Nonpoint Source Trading for Managing Agricultural Pollutant Loadings to Coastal Waters*, 30 WATER RESOURCES RES. 2825, 2825-26 (1994); Arun S. Malik et al., *Point/Nonpoint Source Trading of Pollution Abatement*, 75 AM. J. AGRIC. ECON. 959 (1993).

reductions from its trading partner at a greater than 1-to-1 rate. The complexity of watershed interactions does not permit the identification and implementation of such trading ratios.

The complexity of watershed systems also contributes to the overall monitoring problem. End-of–pipe monitoring allows for relatively precise monitoring of point source discharges. In general, this kind of precision is not available for nonpoint source loads. The EPA's proposed rules include "margins of safety"[213] to account for the monitoring and causal uncertainties associated with nonpoint sources.

One counter-example is a nonpoint program for phosphorus releases into Lake Okeechobee that relies on nonpoint source monitoring.[214] It is the exception that proves the rule, however. The monitoring takes advantage of the lake system's artificially constructed hydrography, including canals and pumping facilities. Elsewhere, monitoring strategies include proposals for remote-sensing via satellite to determine compliance with land management and construction requirements, such as buffers, cover crops, and irrigation systems.[215] Finally, in some cases, quantitative modeling may be used to indirectly estimate loadings. Results from studies in one area can be used to generalize the relationships between observable practices and typical effects in another. While clearly imperfect, such tools may be the most pragmatic means of injecting some knowledge of control-loading relationships into a trading framework.

While the problems associated with nonpoint monitoring and trading are significant, perhaps even more significant is that water quality trading has to date failed to provide significant benefits even among point sources. The reasons for this are largely legal. Technology-based requirements (and their associated effluent standards) are non-negotiable under the CWA.[216] All point source dischargers must

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213. This was particularly apparent in discussion of the new source offset rule. "In such cases," according to the proposed rule, "the Director may require that a greater amount of reductions must be realized and require an offset greater than one and a half to one." Revisions to the National Pollutant Discharge Elimination System Program and Federal Antidegradation Policy In Support of Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. at 46,058. "When entering into an agreement with a nonpoint source, it may be somewhat more difficult to determine exactly how much reduction will be achieved." *Id*.

214. *See* Stephenson et. al., *supra* note 198 for discussion of such monitoring options and detailed discussion of their use in the Lake Okeechobee case and others.

215. *Id.*

216. *See* Kurt Stephenson et al., *Toward an Effective Watershed-Based Effluent Allowance Trading System: Identifying the Statutory and Regulatory Barriers to Implementation*, 5 The Environmental Lawyer 775 (1999) (describing inflexibilities inherent in the CWA and their limiting effect on watershed-based trading schemes). *See generally* 33 U.S.C. §1311(b)(1)-(2) (1994); 33

install appropriate treatment mechanisms to achieve these required discharge levels. It is explicit EPA policy that trading participants can in no way be absolved of this baseline technical requirement.[217] While this position may be understandable from an enforcement standpoint, it significantly limits the flexibility over control options. Limited flexibility means that there are limited gains from trading.

Flexibility is also limited in a number of other ways.[218] For instance, point source effluent standards are industry-specific. Since effluent standards are non-negotiable under the CWA, this implies that no trading can occur across firms in different industries. The practical effect of this lack of flexibility is that a firm seeking a trade may find no other eligible firms with whom to trade.[219] In financial jargon, this is equivalent to a lack of liquidity and undermines the ability of the trading market to reveal and take advantage of cost savings. Another lack of flexibility arises from prohibitions on trading across pollutants. For instance, under the withdrawn new-source offset proposal, the EPA make clear that the offset had to be for the same pollutant.[220]

The informational, scientific, and legal barriers to water quality trading are significant. State experimentation with nonpoint programs and the development of analytical techniques to relate control practices and loadings can be expected. But the history of water quality trading to date urges pessimism regarding the benefits likely to be secured by sophisticated new trading schemes involving point and nonpoint sources. These schemes are largely untried and administratively complex.[221] The search for cost-effective approaches to wa-

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U.S.C. §1314(b) (1994); 33 U.S.C. §1316 (1994).

217. *See* Watershed Framework, *supra* note 195, 2-4.

218. *See* U.S. GEN. ACCT. OFF., U.S. DEP'T OF TREASURY, GAO/RCED-97-155, ENVIRONMENTAL PROTECTION: CHALLENGES FACING EPA'S EFFORTS TO REINVENT ENVIRONMENTAL REGULATION (1997) (The EPA's real or perceived inability to introduce flexibilities into its highly media- and substance-specific regulatory programs is an ongoing source of debate, generally).

219. *See* Robert W. Hahn, *Economic Prescriptions for Environmental Problems*, 3 J. ECON. PERSP. 95, 98 (1983) (detailing that one of the reasons Wisconsin's Fox River trading program failed to induce trades is that only a small number of firms were eligible).

220. "EPA recognizes that there may be circumstances where reasonable further progress toward attaining water quality standards could best be served by allowing the Director the discretion to offset a new or expanded discharge of one pollutant with a load reduction of a different pollutant for which the waterbody is also impaired. EPA, however, is concerned with the technical difficulties of implementing such an option." Revisions to the National Pollutant Discharge Elimination System Program and Federal Antidegradation Policy In Support of Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. at 46,069.

221. *See* U.S. GEN. ACCT. OFF., U.S. DEP'T OF TREASURY, PUB. NO. GAO/RCED 95-64, EPA AND THE STATES – ENVIRONMENTAL CHALLENGES REQUIRE A BETTER WORKING

ter quality improvement should not be allowed to rely exclusively on trading. Instead, a variety of more direct forms of regulation, such as mandatory, enforceable BMPs, should also, and perhaps first, be applied to nonpoint sources.

C. *Allocations, Baselines, and Liability*

One of the most important policy choices in a trading system is the determination of who is initially responsible for pollutant reductions. Consider two different trading schemes. In the first, point sources are responsible for pollutant reductions but can purchase reductions from other point sources or from nonpoint sources. In the second, both point sources and nonpoint sources are responsible for reductions, but can trade among themselves to achieve those reductions in the most cost-effective manner. The federal TMDL program leaves the choice of trading program entirely up to the states. If states are to introduce trading, this type of choice will have to be made. At a basic level, this choice is one over the distribution of the costs of discharge reductions. Both systems allow trading, so theoretically both will result in the same least-cost pattern of reductions after trading has occurred. They differ, however, in their allocation of liability for reductions. In the former case, liability lies with point sources. This means point sources must bear the costs of reducing their own releases or pay nonpoint sources to reduce theirs. In the latter case, liability is shared. Since nonpoint sources are themselves subject to controls they must bear the costs of achieving reductions, or purchase them elsewhere.

In addition to determining the initial liability allocation, any trading system must also clearly define baseline (before-the-fact) discharges. This baseline is necessary if trading-driven discharge reductions are to be verified by regulators. The artificial inflation of baselines is a problem that any trading system must address. Polluters selling credits have an incentive to inflate baseline discharges since inflation increases the amount of discharge reductions they can claim to provide. In the case of point sources, NPDES permits provide a verifiable inventory of baseline releases. Moreover, the point source permitting process counteracts any incentive to over-state releases. Under point source permitting, larger releases tend to imply more

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RELATIONSHIP (1995). It sobering to keep in mind the difficulties associated with even the simplest monitoring and enforcement programs. Enforcement of point source permitting is itself difficult. According to one study, sixty-five percent of major facilities in Michigan were operating with expired NPDES permits, while 150 new facilities waited for new, first-time permits.

stringent, costly control technologies. The nonpoint source situation is quite different. Not having been subject to permit requirements, nonpoint sources lack an independently verifiable, and incentive-compatible baseline. Thus, there will be a problematic tendency for such sources to initially over-estimate releases in an attempt to generate larger reduction credits. One way to minimize this kind of problem is to initially allocate responsibility for reductions to nonpoint sources. With nonpoint discharge standards, nonpoint sources have a countervailing incentive to under-claim contributions to loadings. Of course, the larger lesson is that there is the need for independent verification of releases.

The enforcement of a trading system is also directly related to the allocation of liability. For instance, consider the proposed rules' new-source offset requirements. This is a liability allocation akin to the first situation considered above. Point sources are liable for offsetting reductions. These reductions can be purchased from nonpoint sources. In event of non-compliance by a nonpoint source, the point source is subject to enforcement action, not the nonpoint source.[222] This is true under the EPA's watershed trading framework as well.[223] Consider comments on the EPA's trading framework from one point source which was concerned that "the lack of defined legislation and regulatory controls of nonpoint sources may result in the point source partner of a point source/nonpoint source effluent trading agreement being held solely liable for violations of a water quality standard, even though the source of the violation may be the nonpoint source."[224] However, any point-nonpoint trade presumably involves a contractual agreement between the sources that is independently enforceable under contract law. While agency enforcement action would be directed at the point source, the point source could exercise its contractual remedy in order to secure the nonpoint source's compliance with contract terms. Nevertheless, point source liability for nonpoint source non-compliance increases the transaction costs associated with trading. This creates yet another argument for direct enforcement of nonpoint controls by states.

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222. As in Revisions to the National Pollutant Discharge Elimination System Program and Federal Antidegradation Policy In Support of Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. at 46,072.

223. *See* Watershed Framework, *supra* note 195, at 7-18.

224. *See* Eastman Chemical Company, *Original Comments on Watershed-Based Trading* <http://www.epa.gov/OWOW/watershed/tradecom/level3/ecc.html >.

VI. CONCLUSION

The Total Maximum Daily Load program will significantly alter the politics, economics, and implementation of water quality regulation. Improved monitoring of ambient water quality conditions and the accessible public documentation of impairments will focus government and public attention on water conditions that continue to be problematic, even after twenty-five years of CWA regulation. While industrial point sources will no doubt continue to be vivid symbols of the nation's water pollution problems, this image is increasingly inappropriate. Nonpoint agricultural, commercial, and urban sources, while harder to caricature, are the rightful focus of dissatisfaction. The most powerful aspect of the TMDL rules proposed by EPA is that they are motivated by, and address, water quality issues created by nonpoint sources. The holistic, watershed-level analysis required by the TMDL process will inevitably identify a larger sphere of often unregulated discharge sources. For these reasons alone, the TMDL program is likely to promote significant, desirable changes in the targets and implementation of water quality regulation. This article has provided specific examples of TMDLs and the way in which they are improving the public's knowledge of impairments, motivating new analytic techniques for the identification of sources, and promoting experimentation with new water quality policies. This movement toward a water quality-driven approach marks a welcome, mature phase of water quality regulation.

The changes initiated by the new TMDL rules present a host of challenges. These challenges call for tempered optimism and a willingness to confront the significant implementation issues that will arise from a TMDL-based regulatory system. First, there are numerous scientific difficulties associated with creating legally meaningful causal links between dispersed nonpoint sources, their control activities, and changes in surface water pollutant loadings. The causal linkages are poorly understood, and even when developed in the most rigorous manner, only apply to the watershed for which they were specifically developed. The complex and idiosyncratic nature of pollutant discharge, transport, and deposition processes means that the technical underpinnings of TMDLs will be costly.

Administrative costs, together with resistance from currently unregulated sources, will act as a brake on state efforts to propose bold new approaches to control activities. While water quality-based regulation gives point sources an incentive to lobby for nonpoint controls, organized nonpoint interests will undoubtedly continue to resist control requirements. Federal authority to compel, and funding to entice, nonpoint controls is limited. The central role of state law and location-specific political conditions mean that TMDL implementation will be variable across states. Several issues demand greater legal clarity: interjurisdictional conflict is likely, since downstream jurisdictions will often inherit upstream water quality problems; and, air deposition will present particularly knotty jurisdictional issues. The federal role in resolving these inevitable conflicts deserves attention. In addition, the relationship between water quantity allocations and water quality will demand a reconciliation between state quantity and quality laws.

Finally, the rules' emphasis on trading among point sources and nonpoint sources should be viewed as a desirable aspiration, but also as a distraction in the near-term. Significant administrative, monitoring, and enforcement barriers to water quality trading exist. Trading among point sources has to date failed to be practical. Expansion of trading programs to nonpoint sources will only expand the complexity of trading programs. One of the many preconditions for trading is that nonpoint sources be monitorable and that enforcement mechanisms exist to compel corrective actions when nonpoint discharge restrictions are violated. Credibility, transparency, and enforceability are paramount if flexible environmental controls, such as effluent trading, are to be realistically contemplated. Regulatory, legal, and technical efforts should first be directed toward this goal, which is in itself a significant challenge.

Despite the challenges it presents, the TMDL approach marks movement toward a welcome, mature phase of water quality regulation. The key feature of EPA's proposed TMDL rules is that they are motivated by, and address, water quality issues created by the widest range of sources. The holistic, watershed-level analysis required by the TMDL process will inevitably identify a larger sphere of often unregulated discharge sources. For these reasons alone, the TMDL program is likely to promote significant, desirable changes in the implementation of water quality regulation.