A BARGAIN FOR CLEAN WATER

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This paper reviews the effectiveness, efficiency, and political viability of federal water quality programs and possible reforms of those programs. The review includes not only the Clean Water Act (CWA or the Act), ostensibly the primary vehicle of federal water pollution control policy, but also subsidies under the Farm Bill that have the purpose or effect of reducing water pollution from agricultural sources. The paper's primary focus is the conundrum of what to do about pollution from non-urban stormwater runoff—an issue that has long been identified as crucial to achieving the nation's avowed water quality goal but that remains fundamentally unresolved. The article attempts to synthesize and draw program level conclusions from the extensive literature addressing this issue.

The analysis concludes that: (1) the national policy goal of fishable/swimmable water quality is sound, but care should be taken to assure that additional steps toward meeting that goal are cost-effective; (2) with some adjustments in existing programs, cost-effective further reductions can be achieved through a combination of measures to enhance water quality-based regulation and address non-point source pollution; (3) these measures are best applied by state and local authorities acting through institutions of watershed management; (4) federal guidance and oversight, however, are appropriate and necessary and should be strengthened to assure accountability to regional and national interests; (5) given limited data on water quality conditions, source impacts, and the cost and effectiveness of non-point source control measures, the process of refining national policy should proceed adaptively.

To further cost-effective implementation of national water quality goals, the CWA should be applied or, if necessary,

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amended to: require states and localities in problem watersheds to develop water quality implementation plans applicable to non-point source as well as point source dischargers and facilitate cost-effective implementation on a watershed basis by increasing the flexibility and scope of trading where possible. The newly amended Farm Bill should be applied to foster performance-based allocation of funds for cost-effective non-point source reductions and to link water-quality related expenditures to CWA implementation. Federal resources and authorities should be targeted to waterbodies not meeting water quality standards.

I. STATE OF THE RESOURCE

With its amendment in 1972, the Clean Water Act assumed the general regulatory form that characterizes it today. Our thirty-five years of experience with this structure provide useful data for evaluating its effectiveness and contribution to the public good. The regulatory focus has been reduction of pollutants from point source dischargers, chiefly industrial and municipal sources. In a peer-reviewed study completed in 2000, the Environmental Protection Agency (EPA) studied nationwide trends in dissolved oxygen (DO) concentrations in rivers located downstream of point source dischargers before and after the 1972 Amendments. The study found significant improvements in DO at all spatial scales studied—from river reaches (small scale) to major river basins (large scale).[1] Roughly 70 percent of the reaches evaluated, mostly urban and industrial areas, showed improved levels of DO;[2] there was also significant DO improvement in eight of the eleven large river basins studied.[3] These improvements have been accomplished at an estimated cost of over $40 billion per year (1997 dollars).[4]

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[1] ANDREW STODDARD, JON B. HARCUM, JONATHAN T. SIMPSON, JAMES R. PAGENKOPF & ROBERT K. BASTIAN, MUNICIPAL WASTEWATER TREATMENT: EVALUATING IMPROVEMENTS IN NATIONAL WATER QUALITY xvi (2002).

[2] *Id.* at 175.

[3] *Id.* at 176.

[4] A. Myrick Freeman III, *Water Pollution Policy*, *in* PUBLIC POLICIES FOR ENVIRONMENTAL PROTECTION 194 (Paul R. Portney ed. 2d ed. 2000). *But see* U.S. ENVTL. PROT. AGENCY, A RETROSPECTIVE ASSESSMENT OF THE COSTS OF THE CLEAN WATER ACT: 1972 TO 1997 8-1 (2000), *available at* http://www.epa.gov/waterscience/economics/costs.pdf [hereinafter EPA, A RETROSPECTIVE ASSESSMENT] (estimating total costs of implementing water

Despite improvements attributable to the CWA, EPA reports significant noncompliance with water quality standards nationwide. The compliance data is far from complete. For EPA's most recent water quality inventory, states assessed only 19 percent of the nation's river miles, 43 percent of its lake acres, and 36 percent of its estuarine areas.[5] For those water bodies for which assessment data were available, 61 percent of the river miles, 54 percent of the lake acres, and 49 percent of the estuarine areas met all applicable water quality standards. The rest, between 40 and 50 percent of the assessed waters, failed to meet one or more of these standards.[6] Non-point source runoff, which is not regulated under the Act, is the "primary contributor of water quality impairment in our nation's waters."[7] Although non-point source pollution originates on both urban and rural lands, at a national level rural non-point sources are by far the more significant contributor and are therefore the focus of this analysis.[8]

Since enactment of the 1985 Food Security Act, U.S. policy has included use of federal farm payments to reduce the off-site environmental impacts of agricultural practices.[9] Subsequent Farm Bills have expanded and refined the use of subsidies for environmental protection, including amounts allocated to ag-related water quality measures.[10] There is little data, however, on

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pollution controls on point sources in excess of $40 billion per year (1997 dollars), but concluding that only about $11 billion of those annual costs are attributable to the CWA rather than pollution control measures that would have occurred without the Act).

[5] *See* U.S. ENVTL. PROT. AGENCY, 2000 EPA NAT'L WATER QUALITY INVENTORY ES-3 (2006), *available at* http://www.epa.gov/305b/2000report.

[6] *Id*.

[7] Kaush Arha, Tim Josling, Daniel Sumner & Barton H. Thompson, *Conserving Ecosystem Services Across Agrarian Landscapes, in* U.S. AGRICULTURAL POLICY AND THE 2007 FARM BILL 219 (Kaush Arha, Tim Josling, Daniel A. Sumner & Barton H. Thompson eds., 2006) [hereinafter U.S. AGRICULTURAL POLICY], *available at* http://woods.stanford.edu/docs/farmbill/farmbill_book.pdf.

[8] STODDARD ET AL., *supra* note 1, at 85 (noting that rural non-point sources account for 40 percent of national BOD5 loadings and urban stormwater runoff accounts for 5 percent of the national load).

[9] Craig Cox, *U.S. Agriculture Conservation Policy & Programs: History, Trends and Implications*, *in* U.S. AGRICULTURAL POLICY, *supra* note 7, at 117–18.

[10] *Id.* at 119.

the actual environmental effects of these subsidies.[11] Water quality problems attributable to rural non-point source pollution continue to be pervasive, and as discussed below, commentators have been critical of the design and implementation of these subsidies. Lack of effective management of agricultural non-point source pollution remains the central problem of national water quality policy.

II. NATIONAL GOALS

The CWA's policy goals are expressed as two stages, one technology-based, the other water quality-based. The Act first requires that all point source dischargers meet technology-based limitations (either Best Available Technology or Best Conventional Technology depending on the pollutant). For water bodies for which the application of those limitations is not adequate to achieve water quality standards, the Act requires additional controls necessary to meet those standards. States have the primary responsibility for setting water quality standards for their waters, but the standards must be approved by EPA. Agency regulations state that "water quality standards should, wherever attainable, provide water quality for the protection and propagation of fish, shellfish and wildlife and for recreation in and on the water"—the "fishable/swimmable" goal.[12] The regulations accept less demanding standards where natural and (in limited cases) human-caused conditions prevent the achievement of fishable/swimmable water quality or where controls necessary to attain that level "would result in substantial and widespread economic and social impact."[13]

Economists have examined whether these policy commitments make sense, in light of the substantial costs necessary to meet them. Some studies suggest that costs of implementing CWA requirements have exceeded benefits or may soon, if the Act's current regulatory approach continues. Myron Freeman has estimated the CWA's regulation of point sources to yield annual benefits in the range of $9.1 to $44.3 billion, compared to annual costs of $42.4 billion (1996 dollars); although

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[11] *Id.* at 127.
[12] 40 C.F.R. § 131.2.
[13] 40 C.F.R. § 131.10(g)(1)–(3), (6).

the upper range of his benefits estimate exceeds the costs, Freeman contends that "costs likely substantially outweighed the benefits."[14] A more recent study by EPA suggests a more favorable cost-benefit ratio. In estimating costs, that study isolated costs associated with reductions attributable to the CWA from costs of reductions that, under assumptions in the study, would have occurred anyway without the Act. The annual costs attributable to the CWA controls on point source dischargers were estimated at $14.1 billion compared to partial benefits of those controls of $11 billion per year (1997 dollars).[15] The study notes that these estimates account "only for about 50 to 60% of the total estimated reductions in conventional pollutant loads due to the CWA" and more complete estimates might show that total benefits of CWA controls were "quite possibly larger than the estimated costs of the Act."[16] These results are quite far from the robust net benefits of the CWA's cousin, the Clean Air Act (CAA).[17] If one assumes a pattern of increasing marginal costs and decreasing marginal benefits with more stringent controls, it may be increasingly difficult, on pure efficiency grounds, to justify additional measures to achieve the fishable/swimmable goal.[18]

Nevertheless, there is reason to believe the fishable/swimmable goal is a sound policy touchstone. First, even

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[14] Freeman, *supra* note 4, at 194. *But cf.* Richard T. Carson & Robert Cameron Mitchell, *The Value of Clean Water: The Public Willingness to Pay for Boatable, Fishable, and Swimmable Water Quality*, 29 WATER RESOURCES RES. 2445, 2452–53 (1993) (comparing $37.3 billion in costs to $46.7 billion in benefits (1990 dollars)).

[15] U.S. ENVTL. PROT. AGENCY, A RETROSPECTIVE ASSESSMENT, *supra* note 4, at 8-1.

[16] *Id.* For EPA's more recent attempt to catalogue some of these missing benefits, see U.S. ENVTL. PROT. AGENCY, 2003–2008 EPA STRATEGIC PLAN: DIRECTION FOR THE FUTURE 186–87 tbl.6 (2003), *available at* http://www.epa.gov/cfo/plan/2003sp.pdf.

[17] *See* U.S. ENVTL. PROT. AGENCY, THE BENEFITS AND COSTS OF THE CLEAN AIR ACT, 1970 TO 1990 8, 53 (1997), *available at* http://www.epa.gov/air/sect812/index.html (providing a mean estimate of $22 trillion in benefits from first two decades of CAA implementation compared to $523 billion on costs—a 42:1 ratio); U.S. ENVTL. PROT. AGENCY, THE BENEFITS AND COSTS OF THE CLEAN AIR ACT, 1990 TO 2010 101, 106 (1999), *available at* http://www.epa.gov/air/sect812/index.html (providing an estimate of $110 billion in benefits for 2010 compared to $27 billion in costs—greater than a 4:1 ratio).

[18] Carson & Mitchell, *supra* note 14, at 2453 (concluding that total costs of achieving fishable, swimmable water quality will escalate beyond total potential benefits unless cheaper reductions are provided for).

assuming the accuracy of studies questioning the goal on efficiency grounds, the goal may serve public values other than welfare-maximization. For example, we may believe as matter of principle that degradation of natural environments such as aquatic ecosystems is undesirable and that we should do what we feasibly can to avoid it. Second, estimating benefits of protections for common pool resources such as aquatic systems is fraught with methodological issues. The Office of the Management and Budget, the federal keeper of the cost-benefit flame, acknowledges that "monetizing some of the effects of [environmental, health and safety] regulation is difficult, and quantifying some effects may not even be feasible."[19] National polls in recent years show that public concern over water pollution continues to rank high among environmental worries, generally on a par with air pollution concerns.[20]

Finally, there are opportunities to improve the cost-effectiveness of the Act, including realizing relatively low cost reductions from non-point source dischargers, in ways that will allow further progress toward meeting the water quality goals of the Act at lower marginal costs.[21] Evidence suggests that

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[19] OFFICE OF MGMT & BUDGET, INFORMING REGULATORY DECISIONS: 2003 REPORT TO CONGRESS ON THE COSTS AND BENEFITS OF FEDERAL REGULATIONS AND UNFUNDED MANDATES ON STATE, LOCAL AND TRIBAL ENTITIES 167 (2003) (providing guidelines for measuring costs and benefits).

[20] POLLING REPORT.COM, NEWSWEEK POLL, http://www.pollingreport.com/enviro.htm (Aug. 1–2, 2007; Apr. 13–14, 2000), (last visited Sept. 20, 2008) (showing water pollution tied with air pollution as second "most important environmental problem facing the world today" after global warming); Joseph Carroll, *Water Pollution Tops Americans' Environmental Concerns*, GALLUP, Apr. 21, 2006, http://www.gallup.com/poll/22492/Water-Pollution-Tops-Americans-Environmental-Concerns.aspx (finding in a poll conducted March 13–16, 2006 that "Americans greatest environmental concerns center around those involving different aspects of water pollution"); Darren K. Carlson, *Water Worries Deluge Environmental Concerns*, GALLUP, Apr. 6, 2004, http://www.gallup.com/poll/11227/Water-Worries-Deluge-Environmental-Concerns.aspx (showing, in a poll conducted March 8–11, 2004, that a higher percentage of respondents "worry . . . a great deal" or "fair amount" more about water pollution than other environmental problems).

[21] *E.g.*, Randolph Lyon & Scott Farrow, *An Economic Analysis of Clean Water Act Issues*, 31 WATER RESOURCES RES. 213, 218, *available at* http://www.agu.org/journals/wr/v031/i001/94WR02047/94WR02047.pdf (finding that substituting agricultural and urban runoff reductions for secondary treatment requirements at sewage treatment plants produced a positive cost-benefit ratio).

additional nutrient reductions from non-point sources can be obtained for a fraction (15 to 35 percent) of the cost of further reductions by point sources.[22] The CWA's policy apparatus now squeezes increasingly expensive increments of improvement from point sources; a key challenge for CWA reform, as explored in Part IV below, is to obtain much cheaper non-point reductions instead.

This is not to suggest that achieving fishable/swimmable water quality is possible or wise everywhere in the nation. EPA regulations provide at least a limited recognition of this by allowing states to adopt less demanding water quality standards to reflect natural limiting conditions or to avoid economic disruption.[23] Myrick Freeman has suggested a more refined approach under which a cost-benefit study would be done for each watershed and a watershed goal would be established for that watershed, taking into account local conditions and preferences.[24] However, the costs and the methodological and philosophical difficulties associated with such a process, applied across the nation's more than 2200 watersheds, make it of dubious value. And there are less formal ways in which implementation of federal water quality programs can take into account differences in local conditions and preferences. For example, federal officials can focus their limited resources and authorities on restoring and preserving water bodies for which there is demonstrated public concern and a strong national interest, as to some extent they already do.[25]

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[22] *See* ENVIRONOMICS, A SUMMARY OF U.S. EFFLUENT TRADING AND OFFSET PROJECTS (1999), *available at* http://www.epa.gov/OWOW/watershed/trading/traenvrn.pdf. At North Carolina's Nesuse River, there were nutrient reduction costs of $5–6/lb for non-point sources compared to point source control costs of $25–$30/lb elsewhere in the state and reduction costs of $13/kg for non-point sources compared to $55–$65/kg for point sources in the Tar-Pamlico Basin. One report states that "reductions achievable for $1 million from non-point sources would cost $7 million from point sources." *Id.* at 25–26. And in Wisconsin, phosphorous reductions in Wolf-Fox Basin were available at an average cost of $26/lb compared to further reductions by point sources costing an average of $73/lb. *Id.* at 35.

[23] 40 C.F.R. § 131.10(g) (2008).

[24] Freeman, *supra* note 4, at 195–96.

[25] EPA-state program offices and task forces focus resources and authorities on high-visibility, interstate waters: *e.g.*, the Chesapeake Bay Program, Great Lakes National Program, and the Mississippi River-Gulf of Mexico Watershed

III. REGULATORY SCOPE

The CWA's primary regulatory authority extends to "point source" discharges, which are defined as the addition of a pollutant through a point source into navigable waters. The Act defines "navigable waters" as "waters of the United States and the territorial seas." Thus the Act's regulatory scope has two main dimensions—geographical feature (navigable versus non-navigable waters) and type of discharger (point versus non-point sources). The Supreme Court has limited the CWA's geographical reach to traditionally navigable waters and tributaries and wetlands with a hydrological connection to those waters.[26] It has excluded "isolated" waters and wetlands.[27] This paper assumes that this scope reflects an appropriate exercise of centralized regulatory authority, given the potential for interstate spillovers in the covered aquatic systems and the established federal interest in protecting traditionally navigable waters.[28] I focus below on the second dimension of the Act's regulatory scope, based on type of discharger.

The Act defines "point source" as any "discernible, confined and discrete conveyance."[29] The definition includes "concentrated animal feeding operation[s]," but excludes "agricultural stormwater discharges," including any such discharges from a "discrete conveyance."[30] The Act's exclusion of pollution from agricultural runoff and from non-point sources more generally was a political concession to a collection of economic interests, including the powerful Farm Bureau and other agribusiness interests.[31] The 1972 Congress justified the exclusion of non-point

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Nutrient Task Force.

[26] *See* Rapanos v. United States, 547 U.S. 715 (2006).

[27] *See* Solid Waste Agency of N. Cook County v. U.S. Army Corps of Eng'rs, 531 U.S. 159 (2001).

[28] *See generally* WALLACE OATES, FISCAL FEDERALISM 31–38 (1972); Richard L. Revesz, *Federalism and Interstate Environmental Externalities*, 144 U. PA. L. REV. 2341 (1996) (discussing federal regulation of interstate air pollution).

[29] 33 U.S.C. § 1362(14).

[30] *Id.*

[31] OLIVER A. HOUCK, THE CLEAN WATER ACT TMDL PROGRAM: LAW, POLICY, AND IMPLEMENTATION 166 (2d ed. 2002); Paul R. Portnoy, *EPA and the Evolution of Federal Regulation, in* POLICIES FOR ENVIRONMENTAL PROTECTION 28 (Paul R. Portney ed. 2d ed. 2000).

source pollution based on the inability to treat pollution from diffuse sources.[32] Since 1972 EPA and others have demonstrated the ability of a range of management measures to reduce non-point source pollution.[33] It is difficult, although in at least some cases not impossible, to directly monitor discharges from non-point sources.[34] Therefore, setting and enforcing discharge limitations on non-point sources of the sort typically applied to point sources, which require monitoring at the point of discharge, remains problematic.[35] This does not mean, however, that non-point source pollution cannot be effectively controlled, as the 1972 Congress seemed to believe was largely the case.

The 1972 Congress may also have been influenced by the view that control of non-point source pollution is a form of land use control and that land use control rests traditionally with state and local governments, not with the federal government.[36] The traditional allocation of authority may be a relevant consideration in the policy debate, but it is not determinative. Land use decisions are appropriately subject to federal constraints if they generate significant interstate spillovers or otherwise affect national interests, as recognized in existing federal regulation of adjacent wetlands and endangered species habitat.

Unregulated nonpoint source pollution is solely responsible for failure of 30 to 50 percent of U.S. waterbodies to meet water quality standards and is a contributing factor in an even larger percentage.[37] The waterbodies seriously and adversely affected by non-point source pollution include major interstate watersheds,

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[32] S. REP. NO. 92-414 (1972), *reprinted in* 1972 U.S.C.C.A.N. 3668, 3706 (observing that "many nonpoint sources of pollution are beyond present technology of control").

[33] *See* U.S. ENVTL. PROT. AGENCY, NATIONAL MANAGEMENT MEASURES FOR THE CONTROL OF NONPOINT POLLUTION FROM AGRICULTURE (2003), *available at* http://www.epa.gov/nps/agmm/.

[34] Kurt Stephenson, Patricia Norris & Leonard Shabman, *Watershed-Based Effluent Trading: The Nonpoint Source Challenge*, 16 CONTEMP. ECON. POL'Y 412, 415 (1998).

[35] *But see* HOUCK, *supra* note 31, at 87 (noting that "we do not avoid regulating nonpoint source pollution because we are unable to figure out how to do it. Rather, we have deferred to the myth that its impacts are essentially local and of secondary importance. . . .").

[36] Linda A. Malone, *Myths and Truths That Ended the 2000 TMDL Program*, 20 PACE ENVTL. L. REV. 63, 78–79 (2002).

[37] Bill Painter, *Dilution of a Solution*, 24 ENVTL. F. 29 (2007).

such as the Mississippi River Basin/Gulf Coast complex, which drains two-thirds of the lower forty-eight states, the Chesapeake Bay, center of a five-state watershed, and the Great Lakes, fed by portions of eight states and Canada.[38] For waters such as these, some federal involvement is appropriate and likely necessary for effective control of non-point as well as point source pollution to achieve desired water quality.

It might be argued that, while there are no federal regulatory controls on non-point source pollution, federal subsidies are available to reduce non-point source pollution, and thus that an appropriate federal presence exists. Federal taxing and spending power may effectively substitute for federal regulatory power. For this argument to be persuasive, however, it has to be shown that the available subsidies are adequately funded and targeted effectively to generate the non-point source reductions necessary to achieve water quality goals; thus the inquiry shifts from the appropriate allocation of authority to the selection and tailoring of instruments to achieve national goals.

IV. TOOLS

The Clean Water Act and associated USDA programs incorporate several regulatory instruments: (1) conduct or command instruments, including technology-based and water-quality based limitations applied to individual point sources; (2) subsidies to non-point sources to engage in land use practices that reduce pollution; and (3) quantity instruments, in the form of pollution allowances or credits that may be traded between point sources or between point sources and non-point sources. This Part considers the strengths and weaknesses of each of these

[38] *See* U.S. ENVTL. PROT. AGENCY, GREAT LAKES ECOSYSTEM REPORT 37 (2000), *available at* http://www.epa.gov/glnpo/rptcong/2001/body31-40.pdf (explaining that polluted run-off is the most important remaining source of pollution in the Great Lakes); NAT'L RES. COUNCIL, MISSISSIPPI RIVER WATER QUALITY AND THE CLEAN WATER ACT: PROGRESS, CHALLENGES, AND OPPORTUNITIES 29–32 (2007), *available at* http://www.nap.edu/catalog.php?record_id=12051#toc (explaining that excess nutrients in the Mississippi River Basin system are due primarily to nonpoint sources); CHESAPEAKE BAY PROGRAM, BAY TRENDS AND INDICATORS (2007), *available at* http://www.chesapeakebay.net/status.cfm?sid=216 (explaining that agricultural non-point source measures are targeted for more than 50 percent of future reductions needed to meet water quality goals).

instruments in the water quality context and develops a framework in which they could be integrated to produce the most cost-effective steps toward achieving national water quality goals.

A. *Conduct Instruments*

For point source dischargers, the CWA imposes two tiers of conduct requirements. The first is technology-based requirements which are nationally uniform for each class or category of discharger to which they apply. The second is harm-based and depends on the quality of the receiving water into which the source discharges. Every point source covered by the program must meet the technology-based requirements applicable to it, regardless of the effects of its discharges on water quality. In addition, a point source must meet any more stringent requirements necessary to meet water quality standards in the water body into which it discharges. Some commentators have proposed a similar suite of requirements for non-point sources, including a universal requirement that non-point sources apply "best management practices"—the analogue to technology-based requirements for point sources. I review briefly the regulation of point sources under the Act and then consider the feasibility and wisdom of comparable regulation of non-point sources.

1. *Point Sources*

For industrial point source dischargers, EPA has elaborated generic technology-based statutory standards, such as Best Available Technology Economically Achievable (BAT) (for non-conventional pollutants) and Best Conventional Technology (for pH, suspended solids, fecal coliform and biological oxygen demanding pollutants) into industry-specific effluent limitations guidelines.[39] Typically, these guidelines and the discharge permits that incorporate them specify numerical limitations that the discharges from the sources are to achieve, based on the agency's calculation of the pollution reduction available through application of a selected treatment technology. For municipal wastewater treatment plants, the agency has set numerical limitations based on the statutory standard, Secondary Treatment. For point source dischargers of urban runoff (storm sewers and industrial and

[39] 33 U.S.C. § 1311(b) (2000).

construction sites), the Agency has interpreted the statutory BAT and BCT standards more flexibly to allow sources to "design their own pollution plan for minimizing pollutants in their stormwater runoff."[40] Urban runoff is also subject to less stringent monitoring and reporting requirements.

The inflexibility or context-blindness of the CWA's technology-based approach has drawn intense and sustained fire from academic critics over three decades, with return fire from defenders of this approach. I cannot hope to do this debate justice within the confines of this paper, but will address the main criticism against technology-based limitations as a basis for my own conclusions about how the program can best move forward.

The critics' main argument against generic technology-based limitations is that they are "wildly inefficient."[41] Technology-based limitations are inefficient because they are blind both to differences in compliance costs among sources and to variations in the environmental costs that those sources are imposing in the particular circumstances of their discharge. If welfare-maximization is the policy goal, then technology-based limitations, in their particular application, are likely to be either too demanding or not demanding enough.

Critics argue that ambient-based limitations, such as those keyed to attaining water quality standards, are likely to be more efficient, because they do not require expensive treatment where it is not necessary to achieve water quality goals. An ambient-based

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[40] Wendy Wagner, *Stormy Regulation: The Problems that Result when Stormwater (and Other) Regulatory Programs Neglect to Account for Limitations in Scientific and Technical Information*, 9 CHAP. L. REV. 191, 213 (2006). This greater flexibility for stormwater point sources may have several bases, including the greater variability of stormwater discharges (discharges only occur when it rains and vary widely depending on the characteristics of the areas from which the discharge occurs) and uncertainties about the effectiveness of stormwater controls. *Id.* at 202–05.

[41] Cass R. Sunstein, *Administrative Substance*, 1991 DUKE L.J. 607, 628. For critiques of the inefficiency of technology-based controls, see BRUCE A. ACKERMAN, SUSAN ROSE-ACKERMAN, JAMES W. SAWYER, JR. & DALE W. HENDERSON, THE UNCERTAIN SEARCH FOR ENVIRONMENTAL QUALITY 319–21 (1974); Bruce A. Ackerman & Richard B. Stewart, *Reforming Environmental Law: The Democratic Case for Market Incentives*, 13 COLUM. J. ENVTL. L. 171, 172–75 (1988); Bruce A. Ackerman & Richard B. Stewart, *Reforming Environmental Law*, 37 STAN. L. REV. 1333, 1334–40 (1985); William F. Pederson, Jr., *Turning the Tide on Water Quality*, 15 ECOLOGY L. Q. 69, 82–84 (1988).

cap and trade system, providing for allowance trading among pollution sources within a watershed, promises even greater efficiency by allocating reductions to sources with the lowest reduction costs. Cap and trade systems also promise efficiency gains over time by creating incentives for sources to develop and apply more cost-effective reduction measures.

Defenders of technology-based requirements may disagree, for reasons previously discussed, that efficiency is the primary value. But even if efficiency is the policy lodestar, they argue, technology-based limitations may be more efficient in practice than the theoretically more efficient options.[42] In the context of water pollution control, this argument is based on the difficulties of assessing water quality across thousands of watersheds, relating the discharges of diverse sources within those watersheds to their impacts on water quality, and apportioning reduction obligations accordingly. The uncertainties and administrative costs associated with that effort, defenders argue, are likely to result in less efficient outcomes than a technology-based approach.

To the extent that this debate is about what should have been, after more than thirty years perhaps it has become academic in more than one sense. If certain and inexpensive information had been available on water quality, source impacts, and treatment options, the early emphasis on technology-based requirements would have been difficult to justify on efficiency grounds. But that information was not available. Better data and science are available now—enough in the view of the National Research Council to justify a water-quality based approach.[43] But significant shortcomings remain. Water quality data is limited. Less than half of the nation's waters have been assessed, and

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[42] For defenses of technology-based controls against charges of inefficiency, see Howard Latin, *Ideal Versus Real Regulatory Efficiency: Implementation of Uniform Standards and "Fine-Tuning" Regulatory Reforms*, 37 STAN. L. REV. 1267, 1304–31 (1985); Sidney A. Shapiro & Thomas O. McGarity, *Not So Paradoxical: The Rationale for Technology-Based Regulation*, 1991 DUKE L.J. 729, 744–51; Wendy Wagner, *The Triumph of Technology-Based Standards*, 2000 U. ILL. L. REV. 83, 92–93, 107–09.

[43] NAT'L RES. COUNCIL, ASSESSING THE TMDL APPROACH TO WATER QUALITY MANAGEMENT 3 (2000), *available at* http://www.nap.edu/catalog.php?record_id=10146 ("[T]he data and science have progressed sufficiently over the last 35 years to support the nation's return to ambient-based water quality management.").

according to a 2000 GAO Report only a handful of states have the data necessary to fully assess all their waters.[44] GAO also found shortcomings in the identification of the sources of pollution problems.[45] These data limitations undercut the usefulness of complex models used to carry out the essential task in water-quality based regulation of relating discharges from sources to water quality conditions.[46]

Technology-based limitations have produced substantial reductions, generating benefits that by at least some accounts are roughly equal to costs. Even in the acknowledgement of some of their critics, they "made some sense as a crude first-generation strategy"[47] and do not have "convincing replacements."[48] The continued lack of entirely "convincing replacements" across the majority of our watersheds counsels against rapid or wholesale abandonment of technology-based requirements for point sources. But because of the potential efficiency gains, which are important to maintain support for further progress toward achieving clean water goals, we should focus future resources on perfecting the ambient-based approach. As we develop better information on water quality, improve source identification and modeling capabilities, and increase institutional capacity for watershed implementation, technology-based tools can be adapted into more efficient systems, including watershed-based trading schemes, as discussed further below. This adaptation can not only increase the cost-effectiveness of point source controls but also generate cost-effective reductions by non-point sources.

2. *Non-Point Sources*

This endorsement of the technology-based requirements for point sources as a first generation strategy for which there is still a need does not necessarily argue for adoption of analogous

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[44] U.S. GEN. ACCOUNTING. OFFICE, WATER QUALITY: KEY EPA AND STATE DECISIONS LIMITED BY INCONSISTENT AND INCOMPLETE DATA 11 (2000), *available at* http://www.gao.gov/archive/2000/rc00054.pdf.

[45] *Id.* at 32–33.

[46] *See* NAT'L RES. COUNCIL, *supra* note 43, at 68–86; K. H. Reckhow & S.C. Chopra, *Modeling Excessive Nutrient Loading in the Environment*, 100 ENVTL. POLLUTION 197, 206 (1999).

[47] Ackerman & Stewart, *Reforming Environmental Law*, *supra* note 41, at 1364.

[48] William F. Pederson, Jr., *supra* note 41, at 101.

requirements for non-point sources. First, something significant would have to happen politically for Congress to embrace a universal requirement of best management practices on rural or agricultural lands. The coalition that successfully prevented regulation of non-point sources in 1972 remains intact and has successfully resisted much more modest efforts since then to bring non-point sources under some level of management.[49] Second, we have passed the first phase of water pollution regulation in this country, identified with technology-based controls, and have shifted bureaucratic focus and resources to the second, identified with the water quality-based approach. To the extent that it will be necessary to impose some controls on non-point sources, it will be more consistent with the current program emphasis to target those controls as necessary to restore and protect water quality. Targeted controls are also likely to be more politically viable (or at least stir less vehement resistance) than generally applicable requirements.[50] Finally, a water-quality based approach to non-point source controls offers efficiency gains that will strengthen the case for continued progress toward water quality goals. Some pollution reduction measures, such as precision agriculture tools, may maintain or even increase farm profitability and therefore could be applied cost-effectively throughout a watershed.[51] But most non-point source controls designed to provide off-site water quality benefits will impose net costs on the farmers tasked to implement them, and depending on type of control and location, those controls will be more or less cost-effective in achieving the off-site benefits. A water-quality based approach allows decisionmakers to respond to these differences with a more cost-effective allocation of controls.

In its Total Maximum Daily Load (TMDL) program, the CWA provides an institutional setting within which water-quality based controls for non-point sources can evolve. The Act requires

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[49] *See infra* note 59 and accompanying text.

[50] HOUCK, *supra* note 31, at 167 (describing the "political" logic of TMDLs as focusing on an environmental bottom line and avoiding the charge of "treating for treatment's sake").

[51] SUZY FRIEDMAN, RALPH HEIMLICH, BRIAN JACKSON & EILEEN MCLELLAN, FARMING FOR CLEAN WATER: INNOVATIVE SOLUTIONS TO REDUCE CHESAPEAKE BAY FARM RUNOFF 16 (2007) (citing studies by the Iowa Soybean Association On Farm Network).

that states prepare TMDLs for "impaired waters," i.e., those not expected to meet all applicable water quality standards after the application of technology-based requirements for point sources.[52] The requirement extends to impaired waters that are affected only by non-point source pollution as well as those affected to some degree by point source discharges.[53] The TMDL is to be established at "a level necessary to implement the applicable water quality standards."[54] EPA regulations require that the total loading be allocated between point sources ("waste load allocation") and non-point sources ("load allocation") affecting the water body.[55] TMDLs prepared by the states are subject to approval by EPA, and if EPA disapproves the state's submittal, EPA is to prepare the TMDL.[56]

State-prepared TMDLs may include implementation plans, which detail how governmental resources and authorities will be deployed to achieve the targeted reductions, including non-point source reductions. However, EPA does not require implementation plans. In 2000 EPA adopted such a requirement in revisions to its TMDL regulations.[57] With their TMDLs, states were to provide an implementation plan and "reasonable assurance" that waste load allocations and load allocations would be met.[58] While the regulation stopped short of purporting to regulate non-point sources, it drew the ire of farm groups and others, who persuaded Congress to defund the rule and eventually convinced a new administration to withdraw it.[59]

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[52] Water Pollution Prevention and Control Standards and Enforcement Act, 33 U.S.C. § 1313(d)(1)(A) (2000).

[53] Pronosolino v. Nastri, 291 F.3d 1123, 1135–39 (9th Cir. 2002).

[54] 33 U.S.C. § 1313(d)(1)(C).

[55] 40 C.F.R. §§ 130.2(f)–(h), 130.7 (2008).

[56] 33 U.S.C. § 1313(d)(2).

[57] Revisions to the Water Quality Planning and Management Regulation, 65 Fed. Reg. 43,586, 43,586 (July 13, 2000). For a more detailed account of the recent history of the TMDL program and EPA's 2000 regulation, see Malone, *supra* note 36.

[58] Revisions to the Water Quality Planning and Management Regulation, *supra* note 57, at 43,591 (July 13, 2000).

[59] Linda A. Malone, *supra* 36, at 64–69. Six years earlier, agricultural interests also successfully opposed a proposal by the Clinton administration to require states to provide for enforceable measures for non-point sources in water-quality limited streams. U.S. ENVTL. PROT. AGENCY, PRESIDENT CLINTON'S CLEAN WATER INITIATIVE 35, 39–40 (Feb. 1994) (on file with author).

Despite its difficulties in 2000–2003, the requirement of a TMDL implementation plan is worth revisiting. Some states, such as Virginia, already require implementation plans as a matter of state law.[60] Extending such a requirement to all states as a matter of federal law is arguably authorized by the CWA in its present form.[61] It represents a modest effort to ensure that states engage with non-point as well as point sources and coordinate resources and authorities in the effort to meet water quality goals.[62] In addition, by specifying requirements (or programmatic expectations) for non-point sources, it clarifies the "baseline" necessary for the evolution of more extensive point source/non-point source trading.

Existing legislation offers precedents for even more aggressive versions of this approach in analogous contexts. For example, as a condition for receipt of federal funds under the Coastal Zone Management Act, states must include "enforceable policies and mechanisms" in plans to implement non-point source measures in coastal areas.[63] The Clean Air Act is even more demanding, requiring that states submit enforceable state implementation plans (SIPs) for achieving national air quality standards and providing for enforcement of those plans by federal officials and citizens.

The time may not yet be right for something approaching the CAA model in the water quality program, although as developed further in Section C there are strong efficiency as well as fairness arguments for having some sort of enforceable requirements for non-point sources.[64] Meanwhile, if the water quality-based approach is to gain credibility as a vehicle for dealing with non-point source as well as point source pollution, it seems crucial that

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[60] Va. Code Ann. §. 62.1-44.19:7 (2006); VIRGINIA DEPARTMENT OF CONSERVATION AND RECREATION AND DEPARTMENT OF ENVIRONMENTAL QUALITY, GUIDANCE MANUAL FOR TOTAL MAXIMUM DAILY LOAD IMPLEMENTATION PLANS (2003).

[61] *See* Revisions to the Water Quality Planning and Management Regulation, *supra* note 57, at 43,588 (discussing statutory authorities supporting EPA's 2000 regulation).

[62] *See* Water Pollution Prevention and Control Standards and Enforcement Act, 33 U.S.C. § 1313(d)(1)(C) (2000) (providing that TMDLs "be established at a level necessary to implement the applicable water quality standards").

[63] Coastal Zone Management Act, 16 U.S.C. § 1455(d)(16).

[64] *See infra* text accompanying notes 96–103.

we have a means for specifying programmatic expectations for non-point sources; that those expectations result from a process involving stakeholders at the federal, state, and local levels, including funding and regulatory agencies; and that the federal government have some leverage in that process to counter the potential parochialism of states and localities where national interests are at stake, as in the restoration of interstate watersheds such as the Mississippi River, the Great Lakes, and the Chesapeake Bay. If expectations for non-point sources were to mature into enforceable requirements, these requirements could be expressed as limited tradable allowances rather than inflexible conduct instruments, as has occurred for some pollutants under the CAA's SIP provisions.[65]

While TMDL implementation plans are not now required by federal regulation, EPA and the states have given thought to how implementation plans should be developed and what should be in them. Much of that thought is captured in EPA's guidance for "watershed-based plans" that are developed by states using federal funds under Section 319 of the CWA. The guidance contemplates a process that includes local, state, and federal stakeholders in the planning effort. Plan components include identifying the management measures necessary to achieve load reductions allocable to non-point sources and the "critical areas" on which those measures will be needed.[66] The guidance provides detailed instruction on comparing the costs and pollution reductions associated with candidate measures and prioritizing based on the relative cost-effectiveness of measures.[67] And it requires adaptive implementation—monitoring of plan implementation and effectiveness and adjusting the plan based on the results of that monitoring;[68] this would include adjustments in non-point source implementation to reflect monitoring results bearing on the reduction efficiencies of particular measures or combination of

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[65] *See, e.g.*, U.S. ENVTL. PROT. AGENCY, NOx Budget Trading Program/NOx SIP CALL (2008), *available at* http://www.epa.gov/airmarkt/progsregs/nox/sip.html.

[66] U.S. ENVTL. PROT. AGENCY, HANDBOOK FOR DEVELOPING WATERSHED PLANS TO RESTORE AND PROTECT OUR WATERS i–xvi (2005), *available at* http://epa.gov/nps/watershed_handbook/pdf/handbook.pdf.

[67] *Id.* at 11-31 to 11-33.

[68] *Id.* at 13-8 to 13-15.

measures across the watershed.[69] Experience already gained under the guidance offers some assurance that requiring implementation plans with TMDLs would produce meaningful information important to the achievement of water quality goals on a watershed basis.[70]

B. *Subsidies*

Price instruments offer an alternative to conduct instruments that includes taxes and subsidies. I focus on subsidies here, as they have proved politically much more saleable than taxes as an environmental policy instrument in this country and there is already a substantial federal environmental subsidy program, primarily through funds administered by the U.S. Department of Agriculture (USDA). This program is focused, in part, on reducing water quality impacts of agricultural non-point sources—the main remaining cause, as we have seen, of water quality impairment in the U.S. Subsidies may substitute for regulatory programs and, indeed, one of Congress's express purposes for adopting subsidies for agricultural conservation has been to avoid the need for regulatory programs "to meet environmental quality criteria established by federal, state, tribal and local agencies."[71]

Commentators raise several general concerns about the use of subsidies. Subsidies may create perverse incentives that stimulate the very activities that they are intended to discourage. For example, the availability of subsidies to reduce environmentally damaging farming practices may discourage farmers from voluntarily taking ameliorative actions that would have been in their interest to take in the absence of a payment program.[72] Commentators also point out that, if distributed through central institutions that offer the only or primary source of such aid, subsidies may be ineffectively or inefficiently administered.

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[69] *Id.* at 13-14.

[70] *E.g.*, VA. DEP'T OF CONSERVATION & RECREATION, BEAVER CREEK AND LITTLE CREEK WATERSHEDS TOTAL MAXIMUM DAILY LOAD IMPLEMENTATION (2007) *available at*, http://www.deq.state.va.us/export/sites/default/tmdl/implans/bvrltlip.pdf; LANCASTER COUNTY CONSERVATION DIST., WATERSHED IMPLEMENTATION PLAN FOR MILL CREEK (2006), *available at* http://www.hrwc.org/text/watershedmgmtplans.htm#mill.

[71] Cox, *supra* note 9 at 113, 119.

[72] *See* Jonathan Baert Weiner, *Global Environmental Regulation*, 108 YALE L.J. 677, 726 & n.186 (1999).

Because the funding institution (e.g., USDA) has few or no competitors in securing environmental projects (e.g., vegetative buffers to reduce non-point source pollution), "it has fewer incentives to be cost-effective—to select good projects, to monitor performance, and to insist on or produce results—than if it had to compete to fund the best projects and to develop new and better ways of environmental protection."[73]

Subsidies for reducing non-point source pollution from agricultural land have several sources in current federal law. Section 319 of the CWA authorizes appropriation of grant funds for state management plans for addressing non-point source pollution.[74] Much more generous funding is available under the USDA-administered Farm Bill. The Farm Bill includes both commodity provisions, which seek generally to support U.S. agricultural production, and conservation provisions, which seek to protect and restore ecosystem services provided by farmland, such as clean water. Conservation programs that help reduce non-point source pollution include both land reserve programs, such as the Conservation Reserve Program (CRP), which pay to take farmland out of production to protect the environment, and working land conservation programs, such as the Environmental Quality Incentives Program (EQIP) and the Conservation Security Program (CSP), which provide payments for environmentally beneficial practices on actively managed farmland. The total annual USDA conservation budget is over $4 billion, and significant portions of this are directed to water quality. USDA programs under the Farm Bill "provide 86 percent of the total federal funding potentially available for water quality, conservation, and watershed restoration projects."[75] EPA programs account for only about 10 percent of federal funding

[73] *Id.* at 727; *see also* MINDY SLEMAN ET AL., WORLD RES. INST., PAYING FOR ENVIRONMENTAL PERFORMANCE: POTENTIAL COST SAVINGS USING A REVERSE AUCTION IN PROGRAM SIGN-UP 4 (2008) (comparing average cost-effectiveness of USDA-subsidized reductions in phosphorous runoff from agricultural lands ($26.19/lb.) to average cost-effectiveness of reductions in a reverse auction experiment ($3.62/lb.), *available at* http://pdf.wri.org/paying_for_environmental_performance_reverse_auctions_in_program_signup.pdf.

[74] Water Pollution Prevention and Control Standards and Enforcement Act, 33 U.S.C. § 1329(h) (2000).

[75] Cox, *supra* note 9, at 124 & fig.2.

available for these purposes.[76] While some state funds also offer payments for water quality measures on agricultural land, those funds too are dwarfed by the USDA program.

Despite the substantial leverage suggested by the amounts of the conservation funds flowing through USDA, observers have rated the program unsatisfactory in producing cost-effective improvements in water quality or other conservation benefits. Its identified shortcomings are consistent with what the theory would lead us to expect from a centralized environmental subsidy program. As applied to water quality concerns, they include: lack of strategic targeting of funds to areas of greatest need and greatest opportunity for cost-effective improvements; emphasis on practices (e.g., implementation of measures such as stream fencing) rather than on environmental performance (e.g., reductions in stream pollution); and lack of robust monitoring, reporting, and enforcement.[77] Although these shortcomings are predictable for this kind of program, they are not irremediable.

Several reforms could improve the cost-effectiveness of the Farm Bill's conservation subsidies in addressing water quality concerns. First, conservation payments for water quality measures should be targeted at impaired waters where non-point sources are significant contributors and prioritized in order of the most cost-effective reductions. Grant applications would be solicited from landowners closest to the affected water body whose practices have the greatest impact on water quality. Education and technical assistance would be concentrated on non-point source measures, such as precision agriculture, that can be implemented "while maintaining or increasing profitability."[78]

Second, emphasis should shift from practices to performance in an effort to obtain the greatest water quality benefits at the lowest cost. This is not an easy shift, because establishing "[t]he causal relationship between a specific [non-point source] practice and its effect on the environment is a notoriously difficult task."[79] Actual removal efficiencies vary with the particular characteristics of the land on which a measure is implemented and with the

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[76] *Id.*

[77] Arha et al., *supra* note 7, at 209; FRIEDMAN ET. AL., *supra* note 51, at 5–19.

[78] FRIEDMAN ET AL., *supra* note 51, at 16.

[79] Arha et al., *supra* note 7, at 220.

effects of other control measures on that land and in the landscape or watershed more generally.[80] Adaptive implementation at the watershed level could help identify the combination of measures best suited for particular settings.[81]

Third, resources should be devoted to improvements in monitoring, reporting, and enforcement. This includes not only assuring that agreed upon measures are undertaken and maintained, but also monitoring the runoff and stream quality during storm events. Again, this monitoring is likely most useful at the watershed level rather than the individual landowner level. Watershed-oriented grant selection and administration could increase the resources available for this monitoring.[82]

In May 2008, after the initial presentation of this paper, Congress amended the Farm Bill.[83] The amendments show some movement toward directing funds to environmentally significant, cost-effective projects under USDA's two main working lands programs, CSP and EQIP. The amendments restructure the existing CSP into the Conservation Stewardship Program (deftly retaining the established acronym). The new CSP limits eligibility for grants to projects that address one or more "priority resource concerns" as identified by a state level review committee.[84] It also requires USDA to consider cost-effectiveness and environmental performance in ranking applications for grants; assessment of environmental performance is to be "based to the maximum extent possible on conservation measurement tools."[85] Similarly, the amendments to EQIP direct USDA to develop evaluation criteria to address national, state, and local "conservation priorities" and to consider environmental effectiveness and cost-effectiveness in

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[80] FRIEDMAN ET AL., *supra* note 51, at 38.

[81] *Supra*, text accompanying notes 66–69; *see* Arha et al., *supra* note 7, at 220–21 (discussing the feasibility of measuring performance of non-point source measures at watershed level).

[82] Additional incentives for water quality measures might be generated through changes in the Farm Bill's crop subsidy program. Barton Thompson and others have proposed adding nutrient management to protect water quality to the existing requirements for highly erodible land and wetlands as a condition for the receipt of commodity payments. Arha et al., *supra* note 7, at 219.

[83] Food, Conservation, and Energy Act of 2008, P.L. 110-234, 110th Cong., 2d Sess. (May 22, 2008), 122 Stat. 923.

[84] *Id.* § 2301(a)(2) (adding §§ 1238D(4) & 1238F(a)(2)).

[85] *Id.* (adding § 1238F(b)(1)(B), (E)).

prioritizing applications.[86] Provisions of EQIP that focused on water conservation have also been amended to include restoration and enhancement of water quality as well as water quantity on agricultural lands, although they do not separately include cost-effectiveness or environmental benefits among the criteria for reviewing applications.[87]

Although these new provisions are promising, the extent to which they will in fact increase the water quality benefits of the funds available under the working lands programs must await their interpretation and implementation by USDA. The new legislation, on its face, does not require that TMDLs be taken into account in the targeting of these funds. And even if Farm Bill funds for water quality are steered to watersheds for which TMDLs have been prepared, the absence of meaningful implementation plans, as discussed above, will make it difficult to determine the most environmentally beneficial and cost-effective projects. A policy that linked Farm Bill funding for water quality improvements to the results of a TMDL planning process would encourage wider use of implementation plans and make better use of federal funds.

The 2008 Farm Bill amendments offer USDA, EPA and the states an opportunity to better integrate federal conservation subsidies into the larger institutional design for water quality. USDA, its state advisory bodies and local conservation districts should cooperate in the development and use of TMDL implementation plans to prioritize watersheds of concern, identify and fund cost-effective management practices within those watersheds, and monitor the implementation and effectiveness of those measures. This level of integration will be difficult to accomplish politically given the different missions and constituencies of USDA and EPA and given the political pressures to distribute funds broadly across farm constituents, but the rewards would be substantial.

C. *Market-Based Approaches*

Even if effectively targeted in the ways suggested above, it is

[86] *Id.* § 2504 (amending § 1240C(a)–(b)). *But see id*. § 2503 (amending § 1240B(c)) (precluding USDA from considering comparative costs when ranking applications of comparable environmental value).

[87] *Id.* § 2510 (amending § 1240I to replace the Ground and Surface Water Conservation Program with the Agricultural Water Enhancement Program).

highly unlikely that the subsidies available from federal and state sources will be enough to generate the reductions in non-point source pollution necessary to achieve water quality goals.[88] This limitation makes it necessary to look to other tools, including market-based approaches.

Proponents argue the advantages of market-based approaches over competing instruments in cost-effective attainment of environmental goals, transparency, stimulating technology innovation, and reducing administrative costs. The classic market-based instrument is the cap-and-trade program, in which government determines a "cap"—a maximum desired amount of discharge of a pollutant in a geographic area—and creates allowances in the amount of the cap. The allowances are auctioned or otherwise distributed to the pollution sources in the area, each of which is prohibited from discharging in excess of the allowances it holds. Sources may freely trade allowances among themselves. Sources with relatively high pollution reduction costs would be expected to purchase additional allowances from sources with relatively low reduction costs, with the result that the area reductions represented by the cap would be achieved in the most cost-effective manner. Although cost-effective allocation of pollution reduction among sources could be attempted administratively, cap and trade relegates the allocation to the decisions of source managers in a market setting. Proponents argue that this mode of allocation is superior because the source managers have better information about their costs and sharper incentives to reduce their costs through reallocations and because the costs of administering the program are less.

EPA seeks to approach this model in its Water Quality Trading Policy.[89] The policy authorizes trading of pollutant credits among point sources and between point and non-point sources in a watershed or other defined area. Both point and non-point sources can generate credits for sale to other sources by achieving reductions beyond a "baseline" allocable to the source. For waters

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[88] *See* FRIEDMAN ET AL., *supra* note 51, at 63–64 (concluding that achieving and maintaining water quality standards in the Chesapeake Bay will require funding for agricultural controls at a rate 2.7 times the current expenditure).

[89] U.S. ENVTL. PROT. AGENCY, FINAL WATER QUALITY TRADING POLICY (2003), *available at* http://www.epa.gov/owow/watershed/trading/tradingpolicy.html.

for which a TMDL has been approved, the baseline is derived from the point source waste load allocations (for point sources) or load allocations (for non-point sources). Credits generated by non-point sources are subject to "methods to account for the greater uncertainty in estimates of non-point source loads and reductions," including trading ratios of greater than 1:1.[90] The policy does not allow trading "to comply with existing technology-based effluent limitations" applicable to point sources.[91] Thus, trading by point sources is limited to the increment of reduction between technology-based limitations and any more stringent water quality-based limitations.

In their recent examination of "cap-and-allowance markets" in water quality programs, Leonard Shabman and Kurt Stephenson argue that "market-like" devices have two essential design attributes.[92] First, there must be ownership of a commodity that may be bought and sold; in water quality programs, this commodity is discharge allowances, issued in limited amounts consistent with meeting water quality standards. Second, sources must have "substantial discretion . . . to decide how pollution should be controlled (waste control flexibility) and whether to buy or sell allowances (exchange flexibility)."[93] Exchange flexibility is enhanced by a larger number of sources (potential buyers and sellers) and by low transaction costs of sales and purchases.[94]

These criteria suggest some inherent limitations on the potential of market-based approaches in water quality programs. Because surface water is confined and channeled within distinct watersheds, which may be small, and because many water quality impairments occur only in portions of those watersheds, the universe of potential trading partners is often much less than would be the case for air pollutants. Even where the number of sources is relatively large, as in major watersheds with systemic pollution problems, discharges of pollutants may not be fungible over space and time, so that trades are possible only with complex

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[90] *Id.* at 9.

[91] *Id.* at 6.

[92] Leonard Shabman & Kurt Stephenson, *Achieving Nutrient Water Quality Goals: Bringing Market-Like Principles to Water Quality Management*, 43 J. AM. WATER RES. ASS'N 1076, 1078 (2007).

[93] *Id.*

[94] *Id.* at 1079.

adjustments for differential effects of the discharge of a pollutant at different times or in different locations within the watershed. This increases the uncertainty and the administrative costs of the trading system. These characteristics of water quality trading—limited number of trading partners and limited fungibility of discharges—reduce exchange flexibility and may help explain why water quality trading has been much slower to take hold than similar air pollution abatement programs.

In addition to these inherent limitations, the current design of water quality trading efforts departs significantly from Shabman's and Stephenson's criteria for optimal "market-like" programs. First, the inability of point sources to "trade out" of generic technology-based requirements limits their waste control flexibility and therefore the potential gains from trades with other sources. This suggests revising EPA's policy (or amending the CWA if necessary) to increase the scope of trading by point sources, where trading would not risk creating pollution "hotspots" of local concern. For example, as Shabman proposes, all point sources in a watershed might be grouped under a single compliance permit and their individual limitations aggregated to establish a total cap for the group; individual sources would not be constrained by their individual limitations, as long as the group limitations were met. This arrangement increases the latitude for trading both among point sources and between point sources and non-point sources.[95]

The current trading policy also does not require that discharges from non-point sources be capped or otherwise limited.

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[95] *Id.* at 1082–83. On the Neuse River in North Carolina, the state's Department of Environment and Natural Resources issued an NPDES permit to the Neuse River Compliance Association composed of dozens of point source dischargers. The permit provided that each discharger would be deemed to have met its individual nitrogen limitation if the association met a total nitrogen limitation assigned to the group. In the event that the association failed to meet the total limitation, each discharger would be accountable for meeting its individual limitation. STATE OF NORTH CAROLINA, DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES, PERMIT TO DISCHARGE UNDER THE NATIONAL DISCHARGE ELIMINATION SYSTEM, THE NEUSE RIVER COMPLIANCE ASSOCIATION AND ITS CO-PERMITTEE MEMBERS (2004), *available at* http://www.envtn.org/wqt/docs/Dubay/Neuse_permitPart1.pdf. Although the nitrogen limitations at issue in the Neuse River permit were water-quality not technology-based, an aggregate compliance approach could also work for technology-based limitations for the same pollutant or pollutants with the same environmental impact.

The system is only partially capped, as only point sources must hold allowances (permits) in order to discharge. The ability of uncontrolled non-point sources to generate credits risks the problem we identified with subsidies—encouraging activities that the policy seeks to discourage.[96] Also, the failure to limit non-point source discharges means that one of the major advantages of a cap-and-trade system—assurance that a desired environmental endpoint will be met using limited allowances—is not realized. Under the current trading policy, non-point sources may generate and sell pollution reduction credits, after voluntarily meeting "baseline" expectations, but those reductions may be offset by increased discharges by other non-point sources not subject to controls.

Failure to cap or otherwise restrict non-point sources may also discourage trading by raising the threshold for trading by non-point sources: in order to begin to generate pollution reduction credits for sale, a non-point source must first undertake to meet baseline expectations, which are otherwise voluntary and, to the extent not underwritten by subsidies, may be costly to the source. Moreover, in the absence of a TMDL implementation plan specifying what measures are needed to meet the non-point source allocation, baseline expectations may be quite unclear.

In an empirical study of alternative approaches to improving water quality, Paul Faeth examined the cost of nutrient reduction in three Midwestern watersheds that included significant point and non-point contributors.[97] He evaluated four approaches: the first involving point source performance requirements only, the second, conventional subsidies for non-point source reductions, the third, point source requirements with trading (including the option for point sources of purchasing credits voluntarily generated by non-point sources), and the fourth, a sharing of the burden between point source and non-point sources with subsidies for reductions by non-point sources and trading.[98] This last option, which Faeth styled "trading program coupled with performance-based

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[96] RICHARD B. STEWART & JONATHAN B. WIENER, RECONSTRUCTING CLIMATE POLICY 91 (2003) (discussing the analogous clean development mechanism under the Kyoto Protocol).

[97] *See* PAUL FAETH, FERTILE GROUND: NUTRIENT TRADING'S POTENTIAL TO COST-EFFECTIVELY IMPROVE WATER QUALITY (2000).

[98] *Id.* at 32–37.

conservation subsidies," turned out to be the most cost-effective approach.

In Faeth's fourth option, both point and non-point sources would be allocated a share of the responsibility for reductions necessary to achieve water quality standards. That option assumes that subsidies would be available to fund the non-point share of reductions and that those subsidies would be performance-based, targeted to the farmers who could achieve the most cost-effective load reductions. Farmers could generate pollution reduction credits by implementing additional reductions above those purchased by the subsidies, and could sell those to point source dischargers. In an alternative version of this option, which does not assume adequate subsidies to fund agriculture's share, the non-point source share would be based on some minimum performance standard for agricultural practices, and available federal and state subsidies would be targeted to help farmers achieve that standard. Both point and non-point sources would be able to generate credits by exceeding their performance requirements or purchase credits to meet their obligations. Even this option does not fully meet Shabman's criteria for an optimal system, because it does not issue a defined number of discharge allowances consistent with achieving water quality standards (relying instead on variably generated credits).[99] But it approaches "a 'fully closed' trading system."[100]

If we assume realistically that sufficient subsidies will not be available to fund the full share of reductions allocable to non-point sources, both Shabman and Faeth indicate that the most cost-effective water quality management schemes will include enforceable requirements (either to make specified reductions or to hold allowances for discharges) for non-point sources as well as point sources. As in other contexts, we face the current political difficulty of imposing limitations on non-point sources. However, the incremental adjustments previously discussed may enhance the performance of the existing arrangement—a partially capped trading system with subsidies—and generate information and public support for future changes. Targeting subsidies to cost-effective measures in impaired waters promises substantial

[99] Shabman & Stephenson, *supra* note 92, at 1083–84.
[100] *See* FAETH, *supra* note 97, at 37.

improvements in program efficiency. Requiring implementation plans for TMDLs that identify cost-effective management practices for non-point sources can facilitate that targeting. By specifying expectations for non-point sources, implementation plans can also clarify the baseline for generating credits under the existing policy and perhaps ease the transition to more robust participation by non-point sources in the future.

At least for large watersheds with systemic water quality problems, where market-based approaches offer the greatest promise, the ultimate objective would be a cap-and-trade system fully integrating point and non-point sources. But the feasibility of that objective remains subject to a number of questions. These questions include: limitations on the scope of watershed trading due to the characteristics of aquatic systems and the effects of pollutants within those systems; uncertainties in measuring or estimating the actual amounts of pollution flowing from individual non-point sources over time;[101] and the transaction costs associated with trading, which have the potential to swallow the savings achieved.[102] These concerns may prevent the broad scale success of water-quality based trading and force consideration of alternatives, such as mandating management practices for non-point sources in watersheds not meeting water quality standards or, if that proves still to be politically infeasible, abandoning current national water quality goals as not reasonably attainable.

CONCLUSION

The CWA is stuck. There is substantial public support for further progress toward the goals of the nation's water quality program and evidence that further progress could be made for lower marginal costs than much of the progress to date. And yet there is a lack of systematic progress and even, in some of the country's premier watersheds, evidence of slipping backward as the effects of urbanization and more intensive agricultural uses swallow the gains of advanced point source controls. The sole regulatory focus on point sources becomes increasingly inefficient

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[101] FRIEDMAN ET AL., *supra* note 51, at 16.

[102] *See* Feng Fang, K. William Easter & Patrick L. Brezonik, *Point-Nonpoint Source Water Quality Trading: A Case Study in the Minnesota River Basin*, 41 J. AM. WATER RES. ASS'N 645, 652–54 (2005).

with continued efforts to achieve water quality goals, and to the extent that it foists disproportionate burdens on the point source sector is also unfair. The subsidy program designed to engage non-point source dischargers in the absence of regulatory controls is neither sufficiently funded nor well-targeted to maximize water quality benefits or to assure that those benefits are actually achieved. Trading programs struggle under restrictions placed on the scope of trading by point sources and failure to establish requirements for the non-point sector.

These shortcomings combine to make further cost-effective progress toward water quality goals difficult. This paper has proposed incremental steps to address each of these shortcomings: setting specific expectations and ultimately enforceable requirements for non-point as well as point source reductions; increasing the latitude for trading by point sources and integrating non-point sources into more effective trading regimes; and shifting toward a more performance-based, cost-effective allocation of subsidies for non-point source controls. The combination of subsidies, trading, and state and local controls should be integrated through TMDL implementation plans that are monitored, reviewed and, updated regularly and that draw on inclusive processes involving stakeholders within a watershed.

The analysis has focused on the federal role, but the great majority of the policy making and implementation must be done by state and local stakeholders.[103] The goal, ultimately, is a watershed-based system in which non-point sources would bear obligations (and opportunities) comparable to their point source counterparts and in which, to the extent feasible, allowances would be traded freely among point and non-point sources.

[103] *See generally* J.B. Ruhl et al., *Proposal for Model State Watershed Management Act*, 33 ENVTL. L. 929 (2003).