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HOW TO SAVE THE CHESAPEAKE BAY TMDL: THE CRITICAL ROLE OF NUTRIENT OFFSETS

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INTRODUCTION

The latest cleanup plan for the Chesapeake Bay—the "Bay TMDL"—issued by the Environmental Protection Agency ("EPA") in December 2010 lacks an economic foundation and is therefore likely to suffer the same fate as the two previous plans for achieving nutrient pollution reduction targets for the Bay: the first plan setting nutrient goals for 2000, and the second for 2010.[1] Although these earlier plans failed to achieve their goals, they were successes in other significant respects.[2] In attempting to achieve ambitious targets for nutrient reductions, important actions were taken in the Bay watershed states that did lead to environmentally beneficial reductions of nitrogen and phosphorus loads in

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1 In 1987, the Bay states of Maryland, Virginia, and Pennsylvania, together with the District of Columbia and the Environmental Protection Agency, agreed to achieve a forty percent reduction in nitrogen and phosphorus levels in the Bay by 2000. A new agreement was announced in *Chesapeake 2000* setting nutrient reduction goals for 2010. New York State, Delaware, and West Virginia also joined in this agreement. *See* U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-06-96, CHESAPEAKE BAY PROGRAM: IMPROVED STRATEGIES ARE NEEDED TO BETTER ASSESS, MANAGE, AND REPORT RESTORATION PROGRESS (2005); *see also* James T. Tripp & Michael Oppenheimer, *Restoration of the Chesapeake Bay: A Multi-State Institutional Challenge*, 47 MD. L. REV. 425, 425–28 (1988).

2 *See* Jayni A. Shah, *Cleaning Maryland's Waters One Day at a Time: The Clean Water Act's Clear Mandate for Daily Pollutant Limitations Under the "Total Maximum Daily Load" Provision*, 66 MD. L. REV. 1352, 1352 (2007).

the Bay.[3] The same outcome is likely for the Bay TMDL—the interim targets for 2017 and the final targets for 2025 may well not be reached, but significant environmental improvements will probably be realized in the process of trying.

In order to maximize the resulting environmental gains for the Bay, the implementation strategy for the Bay TMDL should endeavor to make maximum use of nutrient offsets—allowing one polluter to purchase or otherwise generate an "offsetting" pollution reduction somewhere else, and in this manner fulfill the polluter's regulatory requirement without having to make a direct nutrient reduction itself. Making maximum use of nutrient offsets will significantly mitigate the economic concerns that may otherwise frustrate the achievement of greater reductions in nutrient pollution loads throughout the Bay watershed.

I. THE BAY TMDL

In December 2010 the Environmental Protection Agency issued a plan for the cleanup of the Chesapeake Bay—the "TMDL" for the Bay.[4] It set interim pollution load targets for 2017 and final targets for 2025. As compared with 2010, the 2017 targets were load reductions of fifteen percent for nitrogen, fourteen percent for phosphorus, and twelve percent for sediment.[5] The 2025 targets were reductions of twenty-five percent, twenty-four percent, and twenty percent, respectively, for these nutrient loads.[6] Excess nutrients in the Bay "fertilize" its algae, stimulating their growth, diminishing water clarity, and significantly depleting Bay oxygen levels when the algae die and decompose.[7]

For each of the three "pollutants" (if not directly harmful in the conventional toxic sense), the overall Bay targets were also disaggregated by the TMDL into 2017 and 2025 nutrient load targets for each of the six states (and the District of Columbia) in the Bay watershed.[8] In consultation

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[3] CHESAPEAKE BAY PROGRAM, CHESAPEAKE 2000 6 (June 28, 2000), *available at* http://www.epa.gov/region03/chesapeake/grants/2013Guidance/Attachment1_Chesapeake_2000_Agreement.pdf.
[4] *See* EPA, CHESAPEAKE BAY TMDL, ES-1 (Dec. 2010) [hereinafter CHESAPEAKE BAY TMDL], *available at* http://www.epa.gov/reg3wapd/tmdl/ChesapeakeBay/tmdlexec.html.
[5] *Id.* at ES-6.
[6] *Id.* at ES-1.
[7] *A Citizen's Guide to Understanding and Monitoring Lakes and Streams: Chapter 2—Lakes*, STATE OF WASH. DEP'T OF ECOLOGY, *available at* http://www.ecy.wa.gov/programs/wq/plants/management/joysmanual/dissolvedoxygen.html (last visited Mar. 4, 2014).
[8] CHESAPEAKE BAY TMDL, *supra* note 4, at Table ES-1.

with EPA, the individual states then each further disaggregated the TMDL nutrient targets themselves among the main sources from which Bay nutrient flows originate: agriculture, sewage treatment plants, stormwater runoff, and septic tanks.[9] As part of an overall "accountability framework" established for the Bay cleanup by EPA, a new system of two-year milestones was also established to provide for frequent monitoring of progress towards the 2017 and 2025 targets and sub-targets.[10]

The Bay states were also individually charged with further disaggregating their state TMDL load targets by the operating jurisdictions that would be responsible for implementing the actual nutrient flow reductions within each of the states.[11] In Maryland and Virginia, for example, this implementation responsibility for stormwater runoff and septic tanks would mostly fall to county governments (or in some cases municipal governments).[12] For sewage treatment plants, implementation would involve a wider set of actors—national, state, sanitary commissions, and the county or municipality in which the plant is located.[13] For agriculture, the implementation responsibility falls to "soil conservation districts" that work to improve local land and water management practices and distribute funds from the U.S. Department of Agriculture Farm Bill funding for various conservation purposes, typically organized along county boundaries.[14]

The disaggregation of total Bay nutrient reduction targets among these various implementing jurisdictions was undertaken by each of the Bay states through the development of Phase 1 and Phase 2 Watershed Implementation Plans ("WIPs") over the 2010–2012 period. Thus, each county and soil conservation district within the Bay watershed received an overall load target for 2017 and 2025 for each of the sources of nutrient flows, as set by the state government working in consultation with the local implementation agencies.[15] The ultimate result of the 2010 Bay

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[9] *Id.* at ES-3.

[10] As of this writing, EPA's most recent report on the achievement of these milestones can be found at EPA, VIRGINIA INTERIM ASSESSMENT OF 2012–2013 MILESTONES AND WIP PROGRESS (May 30, 2013), *available at* http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/InterimAssessments/VA%20Interim%20Assessment%202012%202013%20Milestones%20and%20WIP%20progress.pdf.

[11] *See* EPA, CHESAPEAKE BAY TOTAL MAXIMUM DAILY LOAD FOR NITROGEN, PHOSPHOROUS, AND SEDIMENT (Dec. 29, 2010) [hereinafter CHESAPEAKE BAY TOTAL MAXIMUM DAILY LOAD].

[12] *See* Envtl. Pol'y Workshop, *supra* note *.

[13] *See Summary of the Clean Water Act*, EPA (July 26, 2013), http://www2.epa.gov/laws-regulations/summary-clean-water-act.

[14] *See* Envtl. Pol'y Workshop, *supra* note *.

[15] *See id.*

TMDL is thus literally hundreds of specific nutrient reduction targets for 2017 and 2025 by nutrient source, for geographic areas ranging from the entire Bay to the states, and finally the local counties and soil conservation districts. In theory, these targets have the force of a legal agreement, implementing the requirements of Section 303 of the Clean Water Act of 1972 requiring that the federal government or states develop TMDLs for impaired water bodies (such as the Chesapeake Bay).[16] Because the Chesapeake Bay watershed is a multistate jurisdiction, the development and implementation of the overall Bay TMDL in this case fell to the national EPA.[17]

Despite the large amount of time and effort put into the 2010 Bay TMDL, and the follow-up WIP processes at the state and local levels, much still remains to be determined. It was well beyond either the intended scope or the capacity of the EPA, states, and local implementation jurisdictions to determine in the TMDL all the specific projects and other specific actions that would eventually have to be taken to achieve the 2017 and 2025 targets.[18] There was no attempt in the TMDL planning process to identify the necessary funding sources to undertake such individual actions.[19] There was no flexibility built into the 2017 and 2025 goals to adjust the dates and targets as the likely litigation relating to TMDL implementation took its course and delayed or even potentially prevented actions altogether.[20] Many other matters that could have a significant impact on the pace of implementation and the ultimate results of the TMDL remained highly uncertain at the time of the issuance of the TMDL in late 2010.

II. IS THE TMDL DEAD ON ARRIVAL?

Comprehensive planning of the kind involved in producing the Bay TMDL has a long history in the United States. Much as the Bay TMDL was prepared to meet a legal requirement, state governments from the 1920s onwards required that local zoning regulations must be

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[16] *See* OLIVER A. HOUCK, THE CLEAN WATER ACT TMDL PROGRAM: LAW, POLICY AND IMPLEMENTATION (Environmental Law Institute, 2d ed. 2002).
[17] *Frequently Asked Questions About the Bay TMDL*, EPA, http://www.epa.gov/reg3wapd/tmdl/ChesapeakeBay/FrequentlyAskedQuestions.html (last visited Mar. 4, 2014).
[18] CHESAPEAKE BAY TMDL, *supra* note 4.
[19] *Id.*
[20] *See* Envtl. Pol'y Workshop, *supra* note *.

developed and implemented "in accordance with a comprehensive plan."[21] It was recognized that zoning actions might create large private gains and losses and a main purpose of planning was to assure that the zoning process was impartially guided by professional experts to serve a wider public interest.[22] The legal theory never worked out, however.[23] Just as with the Bay TMDL, the comprehensive local development plans could never hope to resolve in advance the many uncertainties relating to key factors—especially including demand and supply trends in the residential and commercial development markets—that would have a large impact on the end results over a planning span of frequently ten or twenty years.[24]

By the 1950s and 1960s, it was time to reassess the experience of several decades of comprehensive land use planning and zoning. The conclusions were that the comprehensive land use plans had had little actual impact.[25] The plans sat on shelves and were seldom consulted in making local zoning decisions. Local planners and other close observers of the system had themselves become cynical.[26] Yet, the plans were legally required so they continued to be produced, making up in volume and fancy outward appearance for their lack of practical impact. As William Whyte,

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[21] Charles Haar, *In Accordance with a Comprehensive Plan*, 68 HARV. L. REV 1154, 1155–56 (1955).

[22] *Id.*

[23] *See* ROBERT H. NELSON, ZONING AND PROPERTY RIGHTS: AN ANALYSIS OF THE AMERICAN SYSTEM OF LAND USE REGULATION 66, 67 (MIT Press 1977) [hereinafter NELSON, ZONING AND PROPERTY RIGHTS].

[24] *See* NATIONAL COMMISSION ON URBAN PROBLEMS, BUILDING THE AMERICAN CITY 20 (1969).

[25] "The plans prepared by consultants amid great fanfare in the first quarter of this century were ignored in practice." ALAN A. ALTSHULER, THE CITY PLANNING PROCESS: A POLITICAL ANALYSIS 11 (Cornell University Press 1965).

> Throughout this volume, I have consciously used the traditional ideal of comprehensive planning as my benchmark. It has the virtue of clarity, and the public image of the city planning profession has been built substantially upon it. Despite the fact that most academic planners today recognize the impossibility of achieving it, practicing planners in the Twin Cities [and elsewhere in the United States] constantly referred to it in their public statements.

Id. at 415. Yet, even these practicing planners by the 1960s felt a "lack of strong conviction about the comprehensive planning ideal. They did need some ideal, however, and they had no other" available to them as professional city planners than comprehensive planning. *Id.*

[26] *See* RICHARD F. BABCOCK, THE ZONING GAME: MUNICIPAL PRACTICES AND POLICIES 155 (Univ. of Wis. Press 1966).

a leading observer of urban events in that period, commented in 1970, "what all this amounts to is a lot of public-relations activity, and the consensus it produced is an illusion. . . . I have attended many of the civic ceremonies for the presentation of these plans, and I am always amazed at the euphoria which characterizes them."[27]

City land use planning eventually adapted. Planners learned that it was futile to try to comprehensively plan the future in great detail—especially 10 or 20 years out, as had often been the case.[28] The key drivers of development were the water and sewer systems and the transportation system, and these should be the focus of planning attention.[29] It was also much easier to prevent development altogether—say by setting up an agricultural preserve—than to guide an active land development process in which unpredictable private actors necessarily played a central role.[30] Rather than according to a comprehensive plan developed in advance, the actual land development process proceeded incrementally.[31] A developer would propose a specific project for a specific location.[32] Considerable negotiation might then occur between the developer and public authorities as to the density of the project, architectural details, and the division of financial responsibilities for necessary local infrastructure.[33] When a "deal" had been reached, the final step would be a formal approval by the local governing jurisdiction in the form of a legislative action to change the public zoning to allow this use.[34] Planning and zoning thus actually took shape in a "piecemeal" fashion at odds with the formal theory of planning and zoning fixed in advance by objective standards.[35]

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[27] WILLIAM WHYTE, THE LAST LANDSCAPE 168 (1970).
[28] ALTSHULER, *supra* note 25; *see* ROBERT NELSON, PRIVATE NEIGHBORHOODS AND THE TRANSFORMATION OF LOCAL GOVERNMENT Part II (ULI 2005).
[29] *See* MARION CLAWSON, SUBURBAN LAND CONVERSION IN THE UNITED STATES 184 (Resources for the Future, 1971).
[30] WILLIAM A. FISCHEL, THE ECONOMICS OF ZONING LAWS: A PROPERTY RIGHTS APPROACH TO AMERICAN LAND USE CONTROLS 286 (John Hopkins Univ. Press 1985).
[31] PATRICIA BURGESS, PLANNING FOR THE PRIVATE INTEREST: LAND USE CONTROLS AND RESIDENTIAL PATTERNS IN COLUMBUS, OHIO, 1900–1970 194 (Ohio State Univ. Press 1994).
[32] BABCOCK, *supra* note 26.
[33] *Id.*; *see also* CLAWSON, *supra* note 29.
[34] *See* Lee Anne Fennell, *Hard Bargains and Real Steals: Land Use Exactions Revisited*, 86 IOWA L. REV. 1 (2000).
[35] In Columbus, Ohio, for example, "[t]he standard practice . . . was to zone newly annexed land for the least dense (and by implication highest income) single-family development," thus precluding most forms of development. BURGESS, *supra* note 31, at 194. "Then, if a developer presented a proposal for an alternative land use and requested a rezoning [to a higher density], the city could grant it. . . . [C]ity officials did not decide ahead of time

Unfortunately, the local lessons of comprehensive city planning had not been learned at the federal level when a new statutory basis for public land management was being rewritten in the 1970s. The result was again the imposition in the 1970s of a series of legislative requirements for comprehensive planning of future public land decisions by agencies such as the U.S. Forest Service and the Bureau of Land Management.[36] This comprehensive planning of the rural public lands—most of them located in the American West—fared little better, however, than the comprehensive city planning of earlier decades.[37] It was impossible to take account of the many large uncertainties that would significantly influence later on-the-ground decision-making. National election results, for one thing, were important; a new administration might have different policy priorities than the previous administration, yet the plans had been prepared by the previous administration now leaving office.[38] Budgetary considerations were often critical to public land decision-making and yet could not be predicted more than a year or two in advance and were not factored into the plans.[39]

It was also further complicated by the growing litigiousness in American society.[40] Opponents of proposed federal government actions on the public lands discovered that they could often prevail by suing the government for having done an inadequate job of land use planning (or of writing an environmental impact statement).[41] The litigation could be drawn out for years—often the intended purpose of the lawsuits, ironically undermining the public land planning process and leaving the actual practical role of the planning system to create widespread private veto powers over federal actions.[42] If a federal agency could not convince a

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where different types of housing ought to be built; they responded to the plans of the developers." *Id.*

[36] *See* Paul J. Culhane & H. Paul Friesema, *Land Use Planning for the Public Lands*, 19 NAT. RESOURCES J. 43, 50–52 (1979), *available at* http://lawlibrary.unm.edu/nrj/19/1/03_culhane_land.pdf.

[37] *See* ROBERT H. NELSON, PUBLIC LANDS AND PRIVATE RIGHTS: THE FAILURE OF SCIENTIFIC MANAGEMENT (Rowman & Littlefield eds., 1995).

[38] *See* Robert H. Nelson, *Mythology Instead of Analysis: The Story of Public Forest Management*, *in* ROBERT T. DEACON & M. BRUCE JOHNSON, FORESTLANDS: PUBLIC AND PRIVATE (San Francisco: Pac. Inst. for Pub. Pol'y Res. 1985) [hereinafter PUBLIC LANDS AND PRIVATE RIGHTS].

[39] Robert H. Nelson, *Our Languishing Public Lands*, POL'Y REV. (2012).

[40] THOMAS F. BURKE, LAWYERS, LAWSUITS, AND LEGAL RIGHTS: THE BATTLE OVER LITIGATION IN AMERICAN SOCIETY 4 (Univ. of Cal. Press 2002).

[41] U.S. FOREST SERVICE, THE PROCESS PREDICAMENT: HOW STATUTORY, REGULATORY, AND ADMINISTRATIVE FACTORS AFFECT NATIONAL FOREST MANAGEMENT 5 (June 2002).

[42] *Id.* at 31–33.

judge, it might be faced with the prospect of developing a whole new set of planning documents, this process itself taking several more years and then leading to further years of litigation.

By the 1990s, there was a growing academic recognition that public land planning was failing to provide useful guidance for federal decision makers, and yet was imposing large new administrative burdens even as it frustrated efforts to achieve more rational public land management in the West.[43] In 1992, Frank Gregg, the former director of the Bureau of Land Management in the Carter administration, recalled the enthusiasm of the 1970s with its high hopes for reform, including a strong "commitment to even-handed responsiveness to conflicting demands for uses and values. The rules also made an extraordinary commitment to participatory comprehensive planning."[44] Unfortunately, however, matters had turned out much differently.[45] As Gregg later wrote in 1992, "we have

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[43] *See* PUBLIC LANDS AND PRIVATE RIGHTS, *supra* note 37.

[44] Frank Gregg, *Summary*, in HOUSE COMM. ON INTERIOR AND INSULAR AFFAIRS, 102D CONG. 2D SESS., MULTIPLE USE AND SUSTAINED YIELD: CHANGING PHILOSOPHIES FOR FEDERAL LAND MANAGEMENT?: THE PROCEEDINGS AND SUMMARY OF A WORKSHOP CONVENED ON MARCH 5 AND 6, 1992, WASHINGTON, D.C., at 311 (Comm. Print 11, 1992).

[45] The longtime director of the forestry program of Resource for the Future, Roger Sedjo, writes that:

> In the two and a half decades since NFMA [National Forest Management Act of 1976] enactment, little of what was envisaged has come to pass. Although the periodic resource assessment has been undertaken regularly, the planning process has largely been a failure. For example, it has not generated the desired consensus. In the first 125 forest management plans there were about 1,200 appeals and over 100 subsequent lawsuits. Some appeals have been in process for almost a decade without resolution. Even when plans were approved, budgets were generally not forthcoming to allow faithful implementation. There is little connection between the budget that emerges from the congressional political process and provides funds on an aggregate programmatic basis and the various forest plans developed through the decentralized planning process created by NFMA.

Roger Sedjo, *Does the Forest Service Have a Future?*, 23 REGULATION 51, 52 (Winter 2000).

Writing in 2005, the dean of political science students of public land management, Professor Sally Fairfax of the University of California at Berkeley, similarly stated that, owing in significant part to the longstanding failures of the national forest planning and management processes, derived originally from progressive-era hopes for scientific management of the forests, the Forest Service was a broken agency, and that "[t]he time for an agency like the U.S. Forest Service (USFS), created in 1905, . . . is over." Sally K. Fairfax, *When an Agency Outlasts Its Time: A Reflection*, 103 J. FORESTRY 264, 266 (2005). One might hope, she suggested, that:

> [T]he USFS, having personified the ideology underwriting progressive era advances, could lead a renewed charge up another hill. Sadly the

now amassed considerable history participating in and judging the revised system, and we agree that we are in another generation of dissatisfaction," characterized by a decision-making process of "gridlock" and "polarization," perhaps even less rationally guided than the old "primitive" system it had replaced in the 1970s.[46]

In 2002 the U.S. Forest Service—now in a state almost of despair—published a document lamenting its "process predicament" in which it was beset by a "costly procedural quagmire" in which perhaps forty percent of the direct work at the individual national forest level was now taken up in "planning and assessment"—paperwork activities which in the end often led nowhere.[47] The overall result, as the agency characterized its own circumstances, was that "unfortunately, the Forest Service operates within a statutory, regulatory, and administrative framework that has kept the agency from effectively addressing rapid declines in forest health."[48] The explosive forest fires that have raged across the West since 2000 have been in part a consequence of the breakdown of the decision-making processes of the Forest Service and other federal land management agencies in earlier years.[49]

The persistence of comprehensive planning in the United States, despite a long history of practical failure, has a number of explanations, including the failure of planners and public administration students to develop more viable ways of achieving more rational government decisions in the American system of widespread checks and balances.[50] But it is also partly a product of American legal culture. Since the beginning of the twentieth century, the modern administrative state has played a large role in the overall workings of the American system.[51] Decisions by individual government administrators can create large windfalls for some

> agency's quest for a new management gospel has produced an uninspiring series of short-lived slogans apparently designed to protect the agency's eroding authority rather than to redefine its mission for a new age.

Id. at 266. These slogans are repetitively expressed in the agency's planning documents.

[46] Gregg, *supra* note 44.

[47] U.S. FOREST SERVICE, *supra* note 41.

[48] *Id.* at 5.

[49] This was not a great surprise. *See* U.S. GEN. ACCT'G OFFICE, GAO/T-RCED-98-273, WESTERN NATIONAL FORESTS—CATASTROPHIC WILDFIRES THREATEN RESOURCES AND COMMUNITIES 1–2 (Sept. 28, 1998). *See also* ROBERT H. NELSON, A BURNING ISSUE: A CASE FOR ABOLISHING THE U.S. FOREST SERVICE (Rowman & Littlefield eds., 2000).

[50] *See* Michael C. Dorf & Charles F. Sabel, *A Constitution of Democratic Experimentalism*, 98 COLUMBIA L. REV. 269 (Mar. 1998).

[51] *See* DWIGHT WALDO, THE ADMINISTRATIVE STATE: A STUDY OF THE POLITICAL THEORY OF AMERICAN PUBLIC ADMINISTRATION (Holmes & Meir eds., 1984).

private parties, and impose large economic penalties on others. In the United States, the design for the administrative state is largely the responsibility, not of economists, but of the members of the legal profession who write the administrative laws and regulations. They are understandably concerned that administrative decisions should be "fair" and "objective," especially when these decisions can have such large positive or negative effects on particular private parties.[52]

In the American system, recognizing that administrative actions are of great importance to the whole nation, and that they are not experts in such matters themselves, the lawyer-authors of the administrative laws have long routinely written into them requirements that public decisions must be based on objective plans (often said to be "scientific" plans prepared by "experts").[53] Unfortunately, large economic and administrative systems, as the legal profession has often failed to recognize, are not subject to being planned in such a "scientific way."[54] Since the legal requirements for the plans still exist, however, the requisite planning must still be undertaken, becoming a "legal fiction" that can continue for decades.[55] The failed role of comprehensive planning in the administration of urban land use regulations and in the management of the public lands are thus examples of a wider administrative phenomenon. As the Yale political scientist Charles Lindblom once astutely wrote, rather

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[52] *See* DONALD F. KETTL, SHARING POWER: PUBLIC GOVERNANCE AND PRIVATE MARKETS (Brooking Institution 1993).
[53] *See* WALDO, *supra* note 51.
[54] *See* JAMES C. SCOTT, SEEING LIKE A STATE: HOW CERTAIN SCHEMES TO IMPROVE THE HUMAN CONDITION HAVE FAILED (Yale Univ. Press 1999).
[55] The largest tensions between American constitutional requirements—now more than 200 years old—and the administrative complexities of the twentieth century have invited numerous legal fictions in American law as a practical expedient to resolve the difficulties. Georgetown law professor Richard Lazarus writes, for example, that the usual commerce clause justifications for environmental law often do not fit the non-commercial realities of protecting the environment. *See* RICHARD LAZARUS, THE MAKING OF ENVIRONMENTAL LAW 37 (Univ. of Chi. Press 2004). Hence, "to base the validity of federal lawmaking authority for environmental protection on a commercial basis invariably invites the creation of tortured legal arguments and legal fictions," a circumstance that also arises in the case of American land use regulation. *Id.* at 37. Zoning had to be legally justified at the beginning as an exercise of "police power" or as a means of implementing expert comprehensive plans, neither of which fit the actual facts of the local administration of zoning. I explored this problem in 1977 in NELSON, ZONING AND PROPERTY RIGHTS, *supra* note 23, but my proposed solution—recognizing that zoning is actually an informal collective property right—has not been widely accepted in the legal system. For a historical perspective on the efforts to give zoning a more adequate conceptual foundation, see David Schleicher, *City Unplanning*, 122 YALE L. J. 1670 (May 2013).

than following rational plans written well in advance by experts, the real world of American government is typically characterized by "the science of 'muddling through.'"[56]

III. THE NEED FOR ADAPTIVE MANAGEMENT IN THE BAY TMDL

Like many working planners and administrators in government, EPA officials involved in the development of the Bay TMDL seem to have had little awareness of the long history of unhappy comprehensive planning results in the United States. This may have been because for some people "planning" is less a practical method of making decisions than the normative expression of their deepest hopes for a better world—almost a part of a personal secular religion (as seen also in the "five-year plans" that once characterized socialist economies such as the former Soviet Union). In any case, and for whatever reason, the Bay TMDL is yet another comprehensive plan in a long history of such plans.[57] The pollution loads into the Chesapeake Bay involve almost every aspect of the land uses that exist throughout the Bay watershed.[58] The largest single source of nutrient loads—around fifty percent—is agriculture, a mainstay of the economies of the Bay states.[59] The total sewage load is roughly proportional to the total number of people living in the Bay watershed. The use of septic tanks is closely driven by the density of land development and the economic feasibility of building sewage system connections to service the patterns of new residential growth.[60] The patterns of commercial as well as residential development significantly influence the location and levels of stormwater flows that also carry significant nutrient loads to the Bay.[61]

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[56] *See* Charles Lindblom, *The Science of "Muddling Through*," 19 PUB. ADMIN. REV. 79 (1959).
[57] *See* Charles Haar, *In Accordance with a Comprehensive Plan*, 68 HARV. L. REV. 1154 (1955).
[58] *See* HOWARD R. ERNST, CHESAPEAKE BAY BLUES: SCIENCE, POLITICS, AND THE STRUGGLE TO SAVE THE BAY (Rowman & Littlefield eds., 2003).
[59] *Agriculture*, CHESAPEAKE BAY PROGRAM, http://www.chesapeakebay.net/issues/issue/agriculture (last visited Mar. 4, 2014).
[60] *See generally* R. DODGE WOODSON, A BUILDER'S GUIDE TO WELLS AND SEPTIC SYSTEMS (McGraw-Hill, 2d ed. 2009).
[61] *See Stormwater Runoff*, CHESAPEAKE BAY PROGRAM, http://www.chesapeakebay.net/issues/issue/stormwater_runoff (last visited Mar. 4, 2014); *Bay Foundation Calls on States to Better Control Stormwater Runoff*, CHESAPEAKE BAY PROGRAM (Jan. 23, 2014), http://www.chesapeakebay.net/blog/post/bay_foundation_calls_on_states_to_better_control_stormwater_runoff; *see also* NATIONAL ACADEMY OF SCIENCES, STORMWATER MANAGEMENT IN THE UNITED STATES (Washington, DC: Nat'l Acad. Press 2008).

In theory, it would be possible to clean up all such land use sources of pollution to prevent any loads from reaching the Bay. Indeed, that was the officially stated goal—however utopian—of the Clean Water Act as enacted in 1972, the elimination of all flows of pollution into American waters by 1985.[62] In practice, however, such complete elimination of Bay pollution would be immensely expensive. As a result, a complex set of tradeoffs must be made of economic costs against acceptable nutrient loads. These tradeoffs involve not only the direct methods of pollution control from water flows, but the entire Bay land use patterns that significantly influence the levels of such flows. There is no "scientific" method available for resolving such complex tradeoffs having such far-reaching consequences for land use and other economic concerns throughout the full large area of the Bay watershed. It is not possible to determine comprehensively in advance the set of Bay land uses and associated pollution controls that will achieve the nutrient goals being sought—any more than it was possible in earlier years to comprehensively plan the specific land use of a city in advance. Yet, in its prescriptions for exact nutrient outcomes in 2017 and 2025, the Bay TMDL developed by EPA amounts to a comprehensive plan for significant elements of the future land use of the Bay.[63] Rather than exact future land uses, this comprehensive plan establishes exact future nutrient loads by land use source and local geographic area.[64]

Moreover, if they do not undertake the actions necessary to realize these targets, as EPA interprets its TMDL responsibilities and authority, the state and local implementing jurisdictions would technically be ignoring their legal requirements.[65] While EPA would be very unlikely to seek criminal penalties in the event of a deliberate state or local refusal to attempt to comply with the TMDL targets, it has threatened to impose other sanctions such as the withholding of federal funds or the denial of environmental permitting authority now delegated to the states.[66] This is a complex legal area because, while EPA has long had clear legal

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[62] *See* Federal Water Pollution Control Act, Pub. L. No. 92-55, § 33 U.S.C. 1251 et seq. at 816–17 (1972).
[63] *See* EPA, CHESAPEAKE BAY TMDL EXECUTIVE SUMMARY 1 (2010), *available at* http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/FinalBayTMDL/BayTMDLExecutiveSummaryFINAL122910_final.pdf.
[64] *Id.* at 10–11.
[65] *Id.* at 13.
[66] *See* Letter from Shawn M. Garvin, Regional Administrator, United States Environmental Protection Agency Region III to L. Preston Bryant, Secretary of Natural Resources (Dec. 29, 2009), *available at* http://www.epa.gov/region3/chesapeake/bay_letter_1209.pdf.

authority over permitted point sources such as waste water treatment plants and certain stormwater systems, it has not traditionally exercised authority over non-point sources.[67]

The nutrient reduction goals set for 2017 and 2025 thus are treated in the TMDL as legally binding. They are not mere nutrient reduction guidelines for state and local planners and administrators to take into account while implementing the various policies and actions that are being developed at those levels. This raises a set of difficult issues, however, which the 2010 Bay TMDL did not address. These issues center around questions such as the following: what if the TMDL developed by EPA turns out to contain technical imperfections and even inconsistencies, as is likely in such a monumental task; what if the various local actions specified in the WIPs do not yield the levels of pollution reduction that are expected; what if the necessary funding to implement nutrient load reductions cannot be obtained; what if strong political resistance in some states slows or even halts some of the planned TMDL implementation measures; and what if litigation imposes significant delays or otherwise complicates or even prevents altogether the implementation of TMDL elements?

As one might say, the 2010 Bay TMDL adopted a "top-down" system of planning for Bay pollution goals and necessary nutrient reductions. First, the overall goals for water quality were set for the Chesapeake Bay as a whole.[68] These goals were then translated into specific total levels of nitrogen, phosphorus, and sediment loadings to the Bay that would sustain their achievement.[69] The necessary levels of total Bay nutrient loadings were then disaggregated to state levels and then further disaggregated by types of pollution sources and local implementing jurisdictions.[70] A driving consideration in TMDL planning was that at the most disaggregated level—the "bottom" of the "top-down" system—the local numbers there must always cumulatively add up to the higher level targets, including at the very highest level the nutrient load targets for the entire Bay.[71] In this sense, accounting considerations relating to acceptable quantities of Bay nutrient loads were major factors in setting the specific nutrient reduction targets at every stage of the TMDL and WIP development processes. Every individual component of the Bay TMDL is

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[67] *See* JAMES SALZMAN & BARTON H. THOMPSON, JR., ENVIRONMENTAL LAW AND POLICY (New York: Foundation Press, 3d ed. 2010).
[68] *See* CHESAPEAKE BAY TMDL, *supra* note 4, at 6–7.
[69] *Id*. at 7.
[70] *Id*.
[71] *See* Envtl. Pol'y Workshop, *supra* note *.

interrelated with every other component; a change in one part of the TMDL will affect everything else if the internal nutrient flow accounting consistency of the overall Bay TMDL is to be maintained. It was a complex task even to maintain that accounting consistency, never mind achieve the planned nutrient flows later on the ground.

An alternative TMDL planning system would have been "bottom-up." Each local implementation agency might have been asked to describe the pollution reduction actions that it was already undertaking, those that were already planned, and other potential actions that it regarded as feasible in terms of the costs involved. The sum of all these actions might then have been added from the bottom up to determine currently expected and potentially feasible further total nutrient reductions at state levels and finally at the level of the Bay as a whole. Although EPA did consult extensively with the states, including their initial WIP efforts, in the process of TMDL development, it never formally released the results of such consultations for public review, or gave any clear explanation for the methods of disaggregating required nutrient reductions from the top down. There was in general a lack of transparency in the setting of TMDL nutrient load reduction targets by EPA.

This was inevitable because any explicit attempt by EPA to spell out a "scientific" basis for its pollution reduction targets for the various implementing jurisdictions and sources in the Bay watershed would have revealed the implausibility of such comprehensive ambitions and methods. Instead, EPA in effect negotiated pollution reduction targets with Bay jurisdictions and sources in an ad hoc—in part politically driven—manner. Given the legal forces and the time deadlines driving the development of the Bay TMDL, perhaps it was more important simply to have a target than to be able to give a clear objective explanation for the target chosen. The Bay TMDL, like so many other comprehensive plans of the past, is ultimately a legally required public relations document, although there will be wide confusion in the end because the general public has been lead to expect that it is much more. It is useful, however, in stimulating greater public interest in and attention to Bay environmental improvements and creating expectations of such improvements that may be partially self-fulfilling, owing to the political impact of public expectations.

If the TMDL process had begun from the bottom, and if all the expected and potentially feasible nutrient reductions identified were not enough in total to achieve overall Bay water quality goals, then further policy changes might have been contemplated to induce the local levels of the system to take further nutrient reduction actions. For example, regulatory changes or financial inducements might have been provided to stimulate more aggressive nutrient reduction efforts at local levels, resulting in cumulatively larger total nutrient reductions for the entire Bay watershed. This would have also involved a consideration of whether the costs of local nutrient reductions achieved were worth the environmental benefits to the localities and to the Bay (in economic language, whether the gains from nutrient reductions were worth the "opportunity costs" of other government actions thereby necessarily foregone). If the costs were too high, the Bay-wide nutrient reduction targets might have then been lowered, until a satisfactory balance of benefits and costs was realized.

In an ideal planning process, if the costs of planning and other "transaction costs" were small, there would in concept be a mix of such top-down and bottom-up calculations. If planning started at the top, the full implications for all the disaggregated local actors would then be worked out (as with the Bay TMDL). But then the localities would indicate their willingness and financial ability to undertake such actions, addressing matters such as funding and land use regulatory changes that would be required. The total feasible local measures would then be cumulated for states and for the whole Bay. In all likelihood, such new calculations would lead to changes in the Bay-wide goals of the TMDL, given all the new local inputs. There would follow a repetition of such processes of top-down disaggregation and bottom-up aggregation until an overall acceptable and internally consistent TMDL plan for the full Bay watershed was worked out.

In practice, however, the time and resource costs of such a planning process would be much too great for any such comprehensive TMDL planning that sought to take everything into account and to prescribe every detail of the Bay outcome (informal communications among state and local officials, while occurring out of public view, may have partially served to provide such a back and forth exchange of information). In any event, large uncertainties would remain relating to the actual real world consequences of nutrient reduction actions planned. As a result, most planning theorists today advocate much more incremental approaches to planning of large land use systems such as the Chesapeake Bay watershed, often described as systems of "adaptive management."[72] Under an adaptive management approach, certain actions would be taken based

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[72] *See* NATIONAL ACADEMY OF SCIENCES, ACHIEVING NUTRIENT AND SEDIMENT REDUCTION GOALS IN THE CHESAPEAKE BAY: AN EVALUATION OF PROGRAM STRATEGIES AND IMPLEMENTATION (Washington, D.C.: Nat'l Acad. Press 2011) [hereinafter ACHIEVING NUTRIENT AND SEDIMENT REDUCTION GOALS].

on the best available information in light of the objectives sought. The results of these actions would then be assessed, and further actions planned, leading to new assessments, all this repeating in cycles of planning, action, assessment, new planning, new actions, new assessments, and continuing over the years of implementation of the plan.

The National Academy of Sciences in 2011 issued a comprehensive report on the Bay TMDL and its prospects for success in implementing the Bay cleanup.[73] In its report, the National Academy emphasized the significant uncertainties and the resulting need for systems of adaptive management in the Bay TMDL implementation.[74] As the National Academy wrote:

> Adaptive management arose from the recognition that uncertainty is inherent in natural systems, yet management actions generally cannot be delayed until knowledge is complete and uncertainties resolved. At its heart, adaptive management reflects the understanding that many ecosystem management decisions must be made in scenarios that are characterized by uncertainty . . . .

a circumstance clearly characterizing the economic activities, future land uses and ecologies of the Chesapeake Bay watershed.[75]

The National Academy found, however, that the general requirements of a TMDL process, as directed by the Clean Water Act, contained legal rigidities that could pose significant barriers to actually putting adaptive management into practice for the Bay (and TMDLs elsewhere).[76] Hence, even though the EPA and the Bay states had frequently expressed a commitment in principle to adaptive management in their published documents leading up to and including the 2010 Bay TMDL, the National Academy concluded that it was doubtful that they would succeed in practice.[77] As the National Academy reported, it "did not find convincing evidence that the CBP [Chesapeake Bay Program] partners had incorporated adaptive management principles into their nutrient and sediment reduction programs" as laid out in the 2010 Bay TMDL (and subsequent Phase 1

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[73] *Id.* at 97.
[74] *Id.* at 97–105.
[75] *Id.* at 100.
[76] *Id.* at 118.
[77] *Id.* at 121.

and Phase 2 WIPs).[78] Part of the problem was that "successful application of adaptive management in the CBP requires careful assessment of uncertainties relevant to decision-making, but the EPA and Bay jurisdictions have not fully analyzed uncertainties inherent in nutrient and sediment reduction efforts and water quality outcomes," and thus have not built into the Bay TMDL a realistic set of adaptive strategies for altering TMDL implementation as important new information is obtained and other significant learning takes place over time.[79]

Given the requirement, for example, that all the local nutrient reductions cumulatively add up to the overall 2017 and 2025 Bay reduction targets, any significant departures from some parts of the original TMDL planned implementation would require that other parts be reassessed as well. Indeed, as the Bay cleanup strategy is now designed, the entire TMDL would have to be rewritten—or significantly revised—periodically to reflect the resolution of at least some of the many significant uncertainties and other important new information that will be obtained with growing Bay cleanup experience. Constraints of time and resources, however, would almost certainly preclude any such effort to routinely revise the full Bay TMDL to adapt it to the learning constantly taking place.[80] What is more likely is that the 2010 Bay TMDL, and the planned 2012 WIP specific nutrient reductions, will become outdated within a few years and gradually lose their relevance to Bay nutrient reduction efforts. Bay policy making and implementation will then necessarily proceed in an ad hoc and incremental fashion—the familiar American governmental process of "muddling through"—and the nutrient reductions actually achieved will be similarly determined incrementally as the cumulative result of many individual administrative decisions. It will be a new chapter in an old story in the workings of American land planning and its interactions with the complex realities of American politics and administration.

IV. SERIOUS CHALLENGES TO THE BAY TMDL

As noted above, the water quality objectives for the Bay and the total Bay nutrient loadings necessary to sustain these objectives were

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[78] *See* ACHIEVING NUTRIENT AND SEDIMENT REDUCTION GOALS, *supra* note 72, at 121.
[79] *Id.* at 121–22.
[80] The Bay TMDL is described as "the largest such cleanup plan ever developed by the U.S. Environmental Protection Agency (EPA)." *Chesapeake Bay TMDL*, CHESAPEAKE BAY PROGRAM, http://www.chesapeakebay.net/about/programs/tmdl (last visited Mar. 4, 2014).

determined by EPA and the participating Bay states without much reference to budgetary or other economic considerations.[81] In allocating the Bay total acceptable nutrient loads among the six Bay states and the District of Columbia, the TMDL is not fully transparent, but it does not appear that costs were a significant factor—at least explicitly.[82] No explicit attempt seems to have been made to compare the costs per unit of nutrient reduction among the states—say the average costs per unit of nitrogen reduction in Maryland versus the average costs in Pennsylvania—as a TMDL basis for allocating the nutrient reduction targets among the states and the District in a way to minimize total costs.[83] Similarly, within the states, the further disaggregation of pollution reduction targets seems to have proceeded without much attention to the costs of TMDL planned actions.[84] To the extent it can be determined, it appears that the overall approach both Bay-wide and at the state level was to estimate what is physically feasible as an initial basis for provisionally establishing the TMDL's target nutrient reductions.[85] This figure could then be adjusted to take account of various considerations of social equity—including an equitable distribution of nutrient reduction burdens among jurisdictions with similar physical capacities to make the reductions.[86] All of the above reflected what might be termed a "legalistic," "engineering," or "accounting," as opposed to an "economic," approach to TMDL development and implementation.

It was never likely, however, that the Bay TMDL implementation would ever proceed without reference to financial costs and other economic considerations. Whatever the publicly stated commitments to Bay cleanup made by EPA and state and local officials, these were not financially open ended. For one thing, spending more on Bay cleanup may require spending less on other important state priorities such as health, criminal justice, and education. While there was little specific knowledge of the levels of financial burden in the initial Bay TMDL development, this is one of the significant uncertainties that is being resolved with the passage of time and accumulating experience in TMDL implementation.

As of the summer of 2012, considerably more cost data and other economic information were becoming available than in 2010 when the

[81] *See* CHESAPEAKE BAY TMDL, *supra* note 4, at § 6.
[82] *Id.* at 48–53.
[83] *See id.*
[84] *See* Envtl. Pol'y Workshop, *supra* note *.
[85] *Id.*
[86] *Id.*

Bay TMDL was being written. This more recent information suggests that the Bay TMDL will face growing challenges in three areas: (1) the large burden on the Bay states of their total implementation costs; (2) the cost ineffectiveness of TMDL implementation plans; and (3) challenges to the social equity of the differing relative cost burdens imposed on different local implementing jurisdictions within the Bay states.

V. HIGH TOTAL COSTS

Prior to the development of the Bay TMDL, estimates of the total cost of Chesapeake Bay cleanup were made by the Chesapeake Bay Commission ("CBC") in 2003 and the Blue Ribbon Finance Panel ("BRFP") in 2004.[87] The 2003 CBC report, titled *The Cost of a Clean Bay,* estimated the total future costs for Maryland, Virginia, and Pennsylvania to meet the various nutrient pollution goals for 2010, as had been established in the *Chesapeake 2000* agreement.[88] This estimate was equal to $18.7 billion, of which $12.8 billion was considered unfunded at that time.[89] Most of the predicted cost was associated with Goal 3—Water Quality Protection and Restoration ($11.46 billion estimated cost, with only about $2.16 billion funded), and Goal 4—Sound Land Use ($4.16 billion cost, $3.05 billion funded).[90] In its 2004 estimates, the BRFP projected a total cost of around $28 billion to meet local water quality standards and the Tributary Strategies associated with the overall Bay cleanup plans to meet 2010 targets.[91]

Subsequently, funding on this scale never materialized, one of the reasons for the failure to come close to meeting the Bay's nutrient reduction goals for 2010. The 2010 Bay TMDL did not provide estimates of the total costs of achieving its 2017 interim and 2025 final pollution reduction targets for nitrogen, phosphorus and sediments.[92] The first such estimates were developed at the state level as part of the development of the

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[87] CHESAPEAKE BAY COMM'N, THE COST OF A CLEAN BAY: ASSESSING FUNDING NEEDS THROUGHOUT THE WATERSHED (2003), *available at* http://www.chesbay.us/Publications/C2Kfunding.pdf; David A. Fahrenthold, *Panel Brings Bay Cleanup Cost into Focus*, WASH. POST, Oct. 28, 2004, at A10; Karl Blankenship, *Bay Cleanup Costs Could Top $30 Billion*, BAY JOURNAL (Oct. 1, 2004), http://www.bayjournal.com/article/bay_cleanup_costs_could_top_30_billion_.
[88] CHESAPEAKE BAY COMM'N, *supra* note 87, at 2–3.
[89] *Id.*
[90] *Id.* at 16–17.
[91] Fahrenthold, *supra* note 87. *See also* Blankenship, *supra* note 87.
[92] CHESAPEAKE BAY TMDL, *supra* note 4.

state Phase 1 and Phase 2 WIPs.[93] Total TMDL implementation costs for the actions laid out in Phase 2 of the Maryland WIP were estimated by Maryland officials in October 2012 to be $6.28 billion for the period from 2010 to the interim target date of 2017.[94] Over the full period from 2010 to 2025, total TMDL implementation costs for Maryland were estimated to be $14.4 billion.[95] The largest part of the estimated Maryland TMDL costs was for meeting new stormwater management requirements, equal to $2.5 billion by 2017 and increasing to a grand total of $7.4 billion by 2025.[96] These were admittedly not final estimates and were subject to further reconsideration and recalculation, again part of a continuing learning process.[97]

For Maryland, the total costs of TMDL implementation for agriculture are estimated to be $498 million by 2017 and $928 million by 2025, equal to eight percent of Maryland's total 2017 TMDL costs and seven percent of Maryland's total 2025 TMDL costs.[98] Spending of $2.4 billion is projected for wastewater treatment plants ("WWTPs") prior to 2017 (thus meeting the TMDL wastewater requirements for 2025 as well, so no additional WWTP spending is projected after 2017).[99] Total TMDL funding for septic systems in Maryland is estimated to be $824 million by 2017, and $3.7 billion by 2025.[100]

Similar overall estimates were made in late 2011 by state officials for Virginia. They estimated that Virginia's total potential costs of meeting the TMDL would range from $13.6 billion to $15.7 billion by 2025, similar to Maryland.[101] As in Maryland, the largest share of the costs would arise from stormwater pollution control measures, estimated to range from $9.4 billion to $11.5 billion through 2025.[102] Onsite septic systems are estimated to be the next largest cost category, equal to $1.6 billion

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[93] *See* Envtl. Pol'y Workshop, *supra* note *.
[94] MD. DEP'T OF THE ENV'T, MARYLAND'S PHASE II WATERSHED IMPLEMENTATION PLAN FOR THE CHESAPEAKE BAY WATERSHED 56 (2002).
[95] *Id.* at 55.
[96] *Id.* at 56.
[97] *Id.* at 7, 53–56.
[98] *Id.* at 56.
[99] *Id.*
[100] MD. DEP'T OF THE ENV'T, *supra* note 94, at 56.
[101] VIRGINIA SENATE FINANCE COMMITTEE, CHESAPEAKE BAY TMDL WATERSHED IMPLEMENTATION PLAN: WHAT WILL IT COST TO MEET VIRGINIA'S GOALS? 17 (Nov. 18, 2011), *available at* http://sfc.virginia.gov/pdf/retreat/2011%20Retreat/Presentation_Final%20PDF%20for%20Website/5.Chesapeake%20Bay%20TMDL%20FINAL.pdf.
[102] *Id.* at 13, 17.

in costs through 2025, followed by WWTPs ($1.4 billion) and agriculture ($1.2 billion).[103] As compared with Maryland, these Virginia estimates show higher total costs for stormwater, similar total costs for agriculture, and lower total costs for WWTPs and septic systems.[104] The high costs for stormwater are significant for policy purposes because, as the Chesapeake Bay Commission reported in 2012, "implementing urban stormwater BMPs tends to be a much less cost-effective way of reducing nutrient loads than agricultural BMPs."[105] Hence, as will be discussed below, allowing the substitution of agricultural nutrient load reductions (by means of an offset or credit trading system, for example) has the potential for significantly reducing stormwater costs and thus the overall costs of the Bay cleanup.

While similar estimates were not available for Pennsylvania and other Bay states, it is reasonable to assume, based on Pennsylvania's similar contribution to the total nutrient load in the Bay watershed (forty-four percent of total nitrogen, twenty-four percent of total phosphorus, and thirty-two percent of total sediment), that Pennsylvania's total costs of Bay cleanup by 2017 and 2025 will be similar to those of Maryland and Virginia (around $15 billion).[106] The other three remaining states within the Bay watershed, Delaware, New York, and West Virginia, together contribute cumulatively around ten percent of total nitrogen, phosphorus, and sediment loads reaching the Bay.[107] Their combined total cleanup costs for the Bay cleanup thus might reasonably be estimated to be around one-third of the costs of Maryland, Virginia, or Pennsylvania—or about $5 billion in total for these three states.

Combining the cost estimates for all six states and the District of Columbia thus suggests a grand total of approximately $50 billion from 2010 to 2025 for the purpose of cleaning up the Bay nutrient loads. Dividing these costs over fifteen years from 2010 to 2025, it would amount to about $3.3 billion per year. Individually, Maryland, Virginia, and Pennsylvania might each be expected to incur state costs of about $1 billion per year. The states of Delaware, New York, and West Virginia might be expected to incur costs in total among the three of about $325 million per

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[103] *Id.* at 16–17.
[104] *See id.*; *see also* MD. DEP'T OF THE ENV'T, *supra* note 94, at 56.
[105] CHESAPEAKE BAY COMM'N, NUTRIENT CREDIT TRADING FOR THE CHESAPEAKE BAY: AN ECONOMIC STUDY 47 (May 2012) [hereinafter CHESAPEAKE BAY COMM'N, NUTRIENT CREDIT TRADING].
[106] CHESAPEAKE BAY TMDL, *supra* note 4.
[107] *Id.*

year, or around $100 million per year for each of these states. Obtaining this level of funding may be complicated by the fact that none of the latter three states directly borders on the waters of the Bay. In some cases, however, pollution control expenditures that benefit the Bay will also have significant local environmental benefits within the water bodies of Delaware, New York, and West Virginia.[108]

The 2010 Bay TMDL and the state and local WIPs subsequently prepared do not indicate where funding of such a large magnitude—much of which would have to be new—is to be obtained. Indeed, the TMDL, as noted, did not include estimates of the total costs of its implementation. Nevertheless, the large funding requirements more recently estimated will have to be addressed and the potential for funding shortfalls now taken into greater account. Political resistance is likely to develop in some Bay states when the demand for spending of this large magnitude for Bay nutrient reduction is more widely recognized and must be confronted—and the potential impacts on state spending in other areas of government are taken into account. (Pennsylvania may be particularly skeptical, given that it is another state that does not directly border on the Bay.) The actual funding that will become available is thus a major uncertainty, depending in part on future election results at both the federal and state levels.

VI. COST-INEFFECTIVE POLLUTION REDUCTIONS

A key factor behind such high estimated costs of cleaning up the Bay is that the writers of the 2010 Bay TMDL gave little priority to identifying the least costly methods of achieving the Bay pollution reduction targets they sought.[109] They were seemingly more concerned with equity considerations, especially as they might influence public perceptions of the Bay cleanup strategy.[110] Knowing few of the cost details, a common public opinion is that TMDL total pollution reductions should be in rough proportion to the relative nutrient loads coming from different geographic areas and sources within the Bay watershed. If you contribute ten percent of the Bay nitrogen, for example, the public often seems to expect that you should make ten percent of the total nitrogen reductions sought.

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[108] CITY OF NEWPORT NEWS, CHESAPEAKE BAY TOTAL MAXIMUM DAILY LOAD (TMDL) FAQ SHEET, http://www.nngov.com/engineering/resources/eng-tmdl (last visited Mar. 4, 2014).
[109] CHESAPEAKE BAY TMDL, *supra* note 4, at § 6.
[110] *See* MD. DEP'T OF THE ENV'T, *supra* note 94, at 53.

Different geographic areas and different sources of pollution, however, can have widely varying costs per unit of nutrient reduction achieved. The most expensive forms of nitrogen reduction, for example, typically involve the implementation of stormwater control measures.[111] The retrofitting of existing land development to reduce stormwater flows can be particularly expensive, costing, for example, upwards of $500 per pound of nitrogen load reduction achieved thereby, and sometimes even much more than this.[112] Implementing stormwater management measures in new development is usually less expensive, on average by some estimates imposing costs of about $90 per pound of nitrogen load reduction achieved.[113] As the Maryland Environmental Policy Workshop reported, "[e]ven these lower-cost stormwater nitrogen measures are more expensive, however, than upgrades of WWTPs which can range from $15 to $47 per pound of nitrogen reduction."[114] The Workshop further reported that:

> The most cost-effective reduction measures, involving the lowest costs per pound of nutrient reduction, are typically found in agriculture. Costs of nitrogen reduction in this sector, in many cases, fall below $5 per pound. For example, installation of forest buffers around the edges of cropland can achieve nitrogen reductions at a cost of $1.20 to $3.20 per pound. Conservation tillage and growing of cover crops can cost $3.20 and $4.70, respectively, per pound of nitrogen reduction.[115]

A survey of agricultural sources of nitrogen reduction found that for methods using conventional tillage, the lowest cost management practice was strip cropping at $3.94 per pound of nitrogen reduction; for methods using conservation tillage, it was also strip cropping at $10.83 per pound of nitrogen reduction; and for methods based on changed pasture use, it was prescribed grazing practices at $5.23 per pound of nitrogen reduction.[116] There are many other ways in which agricultural

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[111] *See* Envtl. Pol'y Workshop, *supra* note *, at 40–41.
[112] *Id.* at 41.
[113] *Id.*
[114] *Id.*
[115] *Id.*
[116] Nicole Angeli et al., Creating Opportunity for Farmers: Nutrient Trading in Maryland, UNIV. OF MD. (May 2011) (prepared for Maryland Department of Agriculture and Potomac Conservancy) (on file with author).

management practice can be altered to reduce nitrogen at relatively lower costs than other methods involving other sources.

Even within the high cost stormwater sector, some methods cost much more per unit of nutrient reduction achieved than other methods. One analyst estimates that achieving stormwater nitrogen reductions from bio-retention sandy soils, bio-retention non-sandy soils, installing sand filters, wet ponds, or wetlands could range from $123 per pound to $7,410 per pound of nitrogen reduction.[117] "Unconventional means of pollution reduction, such as native oyster aquaculture and algal turf scrubbing, may also be able to achieve nitrogen reductions in a more cost-effective way than stormwater measures or upgrades to WWTPs."[118]

The Maryland Environmental Policy Workshop concluded that "the highest cost methods of nitrogen reduction can thus cost more than 100 times the cost per pound of the lowest cost methods."[119] As noted above, the 2010 Bay TMDL, however, gave little weight to such relative "cost-effectiveness."[120] There are admittedly limits to the available application of each nutrient reduction method. It may not be possible, therefore, to achieve widespread application of some of the most cost effective measures. It would probably not be possible to achieve the full TMDL load targets for 2025 entirely from the lowest cost sources of nutrient reduction that are mostly in agriculture. Nevertheless, if cost-effectiveness had been taken into greater account, it would have been possible to develop a Bay cleanup plan with much lower total costs.

In May 2012, the CBC released a study estimating some of the cost savings that could be achieved if planned nutrient reductions were developed on a basis of cost-effectiveness and a goal to minimize cleanup costs.[121] The CBC study in one set of calculations focused mainly on WWTPs—plus a few other "industrial point sources"—estimating the cost savings that would be achievable if required nutrient reductions at WWTPs within the same state were always made on a cost-effective basis (lower cost WWTP reductions per unit of nutrient reduction achieved would always be made before higher cost WWTP reductions somewhere else in

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[117] Stephen Aultman, *Analyzing Cost Implications of Water Quality Trading Provisions: Lessons from the Virginia Nutrient Credit Exchange Act* 82 (2007) (M.S. thesis, Virginia Polytechnic Institute and State University), *available at* http://scholar.lib.vt.edu/theses/available/etd-08302007-163808/unrestricted/AultmanFinal.pdf.

[118] Envtl. Pol'y Workshop, *supra* note *, at 41.

[119] *Id.* at 42.

[120] *Id.*

[121] CHESAPEAKE BAY COMM'N, NUTRIENT CREDIT TRADING, *supra* note 105, at 6–7.

that state).[122] Within the Maryland WWTP sector, the CBC estimated that WWTP pollution costs would thereby be reduced by sixteen percent; within Virginia by twenty-nine percent, and within Pennsylvania by thirty-one percent.[123]

The CBC study then incorporated agriculture into its calculations, now also allowing for the substitution of more cost-effective agricultural nutrient reductions for otherwise required WWTP reductions.[124] By expanding the pollution control regime to allow such agricultural substitutions ("offsets") as well (and also continuing to allow cost saving substitutions within the WWTP sector itself), the Bay pollution reduction costs would be forty-three percent lower in Virginia, as compared with accomplishing all the required nutrient reductions at the Virginia WWTPs alone.[125] In Pennsylvania, the cost savings from allowing for the substituting of more cost-effective agricultural measures in place of required WWTP reductions would be fifty percent; in New York State, they would be fifty-two percent; and in Maryland, they would be twenty-one percent.[126]

The CBC study then extended its analysis to include required stormwater nutrient reductions (requiring EPA permits under MS4 regulation) as well as required nutrient reductions at WWTPs.[127] Again, the purpose was to estimate the total cost savings achievable by offsetting more cost-effective methods of nutrient reduction in place of the required stormwater and WWTP reductions that would otherwise have to be made. This produced much greater cost savings because stormwater nutrient reductions are so expensive and the possibility of substituting agricultural reductions as offsets therefore offers such great savings. The CBC estimated the cost savings under various assumptions about the degree of geographic constraint in obtaining offsets: (1) the offsets were limited to the same water basin and state; (2) the offsets were limited to the same state (but potentially involving multiple water basins within the state); (3) the offsets were limited to the same water basin (but potentially in multiple states); and (4) unlimited substitutions by the acquisition of offsets anywhere in the Chesapeake Bay watershed.[128]

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[122] *See* Envtl. Pol'y Workshop, *supra* note *.
[123] *Id.*
[124] *Id.*
[125] *Id.*
[126] *Id.*
[127] *Id.*
[128] *See generally* Lindblom, *supra* note 56.

In this last case, allowing selection of the most cost-effective offsetting pollution reductions anywhere in the Bay in place of regulated stormwater and WWTP reductions, the CBC study estimated that this would achieve Bay-wide total cost savings of eighty-two percent.[129] Larger savings are always achievable by expanding the area of eligible offset choices, so this maximum flexibility scenario creates the highest level of Bay cost savings possible. Even with tighter geographic constraints, however, the estimated Bay-wide cost savings are almost as large—an eighty-one percent total cost savings if the most cost effective nutrient offsets are allowed within the same water basin (as the regulated stormwater system or WWTP acquiring the offsets), seventy-nine percent if they are allowed within the same state; and then again seventy-nine percent if limited to the same basin and also the same state.[130] Given that stormwater and WWTPs dominate the total Bay-wide costs of nutrient pollution reductions, as targeted in the Bay TMDL, a conservative estimate—based on the CBC study—is that the total costs of Bay cleanup could be reduced by about sixty to seventy percent, if all planned nutrient pollution reductions were made on a cost-effective basis.

VII. OBSTACLES TO COST-EFFECTIVENESS

It is apparent that there is a very large potential for reducing total Bay cleanup costs. If no constraints are imposed (nutrient reductions can be made on a cost-effective basis anywhere in the Bay), the total current estimated costs of around $50 billion for implementing the Bay TMDL might be reduced to around $15 to $20 billion, a much more manageable number. Even imposing geographic constraints on the availability of offsets, cost savings of this magnitude would be achievable. So why did the writers of the Bay TMDL not adopt such a cost-effective approach that would save such large amounts of money?

For the purposes of examining this question, it helps to assume that, hypothetically (if not altogether so far-fetched), the most cost-effective methods of nutrient pollution reduction within the Bay watershed are all found in Pennsylvania in its agricultural sector (Pennsylvania nutrient loads, amounting to almost half the total Bay nutrients, are carried by the Susquehanna River into the northern end of the Bay, and thus have disproportionately large impacts as these nutrients spread southward

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[129] *Id.* at 47.
[130] *Id.*

throughout the entire Bay). One might then suggest that, under an economically efficient "command and control" approach to pollution reduction, the writers of the Bay TMDL should have simply proposed to adopt regulations to assign all the Bay cleanup efforts to Pennsylvania agriculture.

Politically, and in terms of social equity, however, it would clearly be impossible to assign all the costs of Bay cleanup to Pennsylvania agriculture, just because (as we have assumed) it has the most cost-effective opportunities for making nutrient reductions anywhere within the Bay watershed. Hence, some system of distributing the costs throughout the Bay would be necessary, even if the actual nutrient reductions might still be made in Pennsylvania agriculture. One method would be for the federal government simply to pay for the reductions itself, treating Bay-wide nutrient loads involving multiple states as a national water quality problem requiring a national solution. Alternatively, the various Bay states might create a common fund among themselves to pay Pennsylvania farmers to make nutrient reductions. They would have to devise some formula to determine the relative contributions of each Bay state to this fund.

A third alternative—one favored by many economists—would be to create a single cap and trade credit system for the whole Bay.[131] All nutrient polluters throughout the Bay watershed would be assigned nutrient reduction responsibilities, but they would be allowed to buy offsets in this cap and trade credit system.[132] In our hypothetical case, they would then find that they could purchase their offsets at the lowest costs in Pennsylvania agriculture (at costs less than making their own nutrient reductions directly or buying offsets anywhere else). In this way, the participants in Pennsylvania agriculture would be paid for making their nutrient reductions, perhaps even making a profit; and the purchasers of the Pennsylvania offsets would pay less—often much less. It would seemingly be win-win all around. Indeed, for similar reasons considerable use of cap and trade has been made in controlling air pollution within the United States in large multistate regions and in controlling greenhouse gases in a global context (such as the integrated greenhouse gas emissions trading system of the various countries of the European Union).[133]

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[131] *See* Envtl. Pol'y Workshop, *supra* note *.
[132] *Id.*
[133] *See* Glen Andersen & David Sullivan, *Reducing Greenhouse Gas Emissions: Carbon Cap and Trade and the Carbon Tax*, NAT'L CONFERENCE OF ST. LEGISLATURES (July 2009), http://www.ncsl.org/documents/environ/Captrade.pdf; *The EU Emissions Trading System (EU ETS)*, EUR. COMM'N, http://ec.europa.eu/clima/policies/ets/index_en.htm (last visited Mar. 4, 2014).

So the question can now be rephrased: why did the writers of the Bay TMDL in 2010 not propose a Bay-wide cap and trade system or—perhaps more politically workable—a set of multiple cap and trade systems operating within the same water basins (and perhaps even limiting offsets to locations within the same states as well)? At least by the CBC estimates, total Bay cleanup costs might have been drastically reduced by as much as seventy percent, as compared with adopting a TMDL plan for stormwater, WWTP and other nutrient sources to make the assigned nutrient reductions directly by themselves at much higher expense.[134]

The TMDL writers were well aware of the possibility of using a cap and trade system, and did in fact allow in concept in the TMDL for the future use of cap and trade methods in the Bay cleanup.[135] But the TMDL did not develop any of the details.[136] In the end, the TMDL was designed on more traditional pollution control lines with few specific plans for substituting one pollution reduction for another with offsets, based on cost-effectiveness.[137] One reason for this is that, unlike the Clean Air Act, the Clean Water Act does not provide clear and explicit authorization for the use of cap and trade systems.[138] Another is that there remains significant public opposition to a water cap and trade system.[139] Many environmentalists, for example, consider that the purchase of an offset somewhere else amounts to escaping responsibility for an individual water polluter.[140] Stormwater systems, for example, should clean up their own mess, no matter how expensive it is.

In general, there remains a wide ambivalence in the environmental movement—and at times outright antagonism—to economic solutions to environmental problems.[141] This ambivalence was seemingly felt among

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[134] CHESAPEAKE BAY COMM'N, NUTRIENT CREDIT TRADING, *supra* note 105, at 41–50.
[135] *Id.* at 12–14.
[136] *See* CHESAPEAKE BAY TMDL, *supra* note 4, at Appendix S.
[137] Envtl. Pol'y Workshop, *supra* note *, at 4.
[138] Reflecting the lack of any language in the Clean Water Act of 1972 authorizing the use of nutrient trading, EPA did not issue any official policy guidance for water quality trading (a nutrient cap and trade system) until 2003. *See Final Water Quality Trading Policy*, EPA (Jan. 13, 2003), http://water.epa.gov/type/watersheds/trading/finalpolicy2003.cfm.
[139] *See* Daniel J. Weiss, *The GOP Changes its Tune on Cap-and-Trade*, GRIST (Oct. 23, 2010, 3:12 AM), http://grist.org/article/2010-10-22-gop-changes-tune-on-cap-and-trade-reagan/.
[140] *See* Thomas M. Donnelly & Charles Hungerford, *United States: Environmental Groups Challenge California's "Cap and Trade" Regulations*, MONDAQ (last updated May 23, 2012), http://www.mondaq.com/unitedstates/x/178654/Clean+Air+Emissions/Environmental+Groups+Challenge+Californias+Cap+And+Trade+Regulations.
[141] Barton H. Thompson, Jr., *What Good Is Economics?*, 37 U.C. DAVIS L. REV. 175, 176 (2003).

some of the EPA officials responsible for designing the Bay TMDL. The environmental issue should be seen, it is often thought, in terms of fulfilling moral responsibilities to society, rather than in terms of achieving economic efficiency and cost minimization.[142]

Another, more practical concern is that a cap and trade system might work very effectively for cleaning up the Bay itself, but many localized nutrient pollution problems exist that would not be as effectively addressed—and in some cases could even be aggravated—by a single Bay-wide cap and trade system. Again, taking the hypothetical example above, if all the nutrient reductions were made in Pennsylvania agriculture, even as the costs were distributed throughout the Bay in one way or another, existing nutrient flows in Maryland and Virginia would remain unaffected within their own originating water basins. The Bay cleanup as a whole would benefit from large cost savings but the nutrient cleanup of many local water basins in Maryland and Virginia would not be advanced. In air pollution, this concern with respect to use of cap and trade systems is known as the problem of air "hot spots."[143] This is not a minor concern since there are ninety-two additional TMDLs for impaired sections of individual rivers and streams located within the broader boundaries of the Bay watershed.[144] These local TMDLs have the same force of a legal requirement for compliance as the Bay-wide TMDL.[145]

If costs are to be taken significantly into account, there is thus a tradeoff between cleaning up the Bay itself, and cleaning up the individual

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[142] According to Stanford law professor Barton Thompson:

> [M]any people active or interested in the environmental field question the value and even the legitimacy of using economics to decide environmental questions. To them, environmental protection is not about maximizing the economic value of the environment to humans. Rather, it is about honoring rights to a healthy and sustainable environment, maximizing the spiritual potential of humanity, or preserving the integrity of the entire biotic community. From this perspective, any suggestion to decide environmental goals based on an exacting economic balancing of the costs and benefits of proposed measures seems simply wrong-headed. Those who believe in a strong code of environmental ethics, a group I will label 'environmental moralists,' frequently see the prevalence of economic analysis in current environmental policy debates as an error to be remedied.

Id.

[143] *Id.* at 196 (quoting Richard L. Revesz, *Federalism and Interstate Environmental Externalities*, 144 U. PA. L. REV. 2341, 2412 (1996)).

[144] *Frequently Asked Questions About the Bay TMDL*, EPA, http://www.epa.gov/reg3wapd/tmdl/ChesapeakeBay/FrequentlyAskedQuestions.html (last visited Mar. 4, 2014).

[145] *Id.* For the legal status of TMDLs, see generally HOUCK, *supra* note 16.

tributaries to the Bay.[146] The cost-minimizing solution for the Bay waters will do more for some tributaries but less for others, as compared with a set of strategies focused individually on each Bay tributary.[147] To a significant extent, however, this concern can be addressed by limiting the adoption of cost-effective nutrient offsets to the same tributary, the same state in which the acquirer of the offset is located, or a combination thereof.[148] As noted above, even with such geographic constraints, large overall savings in Bay-wide nutrient reduction costs would be achievable by allowing for wide use of offsets in TMDL implementation.[149]

Such issues and the various considerations were not spelled out during the development of the Bay TMDL in 2010, however.[150] It would not have been necessary to adopt a fully operational cap and trade system as a way of achieving the cost savings; while cap and trade would work to minimize costs, EPA and its TMDL design team might also have developed a full scale model of nutrient flows in the Bay from the various sources, and then experimented with multiple nutrient reduction regulatory strategies to assess their resulting costs. The tradeoffs between overall Bay nutrient reduction costs and impacts on local nutrient concerns could have been identified and helped to drive the allocation of nutrient targets among Bay sources and jurisdictions. It is not clear why this was not done. Perhaps EPA was being driven by tight deadlines to release the TMDL, or was not confident that it had the technical abilities to oversee the creation of a reliable Bay-wide economic model of this kind. At this point three years later, such modeling capabilities, and the analytical tools they would provide are still apparently not forthcoming. Again, this may be one consequence of a legal and engineering as opposed to an economic framework in which the TMDL was being developed and continues to be implemented.

Finally, the Bay TMDL is a signature water cleanup effort of the Obama administration, so perhaps it did not seem to be an ideal candidate for experimenting with new water cleanup strategies.[151] Yet, bureaucratic caution in the end may turn out to be self defeating. In giving

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[146] Envtl. Pol'y Workshop, *supra* note *, at 103–05.
[147] *Id.*
[148] *Id.* at 105–06.
[149] *See* EVAN BRANOSKY ET AL., HOW NUTRIENT TRADING COULD HELP RESTORE THE CHESAPEAKE BAY (World Resources Inst. 2010), *available at* http://www.wri.org/sites/default/files/how_nutrient_trading_could_help_restore_the_chesapeake_bay.pdf.
[150] *See* Envtl. Pol'y Workshop, *supra* note *, at x–xi.
[151] Exec. Order No. 13,508, 3 C.F.R. 13,508 (2009), *available at* http://www.whitehouse.gov/the_press_office/Executive-Order-Chesapeake-Bay-Protection-and-Restoration.

such small weight to economic considerations, the writers of the Bay TMDL may have built a boat that simply will not float. The costs of a full Bay cleanup in the manner prescribed by the TMDL—especially the stormwater targets—may simply be prohibitive, even as significant cleanup actions are likely to be taken and important partial successes in Bay cleanup will no doubt be realized.[152] Many of these actions such as the upgrading of WWTPs to reduce nutrient flows admittedly would have been undertaken even in the absence of the TMDL—and were in fact well underway or even completed when the Bay TMDL was released in December 2010.[153]

VIII. DIFFERING LOCAL JURISDICTIONAL BURDENS OF BAY POLLUTION REDUCTIONS

Because of the top-down character of the TMDL disaggregation of pollution reduction targets to states and then to local implementing bodies, it was difficult or impossible to know at the time of the writing in 2010 of the TMDL just what the full costs and the resulting equity implications for the various Bay implementing jurisdictions would turn out to be.[154] In subsequent writing of WIPs, it fell to the local implementing jurisdictions to develop more detailed action plans for achieving the specific TMDL nutrient targets that had been assigned to them.[155] As these actions were further refined into two-year milestones with specific actions planned,[156] only then was it possible to begin to identify with more concrete numbers the potential equity consequences of the earlier Bay TMDL nutrient load allocations.[157]

In the spring of 2012, working in consultation with the Calvert County Planning Department, a University of Maryland student as part of his masters program undertook an examination of the Phase 2 WIPs for

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[152] Envtl. Pol'y Workshop, *supra* note *, at 2.
[153] *See, e.g.*, *id.* at 20.
[154] *See id.* at xi. On the resulting necessity of a more incremental system of adaptive management, see ACHIEVING NUTRIENT AND SEDIMENT REDUCTION GOALS, *supra* note 72, at 100, 105–08, 110, 112–13, 121.
[155] *Chesapeake Bay TMDL: Frequently Asked Questions About the Bay TMDL-Watershed Implementation Plans*, EPA, http://www.epa.gov/reg3wapd/tmdl/ChesapeakeBay/FrequentlyAskedQuestions.html (follow "Watershed Implementation Plans" tab) (last visited Mar. 4, 2014).
[156] *Id.*
[157] *Getting It Done*, EPA, http://www.epa.gov/reg3wapd/tmdl/ChesapeakeBay/RestorationUnderway.html (last visited Mar. 4, 2014).

ten Maryland counties (out of twenty-three total counties in Maryland), finding that the assigned TMDL nutrient reductions had in fact yielded significant differences in estimated cost burdens among the local county jurisdictions in the state.[158] Indeed, in terms of several measures of relative economic burden, the differences among the counties are striking. Recognizing that the figures are not final, and some counties may have significantly overestimated their likely future costs, total estimated costs for those counties with completed numbers ranged from $46.4 million in total for Somerset County to $4.3 billion for Frederick County.[159] Calvert County and Frederick County are projected to have by far the highest cost burdens per person, per household, per assessable tax base, and as a percentage of annual county budget expenditures.[160] The TMDL costs to Calvert County of implementing the Phase 2 WIP, as estimated by County officials in the spring of 2012, were $14,199 per capita.[161] This compared, for example, with $1,736 per capita for Montgomery County.[162] Relative to the size of the assessable tax base, estimated Calvert County WIP costs were more than ten times as great as for Montgomery County.

On a per acre basis, only Baltimore City and Frederick County had estimated WIP implementation costs per acre exceeding Calvert County, and in the case of Baltimore City that is due to the City's small size in terms of acreage (51,802 acres compared to Calvert's 136,416 acres).[163] These estimated WIP implementation costs are first estimates but it would not be surprising if large differences in relative economic burdens among Maryland counties persisted as the numbers are refined. Similar equity issues in terms of significantly varying WIP implementation costs among local implementing jurisdictions are likely to arise in other Bay states.[164] To the extent that some implementing jurisdictions perceive that they are being treated unfairly, and being asked to bear a disproportionate burden of the costs, they may resist making the nutrient reductions assigned to them in the TMDL. They may even join with others in opposition to the entire TMDL process. As with other important matters,

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[158] Nathan Bowen, Analyses of Maryland Jurisdiction TMDL Caps and WIP Phase 2 Draft Plans (May 2012) (unpublished report completed in partial fulfillment of the masters program requirements, School of Public Policy, University of Maryland) (on file with author).
[159] *Id.*
[160] *Id.*
[161] *Id.*
[162] *Id.*
[163] *Id.*
[164] *See* Envtl. Pol'y Workshop, *supra* note *, at xvi–xvii.

the TMDL does not address explicitly the question of guiding principles for achieving an appropriate equity distribution of the implementation costs among federal, state and, local implementing jurisdictions.[165]

The large costs of stormwater pollution controls are likely to pose particular equity problems. Reducing the nutrient flows from stormwater is, as noted above, typically much more expensive than other forms of pollution reduction. Some local implementing jurisdictions—especially smaller local governments—that are required to achieve a significant part of their nutrient load reductions through new stormwater controls are thus likely to be faced with particularly high TMDL costs relative to population and other measures of fiscal capability.[166] One of the advantages of an offset system is that it would allow land developers and local governing jurisdictions to meet their stormwater TMDL obligations by purchasing offsets at potentially much lower costs per unit of nutrient load reduction, thus limiting the distributional inequities that might arise among such parties.[167]

IX. THE CHALLENGE OF FUTURE NEW DEVELOPMENT IN THE BAY WATERSHED

Besides the major economic uncertainties facing the writers in 2010 of the Bay TMDL—such as the actual likelihood of obtaining nutrient reduction funding on the scale needed—there were also large uncertainties relating to levels of future new commercial and residential development in the Bay watershed over the period from 2010 to 2025.[168] While projections of future growth are available, they are of uncertain reliability. Substantial growth might occur in an area where it is not now expected, while other areas expected in 2010 to grow rapidly might not actually experience such growth in the years to come. This uncertainty significantly complicates the task of disaggregating overall Bay pollution targets to the states and other substate areas for times as far in the future as 2017 and 2025.

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[165] *See* CHESAPEAKE BAY TOTAL MAXIMUM DAILY LOAD, *supra* note 11.
[166] Bowen, *supra* note 158.
[167] Envtl. Pol'y Workshop, *supra* note *, at 66.
[168] For discussion of the methods and uncertainties of estimating 2025 Bay levels of land development and population, see *Establishing the Phase III WIPs on Forecasted 2025 Land-Use Conditions*, CHESAPEAKEBAY.NET, http://www.chesapeakebay.net/channel_files/19130/issue_paper_v2_establishing_phase_iii_wips_on_a_future_2025_land_use.pdf (last visited Mar. 4, 2014).

According to the Maryland Department of Planning ("MDP"), for example, if current trends continue, it is estimated that Maryland will add another 478,000 households from 2010 to 2035.[169] MDP further estimates that about seventy-six percent of these households will be served by WWTPs and twenty-four percent by septic systems.[170] The actual outcome is important because the Bay nutrient load per household from new development on well and septic systems is about six times as great as new nutrient loads from sewered areas.[171] The total Maryland nitrogen loads from the new development projected would amount to an additional 3.66 million pounds of nitrogen per year by 2035.[172]

The TMDL total nitrogen reduction target for 2025 in Maryland is 11.83 million pounds.[173] New development occurring from 2010 to 2035 will thus work to counteract about thirty percent of the total Maryland target for nitrogen reductions from 2010 to 2025. This new development, moreover, will be concentrated in certain geographic areas of Maryland where the added nutrients will probably be well above thirty percent. One approach would be to simply go with the best future growth projections available and to factor these into the development of the Bay TMDL and the WIPs. It is usual in efforts such as the Bay TMDL to develop a "baseline" estimate of future events under "business as usual."[174] The necessary actions (such as nutrient reductions) to achieve a future goal then take account not only of the status quo at present, but also of the expected future baseline events that will affect the ability to achieve the goals (such as new land use development in the Bay watershed in the case of the TMDL).

The writers of the TMDL, however, did not adopt this standard approach.[175] Perhaps they were concerned about the many large uncertainties relating to the absolute magnitudes and locations of future Bay growth. They may have also been concerned that such an approach would

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[169] Maryland Department of Planning, *Plan Maryland: A Sustainable Growth Plan for the 21st Century* Figure 2-9 (Dec. 2011), *available at* http://plan.maryland.gov/PDF/plan/PlanMaryland_Final.pdf.
[170] *Id.* at Figure 2-10.
[171] *Id.* at Figure 2-9.
[172] *Id.* at Figure 2-38.
[173] MD. DEP'T OF THE ENV'T, *supra* note 94, at 28–29.
[174] For an example of the use of the "business as usual" approach in the area of climate change, see Frank Ackerman & Elizabeth Stanton, *The Cost of Climate Change: What We'll Pay if Global Warming Continues Unchecked*, NAT. RESOURCES DEFENSE COUNCIL (May 2008), *available at* http://www.nrdc.org/globalwarming/cost/fcost.pdf.
[175] *See* ACHIEVING NUTRIENT AND SEDIMENT REDUCTION GOALS, *supra* note 72, at 109.

have required them to plan for significantly larger nutrient reductions in order to achieve 2025 targets, raising the total estimated costs (already high) of implementing the Bay TMDL. If larger nutrient reductions had to come in part from existing sources to accommodate new development, these sources in a certain sense would have been paying the price to create room for additional future nutrient flows from new growth within the overall Bay watershed.

A possible approach would be a requirement to routinely revisit the TMDL and the nutrient targets as the details of actual growth become known in future years. In effect, a modified TMDL would have to be written as uncertainties about growth were being resolved by actual experience. This would also be an unappealing prospect, however, in light of the high transaction costs of writing TMDLs, and the new public controversies that might be provoked. The 2010 Bay TMDL therefore also did not adopt this approach.[176] Given the somewhat intractable nature of the problem of nutrient flows from future significant new growth and development, the best the Bay TMDL writers could do was to recommend that future new development be required to obtain offsets to the new pollution loads it was generating.[177]

Yet, despite the large importance to the TMDL of offsets in dealing with new development, the TMDL provided few details concerning the design and workings of future offset systems.[178] Given the lack of more specific Bay-wide guidance from the 2010 TMDL, each Bay state has been left largely to pursue its own course in the development of an offset system.[179] Most states have said that they expect to have the design of an offset system in place by 2013 but matters appear to be proceeding more slowly in this critical area.[180] A number of major policy and management issues—such as the geographic boundaries for the availability of offsets in potential new cap and trade systems—will have to be resolved in order to put an operating offset system into place.[181]

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[176] *Id.* at 108.

[177] CHESAPEAKE BAY TMDL, EPA 10-1 (2010), *available at* http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/FinalBayTMDL/CBayFinalTMDLSection10_final.pdf.

[178] *See* Envtl. Pol'y Workshop, *supra* note *, at xviii.

[179] *Id.*

[180] *Id.*

[181] *Id; Maryland's Trading and Offset Programs Review Observations*, EPA, 2–3 (Feb. 2012), *available at* http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/Phase2WIPEvals/Trading_Offsets/MDFinalReport.pdf. *See generally* Envtl. Pol'y Workshop, *supra* note *.

X. A BRIEF HISTORY OF OFFSETS

The concept of offsets was first developed as an implementation strategy under the Clean Air Act ("CAA").[182] Enacted in 1970, the CAA required EPA to set national ambient air quality standards and to designate those parts of the United States that were in "nonattainment" of these standards.[183] The states were then assigned the responsibility to develop "state implementation plans" ("SIPs")[184] that would lead to future attainment of the air quality standards.[185] The writing of a SIP was thus a CAA analogue and predecessor to the writing of a TMDL to achieve water quality standards in a given river, lake or other water body.

As with new land development in the Chesapeake Bay watershed (one might call it a water quality "nonattainment" area), new sources of air pollution that located in air nonattainment areas would add to the existing problem of pollution.[186] As with the Bay, these new sources could not easily be predicted in advance.[187] As with the Bay and land development, moreover, it was politically unacceptable for EPA simply to declare that all new sources of air pollution would be excluded across the wide sections of the United States that were in nonattainment of the air quality standards.[188] The solution adopted by EPA in the 1970s was to allow new sources of air pollution to locate in nonattainment areas but to require these sources to generate an offset to their own additional pollution.[189]

Such air pollution offsets would be generated by actions that reduced air pollutant loads somewhere else—for example, another existing air polluter might take action to reduce its own pollution flows. Indeed, as EPA implemented the policy, new sources of air pollution would often be required to generate more than a one-to-one offset within a nonattainment area.[190] In this manner, new sources of pollution could actually contribute to improved air quality in these air nonattainment areas, since the pollution offsets generated would be greater than the additional pollution created by the new source.

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[182] Clean Air Act, 42 U.S.C. § 7401 et seq. (1970); Wallace E. Oates, *From Research to Policy: The Case of Environmental Economics*, 2000 U. ILL. L. REV. 135, 142–43 (2000).
[183] Clean Air Act, 42 U.S.C. §§ 7407(d), 7409 (1970).
[184] *Id.* § 7410(a).
[185] Oates, *supra* note 182, at 142–43.
[186] *Id.* at 143.
[187] *Id.*
[188] *Id* at 138–39.
[189] *Id.* at 143; Clean Air Act, 42 U.S.C. § 7503(c).
[190] *See* Karen Fisher-Vanden & Sheila Olmstead, *Moving Pollution Trading from Air to Water: Potential, Problems, and Prognosis*, 27 J. ECON. LIT. 147, 160 (Winter 2013).

In short, if new industrial source A would add 100 units of new air pollution in a nonattainment area, it would be responsible for finding an existing pollution source B that would reduce its emissions by say 1.5A units depending on the offset trading ratio. In addition, before relying on such offsets, the new source A would be required to adopt the most effective pollution abatement technology that is currently legally required, thus minimizing its own new levels of emissions.[191] Such experiences with direct offsets under the Clean Air Act set the stage for the tradable permit market established for sulfur dioxide ("SO_2") and nitrogen oxides ("NO_x") under the 1990 Clean Air Act Amendments.[192] Since the 1990 law was enacted, SO_2 emissions have fallen by around 10 million tons, a 60 percent reduction.[193] This has sharply reduced the frequency and severity of acid rain, helping to improve water quality in northeastern states.[194] Equally or more important, it has also significantly reduced the amount of small particulate matter in the air, curbing mortality and also yielding other benefits to human health.[195] The SO_2 emissions "allowance" trading market—the "cap and trade" system—first established by the 1990 CAA Amendments is widely regarded as a major success story and as a good model for the wider use of market forces to set clear future environmental targets that can then be achieved at reduced costs.[196]

An offset system is sometimes regarded as identical to an emissions credit trading system. Some discussions of cap and trade in fact refer to "credits" and "offsets" interchangeably.[197] While there is no standard protocol, it might be helpful to suggest a specific meaning of each term. In common usage, an "offset" might be seen as a more general term while an emissions trading "credit" is a particular form of offset involving some form of financial transaction. But there can be other ways which offsets might be created and acquired. Whether money is involved or not, polluter A may simply engage directly with some other polluter C to make offsetting reductions in the levels of pollution from C. Unlike the pricing and other impersonal market features of a full scale emissions credit

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[191] *6.2.1 Offset Program*, EPA, http://yosemite.epa.gov/ee/epa/eed.nsf/dcee735e22c76aef85257662005f4116/aa3d2e8d44f91af38525777d000cbcba!OpenDocument (last updated Feb. 25, 2014).
[192] Oates, *supra* note 182, at 136.
[193] *SO2 Emission Reductions from Acid Rain Program Sources and Improvements in Air Quality*, EPA, http://www.epa.gov/captrade/maps/so2.html (last visited Mar. 4, 2014).
[194] *Id.*
[195] *Id.*
[196] 42 U.S.C. § 7401 et seq. (1970).
[197] *Maryland's Trading and Offset Programs Review Observations*, *supra* note 181.

trading system, such a personal transaction among two parties might be compared with a barter exchange. Additionally, if polluter A has multiple sources of pollution within its company operations, it might be able to generate needed offsets within the same firm itself—by reducing its pollution levels at one firm location to compensate for increased pollution levels at another location.

XI. BAY USE OF OFFSETS

Besides providing a means of dealing with the problem of new development, as discussed above, offsets offer the possibility of large cost savings in the overall implementation of the Bay TMDL.[198] Among the six Bay states and the District of Columbia, Virginia has gone the farthest in putting an offset system for its Bay water quality program into practice.[199] Authorized by the legislature in 2005, and beginning operations in 2007, the Virginia Exchange Program allows for WWTPs to acquire offsets as a way of meeting their individual Wasteload Allocations ("WLAs").[200] Specifically, a WWTP can purchase a nutrient "credit" from another WWTP to meet its WLA.[201] A credit is generated at a WWTP by reducing its nutrient flows below its WLA.[202] The Exchange Program also allows for the acquisition of non-point source load allocations through the use of agricultural best management practices ("BMPs") within the same basin as the WWTP discharger, although little such activity has occurred.[203]

For those local stormwater systems regulated by EPA, as authorized by new Virginia legislation in 2011 (SB 1099),[204] any locality that has adopted a local stormwater management program can allow offsets as long as:

> [T]he applicant demonstrates that alternative site designs have been considered that may accommodate on-site BMPs, on-site BMPs have been considered in alternative site designs to the maximum extent practicable, and

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[198] VA. CODE ANN. § 62.1-44.19.15.C (2011).
[199] *VPDES Watershed General Permit for Nutrient Discharges to the Chesapeake Bay*, VA DEP'T OF ENVTL. QUALITY, http://www.deq.virginia.gov/Programs/Water/PermittingCompliance/PollutionDischargeElimination/NutrientTrading.aspx (last visited Mar. 4, 2014).
[200] VA. CODE ANN. § 62.1-44.19.15.B.
[201] *Id.*
[202] *Id.*
[203] *Id.*
[204] VA. CODE ANN. § 603.8:1 (2011).

> post-development nonpoint nutrient runoff compliance requirements cannot be met on site. If the applicant demonstrates on-site control of at least 75% of the required phosphorous reductions, the applicant will then be allowed to purchase offsets.[205]

Such offsets must have already been established and available prior to development of the site.[206] Furthermore, the offsets must be available in the same tributary as the development activity and within allowable hydrologic unit codes.[207]

In the District of Columbia, the Department of the Environment ("DDOE") adopted a program in 2012 to allow offsets as part of its new mandated 1.2" stormwater retention standard.[208] The offsets take the form of "Stormwater Retention Credits" ("SRCs") that can be acquired elsewhere in lieu of full retention compliance onsite.[209] SRC eligible projects include filtering systems, infiltration practices, storage practices, stormwater ponds, stormwater wetlands, and open channels.[210] The District will require "trading ratios" of greater than 1—perhaps 1.5.[211] The acquirer of an SRC would have to offset more than the amount of additional stormwater left onsite. The District expects that the use of offsets in its stormwater retention program for new development will result not only in significant cost savings but also in the retention of greater total amounts of stormwater District-wide (due to the trading ratios greater than 1).

The other Bay state with experience in the use of nutrient offsets is Pennsylvania.[212] The state's Nutrient Credit Trading Program ("NCT"), administered by the Pennsylvania Department of Environmental Protection ("PADEP"), is limited to municipal and industrial holders of EPA permits under the National Pollutant Discharge Elimination

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[205] *Id.*
[206] *Id.*
[207] *Id.*
[208] *Proposed Regulations Open Door to Offsite Compliance Options in Washington, DC*, GREEN GROUND LAW PLLC (June 2013), http://greengroundlaw.com/wp-content/uploads/2013/06/Proposed-DC-Stormwater-Regulations.pdf.
[209] *Id.*
[210] *Id.*
[211] *Id.*
[212] *See Nutrient Trading*, PA. DEP'T OF ENVTL. PROT., http://www.portal.state.pa.us/portal/server.pt/community/nutrient_trading/21451 (last visited Mar. 4, 2014).

System ("NPDES").[213] Offsets must be generated within the same water basin (primarily in practice the Susquehanna); both point and non-point sources are eligible to generate offsets.[214] Most of the limited trading thus far has been for nitrogen credits, although phosphorous and sediment offsets are also allowed.[215]

In 2008, Lycoming County, PA, for example, was faced with a major issue: seven WWTPs in need of $225 million in upgrades.[216] To address this problem, Lycoming created a county-based nutrient trading program that followed the outlines of the PADEP program.[217] The Lycoming County Conservation District calculates offset credits, and DEP certifies them through the state's trading program.[218] One WWTP in the county estimates that it can save $1.2 million over a twenty year period by purchasing nutrient credits rather than expensive upgrading.[219] Throughout Pennsylvania, thirty-one nutrient reduction projects were certified in Pennsylvania in the compliance year of October 2010 to September 2011 amounting to 358,971 lbs of nitrogen and 10,546 lbs of phosphorus available as offsets.[220] At a state credit auction in September 2012, 36,650 nitrogen credits (including for future years up to 2015) were sold for prices ranging from $3.17 to $3.23.[221]

Although no sales of offsets had occurred in Maryland as of the summer of 2012, nutrient trading is included in Phase II of Maryland's WIP, including non-point to non-point source trading.[222] The broad policy

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[213] *Nutrient Credit Trading Program*, PENNVEST, http://www.pennvest.state.pa.us/portal/server.pt/community/nutrient_credit_trading/19518 (last visited Mar. 4, 2014).

[214] *The Conowingo Dam and Chesapeake Bay Water Quality*, CHESAPEAKE BAY PROGRAM BACKGROUNDER, *available at* http://www.chesapeakebay.net/documents/Backgrounder_-_Conowingo_Dam_1_14_13_FINAL.pdf (last visited Mar. 4, 2014).

[215] *Id.*

[216] PA. DEP'T OF ENVTL. PROT., PENNSYLVANIA CHESAPEAKE WATERSHED IMPLEMENTATION PLAN, PHASE 2, at 17–19 (Mar. 30, 2012), *available at* http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/PhaseIIWIPS/PAFINALPhase2WIP3-30-2012.pdf.

[217] *Id.* at 18.

[218] *Id.*

[219] *Id.* at 19.

[220] Envtl. Pol'y Workshop, *supra* note *, at 133.

[221] *Public Results for Pennvest Auction Round 1 September 12, 2012*, MARKIT (2012), http://www.markit.com/assets/en/docs/products/environmental/auctions/Public%20result%2009-12-12-B.pdf.

[222] *See* MD. DEP'T OF THE ENV'T, MARYLAND POLICY FOR NUTRIENT CAP MGMT. AND TRADING IN MARYLAND'S CHESAPEAKE BAY WATERSHED (Apr. 17, 2008), *available at* http://www.mde.state.md.us/programs/Water/TMDL/TMDLImplementation/Documents/AccountforGrowth/NutrientCap_Trading_Policy_April_2008.pdf. *See also* MD. DEP'T OF AGRIC.,

provisions were set out for nutrient trading in a 2008 document from the Department of the Environment.[223] Farmers must first meet any legal requirements for nutrient reductions (their "baseline requirements") before they can sell additional reductions as credits.[224] Maryland has specifically identified three categories of nutrient reduction practices potentially going beyond baseline requirements that can be used as offsets: (1) BMPs with approved load reductions such as no till riparian forest buffers and grass buffers, wetland restoration, tree planting, cover crops, and animal management systems; (2) BMPs requiring technical review such as dairy feeding, precision agriculture, conservation tillage, precision grazing, water control structure, stream restoration, cropland conversion, and ammonia emission reduction; and (3) other BMP practices or innovative approaches such as algal turf scrubbers, oyster aquaculture, manure incorporation, and phosphorus-absorbing materials.[225] Other Maryland guidelines include a requirement that nutrient credits must be used in the year in which they are acquired.[226] Also, the full annual credit produced by the practice will not be certified until the year following the year of BMP installation.[227] An important limitation is that farmers cannot use federal or state cost-share funds to generate offsets (the projects can, however, be used to generate credits after the contracted funding period for the BMP actions has expired).[228] Also they cannot generate credits or other offsets by retiring farmland from active production.[229] Maryland has been slow, however, in working out and incorporating into regulations the details for implementing an offset program.

MARYLAND POLICY FOR NUTRIENT CAP MGMT. AND TRADING IN MARYLAND'S CHESAPEAKE BAY WATERSHED, PHASE II-B: GUIDELINES FOR THE EXCHANGE OF NONPOINT CREDITS, MARYLAND'S TRADING MARKET PLACE (Apr. 2008), *available at* http://mdnutrienttrading.org/docs/Phase%20II-B_Crdt%20Purchase.pdf.

[223] *See generally* MD. DEP'T OF AGRIC., MARYLAND POLICY FOR NUTRIENT CAP MGMT. AND TRADING IN MARYLAND'S CHESAPEAKE BAY WATERSHED, PHASE II-B: GUIDELINES FOR THE EXCHANGE OF NONPOINT CREDITS, MARYLAND'S TRADING MARKET PLACE, *supra* note 222.

[224] *Id.* at 6, 12.

[225] *See* MD. DEP'T OF THE ENV'T, MARYLAND POLICY FOR NUTRIENT CAP MGMT. AND TRADING IN MARYLAND'S CHESAPEAKE BAY WATERSHED, *supra* note 222, at 19.

[226] *Id.* at 5, 10.

[227] *What Is Maryland's Trading Program*, MD. NUTRIENT TRADING, http://www.mdnutrienttrading.com/ntwhatis.php (last visited Mar. 4, 2014).

[228] *Id.*

[229] *See* MD. DEP'T OF THE ENV'T, MARYLAND POLICY FOR NUTRIENT CAP MGMT. AND TRADING IN MARYLAND'S CHESAPEAKE BAY WATERSHED, *supra* note 222, at 1.

XII. CONSIDERING AN ALTERNATIVE AGRICULTURAL BASELINE DEFINITION

Under existing Maryland policy (and similar policies in other Bay states), as noted above, any generation of agricultural nutrient offsets will require first bringing a farmer's nutrient loads below the current baseline nutrient requirements—as established in existing law and regulation.[230] There is no assurance, however, that most farmers will achieve their baseline requirements at any time soon. EPA authority to regulate non-point sources of pollution such as agriculture is uncertain. States have been reluctant to impose meaningful penalties on farmers failing to fully implement legally mandated new BMPs that are designed to reduce nutrient loads.[231] Even if they sought to do so, enforcement of BMP requirements dealing with the actions of many thousands of individual farmers is notoriously difficult.[232] Indeed, farmers have often been willing to make significant changes in nutrient management practices only when they have been paid for doing so by government programs, especially those of the U.S. Department of Agriculture under the Farm Bill.[233] Yet, with current federal budget pressures, that source of funding may be cut back in the future.

In concept, a baseline is a farm outcome that would be achieved in the absence of the payment for an offset or credit.[234] In the real world, however, as experience has often shown, legal requirements are not self-enforcing and can even become altogether fictional. Hence, in the case of implementing the Bay TMDL, given that full farmer compliance with state nutrient management requirements may be problematic, it may be desirable to encourage farmers to take nutrient reducing actions even when they have not yet fully met all legal requirements (stated another way, full "additionality" above the baseline would not be required of the farmer). If they have not yet met their nutrient baselines as defined in

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[230] *What is Maryland's Trading Program*, *supra* note 227.
[231] Michelle Perez, *Regulating Farmers: Lessons Learned from the Delmarva Peninsula*, CHOICES (3d Quarter, 2011), http://www.choicesmagazine.org/choices-magazine/theme-articles/innovating-policy-for-chesapeake-bay-restoration/regulating-farmers-lessons-learned-from-the-delmarva-peninsula.
[232] *See* Michelle Perez, Does the Policy-Making Process Affect Farmer Compliance? A Three-State Case Study of Nutrient Management Regulations (Aug. 2010) (Ph.D. dissertation, University of Maryland, College Park), *available at* http://gradworks.umi.com/34/09/3409721.html.
[233] Envtl. Pol'y Workshop, *supra* note *.
[234] *Id.* at 90–91.

current policy, many farmers may simply be precluded from participating in an offset program. The total supply of offsets from agriculture might then prove to be significantly limited, even when a more generous supply of agricultural offsets would create major opportunities for wider provision of offsets, thus offering the potential for large Bay cleanup cost savings. In other words, a more generous treatment of baseline requirements for farmers may serve as a more effective means of stimulating agricultural nutrient load reductions, as compared with the frequently weak enforcement of existing nutrient laws and rules in the agricultural sector.

One possibility is that a benchmark for farmer nutrient flows will be considered the relevant baseline for generating offsets, whatever the legal requirements for future actions may be. In other words, farmers could sell offsets for nutrient reductions that simply bring them into compliance with current legal requirements, as long as these reductions were below the benchmark. Aside from the issue of potentially rewarding farmers from evading the nutrient management laws (however widespread this is in practice in the agricultural sector), it will probably be objected that such a policy will favor the bad actor farmers who have failed to meet their full legal requirements. Yet, this is a problem that arises in many government settings. Under the conservation programs of the Farm Bill, some farmers get paid for doing what other farmers have already done with their own resources as a matter of upholding good management principles.[235]

The World Resources Institute recently analyzed the economics of a possible offset program for the Mississippi River Basin.[236] It proposed to establish such a benchmark, labeled in the WRI study as a Trading Eligibility Standard ("TES").[237] This standard would be defined as the level of farm nutrient flow per acre sufficient to bring about a forty-five percent reduction in total nutrient flows from the whole area under consideration.[238] It then considers the economic and credit trading implications of two alternatives: (1) credits could be sold only by making actual "additional" nutrient reductions below an existing farmer nutrient load level (and also below the TES); and (2) credits could be sold on a "non-additional" basis for any realization of load levels below the TES, even

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[235] *Id.* at xxi, xxiv.
[236] *Id.* at 90.
[237] Michelle Perez et al., *Nutrient Trading in the MRB,* WORLD RESOURCES INST. 6 (June 2009), *available at* http://pdf.wri.org/nutrient_trading_in_mrb_feasibility_study.pdf.
[238] *Id.*

if this had already been accomplished by the farmer prior to the commencement of the trading regime.[239] In concept, then, depending on the benchmark, a farmer could sell credits without having fully complied with all existing state requirements.

The baseline problem being raised here could also be addressed in another—perhaps preferable—manner. If at present there are too many "fictional" legal requirements for farmers to make nutrient reductions, the baseline requirements could themselves be lowered to bring them closer into line with what farmers will be willing to do voluntarily—and governments will have a reasonable prospect of being able to enforce. Consider two possible legal baselines for required nutrient reductions, level A and level 2A. If level 2A is in practice unenforceable—there could be many reasons ranging from impossibility of adequately monitoring of compliance to fierce farmer political resistance that limits the actions of state officials—it will be harmful to the Bay cleanup to maintain the higher baseline of 2A. It would be better to lower the baseline to A, and then let farmers sell offsets as a financial incentive to raise their nutrient reductions to a higher level of 2A. As one might say, rather than having to receive Farm Bill conservation funding to induce such environmentally beneficial actions, the sale of the additional nutrient offsets could serve as a substitute financial instrument in place of government funds that are insufficient to accomplish desired nutrient reductions.

There is also a case for having a more abundant supply of agricultural offsets available in general. As noted above, some currently mandated nutrient reductions for stormwater are extremely expensive, especially relative to the costs of making agricultural nutrient reductions. If there are no offsets available to be acquired by stormwater nutrient sources, the high costs could lead to fierce political and legal resistance to TMDL implementation from these sources. Cheaper agricultural offsets, as one might say, offer a way of letting off the "financial steam" that could otherwise create unmanageable pressures for the Bay TMDL cleanup efforts. If these less expensive offsets served to stimulate greater total nutrient reductions in the agricultural sector, all the better. Fictionally tight agricultural baselines may "feel good"—especially to those who resent farmer resistance to greater nutrient reductions—but may be counterproductive to the Bay cleanup that is the ultimate priority.

Such a policy may not be needed, however, in some cases. According to University of Maryland conservation biology student Nicole Angeli—who

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[239] *Id.* at 6, 20, 46.

worked for several years with local soil conservation offices in Maryland—there are many farms in Maryland that are already below the nitrogen baseline for regulatory compliance.[240] This means that these farms, if participating in an offset policy, would be able, even under current baseline policies to generate significant new income by providing offsets at present without first having to make further changes in their farm management practices to achieve a baseline.[241]

XIII. GEOGRAPHIC CONSTRAINTS ON OFFSETS: SOME PROS AND CONS

As noted above, one of the key issues for Bay offset policy is the level of geographic constraints versus the degree of geographic flexibility in the availability of offsets, relative to the location of the party acquiring the offset. This involves various pros and cons as described briefly below.

A. Offsets Within the Same River Basin

Limiting offsets to the same river basin helps to ensure that local water quality does not suffer from an increase in nutrient loads as the user of the offset acquires it in another water basin. In other words, any nutrient reductions required will occur in the same basin, whether through a direct reduction or through the substitution of an offset somewhere else in the basin. It also ensures that any financial benefits from offset generation and sale are kept within the same basin. A within-basin policy might be seen as the most equitable solution in that it keeps the benefits and costs of offsets confined within the same group of residents of the basin. It minimizes the potential for political tensions that might arise if offsets came from a different river basin than the original polluting source.

In-basin acquisition of offsets could be further restricted to the same state, or it could allow acquisition across state lines. In some cases a multistate system of basin offsets would have clear advantages. For instance, if a water basin in the Maryland Eastern shore allows offsets to be obtained upriver in Delaware, the offset acquired in Delaware might be less costly and yet would generate as many or more environmental benefits as any offset that could be acquired in the same river basin in Maryland. It would be more difficult, however, if a Delaware nutrient

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240 Angeli et. al., *supra* note 116.
241 *Id.*

source acquired an offset from a downstream Maryland source in the same water basin. In that case, the Maryland source might be less costly but the environmental benefit of reduced nutrient would not occur within Delaware, thus creating an economic versus environmental tradeoff (if the economic benefits are large enough, the tradeoff could of course still be worth incurring some environmental disadvantages). One option might be to have a joint Maryland-Delaware body to administer the offset system within the river basin and approve offsets in each individual case after considering such tradeoffs.

B. *Offsets Within the Same State*

Another possibility would be to allow offsets in the same state, even when the offset was in a different water basin than the user of the offset. A pollution source in the Potomac River basin, for example, might acquire an offset from the Patuxent River basin. There could be economic benefits from such a policy in two respects: first, the total costs of nutrient reductions within the state might be reduced, if less expensive offsets were available in the Patuxent basin; and second, there would be the financial benefit in the Patuxent watershed where sale of the offset would occur. Environmentally, the basin supplying the offset would benefit from the reduced nutrient load it would experience, while the basin of the offset purchaser would forego a nutrient reduction that otherwise would have occurred without the offset. Once again, there might be a statewide body to assess the acceptability in each individual case of proposed offsets, based on the tradeoffs that would result from an interbasin trade within the same state. This in itself could provoke internal tensions within the state, admittedly, as to the appropriate criteria and state fairness in making such individual determinations; in that case it might be preferable to simply have a general offset policy, yes or no to interbasin trades.

C. *Bay-Wide Offset Availability*

As noted, the greatest cost savings in terms of the cleanup of the Chesapeake Bay would come from allowing offsets to be generated anywhere in the Bay watershed. High priority areas such as the Susquehanna River basin might sell offsets to out-of-state purchasers as a means of funding major nutrient reductions there with consequent large environmental benefits to the entire Bay. It might also be argued that sale of offsets from Pennsylvania to downstream users would serve overall social equity. The greatest benefits of the Bay cleanup will be realized by the residents of Maryland and Virginia, yet some of the greatest environmental benefits (and lowest economic costs) might be associated with Pennsylvania nutrient reductions.[242] So it might more closely align the location of total economic and environmental benefits and costs by having Maryland nutrient polluters pay for significant cost-effective reductions in Pennsylvania through the workings of an offset system.

Environmental and cost-effectiveness considerations might similarly argue for letting Virginia nutrient polluters obtain their offsets from Maryland. Depending on the exact circumstances, the pollution reductions in Maryland might have a greater beneficial impact on Bay water quality, as compared with the same expenditures for pollution reductions in Virginia that would reach the Bay closer to the Atlantic Ocean. For example, the James River nutrient flows that enter the Chesapeake Bay near the mouth of the Bay will typically have a smaller overall impact on the health of the Bay than nutrient flows originating in either Maryland or Pennsylvania.[243] An offset system that results in James River polluters paying for nutrient reduction offsets in Maryland thus might offer significant economic and environmental benefits from a Bay-wide perspective. Of course, as noted previously, this would result in unchanged nutrient flows in the James River itself, raising potential water quality issues there.

D. Separate Offset Policies for Nitrogen and Phosphorus?

The three pollutant loads designated for reduction by the Bay TMDL are nitrogen, phosphorus, and sediment. Acquisition of offsets for nitrogen and phosphorus flows would take place separately, but it has typically been assumed that the geographic constraints in terms of the boundaries of the trading systems would be the same.[244] It is important to recognize, however, that nitrogen and phosphorus have different physical characteristics that create significant differences in their effects on aquatic plant growth in freshwater and saltwater.[245] Nitrogen is more

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[242] Pennsylvania is the source of a large part of the nutrient pollution into the bay (through the Susquehanna River, as discussed above). Yet, Pennsylvania does not border the Bay. The residents of Maryland and Virginia will thus have easier access to the bay and its benefits.

[243] *See "Save the Bay,"* VIRGINIAPLACES.ORG, http://www.virginiaplaces.org/chesbay/savethebay.html (last visited Mar. 4, 2014).

[244] Envtl. Pol'y Workshop, *supra* note *, at 106.

[245] U.S. DEP'T OF THE INTERIOR, THE QUALITY OF OUR NATION'S WATERS—NUTRIENTS AND PESTICIDES, U.S. GEOLOGICAL CIRCULAR 1225 (1999).

readily dissolvable in water; this means that nitrogen travels more rapidly to the Chesapeake Bay while phosphorus and sediment typically remain longer in water basins, moving more slowly to the Bay.[246] As a result, phosphorus tends to contribute more than nitrogen to eutrophication of freshwater rivers and streams.[247] By contrast, excess nitrogen typically creates the greatest problems of algal blooms in coastal Bay waters with higher salt concentrations.[248] Indeed, nitrogen is generally the primary limiting nutrient in the seaward portions of estuarine systems, while in freshwater lakes, ponds, reservoirs, and streams, phosphorus is the nutrient that has the most influence on plant growth and other nutrient pollution problems.[249]

These different physical characteristics of nitrogen and phosphorus have potentially significant implications for the geography of Bay offsets. For nitrogen, the potential for hot spots in individual river basins is less than that for phosphorus.[250] The largest negative impacts of nitrogen pollution are felt in the Bay itself. This suggests that an offset policy might allow for nitrogen offsets available over wider geographic areas such as multiple states and basins, potentially even the whole Bay watershed. If nitrogen trading were to occur over wide geographic areas, there might be significant overall cost savings, while the disadvantages for individual river basins of such nutrient trading would be minimized—at least relative to phosphorus. For example, cross state nitrogen trading between Maryland and Pennsylvania water basins might be permitted. Phosphorus trading, however, might be confined to the same basin.

E. Bay Water Basin "Attainment Areas"

In the administration of the Clean Air Act, the nation is divided into "attainment" and "nonattainment" areas for ambient air quality standards.[251] There are large differences in the requirements of the Clean Air Act according to the attainment or nonattainment status of an air quality basis. The river basins of the Chesapeake Bay might similarly be

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[246] *Nitrogen (N) and Water*, LENNTECH, http://www.lenntech.com/periodic/water/nitrogen/nitrogen-and-water.htm (last visited Mar. 4, 2014).
[247] *Id.*
[248] *Id.*
[249] *Id.*
[250] *See* ASIT K. BISWAS ET AL., WATER QUALITY MANAGEMENT IN THE AMERICAS 56 (Springer 2006).
[251] *The Green Book Nonattainment Areas for Criteria Pollutants*, EPA, http://www.epa.gov/airquality/greenbk/ (last updated Dec. 5, 2013); *see also* SALZMAN & THOMPSON, *supra* note 67.

divided into attainment and nonattainment areas according to whether water quality goals are currently being met ("attained") or not. Attainment areas would include those river basins where the water quality is already capable of supporting the designated water uses, as compared with basins that have not yet come into "attainment" with nutrient targets.

In particular, if an individual river basin has already met its water quality targets (perhaps as the result of a successful TMDL implementation), the case for limiting offsets to that same river basin is diminished. Rather, if the offsets are obtained in another river basin that has not yet met its water quality targets, one might argue that this is itself environmentally preferable. One water basin already in attainment status would continue to be in attainment, while another separate basin—the provider of the offsets—would move closer to fulfilling its TMDL goals, even as total nutrient flows to the Bay itself would remain the same.

Given that large reductions in future years should bring many more water basins into attainment of their TMDL goals, it is feasible to think that under such a policy increasing numbers of river basins will become eligible to acquire offsets outside the local basin itself. According to EPA, at present an estimated 9 million pounds of nitrogen and 200,000 pounds of phosphorus could be traded without causing water quality impacts in the tidal segment receiving the increase, or credited, load.[252]

CONCLUSION

Under the Clean Water Act, a TMDL is a plan to achieve a water quality objective for a given water body within some future time period.[253] Under the Clean Air Act, a SIP is a plan to achieve an air quality objective for a given airshed within some future time period.[254] Indeed, while there are some differences (e.g., the water quality objective can be established by the individual state, while EPA establishes a single nationwide air quality standard), in most respects a TMDL is the water quality version of a SIP for improved air quality. But the states have been writing SIPs since the early 1970s, while the writing of TMDLs is much more recent (EPA and the states simply ignored the TMDL language of the Clean Water Act until the 1990s).[255]

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[252] CHESAPEAKE BAY COMM'N, NUTRIENT CREDIT TRADING, *supra* note 105.
[253] HOUCK, *supra* note 16.
[254] *See What Is a State Implementation Plan (SIP)?*, EPA, http://www.epa.gov/reg3artd/airregulations/sips/sipdetail.htm (last visited Mar. 4, 2014).
[255] HOUCK, *supra* note 16.

In considering the prospects for TMDL success in achieving water quality goals, it is thus instructive to consider the outcomes of SIPs. For some forms of air pollution such as nitrogen dioxide, the CAA ambient standards have been met everywhere, or almost everywhere, in the United States.[256] For other types of air pollution such as ozone, however, 123 million Americans were still living in ozone "nonattainment" areas as of 2010, even as the CAA was enacted more than forty years ago.[257] In such nonattainment areas, multiple SIPs have been written over the years, and approved by EPA and "implemented" by the states, setting out detailed plans for coming into full compliance with the ozone air quality standard, typically within a five to ten year time frame.[258] Obviously, these SIPs in current nonattainment areas all failed to accomplish their stated objectives, multiple times over.

It has been so difficult to meet ozone air quality standards because the levels of ozone are so closely tied to the broader workings of transportation, electric power production, and other core elements of the economy. Whatever the official requirements of a SIP, they are not easily changed, and when push comes to shove, it is the SIP that gives way. The same is true, however, for achieving nutrient pollution load reductions in a complex economic circumstance such as the full Chesapeake Bay watershed. It would certainly not be surprising, indeed it is probably likely, that the 2010 Bay TMDL will meet the same fate as all the many failed SIPs written for areas that are still in air quality nonattainment today forty years after the first SIP.

Air quality has nevertheless improved greatly in the United States, even if not as much as had initially been hoped for.[259] Key factors have been the regulation of air emissions from trucks and automobiles and from brand new stationary sources of air pollution, both of which are nationwide standards outside the scope of SIPs to influence.[260] Another key factor has been the incorporation of offsets into the administration of the CAA for two especially important conventional air pollutants, sulphur

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[256] *See State Designations*, EPA, http://www.epa.gov/airquality/nitrogenoxides/designations/state.html (last visited Mar. 4, 2014).
[257] EPA, SUMMARY NONATTAINMENT AREA POPULATION EXPOSURE REPORT, http://www.epa.gov/airquality/greenbook/popexp.html (last updated Dec. 5, 2013).
[258] *See* National Academy of Sciences, *Air Quality Management in the United States* Ch. 3 (Washington, D.C.: NAS, 2004).
[259] *See Air Quality Trends*, EPA, http://www.epa.gov/airtrends/aqtrends.html (last visited Mar. 4, 2014).
[260] SALZMAN & THOMPSON, *supra* note 67.

dioxide and nitrogen oxides.[261] As authorized by the Clean Air Act Amendments of 1990, offsets have been bought and sold in full fledged cap and trade offset systems operating for these pollutants since the 1990s, resulting in large cost-effective reductions in total air pollutant loads.[262]

A similar scenario may well play out for Chesapeake Bay water quality. EPA permits significantly tightened the nutrient reduction requirements for Bay watershed WWTPs and many upgrades were already taking place before the Bay TMDL was written (and have resulted in significant nutrient load reductions in recent years).[263] EPA also directly regulates many local stormwater systems that qualify as point sources under its MS4 standards—again increasingly requiring upgrades in recent years that would have occurred with or without the TMDL.[264] Bay states have been attempting to require farmers to write BMPs including nutrient load reductions for at least a decade and have been increasing the pressure (with mixed success) on farmers to actually implement them. The projected nutrient reductions from all of these preexisting efforts have been included as part of the 2010 Bay TMDL to meet its official nutrient targets for 2017 and 2025. The efforts will continue whatever the fate of the TMDL will be, but the actual reductions they will achieve will depend on many uncertainties that remain to be resolved.

The one important CAA strategy that has not been much employed in the Bay cleanup is the use of offsets. An offset system could result in large savings in total Bay cleanup costs—perhaps fifty percent or more—while achieving equal or superior environmental results. The Bay TMDL included a provision for the use of offsets but almost as an afterthought. Almost all the details of implementation of offset systems, probably including prominently full cap and trade systems, was left to the states and to the future. These efforts have since been proceeding slowly. The Bay TMDL thus failed to seize the moment in the one area where it could have introduced critical new ideas and nutrient control methods, a large role for offsets in the future in the Bay cleanup.

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[261] *See Cap and Trade Basics*, EPA, http://www.epa.gov/clearskies/captrade.html (last updated May 18, 2012).
[262] *Id.*
[263] *See, e.g.*, *Bay Restoration Fund*, MD. DEP'T OF THE ENV'T, http://www.mde.state.md.us/programs/Water/BayRestorationFund/Pages/index.aspx (last visited Mar. 4, 2014).
[264] *See, e.g.*, Erica Goldman, *Urban Stormwater and the Bay*, CHESAPEAKE QUARTERLY ONLINE, http://ww2.mdsg.umd.edu/cq/v07n2/side4/ (last updated Aug. 29, 2013).