Analyzing Nonpoint Source Water Pollution Problems: Nutrient Control Policies in the Chesapeake Bay States

Philip Favero, Ph.D
Institute for Governmental Service
University of Maryland at College Park

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Foreword

"We may love a place, but still be dangerous to it." Wallace Stegner wrote these words about his beloved American West, but they apply equally well to the Chesapeake Bay. Among many reasons, we love the bay as a source of food, for its recreational opportunities, and for its ability to absorb waste. Ironically, it is our very love for the bay and, therefore, our propensity to live near it, that threatens its existence.

This paper is intended for people who make public decisions about the bay and about other environmental resources—both interested citizens and public officials. It provides a nonmathematical, institutional model for investigating nonpoint source water pollution issues—beginning with a set of ideas for how to analyze the issue—to judgements about the value of policies and programs designed to solve the problem. The model is applied to nonpoint source nutrient water pollution in the Chesapeake Bay, an issue that is of emerging concern and undoubted importance. After an explanation of nonpoint source issues, a definition of the model, and an examination of research methods—all contained in Chapter 1—the model is used in chapters 2 through 4 to guide analyses of nonpoint source policies in Virginia, Pennsylvania, and Maryland. These chapters include case studies of innovative efforts in the three states. The discussion, in Chapter 5, offers suggestions for researchers and public policy makers about how to analyze nonpoint source water pollution issues.

Many people in the Chesapeake Region contributed to this study. At the risk of forgetting someone, and with this usual caveat that the author alone is responsible for errors, a list of contributors is provided in Appendix A. People listed in Appendix A provided information during personal interviews or furnished written comments and materials. This paper is dedicated to the contributors; my family; colleagues at the University of Maryland at College Park and at the Maryland Department of Natural Resources; and the U.S. Environmental Protection Agency, which provided financial support during my sabbatical leave from the university. Without the help of all these, conducting the study would not have been possible.

Contents

1. An Introduction to Bay Nonpoint Source Policy Issues and to Methods for Studying Them

Bay Policy Actors and Roles

William Shakespeare never saw the Chesapeake Bay. Nevertheless, his metaphor of the world as "a stage and all the men and women merely players" is a useful way to begin thinking about the formation of public policies for the bay. Shakespeare's analogy of life and theater orients our inquiry into bay policy development beginning with actors and their roles.

Residents' Roles: A People's Bay

Over the last several decades, most residents of the bay basin have played supporting roles; they have taken actions out of the limelight. Nevertheless, our combined actions have had large impacts on the bay. Our story is one of "good news-bad news." The good news is that we enjoy being near the Chesapeake Bay and, in ever increasing numbers, we've decided to live around it. The bad news is that we enjoy being near the Chesapeake Bay and, in ever increasing numbers, we've decided to live around it. We may love a place, but still be dangerous to it.

Living near the Chesapeake Bay is a tradition. Surely, from the first time indigenous people scouted it, America's largest estuary has sustained and delighted us. The bay has yielded countless oysters, soft and hard crabs, and other culinary delights; exploration experiences on beach and boat; open vistas to wooded coves and distant shores; and the means to leave routine life on land for water recreation.

European explorers, in awe of the bay's abundance, described what they saw. Captain John Smith, in the early 1600s, wrote of seeing enough striped bass to fill a 100-ton ship and "more sturgeon than could be drowned by dog or men." Another explorer noted wild celery so thick that it impeded attempts to row a boat. And another described oyster shells piled high enough to form hazards to navigation.

By the mid-twentieth century we were, however, "loving the bay to death." As former Environmental Protection Agency (EPA) Administrator William Ruckelshaus noted, "...our Chesapeake is a 'peoples bay' and therein lies its infinite charm and the seeds of its destruction." By mid-century we had built homes, factories, and businesses to be near the bay's treasures, removed trees, paved land, and discarded our wastes into the bay and its tributary streams and rivers. As a result, the bay's living resources declined precipitously.

But as residents became aware of the decline of bay resources, many became dissatisfied. Some communicated their concerns for the bay to politicians; some joined interest groups to "save the bay." People's dissatisfaction with the bay's decline set the stage for collective actions to restore it.

Major Roles Leading to Bay Agreements

Environmental groups—particularly the Alliance for the Chesapeake Bay and the Chesapeake Bay Foundation—gathered people's dissatisfaction to form demands for action. The groups expressed the demands to public decision makers in local, state, and national governments. Working with leaders of the states in the bay basin and with federal officials, environmentalists supported agreements for multi-government action.

Since 1983, the governors of Maryland, Pennsylvania, and Virginia, the Administrator of EPA, the mayor of the District of Columbia, and the chair of the Chesapeake Bay Commission (representing the legislatures of the three states), have acted in concert as the Chesapeake Executive Council. Politicians have responded to demands for saving the bay. They've also molded public opinion in support of programs to improve the bay (Favero, Pitt

& Tuthill 1988). And they've used the work of scientists and government agency staff to form policies. Annually, the principals of the Executive Council take center stage to announce agreements about new policy initiatives. Several of the agreements mark the evolution of bay policies.

On December 9, 1983, Executive Council members signed a commitment to restore the bay's water quality and living resources and established the Chesapeake Bay Program. The 1983 Agreement provided not only a promise of initial public funding for the bay; it also created a network of individuals and groups with a common interest in continuing public efforts to improve the bay. The network includes elected politicians responsive to public demands for bay improvements; managers of private firms who seek contracts for projects such as stormwater systems and wastewater treatment plant upgrades; state and federal officials who manage bay improvement programs; and higher education faculty who research and extend educational services about the bay. The 1983 Agreement was a threshold event made all the more impressive by the facts that Western Marylanders, while living in the bay basin, are distant from the estuary's amenities; Virginians from the western portion of that state are likewise distant from the bay and are not in the basin; similarly, only part of Pennsylvania lies in the basin; and all of the citizens of Pennsylvania and the District of Columbia live "upstream" from the bay's shores.

Five years after the initial agreement, with mounting scientific evidence that nutrients are a key cause of the bay's decline, the principals signed an agreement by which they pledged to reduce nitrogen and phosphorus loadings into the bay basin. The 1987 Agreement made the Chesapeake Bay Program unique among intergovernmental compacts to improve the environment. In it the principals pledged that signatory jurisdictions will reduce, by 40 percent in the year 2000, the 1985 "controllable" nitrogen and phosphorus loads. "Controllable" is defined as the difference between the 1985 base load and the estimated loads from a totally forested (undisturbed) watershed. In 1992, the Executive Council agreed also that once the 40 percent reduction is attained, reduced level of nutrient loadings will become a limit or "cap" in perpetuity.

By agreeing to the reduction and cap, the Executive Council concentrated public resources on efforts to reduce nutrification. They began to "compete" with other signatory jurisdictions to reduce nutrient loadings, and they pledged to implement nutrient reduction methods that are sustainable into perpetuity.

In 1992, the Executive Council reaffirmed the overall 40 percent reduction goal and pledged further that jurisdictions would develop individual "tributary strategies" to reduce nutrient loadings for major rivers flowing to the bay. Each tributary strategy, the principals agreed, should reflect specific management plans tailored to anticipate population growth and economic growth between 1985 and 2000. At a subsequent meeting, the Executive Council also agreed to expect the development of final strategies by 1997; meanwhile, all tributaries would continue under the interim 40 percent reduction goal. In targeting population growth and economic growth as major causes for environmental degradation of the bay, the principals called for more active involvement in the bay cleanup effort by local governments—jurisdictions that have significant land use authority in the Chesapeake region. The emphasis on land use reflects increasing knowledge that nutrient pollution is often diffused, or "nonpoint."

Emergence of the Nonpoint Source Pollution Issue

The 1972 Federal Clean Water Act defined "point source" water pollution as the discharge of effluent that can be traced to a single place, be it a factory, wastewater treatment plant, or other source; but it did not define nonpoint source water pollution. Since 1972, but especially since the mid-1980s, the significance of nonpoint source pollution—that is, diffused pollution created through surface water runoff and through percolation into groundwater—has become better understood. Scientific models estimate that nonpoint source pollution contributes the major portions of phosphorus and nitrogen loadings to the Chesapeake Bay (Shuyler 1993). The models estimate that for the base year of 1985, the nonpoint source portion of the total 27.2 million pounds of phosphorous loaded into the Bay, was 18.6 million pounds—68 percent of the total load. Of the 376.3 million pounds of nitrogen estimated to have been loaded to the Bay in 1985, 291.6 million pounds—77 percent—were from nonpoint sources.

In keeping with their pledge to reduce nutrient loadings, and in light of new scientific evidence about pollution sources, the signatory states to the

Bay Agreement—Maryland, Pennsylvania, and Virginia—are developing policies and programs to control nonpoint source pollution. To analyze those actions requires providing answers to several questions:

1. Who and in what ways are people in the bay basin involved in creating nonpoint source water pollution?
2. What actions have the states taken to control nonpoint source pollution, and what may be said about the impacts of the actions?
3. How has action been taken; that is, why have the states developed some policies and programs, but not others?

Answers to these questions will provide lessons, out of the Bay Program experience, about the nature of nonpoint source water pollution and government actions to control it. But first we need an analytic framework to form the questions and research methods to know how to ask them.

An Analytic Framework

The issue of nonpoint source nutrient water pollution is not unlike other public issues. Some people are behaving in ways that are harmful to others. When one group of people harms others, a public issue arises (Dewey 1927). Government, of necessity, becomes involved in public issues by making choices—either to effect change or to preserve the status quo.

Situation

For every public conflict there is a "situation," that is, a set of physical and social characteristics by which people have become interdependent. Some characteristics of a situation must be taken as givens. For example, considerations about how to solve nonpoint source nutrient water pollution must take into account the fact that animals produce nutrients as a by-product of life.

A. Allan Schmid (1978) noted the importance of situational analysis for the study of public policy making. George Johnston (1988) and Paul Thompson (1994) applied situational analysis to environmental policy making. To analyze the situation of nonpoint source policies for the bay requires a basic understanding of the physical science of nutrient pollution. (See Alliance for the Chesapeake Bay 1993). It also requires obtaining social knowledge about who the polluters are and what motivates them to act as they do.

Drawing on Schmid again, Johnston and Thompson identified three additional concepts that are building blocks for a framework to analyze environmental policy making. They are **institutions, behavior, and performance.**

Institutions

Douglass North (1990) defined institutions as "... the rules of the game in society or, more formally, ... the humanly devised constraints that shape human interaction." Institutions may be formal or informal (Wandschneider 1986). They include laws, administrative codes, customs, organizations, and traditions (Buse & Bromley 1975).

When people attempt to solve a public issue, existing institutions guide the behavior of individuals and groups involved in the policy-making process. As a result of that process, governments often create new institutions in an attempt to affect people's behavior. Both kinds of institutions—those that shape policy making and those that are the result of policy making—are evident in nonpoint source policies being developed in the bay region.

Recently, for example, Pennsylvania, Virginia, and Maryland created rules for cost-sharing agreements with farmers. The agreements encourage farmers to install agricultural structures that are designed to reduce nutrient runoff. All three states developed cost-share agreements through processes that reflect their own unique rules of the game for policy development. That is, state-by-state, there were unique institutions that guided the processes of legislating, implementing, funding, and administering cost-share agreements. Not surprisingly, because institutions differ among the three states, so too do the cost-share agreements. To fully analyze cost share and other institutions for reducing nonpoint source pollution, a researcher must investigate both policy-shaping institutions and the institutions that result from policy making.

Behavior

Institutions provide incentives—rewards and punishments—that influence human behavior. For example, because commercial farmers are motivated by profits, and because agricultural cost-sharing arrangements provide farmers with additional profit-making opportunities, such institutions are likely to encourage farmers to undertake additional nutrient management efforts. To be successful, new institutions must be designed with due consid-

eration for the incentives they create, so as to anticipate the human conduct they will encourage and to avoid unintended, undesired behavior that often occurs with public policies (Tenner 1996). An investigator also needs a concept to think about how to evaluate institutions and behavior created by public policies. "Performance" is that concept.

Performance

Performance refers to the consequences of public policies. Performance is gauged typically against some policy goal(s) such as that of a 40 percent reduction in nitrogen and phosphorus loadings. Measures of policy consequences may be intermediate or ultimate. For example, counting the number of additional participants in a cost-share program would be an intermediate gauge of the performance of the institution. The ultimate measure would be additional pounds of nitrogen and phosphorous removed from the bay because of the program. The research question for measuring either intermediate or ultimate performance is what indicates the consequences of this institution?

With a framework for analysis—situation, institutions, behavior, and performance—now defined, the kinds of questions to ask about nonpoint source pollution policies in the signatory states may be posed. The overall question is: "Given the increasing knowledge that Chesapeake Bay water quality is being degraded by nonpoint source nutrient loadings, how are governments in the three signatory states responding?" The sub-questions are:

1. What is the situation, i.e., what are the characteristics of nonpoint source nutrient pollution?
2. What institutions are shaping the states' responses?
3. What institutions are the states creating?
4. What incentives to behavior do the institutions create?
5. How are the institutions performing?

A Practical Guide for Asking Questions

Ingram (1984) provides a practical guide for institutional analyses of natural resources issues such as nonpoint source water pollution. That guide takes into consideration all three concepts defined to this point: situation, institution, and behavior. She suggests asking the following questions:

1. What is the problem and its limits?
2. Who are the actors, and what stake do they have in the problem?
3. What resources do the stakeholders have to advance their interests? Resources include
   - legal rules and arrangements
   - economic power
   - prevailing values and public opinion
   - technical expertise and control of information
   - control of organizational and administrative mechanisms
   - political resources
4. What are the biases of alternative decision-making arenas?
   - How do they affect processes of bargaining, negotiation, and compromise?
   - How do they affect access?
   - How do decision-making arenas—Congress, state legislatures, courts, administrative agencies, local governments, popular processes, other institutions—interrelate over time?
5. What options do actors have to respond to solve impediments and problems? Options may include
   - -market mechanisms
   - -changes in legal definitions, rights, and relations
   - -changes in government management practices

The practical guide by Ingram (1984) suggests additional, more detailed questions to ask. Next, research methods are needed to know *how* to ask questions.

Research Methods

Given the questions to be answered in this inquiry about nonpoint policy making, the appropriate method is qualitative research. Qualitative methods involve examining whole programs and case experiences; assuming change is constant and ongoing; and seeking detailed, "thick," in-depth data and information (Patton 1990). Case studies are particularly appropriate for the inquiry because they reveal systems relationships in a dynamic setting (Yin 1994). In this instance, the investigation concerns relations among institutions, behavior, and performance; the dynamic setting is that of policy creation.

Units of Analysis

Graham Allison (1971) suggests a method for choosing units of analyses in case studies of public policy making that fits this inquiry well. Allison defines three units: total jurisdictions; organizations

within jurisdictions; and individual actors. He demonstrates that, for a case study of policy making, analyzing each of the three units separately provides unique insights; and analyzing them jointly yields complementary insights. For this inquiry into nonpoint source policies, all three types of units were used. They were the three state jurisdictions as whole entities; legislatures, agencies, boards, interest groups and other organizations that operated within the states; and individual actors such as governors and key legislators who influenced the policy process.

Data and Information Collection Methods

The investigation began with a literature review, proceeded to the development of a questionnaire and a first round of personal interviews, turned to the selection of three case studies, then advanced to a second round of interviews. During both sets of interviews, documents were collected and later reviewed. The study continued with the composition of draft documents that were submitted to people who had been interviewed; their reviews were then used to write the final draft.

In conducting the preliminary literature review, a Chesapeake Bay Program overview of nonpoint programs in the signatory jurisdictions provided the starting base for the inquiry (Implementation Committee 1988). State program descriptions in that publication suggested ideas for a draft interview instrument that was designed to gather overview information in a first round of interviews. During the Spring of 1996, 12 people from academia, government agencies, and the private sector—all listed in Appendix A—reviewed the instrument and provided comments for revisions. A copy of the instrument in its final form and the list of names of reviewers are included in this report as Appendix B.

Eighteen people from Pennsylvania, Maryland, and Virginia participated in the first round of personal interviews by responding to questions contained in the instrument. Interviews took from one to three hours and were conducted during the Summer and Fall of 1996. Three advisors, Cecily Majerus—University of Maryland at College Park, William Matuszeski—EPA Chesapeake Bay Program, and Thomas Simpson—Maryland Department of Agriculture and University of Maryland at College Park, suggested a preliminary list of people to interview in the first round. Additional names were added by a "snowball method" whereby those interviewed from the preliminary list were asked to suggest others. Most of those interviewed were public officials in the three signatory states. To reduce any concerns about speaking frankly, those interviewed were assured that their answers would not be attributed to them, unless the statements were public knowledge or permission was received.

Those interviewed in the first round provided general overview information about their state's philosophy, policies, and programs to solve nonpoint source water pollution problems in their respective bay areas. First-round respondents, the three advisors, and others knowledgeable about state programs also provided information about which programs states were most proud of and which programs people were curious to learn more about. Eventually, three cases, one for each state, were selected for in-depth study. The cases—all of which demonstrate significant departures from traditional policies—are (1) Virginia's Chesapeake Bay Preservation Act; (2) Pennsylvania's Nutrient Management Act; and (3) Maryland's Tributary Strategies and Teams.

Once the cases were selected, first-round interviewees who were particularly knowledgeable about them were contacted again, either personally or by telephone; they provided supplementary information—both verbal and written—about the cases. An additional literature review about the three cases was also conducted. For this second round of interviews, seven more people were visited in Pennsylvania and two more in Virginia. Two others provided reactions to draft papers. The executive director of the Chesapeake Bay Commission was also interviewed. Charles Abdalla, from the Pennsylvania State University, set up and jointly conducted all the second-round interviews done in Pennsylvania.

For Maryland, all the tributary team chairs for 1996 were interviewed. They provided information about the workings of their teams. Names of all those who contributed information in the first and second rounds, other interviews, and reactions to draft papers are contained in Appendix A.

The approach to studying tributary strategies and teams in Maryland was augmented by a complementary research method. The principle investigator became a participant observer of the state's tributary teams by joining an interagency workgroup that assists the development of the teams; attending one or more meetings of five of the ten

teams; and participating in the combined teams' first annual meeting on January 11, 1997. People who are active in the interagency workgroup are also included in Appendix A.

Reports on findings—state by state—follow. Each report uses a standard format—beginning with a perspective on the state's geographic and historic place relative to the bay, then providing ideas about the state's bay program philosophy—that is, what the state values in its nonpoint source programs. A brief overview of the state's salient nonpoint source programs follows. The case studies—in-depth institutional analyses of Virginia's Bay Preservation Act, Pennsylvania's Nutrient Management Act, and Maryland's Tributary Strategies and Teams—conclude the state reports.

2. Virginia's Initiatives, Including the Chesapeake Bay Preservation Act

About one-third of the bay basin is in Virginia—a larger area than in any other jurisdiction; thus environmental policies in the state have a major impact on bay water quality. Two-thirds of Virginia's land area—including the most populous portion of the state—is in the basin; thus most, but not all of the state's citizens directly affect the bay by how they use their land.

In keeping with the Executive Council Agreement of 1992, Virginia is developing customized tributary strategies for nutrient reduction, beginning with a strategy for the Potomac River Basin. In 1996, the Virginia General Assembly required the state's Secretary of Natural Resources to coordinate the development of tributary plans and to report annually on progress to develop those plans (Article 2, Chapter 5.1, Title 2.1 of the Code of Virginia). In its 1997 session, the General Assembly affirmed detailed requirements for reports on tributary plans and amended the timeline for development of plans (2.1-51.12:2 of the Code of Virginia).

State Government Philosophy: Values and Policy Design Questions

The secretary's first annual report (Virginia Secretary of Natural Resources 1996) says much about the philosophy of bay policy making among current leaders of Virginia's executive branch. Values in the report are revealed by preferences for the following:

- Extensive and intensive collaborative policy development with stakeholders, interest groups, and local citizens
- Voluntary as opposed to regulatory actions, based on the assumption that "sources of nutrients are willing to be part of the solution"
- Government financial support for nutrient reduction as a "major element in the funding pattern"

Consider the three preferences, one by one.

Collaboration

Collaboration with stakeholders, interest groups, and citizens is beneficial in that it provides opportunities to gather information, garner support, and build partnerships. But in the short run, collaboration has an opportunity cost; the time needed to reach many groups and communicate intensively with them delays action. In the long run, building partnerships may be necessary for sustained efforts in nutrient reduction.

The short-run issue thus is one of balance: how much time is needed to collaborate effectively without delaying action too long? A related question is: how concerned should Virginia and the other signatory jurisdictions be about delaying the 40 percent nutrient reduction beyond the year 2000? The secretary's report states that Virginia is more concerned about achieving the goal "in a timely, practical, cost-effective and equitable manner" than about achieving a 40 percent reduction by 2000.

Voluntary Action

A preference for voluntary over regulatory action is desirable in that it corresponds with the common and cherished American value of minimal government. But sole reliance on volunteers may not suffice to solve the problem of nutrient water pollution in the bay basin; if that happens, who would government's choice—the choice to avoid regulation—serve?

The purest form of reliance on volunteers—government action only for education and moral suasion—is based on the assumption that people who are sources of nutrients will change their behavior out of increased knowledge of the damage they do, strengthened belief in stewardship, a heightened sense of community with people whom they hurt, concern about the possibility of government coercion, or a realization that they're better off doing it. Education and moral suasion may, without other

government interventions, solve the problem; but economic forces sometimes work against that.

Creating nutrient water pollution is often not considered a cost of production or of consumption; thus when nutrient pollution happens, the economic motivations of business profit and consumer utility can be difficult to overcome. It may be too much to expect that nurserymen who overfertilize bedding plants because consumers prefer "lushness" or homeowners who overfertilize their lawns because they prefer the greenest grass in the neighborhood will make very large changes in their behaviors when they learn about the consequences of too much nitrogen. In the absence of hard-to-achieve changes in people's taste—toward a bit less green—the largest modifications to behavior will occur if and when researchers determine and those who fertilize learn ways to achieve the same amount of green with fewer nutrients.

Other economic disincentives to voluntary action for nutrient reduction in the bay watershed exist as well. The first is the so-called "free rider problem." This refers to the difficulty, if not the impossibility, of excluding people who do not contribute resources to reducing nutrients from enjoying the benefits of cleaner water. With normal human behavior, free riders balk at paying for what they can enjoy at someone else's expense.

A related problem is the "upstream/downstream problem," which refers to the fact that one of the primary benefits of nutrient removal—reduced algae growth—are downstream in the bay, rather than upstream where cleanup efforts are made. A disincentive is created, again, for people to invest in water improvements that will be enjoyed by noninvestors. Virginia, like the other signatory states, is accounting for the upstream/downstream problem by "selling" the idea to upstream citizens that benefits accrue locally as a consequence of bay improvement efforts. The success of targeting programs for small watersheds across the bay basin will depend, in large part, on the ability of the states to convince upstream citizens that local benefits are worth the local costs.

Other than education and moral suasion, government has several other options to promote voluntary actions that reduce nutrient pollution. These include cost-share programs to encourage investments in BMPs and wastewater treatment plants; judicial remedies whereby aggrieved parties take polluters to court; and quasi-market institutions to promote nutrient trading. Virginia conducts a cost-share program for nonpoint source pollution, allows legal suits against polluters, and is taking the lead in the bay basin to considering nutrient trading. Each option has consequences, some more predictable than others. The issue and challenge for policy makers thus is: Based on realistic expectations of human behavior and the likely consequences of alternative policy options, how much government regulation is needed to solve the nutrient pollution problem?

Government Finance

Finally, government financial support for nutrient reduction is acknowledged as a necessary cost for progress. But the issues, like devils, lurk in the details. How much money is needed? How much should federal, state, and local governments contribute? And how much of the cost burden should be imposed on polluters and how much on beneficiaries of nutrient reductions?

The first tributary strategy for Virginia, described in *Shenandoah and Potomac River Basins Tributary Nutrient Reduction Strategy: Final Draft* (October 1996), examines these issues. The report provides a range of cost estimates to achieve the full 40 percent reduction goal for the Shenandoah and Potomac Basins. To install recommended controls beyond current/planned programs would cost a total of $157 million to $193 million, mostly for upgrades of wastewater treatment plants. Revenue sources to meet these costs include dedicated fees and charges, voluntary contributions, and intergovernmental transfers. The report also suggests criteria for choosing among the sources: cost of administration; revenue-generating potential; reliability; incentive effects; level of administration; and equity.

In a series of public meetings to examine the revenue sources and criteria for choice, Virginia officials found participants preferred voluntary and dedicated revenues over general revenue sources. Other findings were (1) there was no consensus about equity—some people favored having beneficiaries pay, while others wanted dischargers to pay; (2)some stakeholders expressed uncertainty about the benefits of nutrient removal and favored waiting to discuss costs until after examining the value of benefits; and (3) an "overriding concern" was for understanding how funds could be spent and who would decide how to spend them before selecting a funding source. At the beginning of 1997, executive branch officials, members of the

General Assembly, and others were meeting to make funding decisions. During its 1997 session, the Virginia General Assembly appropriated $15 million for water quality cost share in fiscal year 1998—$12.5 million of which will go the Commonwealth's Chesapeake Bay watershed (Davenport 1997).

The policy design questions surrounding values in the secretary's report illustrate the challenges Virginia, in the last year of Governor George Allen's administration, faces in its nutrient reduction efforts. But truly, they are questions facing all the signatory jurisdictions as well.

Nonpoint Source Programs

Virginia's Department of Conservation and Recreation (DCR) is the lead agency for developing and implementing nonpoint source programs in the state. A multiagency Nonpoint Source Advisory Committee, chaired by DCR, coordinates the state's nonpoint source efforts. The state's programs are designed to address significant sources of nonpoint source pollution. Among the efforts, several stand out as prime examples.

Nutrient Management

Virginia's Nutrient Management Program is designed to help farmers and other land managers apply and store fertilizers in ways that prevent nutrients from reaching surface or groundwater. Nutrient management regulatory requirements are currently included in Virginia Pollution Abatement permits and biosolids application permits. Since its beginning in 1989, the program has broadened to include nutrients other than nitrogen; plant nurseries as a target industry; and urban landowners. Nevertheless, agriculture remains the primary sector of concern. Since 1989, approximately 450,000 acres and 1,750 farms have obtained nutrient management plans through this program; of those, about 70 percent of the acres and farms are in the bay watershed portion of the state. Twelve technicians work in the program to provide farmers with planning advice.

Since 1990 the state has offered a tax incentive to encourage more farmers to participate in nutrient management. State tax credits are available to farmers who have nutrient management plans to purchase qualifying nutrient application equipment—credit for 25 percent of the purchase price or $3,750, whichever is less. Virginia intends to expand this program in 1998 by offering tax credits for installed BMPs of up to $70,000 (Commonwealth of Virginia 1996).

In addition, the Virginia General Assembly authorized, in 1994, training and certification regulations to establish a voluntary program for persons preparing nutrient management plans. DCR, which administers the program, had trained and certified 85 people by the end of 1996. Sixty percent of those were from the private sector, the majority of whom represented fertilizer and sewage sludge disposal firms. DCR expects newly certified planners to increase the number of farms and acres under nutrient management plans. For example, in the Potomac basin, the state expects shortly to triple, annually, new acreage covered by nutrient plans (Virginia's Potomac Basin Tributary Nutrient Reduction Strategy 1996).

Virginia is also committed to providing staff resources required for nutrient management planning for poultry producers. This commitment follows an announcement in 1995 by the Virginia Poultry Federation that all four of the major poultry integrators in the state—Purdue Farms, Rocco, Tyson Foods and WLR Foods—will require their poultry growers to have nutrient management plans before beginning operation. Furthermore, the federation announced the goal of having nutrient management plans for all existing growers as soon as state-certified planners are available to assist (Virginia Poultry Federation 1995).

Developed Land

Effective erosion and sediment control laws reduce nutrient runoff and sediment transport created by construction disturbances. Virginia's Erosion and Sediment Control Law and Regulation establishes standards for local government programs. But in 1993, a study revealed that only 23 percent of the Commonwealth's 171 local E & S control programs were in compliance with state standards (Cox 1993). Shortly thereafter the Virginia General Assembly passed legislation that provided local governments with more enforcement and financial capacity. The legislation also requires technically correct and officially approved plans. It provides authority for frequent site inspections by the state and for enforcement actions when necessary. As a result of that legislation, Virginia has a goal for the year 2000 that every local government will have an E & S program that meets minimum state standards (Virginia's Potomac Basin Nutrient Reduction 1996).

Agricultural BMPS and Stewardship

Although Virginia appropriates slightly over $1 million annually in cost-share funds for agricultural BMPs in the Chesapeake Bay drainage area—funds provided by EPA under the Chesapeake Bay Program—the state emphasizes voluntary planning and installation of such practices, with a minimum of state cost share. State programs encourage voluntary actions by providing information on the agronomic effectiveness and financial advantages of BMPs to farmers. Cost share is considered primarily "demonstration," rather than "implementation." As one state official put it, the cost-share program is "designed more to sell conservation than it is to buy it." Virginia runs a 75:25 cost-share program with a payment cap for each BMP. While eligible BMPs receive an average 50:50 cost share, less expensive BMPs receive a relatively large state share, and more expensive BMPs receive a smaller share.

The state targets the program by "hydrologic units"—land areas that average about 50,000 acres. Priority is given to those units having the highest pollution potential. Statewide, about 500 hydrologic units are digitized for computer analyses; these are programmed to inventory data on land use, animal densities, soil erosion rates, and other factors (Virginia Department of Conservation and Recreation 1996). In the most recent year for which data are available, about 900 cost share agreements were funded by the state; over 400 eligible projects were not funded because of budget constraints and their location in lesser priority hydrologic units.

The Commonwealth's Agricultural Stewardship Act of 1996, scheduled to take effect April 1, 1997, requires farmers whose operations cause or will cause water pollution to develop plans for installing "stewardship measures," i.e., BMPs (Virginia Commissioner of Agriculture and Consumer Services 1996). This so-called "Bad Actor Law" applies to agricultural activities not already officially permitted. It does not apply to forestry activities nor to odor concerns. The law is "complaint-driven," meaning it requires an investigative response to a complaint about a water pollution incident or practice. Local Soil and Water Conservation Districts or the Commissioner of Agriculture and Consumer Services must respond to each complaint. Agricultural commodity groups supported the passage of this act because, it seems, they wanted agriculture to be known as conservation-minded and because they wished to avoid heavier state or local government regulations.

Other Program Examples

Virginia also includes in its nonpoint source programs: (1) requirements for managing wastes of animal operations having the equivalent of 300 animal units in confinement, liquid poultry wastes, and poultry litter; (2) voluntary silviculture BMPs; and (3) on-site shoreline inspections and technical analyses, available to landowners on request. These additional programs are important, but when Virginia State officials and out-of-state observers speak about fundamental changes in Virginia's nonpoint source policies, they most often refer to the Chesapeake Bay Preservation Act.

The Chesapeake Bay Preservation Act

In 1986 Virginia Governor Gerald Baliles provided strong leadership for government action on environmental problems. At that time, two of Virginia's representatives to the Chesapeake Bay Commission—Delegate W. Tayloe Murphy, Jr. and Senator Joseph Gartlan, Jr.—urged their colleagues in the General Assembly to provide funds for a group to study land use issues and the bay. The legislature responded by providing $20,000 to the commission for "an evaluation of local land-use policies" in Tidewater Virginia—roughly that portion of Virginia east of Interstate 95—a region that contains 29 counties, 17 independent cities, and 38 towns, located in nine planning districts. With a budget available, the commission turned to the Institute for Environmental Negotiations at the University of Virginia to staff the evaluation.

The Chesapeake Bay Land Use Roundtable

The institute began by identifying groups and individuals interested in Virginia's land use issues and about people active in those groups. The institute then invited 17 people to form a policy discussion group—the Chesapeake Bay Land Use Roundtable. Roundtable members included citizen activists, developers, environmentalists, farmers, industrialists, local government officials, and two state legislators—Delegate Murphy and Senator Gartlan. The institute also recruited five public and private experts to provide consultation services to roundtable participants (Chesapeake Bay Land Use Roundtable 1987).

Although participants to the roundtable mirrored and balanced groups interested in land use and the

bay, they did not formally represent specific organizations. Rather, the institute chose participants by their reputed abilities to articulate interests, to respect others, and to engage in constructive dialogue. Many of those invited to join the roundtable had been vocal adversaries in meetings about land use issues (McCubbin 1989). Once the roundtable formed (in June 1986) and for the next 18 months, members engaged in 14 meetings. Participants were aware that their work would likely contribute to legislative consideration of Virginia's land use policies (McCubbin 1989). In the meetings, roundtable members did not achieve total agreement, but they did reach a group consensus. All roundtable members supported, in the published conclusions to their work, a set of desired outcomes and a proposed framework for further state action (Chesapeake Bay Land Use Roundtable 1987).

The roundtable's conclusions provide insights about the nature of nonpoint source pollution and about rules for solving water pollution problems in Virginia. The findings are clear, succinct, broad, and though published in 1987, indicative of many land use issues that persist in Virginia to the present day. The roundtable concluded the following:

1. Land use—or abuse—causes nonpoint water pollution; to this fact, all interest groups agree. Controversies exist, however, about who should control the use of land. Conflicts arise: (a) between private landowners and those with public responsibilities; (b) among public agencies with land use responsibilities; (c) and between state and local governments.
2. The Commonwealth of Virginia, by the authority of its constitution, is ultimately responsible for the quality of natural resources in the state, even though the state has historically delegated land use control authority to local governments.
3. The population of Tidewater Virginia is expected to grow rapidly in the coming decades. Population growth will create changes in land use that, if not managed, will significantly increase nonpoint source water pollution in the region. But local governments of the Tidewater, many of which have no one responsible for land use planning and management, are unprepared to manage population growth. Thus state leadership is needed to forge new policies, institutions, and state-local relationships.

After offering their findings about nonpoint source problems, roundtable members provided five statements about how conflicts over land use control should be resolved (Roundtable, pp. 7-8). The statements, called "Agreements in Principle," suggested a guide for policy making in land use. They are:

1. Virginia's response to issues related to land use and the Bay should flow from an analysis and understanding of Virginia's laws, institutions, historical context, and natural setting.
2. Local governments should retain primary responsibility for local land use decision whenever possible and should be granted the powers necessary to execute that responsibility at the local level.
3. The state should play a strong leadership role in the protection of public lands, critical resources, and environmental quality. The state would have to work closely with local governments to assure that state policies and goals are met.
4. Tensions between public responsibilities to protect natural resources and the environment and private interests in property are inevitable; they must be dealt with as fairly and equitably as possible.
5. Healthy state and local economies and a healthy Chesapeake Bay are integrally related; economic development and resource protection are not and cannot afford to be seen as mutually exclusive.

Virginia operates under the Dillon Rule; localities may exercise only those powers granted to them explicitly by the General Assembly (Benson & Garland 1989). The state had previously directed local governments to adopt comprehensive plans by July 1, 1980 (Sec 1-446.1 of the Code of Virginia). But the General Assembly had not recognized water quality as a legitimate concern. The roundtable proposed a set of new land use initiatives and efforts to strengthen programs for water quality and natural resource protection. The initiatives included the following:

- A statute clarifying the state's interests in protecting the bay and granting local governments planning and zoning authority to protect water quality and other resources
- Minimum standards for land use planning and requirements for zoning ordinances by local governments in the Tidewater Region to govern areas of particular concern—wetlands, coastal sand dunes, barrier islands, and shorelands along tributaries and the bay

- State review of plans and ordinances for consistency with common standards, and state financial and technical assistance to local authorities to meet those standards
- A citizen board to develop planning standards, provide financial and technical assistance, and approve plans and ordinances

The roundtable published its conclusions in December of 1987 and sent a copy to each member of the General Assembly. Meanwhile, Delegate Murphy and Senator Gartlan convened a group of legal experts to transform the roundtable's recommendations into a legislative proposal for the 1988 session of the Virginia General Assembly (Murphy and McKenney, 1990).

Legislative Debate and Action

In an extraordinary show of support during his State of the Commonwealth speech before the General Assembly on January 13, 1988, Governor Baliles adopted the roundtable proposals as the cornerstone of his environmental policy for the year (Baliles 1988). Shortly thereafter, on January 26, Delegate Murphy and Senator Gartlan introduced a legislative bill in the General Assembly, based on the roundtable report (McCubbin 1989). The bill called for the establishment of a cooperative state-local program designed to incorporate general water quality protection measures into the comprehensive plans, zoning ordinances, and subdivision ordinances of local governments in Tidewater Virginia; and the definition and protection of environmentally sensitive lands. To implement the program, the bill called for a nine-member citizen board, called the Chesapeake Bay Local Assistance Board (Board), to promulgate regulations that establish program criteria, provide technical and financial assistance to Tidewater local governments, provide technical assistance and advise to regional and state agencies, and ensure that local government plans and ordinances are in compliance with State regulations. The bill also proposed the creation of the Chesapeake Bay Local Assistance Department (CBLAD) to provide staff support to the Board.

Murphy and Gartlan's legislation drew significant opposition from three groups that had been represented, unofficially, on the roundtable: land developers, farmers, and local government officials. Developers and farmers expressed concerns that the proposed legislation would overly restrict their activities and lead to lower property values. Local public officials, through their representative organizations—the Virginia Municipal League and the Virginia Association of Counties—opposed the legislation because they feared it would interfere with zoning and planning prerogatives traditionally exercised at the local government level. The Municipal League supported the aim of the bill—to protect the bay—but opposed the requirement that local governments comply with state guidelines for planning and zoning (McCubbin 1989).

The General Assembly rejected two proposed amendments to the bill. The first would have made state guidelines for local governments voluntary instead of mandatory; the second would have required prior approval by the General Assembly for program criteria promulgated by the Board (McCubbin 1989).

Legislators in the Virginia House of Delegates did add several amendments to the legislation:

1. In response to local government concerns, legislators removed the Board's authority to approve all local government comprehensive plans and ordinances prior to implementation. But they let stand the Board's authority to "ensure that local government comprehensive plans, zoning ordinances and subdivision ordinances are in accordance with the provisions of (the Act)" (Virginia Code Section 10.1-2103).
2. They deleted language directing the Board to consider "all adverse effects" of land use to water quality and substituted "significant degradation" to water quality caused by land use.
3. The delegates restricted application of the act to protection of water quality rather than to all natural resources.
4. They added language requiring the Board to consider "the economic and social costs and benefits" of any criteria it proposed.
5. And they added a provision protecting vested rights of land owners in local land-use decisions (McCubbin 1989).

Likewise, Members of the Virginia State Senate adopted several amendments to the legislation:

1. The Senate required that the Board be composed of at least one person from each of nine affected Tidewater Planning Districts.
2. Senators rewrote the vested rights provision of the bill to indicate the legislation would not "affect vested rights of any landowner under existing law."

3. And they invested the Board with exclusive authority to institute legal actions to ensure localities would comply with the legislation. In effect, this last amendment prevented environmentalists from challenging the legality of specific development projects allowed by local governments in compliance with state guidelines, but it also prevented developers from suing local government for their actions in order to delay implementation of the Act (McCubbin 1989).

Sixty percent of all members of the General Assembly signed onto the proposal when it was introduced. On March 3, 1988, less than two months after they received the bill, members of the General Assembly passed it, as amended, with a large majority. Governor Baliles then signed the legislation and on July 1, 1988 a new cooperative state-local institution—the Chesapeake Bay Preservation Act (Code of Virginia, Chapter 21 Sec 10.1-2100 et seq.)—took effect.

In reflecting on passage of the act, Delegate Murphy emphasizes the role played by Governor Baliles. In Murphy's opinion, the roundtable provided a consensus statement, but support for the consensus eroded as details were written into legislation and debated in the General Assembly. When consensus erodes, Murphy believes, progress depends on politicians who are willing to take risks and exercise leadership. In Murphy's opinion, Governor Baliles provided the leadership needed to win quick passage of the act in the face of strong opposition.

Post-Passage Disagreements

During the first year after the act became law, legal and policy authors disagreed about its meaning. In the view of McCubbin (1989), the General Assembly had passed legislation that did not alter, in any significant way, conclusions reached by the roundtable. Amendments to the original bill, McCubbin wrote, should be viewed as insignificant. As evidence she offers the fact that, even after amendments were accepted by the General Assembly, roundtable members continued to support the legislation as an accurate expression of their consensus.

W. Todd Benson, at the time an assistant county attorney in Henrico County, and Philip O. Garland disagreed (1989). Among several questions they raised, one seems central: did the authority conveyed to the Board by the act include the power to "promulgate regulations binding on localities?" They cite instances from the early 1980s in which the Virginia executive and legislative branches confirmed the state's tradition of local government land-use authority. The roundtable consensus, Benson and Garland wrote, was rooted in that tradition. Moreover, the authors interpreted amendments to the original bill as significant indications of intent by the General Assembly to preserve local land-use authority. The authors pointed, in particular, to the amendment removing the Board's authority to review local comprehensive plans and land use ordinances prior to adoption. In their view, the role created for the Board by the act was to "assist," not to "dictate."

Delegate Murphy responded quickly to Benson and Garland's argument (Murphy & McKenney 1990). Murphy wrote from personal experiences in the roundtable and the General Assembly. His position was that the General Assembly intentionally legislated a cooperative state-local program in which the state, through the Board, may exercise direct regulatory authority over local government land-use planning, zoning, and subdivision rule making. In Murphy and McKenny's opinion, the General Assembly had given each local government in the Tidewater Area an "opportunity, albeit by mandate, to cooperate in the protection of the state's, and therefore at least partially the local government's, natural resources" (Murphy & McKenney 1990). While the authors debated over what the act meant, interest groups struggled over regulations to implement it.

Regulatory Development

Farmers, builders, loggers, private landowners, and other groups had differing views on what the regulations should be. So did local governments and state and federal agencies with natural resource responsibilities. The press made differences among the groups well known. Despite the differences, however, the act provided the Board with only one year—until July 1, 1989—to write a set of regulations for local government implementation.

The Board immediately began to develop criteria for local governments so as to determine land areas of concern and to grant, deny, or modify requests to rezone, subdivide, or develop land in those areas. Staff involved interest groups and individual citizens in the process of writing regulations. The staff organized a public information meeting and a meeting for local government and

planning district officials in each of the nine planning districts in the Tidewater region. Additional meetings were held for interest groups, technical committees, and an advisory committee to the Board. The intent was to inform people about the act, to identify issues, and to reflect those issues back to the Board.

In the Spring of 1989, the Board published a set of draft regulations for public comment. After publication of the draft, during a 60-day period provided for public comment, the Board held nine public hearings—one in each of the planning districts. In total, more than 2,000 people attended the public information meetings and hearings, more than 300 spoke before the Board, and more than 1600 submitted written comments (CBLAD 1996). From oral and written comments, the staff recommended a set of final regulations to the Board. These the Board adopted in June 1989 and sent to Governor Baliles; the Board's work had been completed within the twelve month window provided by the act.

Governor Baliles extended the period of comment for 30 days, however, when agricultural and environmental groups objected to the regulations because of criteria for septic systems and for stormwater management and buffer areas for agriculture. Agriculture groups were unhappy because of equivalency in the criteria, between agriculture and urban lands, regarding stormwater management and buffer areas. Environmentalists were dissatisfied because criteria for septic systems would have been left to the discretion of local government health departments, whereby the environmentalists believed, they would be too weak. During the 30-day period the Board revised the regulations, resolving the equivalency issue and inserting state rules for most septic systems within locally designated Chesapeake Bay Preservation areas. The Board then readopted the regulations, and they were certified on September 20, 1989.

Immediately thereafter, plaintiffs challenged the legality of the regulations in court. After a year of litigation, the court decided the case and issued an opinion notable for two of its conclusions: (1) the court upheld the legality of the regulations on substantive grounds, stating that the requirements for public involvement and for adequate technical bases for the regulations had been met; and (2) the court held that state law had been violated because the regulations had been certified too quickly—on the last day of the mandatory comment period—rather than after the period had ended. The Board was forced, thereby, to readopt the regulations. But the practical result of the litigation was only the year of delay it caused. In 1991, the Board made minor modifications to the management regulations, resulting in the rules currently in force.

Implementation

To understand the status of existing land use planning capabilities in Tidewater localities after the act became operative, CBLAD—the administrative unit created to implement the act—analyzed local planning methods, plans, and policies—particularly those related to water quality (CBLAD 1996). The department's conclusions were that local governments:

- often lacked information on environmental resources
- reviewed water quality protection inadequately or not all
- had incomplete or no information on development trends
- had information in inconsistent formats
- had not, in general, adequately assessed available environmental data

CBLAD found, in short, that "there was a significant need for better information at the local level," particularly for environmental resource protection (CBLAD 1996). Moreover, CBLAD found that many Tidewater jurisdictions had not done timely updates of their comprehensive plans, nor were they using innovative planning techniques. Based on its research findings, CBLAD initiated assistance to local governments to help them progress through the three phases of compliance required by the regulations. The Board, through CBLAD, provides financial and technical assistance for completing the phases. Through a competitive grants program, the Board also relieves the burden of implementation by offering funding to local governments—a dollar-for-dollar match with local cash or in-kind services.

Phase I objectives are to determine the extent of environmentally sensitive lands, to map those lands, and to implement performance criteria. In this phase, local governments designate Resource Protection Areas (RPAs), which are sensitive lands at or near the shoreline and a minimum 100-foot buffer landward, and Resource Management Areas (RMAs), which are lands contiguous to the inland boundary of the Resource Protection Areas that, if improperly used or developed, have a potential to

degrade water quality. Development within RPAs is restricted to water-dependent uses. Within RMAs, development must be accomplished using established performance standards. Eleven performance standards apply, among them: minimization of impervious cover and land disturbance; septic tank pump-out every five years; and agricultural land conservation plans. Areas of concentrated development, already existing, may be designated in portions of either RPAs or RMAs.

Phase II requires local governments to adopt comprehensive plans or plan amendments to incorporate water quality protection measures consistent with the act. Comprehensive plans must address physical constraints to development, water supply, waterfront access, and redevelopment. The intent is that comprehensive plans integrate water quality considerations with local policies for economic development, historic preservation, and revitalization.

Phase III requires local governments to adopt or revise zoning ordinances, subdivision ordinances, and other development standards to protect water quality. Local governments must examine their local development standards for consistency with the Bay Act and Regulations. They must ensure that their development standards reflect the act by making provisions for the protection of water quality, by referencing performance criteria in the regulations, and, in general, by resolving any inconsistencies to the act and its regulations within a locality's land-use management program.

In sum, the Board has used a resource-based approach to implement the act, taking into consideration unique resource characteristics and treating differently various land forms. The Board requires local governments to regulate land use where necessary and to the degree appropriate. This approach allows local governments the flexibility to develop programs based on community characteristics and goals. The Board has encouraged innovative and creative approaches to achieve program objectives. The result is a heterogenous set of local Bay Act programs.

Over the lifespan of the act, the Commonwealth of Virginia has provided about $8 million in implementation grants to local governments (Bay Act Status Report 1996). Mapping projects, computer systems, revisions of plans and ordinances, and salaries for planners, engineers, and enforcers received most of the grant monies. The state also provides, through eighteen staff members in CBLAD, technical assistance and advice to local governments. With state grants and technical assistance, and with their own internal resources, the counties, cities, and towns of Tidewater Virginia are progressing toward implementation (CBLAD 1996).

As of early 1997, 83 of the 84 jurisdictions had adopted Phase I programs—designation of Preservation Areas and adoption of ordinances to implement performance criteria. Twenty of the 84 had completed Phase II—integration of water quality improvement measures into local comprehensive plans—and had their plans reviewed by the Board. Another 13 revised plans awaited Board review; the remaining half were revising their comprehensive plans. Several local governments had begun Phase III—the development of ordinance amendments.

Experiences by local jurisdictions serve to illustrate how funds and technical assistance provided by the Bay Preservation Act have worked in individual communities and regions. The following three experiences were all described in *Chesapeake Bay Communities: Making the Connection* (1996):

Using a grant of $30,000 awarded by CBLAD in 1995, the Rappahannock Area Development Commission developed a program to notify septic owners of the need to comply with regulations requiring pumpouts every five years. Local governments in a 1,300-square mile region that includes portions of the Rappahannock, Potomac, and York Rivers will assume responsibility for the project after its development by the Commission.

Prince William County, with funds provided by CBLAD, the U.S. Fish and Wildlife Service, and the U.S. Environmental Protection Agency, created a stormwater management program that protects stream habitat, improves drainage and water quality, and controls erosion and pollution. To sustain the effort, the county initiated a fee for property owners based on the amount of impervious land they own.

Hampton Roads Planning District Commission, with over 3,000 square miles, 1.5 million people, and fifteen cities and counties, prepared a guide for nontraditional homeowner BMPs. Funded by CBLAD, in part, the guide provides information about how landscaping, nutrient and pest management, use of native plants, and

water conservation can be used to increase water quality.

Performance

The Board was conducting a review of its regulations in early 1997. The process uses an advisory group that includes 13 members who represent stakeholders in land-use planning and control for the Tidewater Region. Board members will oversee the redrafting of regulations. While the review is incomplete, three conclusions about progress thus far seem likely to drive the review process.

The Commonwealth Government of Virginia, by authority of the Chesapeake Bay Preservation Act and Regulations, established unprecedented control over local government actions to plan and control land use in the Tidewater Region. Implementation of the act has been steady, if not rapid. Nearly all local jurisdictions have completed Phase I, and significant numbers of localities are implementing Phases II and III. Local governments have accepted the act, and the Commonwealth of Virginia will maintain its authority. Any changes in regulations for local government will likely be limited to providing more local freedom to adapt state rules to local conditions and streamlining criteria to improve their effectiveness.

In implementing the act, local authorities have made least progress in the development of agricultural conservation plans; such plans are required for farms in preservation areas. The slow pace results from an unexpectedly large number of farm acres in the preservation regions. Absentee landowners, of which there are many in the Tidewater Region, also impede progress; they are relatively inaccessible and uninterested in assisting the process. Estimates are that at the beginning of 1997, only 10 to 15 percent of the required acreage was under conservation plans. The Board is likely to rewrite regulations for agricultural land, either by strengthening the ability of local officials to write conservation plans or by using alternative means to promote conservation practices.

Finally, the model developed for implementing the act and its regulations—a cooperative arrangement of state, regional, and local authorities—has worked well and is unlikely to change in any fundamental way. The following are elements of that model:

1. CBLAD, a state agency with technical capacity and grant-making ability, assists local governments, many of which are too small and too financially pressed to hire adequate staff or to fund needed projects;
2. The regional planning councils, as representatives of local governments in parts of the Tidewater, are able to develop programs that meet the aggregate needs of their members by using CBLAD grants. Examples are the septic pumpout notification and tracking project and the homeowners' guide to nontraditional BMPs.
3. Local governments, while required to plan and legislate for water quality protection, have the freedom to adjust their efforts to local situations and resource conditions that they are best able to understand and articulate.

This model may also serve other states interested in creating institutions that balance statewide land use controls against local freedom of adjustment and that provide state and regional government economies of scale to assist environmental programs in small units of local government.

3. Pennsylvania's Programs and the Nutrient Management Act

Pennsylvania's involvement in the Chesapeake Bay Program is both important and puzzling. Because nearly one third of the 67,000- square-mile Chesapeake Bay Basin lies in the Commonwealth of Pennsylvania—primarily in the Susquehanna River drainage area—the Keystone State is an important member of the program. As it flows south from Pennsylvania into Maryland, the Susquehanna contributes one-half of the fresh water and nutrients entering the bay.

Pennsylvania has, however, no bay shore. It is the "upstream state" of the bay agreements. Nevertheless, during the administrations of several governors—both Democrat and Republican—it has made major and continuous efforts to improve the bay. Why does Pennsylvania make such efforts?

Pennsylvanians answer with several explanations: the Commonwealth's citizens benefit by their access to bay recreation and seafood harvests; they take pride in their contribution to improving the natural environment; they enjoy upstream benefits of cleaner streamwaters like improved habitat for living resources; and they can reduce costs to farmers by eliminating excess fertilizer applications.

State Government Philosophy

Pennsylvania's bay cleanup philosophy demonstrates "neighborliness" and sets a standard for interstate relations. As one official noted, "Almost all states are upstream and downstream from someone else." Pennsylvania has chosen to be a good upstream neighbor, thereby creating expectations for like behavior across the mid-Atlantic region.

The bay cleanup effort crystallized Pennsylvania's nonpoint source programs; in the words of one official, "The Bay effort put our nonpoint source programs on the map." But state officials are forthright in saying also that they do not expect Pennsylvania will reach the 40 percent goal by the year 2000 (Funk 1996). The Commonwealth predicts that 91 percent of the nitrogen reduction goal and 94 percent of the phosphorus reduction goal will be met by 2000 (PDEP 1996).

Funding levels constrain greater achievements. The state's tributary strategy notes that "...the progress of Pennsylvania's nutrient reduction program is dependent upon...financial resources available to implement the program" (PDEP 1996). Pennsylvania state government has a policy not to establish any unfunded mandates or initiatives to reach bay cleanup goals (PDEP 1996). Since taking office in 1994, the administration of the state's current governor, Tom Ridge, has increased funding for water quality improvements by obtaining $500,000—an increase of about 20 percent—for technical and administrative staff in County Conservation Districts. The Ridge administration also has supported level funding for other programs designed to support bay cleanup efforts.

Advocates of nonpoint source cleanup efforts in Pennsylvania are working to maintain the visibility and priority status of those programs within the state's budget process. Some of the programs require additional funds to become effective; the prime example is a need for more resources for stormwater management. Likewise, supporters of the agricultural cost-share program are hopeful, but uncertain, that sufficient funds will be allocated for implementing the agricultural BMPs needed to reach the 40 percent goal.

Core Nonpoint Source Programs

To meet its goal, Pennsylvania must reduce nitrogen loads by 19.8 million pounds and phosphorus by 2.5 million pounds from the 1985 base year. To maintain the 60 percent cap beyond the year 2000, the state must control nitrogen loads at a maximum level of 29.7 million pounds and phosphorus at a maximum level of 3.7 million pounds (PDEP 1996). The commonwealth is conducting point and nonpoint programs to achieve nutrient reductions; the latter programs include five initia-

tives that are focused primarily on agriculture. Four of the five are described in this report as "core programs;" the fifth, the Nutrient Management Law, is the subject of a case study.

Conservation Practice Program for the Bay Watershed

Pennsylvania's Conservation Practice Program, by which the state shares, with farmers, the costs of installing agricultural BMPs in the bay watershed, is expected to reduce nitrogen loadings by about 7.8 million pounds and phosphorus loadings by about 0.78 million pounds, per annum, by the year 2000 (PDEP 1996). The program is voluntary and responds to farmer requests for technical and financial assistance. While, at one time, the program was restricted to certain targeted counties, equity concerns led the state to expand the program to the whole watershed; now, local conservation districts prioritize requests by their potential for nutrient reductions.

Pennsylvania's effort complements federally funded BMP implementation and technical assistance programs. To receive public funds, farmers agree to address all critical nutrient pollution problems on their land, as identified by the conservation districts, and to implement approved nutrient management plans. The maximum government cost share, per BMP, is 80 percent; the total public dollar share per farmer may not exceed $30,000.

From January 1985 to December 1999, Pennsylvania officials project they will have assisted about 1,500 farmers to add conservation practices on about 36,000 acres; developed nutrient plans for 131,000 acres; and installed more than 1,200 animal waste storage facilities. Federal programs will likely have added another 1.5 million acres of land with conservation practices, 340,000 acres of nutrient management plans developed, and more than 1,300 animal waste storage facilities.

Estimated budget outlays for the state's cost-share implementation are $2.5 million for 1993 and a target of $3.0 million, per year, from 1994 through 1999. Total costs to the state and federal governments for installation of conservation practices, from 1995 through 1999, will be about $80 million, assuming continued funding from both levels of government (PDEP 1996).

New Agricultural Nonpoint Source Initiatives

Pennsylvania recently initiated two new agricultural programs for reducing nutrient loadings—one to reduce barnyard runoff and the second to protect stream corridors. Barnyard runoff is a significant contributor to nonpoint source pollution in the state. To combat this problem, the commonwealth has established a BMP that is directed to farms with barns, feedlots, and other livestock concentration areas. Major components of runoff control will be roofing, concrete paving, gutters, and other means to divert, filter, collect, or treat water. Total program costs for this BMP for the period 1996 through 1999 will be about $1.8 million. The program is expected to reduce nitrogen loadings by 300,000 pounds and phosphorus loadings by 37,000 pounds over that same period of time.

Stream corridor protection involves several actions. Two separate but complementary programs for streambank fencing are administered by the Pennsylvania Department of Environmental Protection (PDEP) and the Pennsylvania Game Commission. Between 1985 and 1995, these programs assisted in fencing 138 miles of streams across the state's Chesapeake Bay watershed. The programs provide materials, installation, and technical assistance in exchange for landowner agreements to maintain fencing systems for 10 years. Objectives are to improve water quality and habitat for wildlife. The PDEP fencing program will be expanded significantly to add more miles of stream. In combination, between 1995 and 2000, the efforts are expected to add another 212 miles of fence. At a cost of $2 million from 1985 through 1999, the programs should provide fencing for 350 miles of streams and reduce nitrogen loadings by 37,000 pounds and phosphorus loadings by 460 pounds.

Two other new initiatives in stream corridor protection are also being made in Pennsylvania. They are (1) expanded efforts to include stream protection systems in farm nutrient management and BMP cost-share programs; and (2) partnerships with private companies, nonprofit organizations, and state and federal agencies to promote vegetative buffers to protect the quality of water in Pennsylvania's streams.

Other Public and Voluntary Agricultural Programs and Efforts

Pennsylvania has begun documenting reductions in nutrient loadings attributable to the USDA Con-

servation Reserve Program. This program removes, from agricultural production for a period of ten years, highly erodible land and land that contributes to a serious water quality problem. Federal annual rental payments compensate farmers for lost production. Nutrient reductions result from vegetative cover over idle land. The Conservation Reserve Program is expected to include 44,315 acres in 1999 and to result in nitrogen reductions of 948,000 pounds and phosphorus reductions of 20,000 pounds in that same year.

Urban Initiatives

Pennsylvania's Erosion and Sediment Pollution Control Program, administered by PDEP and the state's conservation districts, prevents or reduces soil erosion during construction, agricultural plowing and tilling, or other land-disturbing activities. Historically, implementation of the program has been uneven across counties, particularly in regards agricultural land disturbances (Select Committee 1990). But a survey conducted in 1993 did reveal improved program compliance in 87 percent of the counties in the state's bay watershed area (PDEP 1996).

The state's Stormwater Permitting Program requires controls on runoff from construction sites. Pennsylvania requires counties to develop stormwater management plans, after which local governments within counties must adopt ordinances to correspond with the county plans. But state assistance to implement county stormwater planning has been minimal (Select Committee 1990). As a result, many counties—particularly rural ones—have not developed plans; and therefore, their local governments have not adopted ordinances.

Construction projects, to which the Stormwater Permitting Program applies, are typically of short duration—usually less than one year. Estimated nutrient savings thus are not continual. Nevertheless, recent federal law requires stormwater permitting for many more construction activities. Statewide, the increase is likely to be from 100 projects requiring permits in 1992 to about 4,500 projects requiring permits in 2000. As a result of this program, projected savings of nutrient loadings in 1999 are 144,000 pounds of nitrogen and 7,000 pounds of phosphorus (PDEP 1996).

Pennsylvania also counts, as initiatives among its core programs, two new efforts—Riparian Buffer Workshops for Local Governments and Citizens, and Keystone '93 Programs (PDEP 1996). The workshops, to be conducted at four sites by the Alliance for the Chesapeake Bay in cooperation with the Pennsylvania State Government, will encourage the creation of vegetated riparian buffers through planning, zoning, land acquisition, and other means. Keystone '93 Programs—the Rivers Conservation Program, Keystone Land Trust Grant Program, and Keystone Community Grant Program—are a cluster of programs designed to fund open space conservation.

Nutrient Management Law: A Case Study

Like Virginia's Bay Restoration Act, Pennsylvania's Nutrient Management Law illustrates a case in which multi-interest collaboration made a significant contribution to policy development. During the late 1980s and early 1990s, support swelled in Pennsylvania for stronger state regulations to reduce nutrient runoff from animal waste; opposition also arose. In 1990, when then-Governor Robert Casey appointed the "Select Committee on Nonpoint Source Nutrient Management," representatives of farm organizations, environmental groups, local governments, and business interests collaborated to develop a state policy for managing farm nutrients through state regulation. The collaborative effort was imperfectly designed and has not eliminated conflict over the idea of regulation, nor dissatisfaction with state legislation or rules of implementation. Collaboration has not substituted, moreover, for the use of political power. But collaboration did make a contribution to a major law, one that some state officials expect will significantly reduce nitrogen and phosphorus loadings to Pennsylvania's Bay Tributaries and other waters (PDEP 1996), and one that other states will want to examine.

Background

After the Chesapeake Bay Executive Council signed the 1987 Agreement establishing the 40 percent reduction goal, many Pennsylvanians became increasingly concerned about nonpoint source pollution and contributions of the state's agricultural industry to nutrient loadings. The Executive Council's nutrient reduction strategy, published in 1988, noted that agricultural runoff contributes "82 percent of the total controllable nitrogen load and 65 percent of the controllable phosphorus load...flowing from Pennsylvania each year" (Chesapeake Executive Council 1988). Moreover, the strategy noted that animal waste contributes the single largest portion of both the nitrogen and phosphorus

loads. In 1988, control of 85 percent of Pennsylvania's animal waste would have accomplished the 40 percent nutrient reduction goal for the state (Executive Council 1988).

Pennsylvania had regulations to reduce animal waste pollution. Promulgated under the Clean Streams Law, the regulations required livestock farmers who spread or stored manure to adopt nutrient management BMPs. Guidelines for animal waste management were contained in the publication *Manure Management for Environmental Protection*, commonly known as the "Manure Management Manual" (PDEP 1986). Critics claimed, however, that while the manual established adequate standards, provided the Commonwealth with appropriate authority, and offered a useful education tool, state agencies had not developed a clear and decisive strategy to implement its regulations. Enforcement was "permit by rule," meaning that as long as a farm was in compliance with the manual, it didn't need a permit. Problems went unnoticed because enforcement relied only on neighbor complaints. Confusion existed, the critics wrote, "over the nature of the regulations and the manner of their enforcement" (Garber & Gardner 1989). Popular dissatisfaction with animal waste management encouraged legislative proposals in 1989.

Governor Casey's Select Committee

In 1989 the Pennsylvania General Assembly debated how to clarify animal waste regulations and establish a strategy and program for enforcement. But, although the General Assembly held hearings about legislative proposals, no law was passed.

State officials in DER were aware of flaws in the commonwealth's manure management policies, but believed the legislative proposals in the 1989 session were less than ideal because they contained loopholes; thus they were interested in a collaborative study process leading to improved legislation. Likewise, Governor Casey believed animal waste issues were becoming too partisan and needed to be examined by a group of scientists and stakeholders. So, in March of 1990, the governor appointed the Select Committee on Nonpoint Source Nutrient Management. He charged the committee to "investigate the problem of nonpoint source nutrient pollution throughout Pennsylvania, evaluate current control practices and programs, and make recommendations to reduce the contribution of nutrients to surface and ground waters of the Commonwealth" (Select Committee 1990).

State Representative Jeffrey W. Coy chaired the committee, which included nine members chosen to represent varied interests surrounding animal waste management—a farmer, an ex-farmer who administered a USDA agency, an official from the Chesapeake Bay Foundation, a leader of a major Pennsylvania farm organization, two technical experts from The Pennsylvania State University, two state legislators, and a Chesapeake Bay Commission member for Pennsylvania. A former staff member to the committee, on later reflection, believed the committee should have represented a broader range of stakeholders and that their absence reduced the policy ideas, political influence, and support needed for policy development and resources needed for implementation.

In response to the governor's charge, the committee held three public hearings to gather testimony about the impacts of excess nutrients in Pennsylvania's rivers, streams, lakes, and drinking water; agricultural and other sources of nutrients; and governmental efforts to control nonpoint source nutrient pollution. The committee also conducted a fact-finding tour of several central Pennsylvania farms to observe, in the field, nutrient management practices and problems. Little information on nutrient management initiatives in other states was integrated into committee deliberations because, it was believed, Pennsylvania was a pioneering state and was developing unprecedented policy.

During the Fall of 1990, subjects of agreement emerged out of committee deliberations and staff-committee interactions. By October, for example, the Select Committee had agreed that new nutrient management legislation should be enacted for agricultural specifically and other nonpoint sources generally; all agricultural operations should be required to have nutrient management plans, but phased implementation should be done by targeting—beginning with new agricultural operations and those undertaking significant expansion; and the state Conservation Commission, as representative of a broad range of interest groups, should be the lead agency. In December 1990, the committee issued a report (Select Committee 1990).

The committee found that excess nutrients in the state's waters were creating significant and increasing problems—polluted wells, eutrophication of lakes and reservoirs, and nutrient enrichment of the Chesapeake Bay. In addition, the committee found that agriculture, primarily because of livestock ma-

nure and chemical fertilizers, was the single largest contributor to nonpoint source nutrient water pollution, although atmospheric deposition, on-lot sewage disposal, and urban stormwater runoff also made significant contributions. In examining governmental programs, the committee concluded that there was not a sufficiently clear mandate to deal with the problems, and that "Expanded voluntary, educational programs will be important and helpful but not sufficient to achieve the reductions of nonpoint sources in Pennsylvania necessary to alleviate nutrient pollution. Additional regulatory programs," the committee advised, "are needed" (Select Committee 1990). The committee suggested placing more attention on reducing nutrients from agricultural operations and noted that "Many farmers can realize economic benefits from improved nutrient management, through reduced fertilizer use and more judicious application of manure and other nutrients" (Select Committee 1990).

The committee presented eleven recommendations to Governor Casey (Select Committee 1990). The recommendations document areas of consensus achieved by the committee and help explain the motivations of interests represented.

1. All agricultural operations in Pennsylvania should eventually be required to prepare and implement nutrient management plans.
2. Nutrient management plans should be based on meeting surface and groundwater quality objectives as well as agronomic needs.
3. Certain specific categories of agricultural operations should be targeted for preparation and implementation of nutrient management plans on a priority basis.
4. The Pennsylvania Department of Agriculture (PDA) should develop and implement a program for state certification of nutrient management specialists, both commercial and individual. It should be a requirement that all nutrient management plans be prepared by an individual certified by the state program.
5. The county Conservation Districts should provide some degree of oversight of nutrient management plans. Government agency review and approval of nutrient management plans should not be required for most agricultural operations, if the plans have been prepared by a certified nutrient management specialist. However, the highest priority targeted operations should be required to submit their plans to the county Conservation Districts for review and approval. All nutrient management plans should be on file with the county Conservation Districts.
6. The Pennsylvania Department of Environmental Resources (PDER) should be required to report to the General Assembly what additional regulatory, statutory, and budgetary actions are needed to control nonagricultural sources of nutrients, including atmospheric deposition, on-lot sewage disposal, and urban stormwater.
7. The lead agency for the nutrient management program should be the State Conservation Commission (SCC or Commission), in consultation with PDA and PDER. Lead agency responsibilities should include:
   - Development of criteria and regulations
   - Education
   - Technical assistance
   - Program oversight and coordination
   - Certain aspects of the program should be specifically assigned to other agencies, as follows:
   - Development and administration of a nutrient management specialist certification program - PDA
   - Nutrient management plan oversight - county Conservation Districts
   - Enforcement - PDER (Bureau of Water Quality Management)
8. Local ordinances that regulate nutrients should be required to be consistent with the statewide program
9. If an agricultural operation is fully and properly implementing a certified nutrient management plan, it should be considered an affirmative defense in any enforcement action taken for violation of the nutrient management legislation.
10. Funding for the nutrient management program should be adequate for the administration of its various components by the designated agencies, including the development of nutrient planning criteria and other activities of the SCC, development and administration of the nutrient management specialist certification program by PDA, plan review and approval by the county Conservation Districts, and inspection and enforcement by PDER.
11. The General Assembly should give serious consideration to the creation of a statewide financial assistance program to farmers for nutrient management.

The committee agreed with criticisms of Manure Management Manual enforcement in observ-

ing that, "Although the Select Committee believes that there may be general authority to create a nutrient management program, the best way to implement the Select Committee recommendations is through enactment of new legislation which clearly defines the requirements and responsibilities for a statewide nutrient management program" (Select Committee 1990).

Thus the Select Committee, with its diverse membership, achieved a notable consensus. It identified agriculture as the main, although not the sole, source of problems caused by nonpoint source nutrient loadings to Pennsylvania's waters. It recommended clear, consistent, and enforceable regulations requiring nutrient management for all the state's farms. And it requested adequate funding to develop and enforce a regulatory effort. By its recommendations, the committee report served the interests of both environmental and agricultural advocates.

For their part, environmentalists achieved a consensus statement to gain the support of Governor Casey and to counter the arguments of anyone opposed to state actions to reduce nutrient loadings. The committee agreed that the Manure Management Manual was inadequate for reducing animal waste runoff and advocated a phased approach for applying nutrient management requirements, beginning with new and expanding farms; operations with identified water-quality problems; and farms producing more livestock manure than can be "applied in an agronomically and environmentally sound manner to the cropland which is farmed as a part of the operation, or over which the agricultural operation has direct control" (Select Committee 1990). Moreover, the committee stated its ultimate goal as nutrient management on *all* farms in the commonwealth. Finally, the committee supported strengthening state programs in air quality, on-lot sewage disposal, and stormwater management.

Agricultural interests could also count several achievements among the committee's recommendations. The committee advocated a requirement that all local government ordinances that regulate nutrients be consistent with state law, and suggested that consideration be given to removing the ability of local governments to implement nutrient management ordinances without a state delegation of authority. The requirement for local government restrictions was included, according to the report, to protect farmers against inconsistent standards and requirements and double jeopardy—by state and local prosecution—for alleged violations.

Agricultural interests could be pleased also because the committee recommended that PDA should implement the program for state certification of nutrient management specialists and should consult with the state Conservation Commission—the proposed lead agency for the program. PDA, like departments of agriculture in other states, is thought to have an organizational culture that is sympathetic to farmers' values, thus placing it in a position to influence policy decisions, even when it is not the lead agency, reducing farmers' anxieties.

The committee also recommended that "If an agricultural operation is fully and properly implementing a certified nutrient management plan, it should be considered an affirmative defense in any enforcement action taken for violation of the nutrient management legislation" (Select Committee 1990). The committee pointed to atmospheric deposition, on-lot sewage disposal, and urban stormwater runoff as sources of nutrient pollution from nonagricultural sources. Finally, the committee recognized that nutrient management regulations for farmers would impose additional costs on Pennsylvania's agricultural sector, a sector that, if it is to survive, must be cost-competitive with agriculture elsewhere. Therefore, the committee urged the General Assembly to create a financial assistance program for Pennsylvania farmers for nutrient management.

Legislation

During the 1991-1992 session of the Pennsylvania General Assembly, Representative Coy proposed legislation that incorporated recommendations from the Committee Report (House Bill No. 496; 1991). Governor Casey and environmental groups endorsed the bill. Likewise, the Chesapeake Bay Commission viewed the proposed legislation as a potential model for Virginia and Maryland (CBC 1991).

But reactions among farmers were mixed. Leaders of the Pennsylvania Farmers Association (now the Pennsylvania Farm Bureau) supported Representative Coy's proposal by arguing that farmers should be active in shaping the best law possible; in a close vote, the leaders obtained the endorsement of the association's members. Two other major farm organizations—the Pennsylvania Farmers' Union and Grange—also supported the bill (Dumeyer 1991). But vocal opposition arose

among some farm operators, local farm organizations, and agribusinesses. An organization called the Family Farm Movement formed in opposition to House Bill 496 (*Intelligencer Journal* 3/31/92). In May of 1992, the Movement claimed the membership of 3,800 farmers and 100 organizations and businesses—although others disputed that claim—and endorsed several changes to the proposed legislation, most notably making nutrient management voluntary rather than mandatory, transferring enforcement of the act from PDER to PDA, and basing compliance inspections on a random lottery (*Intelligencer Journal* 5/7/92).

The Republican Caucus of the Pennsylvania House of Representatives also raised concerns about Coy's bill, particularly about regulating only agriculture and about budget implications (Dumeyer 1991). Republican Representative John Barley had, in the same session, introduced a rival bill—HB No.448—that would have placed administrative responsibility for nutrient management in PDA and required soil tests for landowners using chemical lawn care services. During the session, Barley's proposal was referred to the House Agriculture and Rural Affairs Committee, but no action resulted. The House of Representatives approved Coy's legislation and sent it to the state Senate. But opposition arose in the Senate, where some legislators with agricultural constituencies spoke against the bill; Coy's bill died in there at the end of the session, in November 1992.

Representative Barley holds the view that, in their efforts to protect the environment, Democrats are sometimes too prone to use regulation, rather than education and incentives. Thus he was critical of many of Democratic Governor Casey's environmental initiatives and pleased that Coy's bill, which he regarded as too regulatory, had not become law.

But Barley was unpleasantly surprised when, in November of 1992, the Democrats became the majority party of the Pennsylvania Senate, thereby giving their party control of both houses of the General Assembly. At that time, Barley decided that he would work with Representative Coy to develop compromise legislation.

During the 1993-1994 legislative session Representative Coy introduced House Bill 100—an exact replica of House Bill 496 from the previous session. Barley worked with Coy to shape a compromise bill. The results of their collaboration—an amended version of House Bill 100—strengthened the administrative role of PDA and applied the legislation only to concentrated animal operations; but essential elements of Casey's committee proposals—regulations designed to clarify and strengthen the management of agricultural animal waste—remained in the bill (Dumeyer 1993). In May of 1993 the General Assembly passed the compromise proposal, known as the Nutrient Management Act (Act 1993-6), and in July of that year Governor Casey signed it. In detail, the act:

1. Charged the state Conservation Commission to develop regulations that establish minimum criteria for nutrient management plans incorporating best management practices, provide financial assistance to the extent that funds are available, and enforce the act, except that enforcement may by delegated to local conservation districts.
2. Established a Nutrient Management Advisory Board, appointed by the commission, to review and comment on regulations developed by the commission. Board members include:
   - farmers (5), representing the livestock, swine, meat poultry, egg poultry, and dairy industries
   - animal nutrition specialist
   - feed industry representative
   - fertilizer industry representative
   - commercial agriculture lenders representative
   - local government representative
   - university agronomist
   - hydrologist
   - citizen representatives (2) who are not farmers
   - environmental representative
3. Directed the PDA, in consultation with the commission, to develop a nutrient management certification program for people who develop nutrient management plans.
4. Required farms with two or more animal equivalent units (AEUs), per acre, on an annualized basis, to submit a nutrient management plan within one year after the effective date of regulations and to implement a plan within three years after it is approved.

   (An AEU is 1,000 pounds of live weight of livestock or poultry animals. An AEU per acre is an animal equivalent unit per acre of crop land or acre of land suitable for application of animal manure.)

   (The three year implementation deadline is extended two additional years if improvement

costs cannot be financed through available funding mechanisms and state financial assistance of $2 million has not been appropriated by the state legislature within one year of the effective date of the regulations.)

5. Provided financial assistance for implementation of nutrient management plans, to the extent funds are available, in the form of loans, loan guarantees, and grants.
6. Preempted local units of government from enacting any ordinance inconsistent with or more stringent than the requirements of the act or its regulations.
7. Required the PDER to assess, for the General Assembly, the impacts of other nonpoint sources of nutrient pollution, including:
   - malfunctioning on-lot sewage systems
   - improper water well construction
   - nonagricultural use of nutrients
   - stormwater runoff
   - atmospheric deposition

A brief and useful summary of the act is found in Beegle, Lanyon, and Lingenfelter (1996).

Regulatory Negotiations

If the Select Committee created a blueprint for reaching nutrient reductions and the General Assembly constructed the Nutrient Management Act to drive toward reductions, the Nutrient Management Advisory Board (Board) authored the rules of the road. Actions by the Select Committee, the General Assembly, and the Board are mileposts in the process of developing nutrient management policy for Pennsylvania.

In writing the rules to implement the Nutrient Management Act, the Board operated in an unprecedented manner and in a time of shifting administrative structure. When the Board first began meeting in mid-1993, it followed, by its relationship with state agency staff, standard operating procedure—a staff-Board partnership. The staff, drawn from PDER where the state Conservation Commission was located, organized public hearings and initiated a rule-drafting process; the Board participated in hearings, reacted to draft papers, advised on technical and political issues, and recommended changes to draft papers.

The effort to develop implementation regulations was, of necessity, a detailed process. According to the act, the commission had two years—until July 1995—working with the Board, to promulgate regulations that established minimum criteria for nutrient management plans. The regulations were to include identification of nutrients to be managed; establishment of proper application rates of nutrients to land of various soil types and agricultural uses; verification of acceptable best management practices and specifications for their development; installation of record-keeping requirements; and establishment of conditions under which amendments to plans may be made, criteria for manure handling in emergency situations, and conditions when changes are necessary due to unforeseen circumstances.

The standard process of writing regulations for the Nutrient Management Act continued for one year and into a second. In November of 1994, Republican candidate Tom Ridge won election to become Governor of the Commonwealth of Pennsylvania and the Republican Party took majority control of the commonwealth's General Assembly back again from the Democrats. When he assumed office, Governor Ridge appointed new cabinet secretaries, including new leaders for the Departments of Agriculture and Environmental Resources. With the changes in executive and legislative leadership came an alteration in philosophy about government regulations and, eventually, a new administrative structure for the state Conservation Commission.

The new philosophy about regulation correlated with a change in the writing process to implement the Nutrient Management Act. The views of participants to the process differ about what concerns Governor Ridge's appointees had were "political" and what concerns were "substantive;" but, in any case, when the new appointees arrived, they decided the standard procedure—state government staff initiating drafts and the Board reacting to them—was improper because it placed the staff, which they suspected of being too prone to regulate, in too powerful a position. Therefore, in early 1995, they revised the process to make the Board responsible for drafting regulations and placed the staff in the role of assisting the Board in its writing process. The Board, after some initial uncertainty and dissention about how to proceed, organized itself into three drafting committees, one each for manure management, stormwater and setback issues, and financial issues. Thus began 20 months of regulatory negotiations, within the drafting committees and the full Board, and the incorporation of extensive public comments, to produce rules for consideration by the commission.

Concurrent with the change in procedure, the Ridge administration and the General Assembly created, from parts of PDER and elsewhere, a new state land management agency called the Department of Conservation and Natural Resources, and renamed what remained of PDER the "Department of Environmental Protection" (PDEP) (Act 1995-18). Shortly thereafter, state legislative leaders in the new Republican majority—including Representative Barley as Majority Whip in the House of Representatives—insisted, over the objections of environmentalists and administrators in PDEP, that state agencies administering the Nutrient Management Act be restructured. In the reorganization that resulted, PDA gained the budget for the executive secretary of the commission (Memorandum of Understanding Between PDEP and SCC 1996; Memorandum of Understanding Between PDA and SCC 1996). PDA also gained authority to co-chair the commission, on alternate years, with PDEP. Several staff members with responsibilities for assisting the development of the Nutrient Management Act were shifted from PDEP to PDA, as PDA took on work with the Board to draft regulations and recommend methods for financial assistance and education (Addendum "A" Memorandum of Understanding Between PDA and SCC 1996).

The Board finished its task of writing draft regulations in April of 1995, shortly after which, in June, the commission gave its approval to the draft. Proposed rules were published in December of the same year (Pennsylvania Bulletin, December 30, 1995). The public provided written reactions by mail and oral comments during four hearings and seven information meetings held in the first quarter of 1996. Sixty two individuals and organizations provided written comments—three legislators, two state agencies, 16 conservation districts, 13 agriculture and conservation organizations, six county Farm Bureau and Grange organizations, three universities and school districts, and 19 individuals, primarily farmers. The comments were technical and specific; they contained suggestions for changes to clarify language, eliminate duplication, and make the rules either more or less stringent (Attachment 3, 1996). Public comments provided information to fuel the last several months of regulatory negotiations by the Board, after which it proposed a final set of regulations for commission consideration, in March 1997—20 months after the date specified in the act. After their approval by the commission, the rules will be subject to a series of normal reviews and would likely take effect in Fall 1997.

Participants to the regulatory negotiation process and to the administrative restructuring among the commission, PDEP, and PDA make two consistent observations about their results: the process added months to the time required for drafting regulations; but regulatory negotiations and administrative changes built trust between Pennsylvania state government and the state's farm community. The end product, to date, is a set of proposed regulations that seem generally acceptable to farmers.

But, although the Chesapeake Bay Foundation (CBF) representative on the Board voted to pass the draft regulations on to the commission for action, the CBF's executive director for Pennsylvania, Jolene E. Chinchilli, expressed concerns about the draft regulations. In a letter to Pennsylvania's Secretary of Agriculture, Chinchilli wrote that, "...while we supported the decision to pass the regulations on to the Commission, CBF does not support this draft of the regulations." Chinchilli stated further that the Foundation's position is that "...key provisions of the regulation have been weakened." The change of greatest concern to CBF is the elimination of a requirement to have an erosion and sedimentation control plan as part of a nutrient management plan. In the view of the foundation, that change will seriously weaken the regulations "because soil conservation is critical to sound nutrient management" and the commission should restore the requirement (Chinchilli 1997).

Major Provisions of the Final Proposed Regulations

As required by the Nutrient Management Act, regulations apply only to concentrated animal operations (CAOs) where animal density exceeds two AEUs per acre on an annualized basis. Voluntary nutrient management planning is encouraged for nonregulated operations. Estimates of the portion of farms to which the CAO regulations apply range, roughly, from 5 to 10 percent. But no one is certain as to the exact number of applicable farms because (1) rented land may be counted as an integral part of a farm operation; (2) only those lands (owned or rented) under the management control of an operator—and on which manure generated in an operation is to be applied—may be counted as part of an animal operation; and (3) agriculture census data at the individual farm level is confidential. One guess is that 50 percent or more of the CAOs will be farms of ten acres or less.

Difficulties in knowing to whom regulations apply make it uncertain that all CAOs will comply by

developing a plan. According to the act, civil penalties of not more than $500 for the first day of each offense and $100 for each additional day of continuing violation of the act or its implementation regulations can be assessed. The act also creates an incentive for participation by providing that implementation of an officially approved plan "shall be given appropriate consideration as a mitigating factor in any civil action for penalties or damages alleged to have been caused by the management or utilization of nutrients pursuant to the implementation" (Act 1993-6, Section 13). In addition, framers of the regulations expect that commercial lenders will request farmers with major animal operations to show their plans when they apply for loans. Farms with less than two AEUs per acre are not required to have plans, but state officials hope they will volunteer to develop them.

Any farm classified as a CAO must obtain a nutrient management plan developed by a Certified Nutrient Management Specialist. PDA has adopted a set of rules and regulations for such specialists (Pennsylvania Bulletin, September 28, 1996). Certified farmers may write a plan for their own operations. All plans must be reviewed by a Public Nutrient Management Specialist for approval, and certain records must be kept. In addition to farm identification, a plan summary, and an implementation schedule, each plan must include the following:

- Information on nutrient allocation and use, including:
  - nutrients available
  - crop production nutrient needs
  - nutrient application rates and procedures
  - excess manure utilization plans
- Plans for BMPs needed to protect ground and surface water in animal concentration areas

Existing CAOs will have one year from the time regulations are adopted to submit their plans for approval. New operations with more than two AEUs per acre must submit a plan within three months of the adoption of the regulations, or prior to commencing manure operations, whichever is later. CAOs are required to implement their plans within three years of plan approval. Implementation requirements are extended by two years for substantial capital improvements if the cost of the improvements cannot be financed through available funding mechanisms, or if $2 million or more has not been appropriated for grants and loans by the Commonwealth of Pennsylvania within one year of the adoption of the regulations. CAO plans must be reviewed at a minimum of every three years by a Certified Nutrient Management Specialist and amended if significant changes have occurred in AEUs, crop requirements, or the method of utilizing excess manure.

The regulations envision delegation of responsibility for implementation of the act from the commission to county conservation districts, either singly or in multicounty clusters. The local districts may chose between two levels of responsibility: (1) outreach and education of farmers, review comment on plans, with official approval by the commission; or (2) outreach and education of farmers, technical assistance to farmers and Certified Nutrient Management Planners, review and approval of plans, approval of implementation delays, and approval of waivers from manure storage setback standards. As of early 1997, 56 county conservation districts—from a total of 67 counties statewide—had accepted the second, higher level of responsibility.

Expectations and Emerging Issues

Assuming regulations to implement the Nutrient Management Act take effect in October 1997, by October 1998 existing CAOs must submit plans for approval. Then by October 2001, or October 2003 if state funds for implementation are not provided, plans must be implemented. Numbers of plans developed and numbers of acres covered will provide the first indications of how the Nutrient Management Act is working.

Officially, the commonwealth expects that the act will provide significant reductions in nutrient loadings in the bay watershed because it both mandates nutrient management and promotes voluntary management and because the Susquehanna River Basin is expected to contain large proportions of the state's CAOs. Pennsylvania's *Chesapeake Bay Nutrient Reduction Strategy* (1996) projects as results of the act, for the period 1995 through 1999, a 7.8 million pound reduction in nitrogen loadings and a .7 million pound reduction in phosphorus.

The physical science assumptions for these projections—acres in agriculture, animal units per acre, nutrient load available for treatment, and load reduction efficiencies—seem accurate. Two additional assumptions are also reasonable, although less certain: equal numbers of farms will implement nutrient management plans because of regulation and because of voluntary efforts; and

regulated farms will have higher animal densities than voluntary farms. One other factor works in favor of reduced nutrient loadings to the bay: the location of most of Pennsylvania's CAOs is expected to be in the Susquehanna Tributary to the bay.

But two other assumptions in the projections seem overly optimistic. One is that 10 percent of the 21,500 farms in the bay basin will submit mandatory nutrient management plans. The true percentage is uncertain, but 10 percent is believed by some state officials to be at the high end of the range of estimates. Predictions about the number of farms subject to regulation are necessarily uncertain because of census data confidentiality and because of the unknown consequences of the formula that will be used to determine AEUs per acre. A second assumption that is too optimistic is the time line. Because of the lengthy process used to negotiate regulations, implementation of plans will likely begin no sooner than 18 months after the date anticipated by the act. Moreover, residual nutrients in the soils of CAOs create an unknown lag time between increased manure management and improved water quality. While load reductions will occur, they may well be lower and later than those projected in the Pennsylvania Strategy.

The strategy also provides estimates of Nutrient Management Act program costs (PDEP 1996). Major categories of costs, all dependent on approval by the General Assembly, will be funds for planning assistance, CAO financial assistance, aid to local conservation districts for delegated functions, demonstration and alternative uses of manure, and education. CAO financial assistance, the largest category of costs, may primarily be in the form of loans over a ten-year period. Loans would rise rapidly during the implementation stage—around the turn of the century—then become more than balanced by loan receipts in the early 2000s. The strategy estimates program costs for the bay drainage area of Pennsylvania at approximately $15.8 million over the period 1995 through 1999, based on 1995 dollars (PDEP 1996). As with all of Pennsylvania's bay efforts, funding for the Nutrient Management Act is dependent on priorities and efforts by Governor Ridge, the Commonwealth's General Assembly, and interest groups and citizens who influence the governor and the state legislature. The need for budget support to implement the act will be critical, especially, for areas of Pennsylvania outside of the bay drainage where state and federal dollars are more difficult to obtain.

4. Maryland's Bay Initiatives, Including Tributary Teams

Maryland's geography and history, and much of the state's commerce and culture, are bound to the Chesapeake Bay. Ninety five percent of the state drains over 17,000 miles of tributary streams and rivers into the bay. European exploration of the Upper Chesapeake and its environs, beginning in the early seventeenth century, led to the settlement, colonization, and statehood of Maryland. The current economic value of the bay to Maryland, as estimated by a state agency, is $678 billion (*Economic Viewpoints*, 1996). Included in that figure are values for many activities dependent on *water quality*, including: fishing; boating; swimming; beach use; and waterfront and water-view living. In today's Maryland, much of the popular culture is Chesapeake-oriented: bookstores abound with bay-based photography and literature; gift shops offer Chesapeake wares ranging from the sublime to the ridiculous, from exquisite waterfowl carvings to crab hats.

State Government Philosophy and Accomplishments

With so much of Maryland bay-oriented, no one would argue with John Griffin, Secretary of Maryland's Department of Natural Resources (MDNR), who said: "The Chesapeake Bay is Maryland's most treasured natural resource." Indeed, perceived threats to the bay as an ecosystem, a treasure chest of natural resources, and a cherished way of life, have provided powerful political symbols to galvanize collective actions for its protection (Favero, Pitt & Tuthill 1988).

Expenditures

The State of Maryland spends many dollars for Chesapeake Bay protection, although the trend has been for declining expenditures during the 1990s (MDNR 1995). From fiscal years (FY) 1990 through 1996, the state spent $189.5 million in *general operating* funds for bay protection. Annual operating budgets for the bay declined, however, from $34.6 million in FY 1990 to $24 million in 1996. In contrast, the state's *capital* budget for the bay rose, over the same seven-year period, from $3.8 million in FY 1990 to $5.9 million in 1996. State of Maryland bay-related capital budgets totaled $37.3 million over the seven-year period.

Maryland's bay effort is multiagency. Traditionally, the governor's office coordinates across agencies, although that function is reduced in the Glendening administration. The Departments of Natural Resources, Agriculture (MDA), the Environment (MDE), and Transportation (MDOT), and the University of Maryland System all spend significant amounts of resources (MDNR 1995). Counting expenditures from FY 1990 to 1995 and appropriations for FY 1996, Maryland's bay-related operating and capital budgets by agency, from Maryland sources only, in millions of dollars, totaled more than $200 million—as shown in Table 1.

When all sources of funds—federal included—for bay-related capital and operating spending by Maryland State Agencies are considered, the total appropriations for FY 1996 are $229.4 million. For all seven years combined, the total is $1.1 billion (MDNR 1995).

Agency Functions

Although the names of bay-related agencies in Maryland have remained the same since 1987, re-

Table 1: State of Maryland Spending for the Chesapeake Bay: 1990-1996 ($ millions)

Agency	Operating	Capital
Agriculture	31.9	31.7
Environment	82.1	3.6
Natural Resources	48.4	2.0
Transportation	0.7	0.0
University of MD System		26.4
TOTAL	189.5	37.3

sponsibilities among agencies have shifted. In his most significant reorganization for natural resource management, Governor Parris Glendening continued a shift begun by previous governors when he moved regulatory functions into a single agency—MDE—and water quality monitoring functions into another agency—MDNR. Governor Glendening also reduced the role of the governor's office in coordinating bay efforts and gave that task to MDNR. To provide cross-agency administrative leadership, Maryland has a "Bay Cabinet" that is chaired by the Secretary of MDNR, meets monthly, and includes representatives of the state agencies that have bay programs, the university, and the governor's office.

Agriculture's Position

When questioned about what they find most distinctive about Maryland's philosophy to improve the bay, many observers first point to leadership by the state's Department of Agriculture. During the past decade, research scientists have found, with increasing certainty and accuracy, that agricultural practices contribute significantly to nutrient pollution of bay waters. But because it conflicts with their sense of themselves as land stewards, the initial response by some members of the agriculture community in Maryland was to deny the research findings.

MDA has taken the lead, however, in shaping agriculture's collective reaction to scientific findings. That position is one of (1) acceptance of responsibility for nutrient pollution, as that responsibility is determined by science; (2) burden-sharing with others in bay cleanup efforts; but (3) resistance to government regulation of agricultural operations. By their resistance, MDA and agricultural interest groups in Maryland have successfully avoided attempts in the state's General Assembly to impose nutrient management regulations.

Instead, MDA has led the argument for *voluntary* efforts by farmers to share, with the public, costs required to reduce nutrient loadings caused by agriculture. MDA's case for volunteerism and cost-sharing rests on the following five assertions:

1. Insufficient public and private resources are available for making nutrient reduction programs mandatory across all of Maryland's agricultural sector.
2. Voluntary efforts by farmers who choose to invest in BMPs imply they will be more likely to maintain those practices over time than they would if investments were mandated.
3. Each farm is unique and requires a customized system of nutrient management that is more likely to be achieved by a voluntary program than by a mandated program.
4. Education, technical assistance, and burden-sharing—rather than official rules—will promote farmer acceptance and will enhance the value of landowner stewardship.
5. Voluntary programs are more likely than mandated ones to encourage farmers to exceed what, alternatively, would be a "ceiling for action," as set by government regulation (Brodie and Powell 1995; Simpson 1997).

In Maryland the philosophy of burden-sharing—farmers with city dwellers, nonpoint sources with point sources, rural with urban people—permeates efforts to improve the bay. Efforts to create tributary nutrient reduction strategies illustrate an application of this philosophy.

Tributary Strategies Philosophy

Following the Executive Council Agreement of 1992 to create tributary strategies, the State of Maryland identified 10 discrete geographic areas in the state's bay watershed and determined the nutrient loadings in each. (See Figure A.) The ten areas include two single river watersheds—the Choptank and the Patuxent; one dual river watershed—the Patapsco-Back; three portions of a single river—the Upper, Middle, and Lower Potomac; and four multiple river/creek areas—the Upper and Lower Eastern Shore, and the Upper and Lower Western Shore tributary regions.

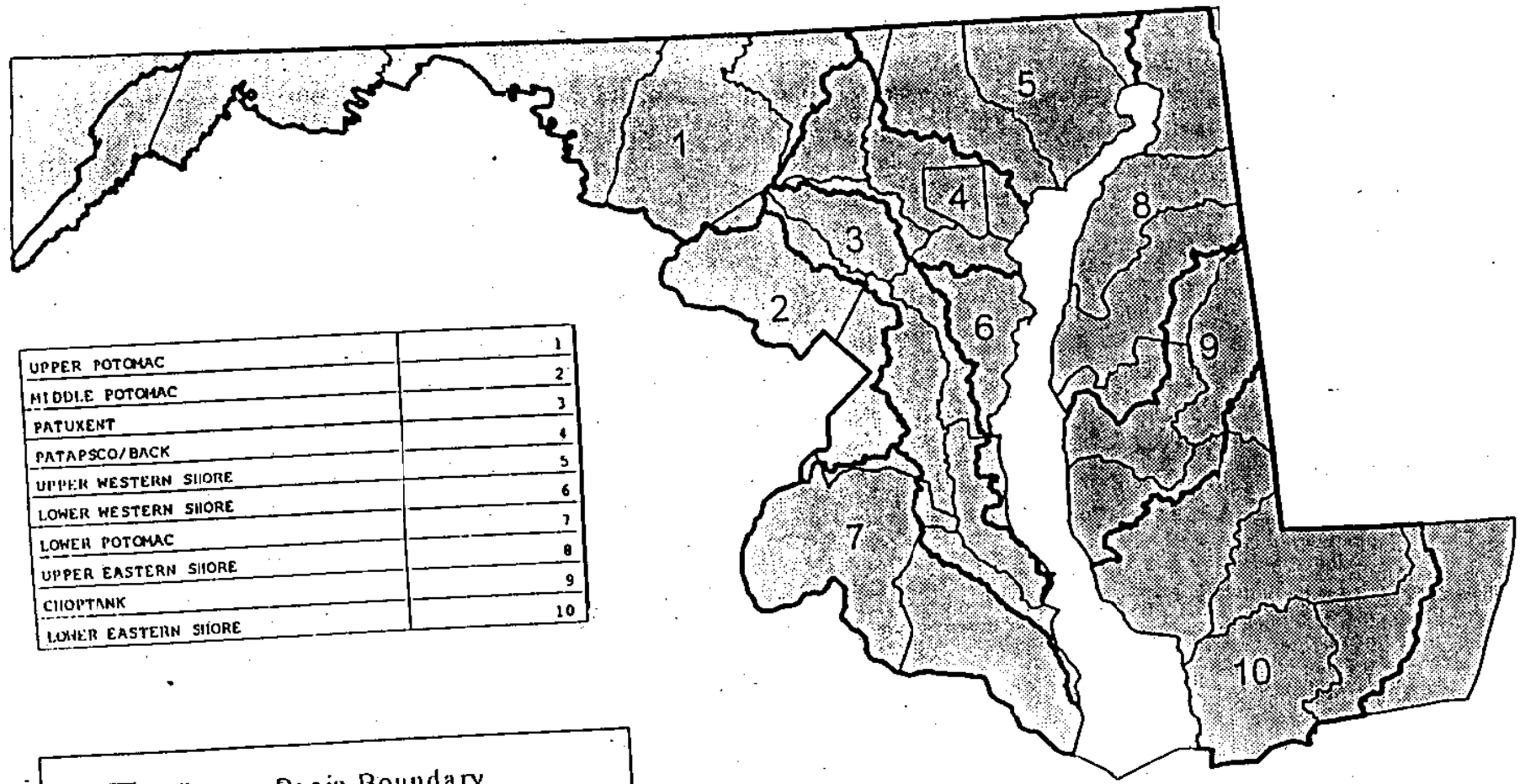
In 1993, leaders of state agencies and governor's aides established a requirement, as the means to reach the state's 40 percent reduction goal, that every tributary area would have the *same* 40 percent goal. As a more cost-effective means to reach Maryland's goal, the state could have targeted some watersheds for more than a 40 percent reduction and some for less. But instead, the state decided (1) an equal reduction goal provides a common and apparently fair method to share the burdens of reducing nutrient loadings; and (2) an equal goal spreads the benefits of any habitat improvements that will result from nutrient reductions.

Progress to Date

In May of 1996 Maryland officials presented a

Figure A

Maryland's Tributary Strategy Basins



report on the state's bay efforts to the Chesapeake Bay Commission (Wenzel 1996a). Highlights of that presentation reveal that during the previous ten years Maryland had:

- created nutrient management plans for 735,000 acres—60 percent of the state's goal
- installed biological nutrient removal (BNR) in 18 wastewater treatment plants and developed agreements with local governments to install BNR in 75 percent of all remaining plants
- placed marine pumpout stations at 126 boat marinas, approximately one-third of the state's total
- reduced nutrients and created wildlife habitat by planting more than 2,500 acres of riparian forests and 55 acres of shoreline fringe marsh.

In summary, state officials reported that Maryland has put into place a set of nutrient reduction programs that will, when fully implemented, achieve the 40 percent goal. They estimated that practices that have been implemented to date will, over time, reduce phosphorus loadings by 38 percent and nitrogen loadings by 23 percent. At the time of the report, federal, state, and local spending on nutrient reduction strategies totaled slightly more than $100 million per year. Progress to reach the 40 percent goal, officials said, depended on continued public support for expenditures of similar amounts to the year 2000.

Core Nonpoint Source Programs

Maryland state and local leaders jointly designed a set of program strategies—both point and nonpoint source—to achieve the state's 40 percent reduction goal. Table 2 contains a summary list of the 34 core strategies, in four categories (Adapted from State of Maryland 1995).

The state designed the strategies through a process of collaborative policy making called "Tributary Strategies Development" and created a new institution to perpetuate the process—the "Maryland Tributary Teams." Tributary Strategies Development and Teams are the subjects of a case study in this report. First, however, core nonpoint source programs for agricultural land, developed land, and resource protection and watershed planning are explained.

Agricultural Land

Options to reduce nutrient loadings from crop and pasture land, which at 1.9 million acres is two-thirds of Maryland's total agricultural land, rest primarily on expanded and accelerated implementation of soil conservation and water quality plans; nutrient management plans; cover crops; conservation tillage; and treatments of lands with high erosion potential. The state will rely also on improved stream crossings; remote watering facilities; additional stream fencing; and more vegetative buffers (State of Maryland 1995). As shown in Table 2, agricultural programs are expected to reduce nitrogen loadings by 6.85 million pounds—35.3 percent of the total, and to reduce phosphorus by .58 million pounds—54.9 percent of the total.

Maryland's Nutrient Management Program. Although they are but two among 15 options for reducing nutrient loads from Maryland's agricultural lands, nutrient management of chemical fertilizers and organic wastes are expected to contribute about 13 percent of the load reductions in nitrogen and phosphorus required to meet the state's 40 percent goal. To accomplish that goal, Maryland intends to increase nutrient management plans on cropland from 39 percent of cropland in 1995 to 60 percent by 2000 (Lawrence 1997).

Maryland initiated its Nutrient Management Program in 1989. The program encourages farmers to reduce water pollution by adopting plans that balance nutrient inputs with crop requirements. Plans utilize a set of BMPs. University of Maryland Cooperative Extension Service (MCES) staff and, since 1992, private nutrient management consultants, who provide certified planning advice. Data through 1995 indicate plans had been provided for 736,000 acres, about 60 percent of the goal for the year 2000 (Steinhilber 1996). A survey of 135 animal producers who had received nutrient management plans from MCES between 1990 and 1993 revealed 43 percent of the respondents said they had implemented the plans on their entire farm. Another 71 percent said they had implemented plans on at least 50 percent of their farm (Steinhilber 1996).

MACS. To promote improved management practices on agricultural land, the Maryland Department of Agriculture administers the Maryland Agricultural Cost-Share (MACS) Program. Begun in 1983 and funded by the state—with support from the U.S. Environmental Protection Agency (EPA)—MACS provides financial assistance of from 50 to 87.5 percent of installation costs for conservation practices (Supervisors' Handbook 1995). In FY 1996 capital budget funds for MACS

Table 2
Maryland's 40 Percent Nutrient Reduction Strategies

Programs	Unit	Coverage	Load Reductions N (lbs/yr)	P (lbs/yr)
Wastewater Treatmnt Plants	# of			
Biological & Chemical Removal	plants	47	11,409,300	252,700
Developed Land				
Erosion & Sed. Control	acres	19,272	37,041	21,909
Enhan. Stormwater Mgmt.	acres	134,901	333,226	35,284
Stormwater Retrofits	acres	7,554	18,614	2,028
Stormwater Conversion	acres	3,426	8,403	935
Septic Pumping	systems	3,269	3,962	0
Septic Denitrif.	systems	101	1,215	0
Septic Connections	systems	5,946	75,357	0
Urban Nutrient Mgmt.	acres	49,818	34,973	0
Cluster New Devel.	acres	1,920	5,760	768
SUBTOTAL			518,551	60,156
Ag Land				
SC/WQ Plan Implem.	acres	468,377	659,556	86,620
Conserv. Tillage	acres	339,805	1,385,902	133,881
Treat H. Erod Land	acres	186,511	333,875	85,158
Retire H. Erod Land	acres	5,941	58,587	7,895
Anim. Waste Mgmt.-Lvstk.	systems	637	338,550	66,537
Anim. Waste Mgmt.-Poult.	systems	392	82,352	16,434
Runoff Control	acres	566	38,025	7,770
Stream Protec. Fencing	acres	2,668	7,847	335
Stream Protection	acres	6,656	8,780	605
Nutrient Mgmt. Frtlzr.	acres	766,849	1,987,773	106,450
Nutrient Mgmt. Organic	acres	100,052	535,782	34,602
Cover Crops w/ N. Mgmt.	acres	150,698	1,218,976	32,611
Cover Crops w/o N. Mgmt.	acres	16,500	196,350	3,300
Horse Pasture Mgmt.	acres	23	*	*
Presideress Test	acres	1,679	*	*
SUBTOTAL			6,852,355	582,198
Resource Protect & Watershed Planning				
Buffers				
Forested	acres	3,204	61,910	8,492
Grassed	acres	4,173	73,745	9,866
Str. Shore Erosion Ctr.	linear ft.	37,782	38,312	25,186
Nonstr S.E.Control	linear ft.	76,810	59,327	39,240
Forest Conserv.	acres	18,333	196,002	23,175
Tree Planting	acres	10,290	21,154	3,919
Forest Hrvstg. Pr.	acres	19,530	54,587	35,859
Marine Pumpouts	marinas	164	99,490	22,072
Pumpout Education	boaters	30,535	*	*
SUBTOTAL			604,527	167,809
TOTAL REDUCTIONS (millions lbs/yr)			19.39	1.06

* Loading reduction rates have not been quantified.

amounted to $5.4 million, an increase of $1.2 million from FY 1995. The MDA operating budget for MACS in FY 1996 was $383,000 (Lawrence 1997).

According to administrative regulations, MACS offers financial assistance to a maximum of $10,000 per practice and $35,000 per farm. An exception is made for farms receiving assistance for animal waste storage; they may receive up to $50,000 for this practice and up to $65,000 for the farm (Supervisors' Handbook 1995; Simpson 1997). Twenty-seven practices qualify as eligible for MACS funds, including various structures and agronomic practices. Funding depends on two criteria: first, and most important, that the existing condition critically affects water pollution; and second, that the farm is located in a priority watershed. Some funds are available for farms not located in priority areas.

The most recent figures published by MDA (1996) show that from July 1, 1983, to June 30, 1995, $29.9 million in MACS funds had been paid to the state's farmers. These funds supported the completion of 5,788 projects.

The environmental and economic consequences of agricultural conservation cost-share programs like MACS are not fully understood. For example, Abdalla (1996) summarized evidence found in research literature on agricultural cost-sharing and found it incomplete. Abdalla suggested additional research be conducted to answer these questions:

1. What incentives exist to motivate farmers, particularly operators of smaller farms, to utilize knowledge and adopt technologies for protecting soil and water quality?
2. Given varying local social and economic situations, what mix of policies and programs—cost-sharing programs included—will maximize pollution reduction in various situations?
3. Assuming that a BMP's profitability, not its reduction in environmental degradation, is the most important factor affecting its rate of adoption by farmers, to what extent are pollution reductions that result from cost-share programs offset by production expansions resulting from increased profitability?
4. Assuming, as preliminary evidence indicates, that larger farms are more likely to adopt BMPs via cost-sharing than smaller farms, and if communities value the preservation of small scale farms, what mix of cost-share and other programs will best accomplish the dual objectives of preserving small farms while reducing the pollution they cause?

Developed Land

The State of Maryland uses nine strategies, as shown in Table 2, to reduce nonpoint source nutrient loadings from developed land (State of Maryland 1995). Within the state's 40 percent strategy those nine are expected to reduce nitrogen loadings by .52 million pounds—2.7 percent of the total, and phosphorus loadings by .06 million pounds—5.7 percent of the total. As the state's population grows, developed land options will take on greater significance. But the underlying problem is one of land use.

In early 1997, Governor Glendening introduced a set of legislative proposals into the 1997 session of the Maryland General Assembly to manage the state's urban growth—particularly the location of residential and business development. The proposals contained implications, among others, for environmental quality. Land-use control policy debates in Maryland, as was the case when the Bay Preservation Act was debated in Virginia, raise issues of balance between public vs. private rights and state vs. local government authority. Conflicts also emerged about the governor's proposal between developed jurisdictions—cities and urbanized counties, which were favored for state infrastructure spending in the proposal—and rural and urbanizing counties, which were not. In the closing hours of the 1997 session, the General Assembly enacted an amended version of the governor's proposal that weakened some provisions, but preserved the core principle of directing growth by means of targeting state spending for physical infrastructure.

Undoubtedly, however, the growth issue will emerge again and become increasingly important in Maryland and the other Chesapeake Bay states. This prediction is possible because of dynamic interrelationships among bay improvements, population, and land use.

To consider these relationships, first assume bay cleanup efforts in the basin do succeed in improving water quality. Such improvements would make the region a more attractive place to work and live, other things being equal. But the cost of maintaining nutrient loadings at the 60 percent cap, under conditions of increasing populations and current land use practices, would, ceteris paribus, grow over time. In the absence of new, more efficient

technologies to reduce nutrient loadings, the more the cleanup succeeds, the more costly it would become.

In this scenario, basin residents would be caught in a social trap—paying increasing amounts of resources just to remain at the same level of water quality. Other than through the use of new technologies, the only possible exit from the trap is to change where and how people live—their use of land. Examinations of how to get out of the trap will thus become more frequent and important, if no less controversial. Citizens and public officials in Maryland, Pennsylvania, and Virginia will be challenged to find new land use and economic growth policies that are effective, acceptable, economical, and equitable.

Resource Protection and Watershed Planning

The third leg of Maryland's nonpoint source strategy is a set of 11 programs in forest, wetlands, and other resource protection and watershed planning options. As shown in Table 2, the load reductions from this set of programs are projected at .60 million pounds of nitrogen—3.1 percent of the total and .17 million pounds of phosphorus—15.8 percent of the total.

Among the resource protection options, the State of Maryland has made a priority of planting streamside forested buffers and protecting existing buffers on agricultural and developed lands. At the Fall 1996 meeting of the Executive Council, the principals signed a document pledging themselves to add 2,010 additional miles of riparian forest buffers by the year 2010. Governor Glendening, speaking for the State of Maryland, pledged to exceed his state's portion of the total riparian miles by adding 600 miles of forest buffers by 2010.

For many months prior to the meeting, Chesapeake Bay Program scientists, farmers, developers, and representatives of local governments and the forest industry struggled to write a mutually acceptable riparian buffer policy. Uncertainty about what policy the principals would endorse persisted until the final hours before the meeting. A major issue leading up to the meeting was whether the policy should be to create *forested* buffers, as it eventually did, or *vegetative* buffers. Landowners, particularly farmers, argue that although trees make good buffers, so do grasses and other vegetation; trees remove more land from agricultural uses than do vegetative buffers. The principals signed the riparian forest buffer policy at their 1996 meeting, but farmers' dissatisfaction over Maryland's buffer strategy persists into 1997.

Tributary Strategies and Teams

Following the 1992 agreement by the Executive Council to create tributary strategies, Maryland state agencies formed a "Bay Work Group" to create watershed-based plans (Wenzel, Banting & Lucid 1996). Staff from the governor's office, the Departments of Agriculture, Environment, and Natural Resources, the Office of State Planning, and the University of Maryland formed the group and led the effort.

Strategies and Options

The work group first divided Maryland's bay watershed into the ten tributary basins shown on Map A and applied the 40 percent reduction goal to all ten tributaries. Then they described existing pollution loads, sources of pollutants, land uses, and fish and wildlife populations in the ten areas.

In 1993 and 1994 the group conducted technical analyses and public meetings with private stakeholder organizations and local public officials. These activities provided the means to identify and analyze likely consequences of options for nutrient reduction. The analyses and meetings yielded information on monetary costs, nutrient reduction benefits, and technical and political feasibility. From that knowledge base, the group drafted an overall strategy, chose the strategies shown in Table 2, and developed sub-strategy options for each of the ten tributary areas.

Tributary Teams

As part of the process for developing strategies, MDA and university staff invited farmers, local government representatives, representatives of farm organizations and agribusiness firms, environmentalists, conservation district staff, and agricultural extension educators to form "agricultural tributary teams." The teams were provided information on the costs, benefits, and feasibility of reducing nutrient loadings from agriculture lands. Then they identified which actions they believed farmers would willingly take to help meet the 40 percent goal. Team meetings also educated people about the contributions of farming to nutrient loadings and built political support among farmers for participation in nutrient reduction efforts.

Environmental staff from the governor's office

were hoping, at the time, that the process of creating tributary strategies could result in greater involvement and an increased "sense of ownership" of bay cleanup policy and programs among citizens, local governments, and grassroots organizations and interest groups. Thus the governor's aides supported the creation of agricultural tributary teams and decided to create ten similar, but broader-based, permanent "Maryland Tributary Teams"—one for each of the tributary areas. To implement their decision they first requested the assistance of state agencies and the state's 23 county governments. But initial efforts to establish the teams met with resistance.

Some state government officials were reluctant to accept local governments as equal partners in the initiative because they believed local officials lacked commitment to the state's pledge to reduce nutrients. On the other side of the issue, some local government officials were suspicious that state government agencies would use tributary teams as "Trojan Horses" to deceive them into accepting unfunded mandates or state regulations. It took several months for the governor's aides to convince both sides that the initiative was conceived in good faith as a true partnership.

Obtaining the involvement of environmental and business groups also proved more of a challenge than expected. Environmentalists were accustomed to working at the state government level and were reluctant to divide their attention and resources among multiple, regional teams. Business groups were likewise reluctant to becoming involved as team members, apparently because they sensed no immediate threats to nor advantages for their firms. In spite of apathy and resistance, the governor's aides and other state and local officials in the work group continued to seek private sector involvement on the teams.

In 1994 the work group issued a statewide call for volunteers to serve as team members. Afterwards, they gathered the names of self-nominees into ten lists—corresponding to the tributary areas; recruited additional people to provide balance among interests and occupations; sent the lists to county elected officials for review, comment, and approval; and, finally, submitted the revised lists to the governor for his review. Governor Glendening and elected county government officials appointed the Maryland Tributary Teams in mid-1995, and the teams have been meeting since September of that year.

Each of the ten teams includes 25 to 35 people, the majority of whom were self-nominated. The teams include concerned citizens; people with agricultural, business, and environmental interests; staff from local and state governments; and staff from federal facilities contained in their watersheds. Typically, about five to ten additional nonmember volunteers attend meetings on a regular basis. The teams' general charge, as presented in members' appointment papers, is to:

- ensure that implementation of the state's programs to reach the 40 percent goal "proceeds on schedule in a fair and equitable manner"
- coordinate "participation among citizens, government agencies, and other interested parties"
- promote "an understanding of Tributary Strategy goals and the actions needed to achieve them through public education" (Wenzel, Banting & Lucid 1996).

The Bay Work Group had decided also that Tributary Teams would have the option of reworking sub-strategy options to meet the 40 percent goal—if their reworking of strategies maintained the total nutrient reduction within the 40 percent target.

To coordinate efforts between the Maryland state government and the teams, four state agencies and the University of Maryland each provide employees, on a part-time basis, called Lead State Agency Contacts, to meet with and assist teams. The state also provides two full-time people, called Team Coordinators, to staff day-to-day operations of the teams. A Tributary Teams Interagency Group, made up of the all state government staff who assist the teams, gathers monthly to coordinate efforts.

During their first year of existence, tributary teams pursued a somewhat common agenda. Team members accepted official appointment by the governor; discussed their mission; conducted team-building exercises; received presentations by experts on the state's bay strategy and options; selected chairpersons from among their members; divided into workgroups to develop plans for education, agriculture, point source pollution, and urban nonpoint source pollution; developed an annual report; and developed grant proposals in response to the state's offer of financial support for their activities.

Team chairpersons met twice during 1996 to

compare notes on their activities and intentions. Afterwards they reported on their discussions to the governor's Bay Cabinet. Local government representatives on the teams also met twice with state staff to compare notes and to discuss teams' progress.

Survey. In a mail survey sponsored by the Interagency Group in mid-1996, tributary team members indicated how their teams were doing (Favero 1997). Sixty percent of members responded to the survey, with answers to questions about quality of relationships among members of their teams, among teams, and between their teams and the broader community. Large majorities of respondents agreed the teams had formed well, developed high levels of mutual trust, had open relationships, and held effective meetings. Another strong majority expressed an interest in meeting people from other teams to share information about how to be effective.

One answer, however, surprised and concerned people in the Bay Work Group and Interagency Group. Forty-four percent of respondents expressed their disbelief that the teams would have significant impacts on water quality in their tributary areas. Such skepticism, while disturbing, should be placed in context. When the survey was administered, after ten months of meetings, the teams were only beginning to develop action agendas. At that time, team members would likely have been less certain about *how* to take action, relative to later, once their actions agendas were set. Another survey would be needed to measure and compare how skeptical team members now are.

First Annual Reports. When their first year ended in September 1996, tributary teams began preparing annual reports. They were asked to report on their activities and accomplishments, on what they had learned, and on what their priorities are for 1997. By the end of 1996 three teams—the Choptank River, Upper Eastern Shore, and Upper Western Shore Teams—had put their annual reports in final form for publication by the state (Tributary Team Annual Reports 1996). The three reports indicate that while teams continue to have much in common, diversity has begun to emerge:

1. All three teams said they had spent considerable time learning about nutrient loading problems and they viewed teaching others about those problems as part of their missions. One team—Upper Eastern Shore—has begun "community outreach briefings" to educate public officials and civic groups.
2. The three teams had divided into smaller workgroups. The Choptank River Team had created three workgroups, focused on "existing agricultural practices, innovative agricultural practices, and developed lands." The Choptank Team generated a conservative and focused agenda, consisting primarily of intentions to examine issues. In contrast, the Upper Eastern Shore Team created 16 workgroups and generated more than 50 detailed recommendations for actions by the state government, local governments, and private groups.
3. The three Eastern Shore Teams—Choptank River, Lower Eastern Shore, and Upper Eastern Shore—united to discuss a state government proposal to eliminate cover crops from the MACS program because of funding constraints. The three consulted technical experts on the issue and formed a Cover Crops Task Force to investigate the need for state cost share for such crops.

By evidence of its report, the Upper Eastern Shore Team has been very active. But the cover letter to that team's report, written by Chairman Raymond Forney, reveals uncertainties about his team's role in relation to the state strategy for improving water quality in the region. In the letter, Forney asks, are we "...to take the strategy, as written by [the state government], as gospel and try to make it happen? Or should we be reviewing and rewriting the strategy based on our own perspectives? How are we supposed to get anything done - will we have a budget or any spending authority, or any influence over policy or legislation or regulation? Is this public/private partnership just a prelude to regulation (Forney 1996)?"

The questions Forney poses are fundamental. Moreover, conversations with other team leaders and members reveal that similar uncertainties are held by others. In early 1997, some team leaders and members seem unclear about the mission of the teams.

Proposals for 319 Grants. Forney's question about resources was partially answered by the Maryland state government when, in mid-1996, it issued a request for proposals from the Maryland Tributary Teams; by this means the state offered to allocate Section 319 Clean Water Act funds to the teams . Projects will be funded for one year, one time only, and each team is restricted to a maxi-

mum of three proposals. The state created two grant categories, the first for funds up to $4,000. This category allows all ten teams, assuming they develop reasonable proposals, to receive a small grant. The second, and implicitly more competitive category, is for proposals of more than $4,000. The timeline for awarding grants began with a state government review of proposals in January 1997, an EPA review in February, an award in March, and funds available in April 1997.

A draft summary of project awards, dated March 28, 1997, reveals an allocation of $377,587 for 29 projects—an average of about $13,000 per grant. Grants went to a variety of education projects—such as programs for horse owners, homeowner associations, and students—and projects with a technical focus—such as an assessment of stream restoration alternatives, and an analysis of stormwater infiltration facilities.

First Annual Meeting. Using ideas provided by tributary team members, state staff, and the mail survey, Interagency Workgroup members designed a first annual meeting of Maryland's Tributary Teams for January 11, 1997. The agenda included the following:

- eight workshops taught by technical experts on issues such as riparian forest buffers, stormwater utilities, and urban nutrient management
- eight workshops designed to build skills for team activities like working with the media, building community involvement, and writing successful grant proposals
- nine information exchange sessions for team members to share ideas about point source water pollution, animal waste management, stream protection, and other topics of common interest

Governor Glendening was the keynote speaker for the annual meeting. He talked about new initiatives for growth management and the importance of Maryland's Tributary Teams for the state's Bay Program. In addition to his public comments, the governor held a private meeting with team chairs wherein he discussed their needs and offered his support.

Strengths and Weaknesses. By late 1996 observers of the Maryland Tributary Teams—Interagency Group Members and others who work with the teams—noted the teams were operating with several strengths. First, because the teams represent many stakeholder groups—organized and unorganized, public and private, state and local, and multiple county—they bring fresh, varied, and particular information into the bay cleanup effort. The diversity of members also suggests that teams have the capacity to provide a neutral setting for multijurisdictional discussions, problem identification, and consensus building across groups.

As to weaknesses, observers first noted what Chairman Forney's letter plainly expresses: team members are not completely clear about what the teams' roles and mission are. Some team members believe they should only provide advice on the nutrient reduction strategies, while others want to initiate local actions to reduce nutrient pollution. To some observers this lack of clarity about role and mission is problematic. Others, however, believe that roles and missions will evolve in due time as teams go about their business and that the end result will be more clarity, and probably more diversity. Some observers, but not all, add that teams are weakened by their lack of authority and suggest the state should grant official powers to teams.

Another concern about weakness, common to many observers, is that teams lack resources—particularly funds and time—relative to the tasks they want to pursue. At the annual conference Governor Glendening responded to this concern by pledging more staff help from the state by the appointment of a third Team Coordinator. Finally, some observers note that membership balance has shifted. They believe there are now too many government employees and too few private sector people serving on tributary teams.

Opportunities and Threats. People's perceptions of opportunities and threats for tributary teams are based on their sense of probabilities—that the teams *may* succeed in doing A or B, and that teams *may* be vulnerable to C or D. In the opinion of those who work with the tributary teams, many opportunities exist. The teams are thought to have the potential for:

- building local support to reduce nutrients
- reflecting local tastes, preferences, and issues in the bay policy development process
- helping coordinate government actions across jurisdictional boundaries
- providing neutral locations for policy development
- attracting additional funding for bay cleanup efforts

But observers also perceive threats to the teams. There are risks, they note, that team members could lose interest because of frustration and discouragement with the slow pace of accomplishments, that teams could become unable to accomplish their tasks because of internal divisiveness or a lack of political skills, and that teams could lose external resources or have insufficient external support to accomplish their goals. Observers also suggest that local governments or state agencies might ignore, block, or misuse the teams if they become too independent or too critical of official policies.

Issues, Alternatives, and Consequences. Maryland state and county governments have, by their appointment and support of the tributary teams, created a unique institution for improving water quality. Counties have assigned members to the teams; the state government has made a large allocation of resources for staff support, has strongly encouraged the teams through the words of the governor and the Bay Cabinet, and has allocated $200,000 in grant monies for the teams. In the future, people responsible for the teams will make choices about three fundamental issues:

1. Should the state government take the initiative to clarify teams' role and mission?
2. What should be done about the changing mix of participants?
3. Should teams be public policy advocates?

Should the State Clarify Teams' Role and Mission? Some interagency group members and others believe teams are weakened by the absence of clear roles and mission. Chairman Forney's letter to the governor asking basic questions about his team's role reinforces this view. But not all state employees who assist tributary teams agree that the state should initiate such an effort. Some are reluctant to impose roles on the teams now, since teams have formed and functioned for more than a year; some also believe a formal examination of roles and mission at this time may signal indecision about state government intentions for teams. Those who advocate a hands-off approach expect teams to create clearer, albeit varied, understandings over time about their roles and mission; and some see a risk that any state government initiative will truncate that evolution. Those who resist writing team roles and mission prefer to continue the existing course—supporting teams and encouraging them to learn by doing.

The alternative is to initiate a process to clarify team roles, probably by writing a "charter" document to state the institutional form of tributary teams. A charter need not be imposed on teams. It could be coauthored by a group of team members, with staff support from local and state government representatives. But that approach involves, for state officials, taking a risk on what the team members would write.

Writing a *viable* charter would not be an easy task. It would need to strike an acceptable and effective balance between tributary team independence and state and local government expectations. For example, it would need to answer questions such as the following:

1. What is the length of term for existing members?
2. Who can remove members and for what reasons?
3. What process will be used to replace members who retire or who are removed from the teams?
4. What may the teams change with respect to state strategies for water quality improvements in their tributaries?
5. May teams take official positions that conflict with the policies of state agencies or local units of government?
6. Should teams have any official authority?

What are the likely consequences of these two alternatives? It seems improbable that after more than a year's experience teams will evolve quickly, in the next year or two, to create clear missions and roles. Without a charter document, more likely the teams will spend more time deciding what they should do, trying some things that work and others that don't, losing members who take with them their institutional memories, taking in new members who must relearn their roles by trial and error, observing other teams, sharing information about roles, and slowly becoming more effective. Questions and conflicts about roles that would need to be answered in a charter document would emerge from time-to-time. The bottom-line question to this approach seems to be, Will those who are investing significant resources to support the teams be willing to accept progress at that pace and level?

If a writing group could achieve an acceptable and effective balance between team freedom and state and local government expectations, it seems unlikely that team members would view this effort

as a signal of state indecision. Rather, it seems more likely that they would welcome the opportunity, at this time, to clarify what teams can and should do. But again, writing an acceptable and effective charter would be a challenge.

What roles might a charter define for tributary teams? In the Fall of 1996, the Interagency Group began a discussion, as yet uncompleted, to examine possible roles for teams. Lauren Wenzel, Interagency Group Chair, prepared a list of possible roles suggested by various people (Wenzel 1996b). The list includes the following options and examples:

1. Act as a network for a broad set of constituencies. For example, represent the agricultural community in reviewing a draft of Maryland's Riparian Buffer Policy.
2. Use team diversity as a strength. For example, come to a consensus on an issue, then use the teams' diversity as a base for building political and community support.
3. Educate local communities about nutrient problems and solutions. For example, hold a workshop on BayScaping, or talk to a Rotary Club about what individuals can do to prevent nutrient pollution.
4. Implement specific nutrient reduction projects. For example, arrange for aerial seeding of cover crops or local tree planting projects.
5. Make recommendations to (lobby) all levels of government to support nutrient reduction efforts. For example, write a letter to EPA to urge a workable solution to the Blue Plains wastewater treatment plant permit.
6. Undertake necessary followup actions to ensure that recommendations are implemented. For example, after recommending nutrient reduction measures on federal military bases, meet with decision makers to identify ways to assist their efforts.
7. Influence state and local government budget priorities. For example, write letters to decision makers in support of additional agricultural technical assistance staff.
8. Identify alternative funding sources, such as private grants or innovative approaches. For example, write a grant to a private foundation to support a horse pasture management program.

One could add to this list the role of rewriting strategies for tributaries, within the 40 percent goal.

What Should Be Done About the Mix of Team Members? Unfortunately, incentives for individuals to devote time to any of these team roles are not strong. Government employee members of teams may view their appointment as part of their jobs, but attending monthly evening meetings, plus providing additional efforts for team activities, are likely to take from members' personal time. Nongovernment individuals have higher opportunity costs; when engaging in team business, they must give up other uses of their time. For some nongovernment members, like retirees, the costs for giving time to teams may be relatively low; but for others, like people with business responsibilities, time away from their own work would have a relatively high cost.

What advantages do members obtain for their participation? The benefits of nutrient reduction for team members are lessened by the facts that they are difficult to obtain, mostly in the future, and located primarily downstream in the bay, rather than upstream in the tributaries. Also, those benefits will be available to all who access and use the products of a cleaner bay whether or not they contributed resources to tributary teams or to other cleanup efforts. Some financial advantages to team membership may be possible to two private groups—farmers and private developers—both of whom want to protect their incomes from nutrient reduction policies that would impose regulatory costs. But for developers, none of the strategies being pursued creates a threat to their business. Farmers do have an interest in shaping cost-share opportunities for the installation of BMPs. But for most people, there are few tangible personal advantages to team membership.

The incentive problem probably explains the observation that the balance between private and public sector team members is shifting toward too many government, too few private sector people. It also lends credence to observers' concerns that the teams are at risk of losing members and energy over time. How might these concerns be answered and the incentive problem solved?

One option, already being employed by the state government, is to encourage a sense of community among team members about protecting the bay. Through certificates of gubernatorial appointment, meetings with Bay Cabinet members, publication of team reports, assistance by state employees, and an annual meeting addressed by the governor, the state government is sending a message that work

on tributary teams is important for the bay and much appreciated by Maryland's citizens. But, while necessary, this strategy may be insufficient to keep team members engaged and active.

Another option for increasing incentives for team participation and effort is to encourage teams to shift a portion of their attention towards local, upstream environmental issues such as drinking water quality, wildlife habitat, and perhaps, urban sprawl. This shift of attention would increase incentives for members to participate in team activities because it would make the potential benefits of team efforts more obvious and more localized for the enjoyment of team members and their families, friends, and neighbors.

Should Teams Become Policy Advocates? The state government could also hope to promote increased activity and energy in teams by encouraging teams to advocate public policy positions. Advocacy is attractive too, because it holds out the potential for promoting government policies and programs that assist the bay. But, unless advocacy is based on a strong consensus within teams, there are risks associated with this option. The teams were designed to span diverse groups interested in water quality issues, and they include government representatives whose employers may be the object of advocacy. Thus encouraging teams to take advocacy positions, without emphasizing the need for team consensus as its basis, risks internal dissention and the alienation of team members.

Public policy advocacy is explicit or implied in several of the eight roles for teams listed above. For example, the first role, representing an interest group position in a policy consideration, risks alienating team members who hold different positions. Likewise, the third role—educating communities, the fourth—implementing projects, and the eighth—obtaining grants, will avoid alienating some team members only if there is a consensus on a team that what they seek to teach, implement, or fund is right. The fifth and seventh roles, lobbying governments and influencing budget priorities, also imply a need for consensus; without such agreements, those roles may put team members who are representatives of governments that are being lobbied and influenced in untenable positions. Although the transaction costs associated with reaching consensus positions about controversial water-quality issues--costs of time and energy. spent in discussion, deliberation, and debate—are undoubtedly high, such agreements would undergird team actions to educate, undertake projects, seek grants, lobby governments, and influence budget priorities.

An alternative to advocacy is to emphasize the second role on the list—using team diversity as a strength. By taking this role, teams could create "neutral spaces" for themselves and for community members to examine water-quality issues; explore policy alternatives and their likely consequences; inform decision makers; and perhaps, reach consensus positions within teams and, if possible, among citizens in their tributaries about what should be done. In undertaking this role, team members need not all agree on how to solve a public issues; all that is required is an agreement within teams that policy decisions should be well informed and that teams can assist information exchanges. Through this option of using team diversity as a strength—a vision of tributary teams as neutral ground for examining water quality issues—teams could associate with local stream and river associations, open space advocates, and with organizations like county Farm Bureaus, realtor associations, and other interest groups without advocating for any particular group nor risking the alienation of some team members. Teams have begun initiating workshops on controversial public issues related to nutrient reductions. In the Spring of 1997, two teams sponsored a meeting, attended by several dozen farmers and environmentalists, about riparian forest buffers. Two other teams sponsored a meeting on financing stormwater systems. And another team is planning a workshop—for developers and public officials—on erosion and sediment control policies.

At this time in our nation's history individuals and groups are cynical about political dialogue and quick to take strident, adverse positions on community issues. Maryland's Tributary Teams offer an institutional alternative to cynicism and adversity. By providing a neutral setting for dialogues about water quality issues, they may be able to assist more reasoned and informed public policy decisions.

Conclusions. Several lessons emerge from Maryland's effort to create watershed-based, multistakeholder teams. First, this is a difficult job. Given Maryland's experience other states can expect some resistance by state and local officials and by interest groups; apathy among those interest groups that do not feel threatened; ambivalence about the mission of the teams; and some incentive problems

in keeping members involved and active over the long run. But given emerging public issues—nonpoint source, land use, and public cynicism about government—building grassroots organizations seems increasingly valuable.

5. How to Analyze Nonpoint Source Water Pollution

The framework "situation-institutions-behavior-performance" guided the collection of data about nonpoint source policies in the signatory states. That same framework provides an analytic lens that, when used to view the descriptions of state programs and the three case studies, suggests meanings, implications, and criteria for judging the value of such policies.

Situation

The signatory states are developing water quality policies in reaction to a common public issue—nonpoint source nutrient pollution. Examination of the states' activities provided many details about the issue. The concept **situation** helps sort and give meaning to these details.

For every public issue, there is a situation—a set of characteristics that explains people's interdependence. Nonpoint source nutrient pollution is no different. Maryland, Pennsylvania, and Virginia are working on an issue with both physical and social characteristics.

Physical Characteristics

Nonpoint source nutrient water pollution shares some physical characteristics with other nonpoint source environmental issues (Braden & Segerson 1993; Shortle and Abler ND), but also involves unique characteristics of nutrient water pollution. In general, the three states are forced to accept the physical characteristics as unalterable givens and must tailor their policy efforts to those givens. The first one is site variability.

Site Variability. Nutrient pollution processes will vary across the basin because of site-by-site differences in topography, soil qualities, surface and groundwater flows, flooding potential, and climate. Related to site variability is an upstream-downstream difference; upstream waters, because they are more turbulent, are less susceptible to nutrient-related damage than are downstream, more stationary waters.

Costly or Infeasible Monitoring of Pollution Sources. To observe nonpoint source nutrient emissions at their sources is costly because the sources are, by definition, diffuse. Moreover, attempting to trace the specific origin of nutrients, by sampling water downstream, is technically infeasible because nutrients from multiple sources mix and interact. A third option for monitoring sources—assuming causation between fertilizer purchases by individual homeowners and farmers and nutrient emissions—is not valid; emissions of nutrients are not necessarily correlated with fertilizer purchases because the timing and techniques of fertilizer use—the when and where of nutrient applications—critically affect levels of emissions.

Time Considerations. Permanent improvements to water quality in the bay, through reduced nutrient loadings, require continuous rather than one-time-only changes in human behavior and techniques. Moreover, water quality improvements are likely to lag, for long periods of time, behavioral and technical changes. Lag effects occur because (1) most nitrogen flowing to the bay moves down through the ground and then slowly, as measured by years or decades, through aquifers until it reaches surface waters; and (2) phosphorus tends to bind with soil and generally becomes part of streambed sediments until it is scoured away by random storm events.

Social Characteristics

As with the physical side of the situation, several social characteristics attend nonpoint source nutrient pollution in the Chesapeake Bay Basin. The following social factors help explain people's interdependencies:

Incompatible Uses. Nutrient loadings to water in the bay basin are one use of the bay—for waste disposal. But if nutrient loadings to the bay and its

tributary waters rise above a threshold level, they will have adverse impacts on alternative uses of those waters. In effect, nutrient loadings above the threshold level make some other uses of the bay water—uses dependent on healthy living resources—incompatible. In 1987 the Chesapeake Bay Program adopted an official threshold level for nutrient loadings—60 percent of the 1985 controllable baseline loadings for nitrogen and phosphorus. The goal—to reduce nutrient loadings below the threshold by the year 2000—would make nutrient waste disposal and other uses of the bay compatible again. But because the goal would extend the 60 percent level as a cap in perpetuity, nutrient loading will continue as a public issue; those people who would use water to remove nutrient wastes and those people who value other uses of bay basin waters will remain interdependent.

Resource Users In Unique Circumstances. About fifteen million people live in the Chesapeake Bay Basin. Signs over bathroom sinks saying "The Bay Starts Here" remind us that each individual among the millions affects the bay, every day. But because the number of residents is very large, it is difficult for a single individual to realize that a change in her behavior will improve the bay.

Adding to the complexity of the situation, individuals and organizations within the basin operate in very different circumstances. For example, private businesses can be expected to use and dispose of nutrients for different reasons than will households or governments. Among individuals, circumstances differ in ways that are likely to affect the use and disposal of nutrients—people's wealth and income, amount of property owned, number of automobiles driven, and so forth.

Moreover, the owner of each parcel of land in the basin manages his property with a unique set of knowledge, values, and goals. Landowners have differing concerns about water quality issues, various understandings of the relationship of their properties' physical characteristics to nutrient loadings, and all manner of plans for the use of their land. **Thus site variability is social as well as physical.**

Uninformed Resource Users. Knowledge, or more correctly the lack thereof, further complicates the issue. Because the effects of nutrients on water quality in the bay were recently discovered, are complex, and are counterintuitive—"Aren't nutrients good?—basin residents are likely to be not well informed about the consequences of their nutrient-related behaviors on water quality.

High Exclusion Costs. It would be infeasible to exclude people from enjoying the benefits of nutrient reductions to the bay. Sport fishermen, boaters, waterside property owners, watermen, seafood consumers, and all others with an interest in improved water quality will readily share the benefits; it would be impossible to prevent that.

But beneficiaries will enjoy the improvements whether of not we have contributed to paying for them. High exclusion costs to the benefits of a cleaner bay create a free-rider condition—whereby beneficiaries will have a tendency to hope and expect that others will pay for the improvements that all can enjoy. The high exclusion costs/free rider characteristic implies that private actions to correct the nutrient pollution problem are unlikely to satisfy people's preference for a cleaner bay. Private individuals and organizations are unlikely to invest sufficient funds to satisfy the demand for a cleaner bay because they cannot sell the products their investments would create. Collective action is necessary to make those investments.

Nonetheless, government programs to reduce nutrient loadings will not be equally appreciated by everyone; some people are likely not to value, commensurate with the cost of taxes they will pay to produce, the benefits of cleaner water in the bay basin. They would prefer not to pay taxes (they are unwilling riders) for nutrient reductions. To date, public support for nutrient reductions in the signatory jurisdictions to the Bay Agreements seems strong. But as the public costs of additional reductions of nutrient loadings increase, the states will anticipate the prospect of increasing numbers of unwilling riders and will consider means to make the benefits of nutrient reductions better known and more generally shared.

Upstream-Downstream Access Differences. Although exclusion costs to the benefits of a cleaner bay are high across the basin, there are also geographic differences. Access to the living resources enhanced by nutrient reductions will be more costly for upstream residents living near turbulent water than it will be for downstream residents living nearer to or on the bay. This access cost difference introduces tension into the question of who will participate in the cleanup and who will pay for bay improvements.

Joint Impact. Assume that nutrient loadings to the bay and its tributaries have been reduced to below the threshold level. And assume, likewise, that other uses of the bay waters are somehow constrained so that depletion of living resources is not occurring. At that time, uses of the bay's resources—for nutrient disposal, fishing, and other means of enjoyment—become entirely compatible, albeit at a maintenance cost to preserve water quality. At the point of full resource compatibility, an additional person could begin using the bay without adding any cost to the resource.

But at the point of full compatibility, a source of conflict among users of the bay resources may be expected nevertheless. That source—called the joint-impact characteristic—will exist because at full compatibility, every user will have an incentive to argue that he is the one adding no cost (Johnston 1988). Who then will pay for maintaining the resource? The joint impact characteristic of a clean bay—the marginal cost of an additional user being zero—complicates the issue because it implies potential conflict over who should pay for maintaining the quality of the bay.

Policy Implications

Physical and social characteristics of nonpoint source nutrient pollution imply significant challenges for public policy makers who are intent on improving water quality in the bay basin. Lessons from Maryland, Pennsylvania, and Virginia imply that if public jurisdictions are to mount successful efforts to reduce nonpoint nutrient pollution, they must overcome several barriers:

Site Variability: Tailoring and Targeting. Physical site variability implies that nonpoint source nutrient pollution will vary over space and time. Thus decision makers are challenged to tailor and target policies that induce site- and time-specific responses (Braden & Segerson 1993). The challenge is heightened by the fact that site variability is social as well as physical; the single most important factor in determining the implementation of a policy on a specific site will likely be the preference of the landowner.

A lesson from the bay states is that well-intentioned, cost minimizing, one-size-fits-all approaches to nonpoint nutrient water pollution are inappropriate. To be effective, policy makers must be knowledgeable about the ways by which sites differ--both socially and physically—and must design policies that are flexible enough to adjust to site differences.

Cost of Enforcement: Incentives to Volunteers. Because monitoring nonpoint source pollution-related behavior is costly, policy makers are challenged to design new mechanisms that can detect and sanction noncompliance (Braden & Segerson 1993). But more practically, high costs for enforcement imply the value of policies that create **incentives for private individuals** to voluntarily comply, thereby reducing the burden of monitoring.

Education. Common ignorance about nutrient water pollution implies the value of education as a policy method--most likely in combination with other means to change behavior.

Time Considerations: Water Quality Benefits; Co-benefits; and Multiple Benefits. Long lag-times for nutrient pollution and the need for permanent—rather than one-time-only—changes in nutrient-related behavior imply the importance of designing policies that are continuous and sustainable—so as to affect nutrient loads over a long span of time. Moreover, lag times between changes in nutrient loading and improved water quality suggest identifying co-benefits of nutrient reduction and informing polluters of them and undertaking actions that create multiple benefits. For example, a co-benefit of nutrient management will almost invariably be reduced fertilizer costs to farmers and lawn and garden owners. Also an action such as riparian vegetative buffer planting can create aesthetic, wildlife habitat, property value, and increased income benefits particularly fees for hunting and fishing rights—that complement a buffer's value for nutrient reduction.

Barriers to Collective Actions. Having many resource users raises the transactions costs needed to work out solutions to nonpoint source nutrient pollution of the bay. Likewise, the presence of a free rider/unwilling rider condition, upstream-downstream access differences, and the joint-impact characteristic imply interpersonal conflicts among basin residents. In short, these characteristics are all barriers to collective actions needed to reduce nonpoint source nutrient loadings and keep them below the threshold level. The 1983 Chesapeake Bay Agreement and the Bay Program it created overcame the initial barrier to collective action for bay improvements. But as our understanding of the consequences of nutrient pollution grows and as new nonpoint source nutrient reduction policies get

considered, these characteristics will continue to raise obstacles to additional collective efforts.

Policy makers thus will be challenged to enhance the sense of community, good neighborliness, and conservation ethic across the basin. Also, by identifying and increasing upstream benefits, co-benefits of nutrient reduction, and personal benefits to landowners and others in the basin, policy makers would increase the likelihood that basin residents will accept the additional costs, over time, of reducing nutrient pollution.

Institutions

Recall that institutions are the formal and informal "rules of the game," the "humanly devised constraints that shape human interaction" (North 1990). Institutions include laws, administrative codes, customs, organizations, and traditions (Buse & Bromley 1975). Institutions have shaped, and are shaping the actions of the signatory states, as they design and implement policies to reduce nonpoint nutrient loadings. Moreover, the resultant policies themselves are institutions—new sets of rules intended to shape human behavior and thereby improve water quality in the basin.

Institutions That Shape State Actions

Among the rules of the game that are shaping state actions to reduce nonpoint nutrient pollution, three kinds of institutions are salient: private property rights, multiple political jurisdictions, and state government authorities.

Private Property Rights. The fact that individual landowners hold private property rights puts meaning into the human side of site variability. Not only do landowners have various preferences for their land, they also have a very large, although not an unlimited, influence in how their property is used.

American property rights law involves a balance of private and public interests (Wunderlich 1995). In recent years, the environmental movement has raised the consciousness of citizens about their interests in natural resource conservation, while the private property rights movement has raised people's consciousness to individual rights under the law. Each movement has resorted to the courts to protect its core values (Delaney 1996).

A principal cause of property rights advocates is an appeal to the Fifth Amendment of the Constitution and the right it provides for landowners to be compensated when a regulatory action results in a taking of their property. Traditionally, public regulation is not considered a taking if a regulation substantially advances a legitimate state interest and the owner is left with an economically viable use of the property (McCubbin 1989). Until recently, a property owner's remedy to a regulation that denies the landowner economically viable use of his or her land, or fails to substantially advance a legitimate state interest, was invalidation. But court cases have now well established that for an invalid regulation, the landowner is compensable (Delaney 1996).

The courts have ruled that the cost of regulations that are designed to benefit the community as a whole should not be borne disproportionately by a small segment of the community. Those ruling are affecting efforts by Maryland, Pennsylvania, and Virginia to balance the equities of common interests in nonpoint source nutrient reductions and private property rights. In their attempts to balance equities, the three states are:

Using Collaborative Policy Development. Virginia's Chesapeake Bay Land Use Roundtable, Pennsylvania's Casey Select Committee, and Maryland's Tributary Teams incorporate collaboration—that is, bringing interest group representatives together to negotiate bargains, mediate differences, and achieve compromises—to identify interests and balance equity. Collaboration is intended to avoid problems commonly observed in interest group politics—delay, self-serving attitudes, competition without regard to the "broad spectrum of interests," absence of opportunity for deliberation, and imbalanced, and as a result, unstable policies (McCubbin 1989).

In her study of Virginia's Roundtable, McCubbin offers the following recommendations for successful collaborative methods (1989):

1. Include all affected interests.
2. Invite individuals as such, rather than as official representatives of interest groups.
3. Use a mediator to define issues, clarify disagreements, discover agreements, and explore alternatives.
4. Strive for consensus.

Some observers argue that collaboration is the best way to develop and implement land use/environmental policies because it has the potential of reducing transactions costs to achieve and imple-

ment such policies and because it may promote equitable solutions (Kazmierczak & Hughes 1996).

But collaboration has major limitations too. There is, first, the practical difficulty of involving all affected interests on an equal basis. Some interests may be unorganized or poorly represented; a criticism of the Casey Committee, for example, was that it did not well represent the interests of Pennsylvania's local governments and resulted in the state's preemption of some local authority over nutrient pollution issues.

Second, the very nature of nonpoint source nutrient pollution, like many other environmental issues, is that it involves conflict; incompatible uses of the bay, and common versus private interests of land use do not offer multitudinous win-win opportunities. One Virginia legislator involved in the effort to pass the commonwealth's Bay Preservation Act observed that after the roundtable's report, state legislators and the governor engaged in "old-fashioned power politics" before the act became law.

Finally, the difficulties observed in Maryland's Tributary Teams suggest that even with good intentions and substantial support, creating collaborative organizations to function over an extended period of time—more than a year, or so—is very difficult because of members' opportunity costs. It seems that collaborative methods for designing nonpoint source nutrient pollution policies are useful, perhaps even necessary; but they are not sufficient; and they are difficult to implement.

Promoting Voluntary Action. Voluntary action is best exemplified in the nonpoint source nutrient policy arena by agricultural BMP cost-sharing programs being used by all three states. The equity principle of the programs is that farmland owners agree to install devices and use methods that promote a common interest in reducing nutrient loadings in return for cost-share monies to fund investments that increase the value of their properties. The practical rationale for such arrangements has been most clearly stated in the bay region by officials from Maryland's Department of Agriculture. The rationale are that there are insufficient funds for mandating behavior among all farmers; farmers are more likely to accept and even exceed standards if they are voluntary; and site variability suggests the need for willing participation by farmers (Brodie & Powell 1995; Simpson 1997). But as Abdalla notes (1996), because agricultural cost-share programs create mixed incentives and because their use and effects have not been well documented, they should be studied more.

Multiple Political Jurisdictions. The Chesapeake Bay Basin contains three kinds of political jurisdictions: (1) jurisdictions that have signed the bay agreements and thereby pledged to undertake certain actions; (2) states and local governments in Delaware, New York, and West Virginia that have not signed the agreements; and (3) about 1,650 local jurisdictions in Maryland, Virginia, and Pennsylvania that have not signed the agreements. The three nonsignatory states and most of the local jurisdictions in the three signatory states have authority over land use and, therefore, some influence, within their boundaries, over nutrient loadings. But the effects of land use authority do not stop at the edge of jurisdictional boundaries; water flows across boundaries; when individual jurisdictions take actions that affect nutrient loadings, they create political externalities—positive and negative extra boundary effects—on citizens in neighboring jurisdictions.

The presence of multiple political jurisdictions in the signatory states implies the need to decide which government level will have policy-making authority for nonpoint source pollution controls to implement bay agreements. For democratic governance, there is no clear-cut advantage in vesting authority in either small, homogenous political units or large heterogeneous ones (Dahl & Tufte 1973). Vesting authority in small units maximizes (1) opportunities for citizens to "vote with their feet," by locating in jurisdictions where the government best reflects their preferences; and (2) the effectiveness of the citizen whose preferences are in accord with the preponderant majority in the small unit. But vesting authority in larger, more heterogeneous units maximizes the ability of those citizens who prefer to solve problems that extend across the jurisdictional boundaries of small units. Pennsylvania's Nutrient Management Act, for example, represents the later, centralized approach. In part the choice of which level of government should have authority is one of whose preferences should count. Institutional arrangements may be devised, however, for authority sharing and for coordination to achieve some advantages of both small and large units.

Maryland's Tributary Teams, jointly appointed by the state and county governments, represent an attempt to promote coordination without creating a

new authority. In contrast, Virginia's Bay Preservation Act represents a shift in legal authority from local to state government. Nevertheless, Virginia state officials have created new institutions for coordination and authority sharing by the ways they have implemented the act. The state government provides technical assistance to small local units, grants for regional actions by local governments, and authority to local governments to adjust their land use controls to local situations and conditions.

State Authorities. In essence, the case studies of Virginia's Bay Preservation Act, Pennsylvania's Nutrient Management Act, and Maryland's Tributary Teams are analyses of how individuals and organizations operated within complex sets of rules. The studies provide, in certain instances, insights about personal actions—Governor Baliles fight for the Bay Preservation Act, Representative Barley's shift in position after the 1992 election, and the struggles of Governor Schaefer's staff to create the tributary teams in the face of resistance from all sides. But out of all the detail of the case studies, three general lessons about state institutions should be apparent.

Study the Total Policy Development Process—Including Implementation. Public policy in response to an issue typically involves not only the creation of legislation, but also the development of rules for implementation. Both the Virginia and Pennsylvania case studies illustrate the significance of the implementation phase—how rules that define or extend legislatures' words can shift authority and can, thereby, please or offend interest groups.

Realize that Institutions may be in Conflict. The institutional context within which state policies are developed is a complex mix of rules—some of which may well be in conflict. Thus, for example, once the Virginia General Assembly passed the Bay Preservation Act, the commonwealth had to overcome a court challenge based on the opposing legal tradition—that local governments had primary land-use control authority. Likewise, opposition to Pennsylvania's Nutrient Management legislation primarily was offered by some agricultural groups concerned about landowners' property rights. And some public officials in both state and local government resisted the formation of Maryland's Tributary Teams because the concept seemed to threaten well-established relationships and standard operating procedures.

Understand Agency Biases. State agencies function, in part, to represent certain interests within government. The most obvious examples of this from the state studies are the roles played by Departments of Agriculture in Pennsylvania and Maryland. In Pennsylvania, agricultural interests succeeded both in including the commonwealth's Department of Agriculture in implementing the Nutrient Management Act; and, once the act was passed, shifting some implementation authority to Agriculture from the Department of Environmental Protection. In Maryland, the Department of Agriculture has been quite successful in making the case for voluntary nonpoint source programs.

Behavior

Behavior may be thought of as people's response to those incentives created by a situation and by the institutions related to it (Johnston et al. 1988). Thus the concept is useful in understanding responses to characteristics of the nonpoint nutrient situation–such as incompatible uses, free riders and unwilling riders, upstream-downstream differences, and joint impact; and related institutions--such as private property rights, political boundaries, and agency biases. Thinking about behavior also helps a person understand the significance of policy designs created to avoid unintended consequences—designs such as incentives to promote voluntary behavior, co-benefits and multiple benefits to gain people's acceptance, collaborative policy development to balance equities, and authority sharing to achieve the benefits of both centralized and devolved government. Lastly, the idea of behavior provides the basis for suggesting that Chesapeake Bay cleanup efforts are creating a large social trap by cleaning water in the bay basin, making the area more attractive as a place to live and thereby increasing the costs of maintaining clean water. In the absence of new, highly efficient technologies for environmental protection, the trap implies, over time, either mounting environmental expenses or environmental degradation—unless fundamental changes in human behavior, particularly the use of land, are made.

Performance

Performance refers to the outcomes of public policies—the "who gets what" consequences. The ultimate judgement of the performance of nonpoint source nutrient reduction policies will be their ability to reduce nutrient loading. But monitoring the nonpoint sources of nutrients is very costly or in-

feasible. Thus the nutrient loading impacts of individual signatory state policies on the problem of excess nutrient loadings may only be estimated at this time. Maryland's estimates, strategy by strategy, are shown in Table 2.

Nevertheless, it is possible also to create some performance criteria for nonpoint source nutrient reduction policies, based on characteristics of the nonpoint source situation and on relevant institutions. These criteria provide rationale for making a priori judgements about how well a policy corresponds to current knowledge about the nature of nonpoint source nutrient water pollution (cf. Russell & Shogren 1993). The following are six performance criteria for nonpoint source nutrient water pollution policies:

Ability to Tailor and Target

Site variability, both physical and social, suggests that a policy that is tailored for a specific site and that targets site- and time-specific responses is preferred to one that ignores variability and induces uniform responses. Because they have relatively low transactions costs between citizens and officials and are likely, therefore, to be relatively more aware of the social and physical details about site conditions, local political organizations—conservation districts, municipalities, and counties—have particular value in tailoring and targeting policies.

Ability to Effect and Enforce

The cost or nonfeasibility of monitoring sources suggests the value of a policy that can effect desired behavior and enforce compliance. Effecting desired behavior implies structuring appropriate incentives—particularly incentives for landowners who, by virtue of their property rights, are able to influence the success of nonpoint source water policies.

Enforcing compliance requires an overseeing body that is able to detect and sanction noncompliance. Because water flows across jurisdictional boundaries and because centralized political jurisdictions—in this case, the state and federal governments—can monitor political externalities of nonenforcement by local jurisdictions, centralized jurisdictions have particular value in creating uniform enforcement.

Ability to Sustain

Because the benefits of nonpoint source nutrient reduction policies are available only after significant time lags, policies that create capital investments and policies that have stable funding sources are preferred, **ceteris paribus**, to other policies.

Ability to Create Co-Benefits

The benefits of nutrient reductions are available unevenly—primarily because of the upstream-downstream factor. Moreover, some people will not value the water quality improvement induced by nutrient reductions (unwilling riders). Landowners, again, are in a position to make their preferences count. Therefore, a policy that bundles water quality improvements with other benefits such as improved wildlife habitat, enhanced aesthetics, or increased property values, is preferred over a policy with the single water quality benefit only.

Ability to Educate

Because nutrient pollution is, it seems, not well understood by landowners and is, in a sense, counterintuitive, a policy that incorporates education of nonpoint source polluters is preferred to one that does not.

Correlation with Water Quality

Because the ultimate goal of nonpoint source nutrient reduction policies is to improve water quality, that policy that has a direct and certain effect on nutrient loadings would be valued over one that has an uncertain effect, **ceteris paribus**.

Application of the Criteria to Case Study Subjects

Although the subjects of the three case studies are dissimilar—two are legislative acts, and one is a new kind of watershed organization—the six performance criteria, nevertheless, may be applied to make some judgments about their value.

Virginia's Chesapeake Bay Preservation Act. This act, as implemented, involves an unusual combination of state and local government authority in Tidewater Virginia. The commonwealth assumed power to effect and enforce water quality standards in land-use plans and controls; but the power is exercised through local government actions and in ways that provide opportunities for the local jurisdictions to tailor and target their plans and ordinances. Implementation of the act, while imperfect, has spanned governors of two parties, and indications are the program is sustainable and improv-

able, over time. Improvements to local land use planning and control that result from state requirements and technical assistance are likely to have multiple benefits—to landscape, wildlife habitat, and both point and nonpoint improvements in water quality. Administration of the act has involved direct education about nonpoint source issues for local public officials and indirect education, some through state grants, to local citizens. The benefits of efforts to change land use, so as to improve water quality, are mostly indirect—and, as such, not as highly correlated, in the short run, as other efforts like upgrades to waste water treatment plans. But, in the long run, changes in land use seem essential to avoid the emerging social trap of population growth/escalating environmental protection costs in the Chesapeake Region.

Pennsylvania's Nutrient Management Act. Although implementation rules weakened sedimentation provisions valued by environmentalists, this act places the commonwealth in a much stronger position to effect and enforce controls over agricultural animal waste than was the case with the Manure Management Manual. By focusing on concentrated animal operations, working through local conservation districts, and requiring individual farm management plans, the act and its implementation regulation provides for tailoring and targeting of effort. Preemption of local government regulation, while necessary perhaps for gaining the acceptance of farm groups, does reduce the influence of some local environmental groups. Broad political acceptance of the act and its regulations, albeit with some reservations by environmentalists, suggests the law is sustainable, even in a climate of fiscal scarcity. Undoubtedly, assuming state cost-share funding, improvements to farm infrastructure will create a co-benefit of increased property values, thus making the act more acceptable to farm property owners. The individual planning process, too, will educate farmers about best management techniques of nonpoint source nutrients. Although uncertainty exists about the number of farms and total acreage covered by the act, and although improvements to water quality will be delayed beyond initial expectations, by targeting concentrated animal operations, most of which are in the Chesapeake Bay Basin, the act is highly correlated with water quality improvements to the bay.

Maryland's Tributary Teams. The Tributary Teams involve an innovative design co-created by the state and multiple local governments and meant to coordinate nutrient reduction efforts among those jurisdictions in ten watershed areas. The teams' ability to tailor and target the state's watershed strategies has not been emphasized and, to date, not exercised. The teams lack the authority to effect and enforce changes in citizen behavior, but they do have the ability to educate and exercise moral suasion. Their educational ability and natural advantage extends too, to their potential role, already being initiated, in providing "neutral ground" for conversations about controversial public issues related to nutrient pollution. Their scope of interest provides them opportunities to focus on efforts that will be highly correlated with water quality and to encourage upstream co-benefits of nutrient management that will encourage participation by Maryland's citizens and political support for the state's sizeable bay cleanup effort. The biggest questions about the teams are whether they can avoid an erosion of energy and declining private sector participation caused by an uncertain mission, the free rider problem, and opportunity costs for private members. If so, they could become a model for other states. But "creating a grassroots movement from the top-down" has proven to be a difficult task, even though the State of Maryland has invested much time, energy, and resources into that effort.

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Appendix A
Contributors

Charles Abdalla
Suzanne Aucella
Roger Banting
John Barley
Russ Baxter
Bill Bostian
Charles Brosius
Karl Brown
Bill Browning
Mark Bundy
Tom Burke
Mauro Chiaverini
Jim Cox
Scott Crafton
Malanie Davenport
Frank Dawson
Richard Douglas
Rich Eskin
Glenn Eugster
Gary Felton
Fran Flanigan
Ray Forney
Rupert Friday
Jack Frye
Vic Funk
Lamonte Garber
Keith Gentzler
Caren Glotfelty
Doug Goodlander
Ted Haas
Rich Hall
Jim Hannawald
Verna Harrison
Jerry Hollowell
Beth Horsey
Jay Howes
Richard Hutchinson
Bill Jenkins
Wayne Jenkins
Q Johnson
Cy Jones
Greg Kappler
Mike Krempasky
Scott Kudlas
Lynn Langer
Kathleen Lawrence
Louise Lawrence
Marya Levelev
Danielle Lucid
Joe Macknis
Russ Mader
Rob Magnien
Cecily Majerus
Paul Massicot
Bill Matuszeski
Ray Morgan
Tayloe Murphy
Dave Nemazie
Sara Nunuez
Kenn Pattison
Theresa Pierno
Marge Podlick
Royden Powell
John Rhoderick
Wayne Rhodes
Lori Roeser
Len Shabman
Lynn Shuyler
Tom Simpson
Bill Stack
Bob Summers
Ann Pesiri Swanson
Paul Swartz
Joe Tassone
Bob Tjaden
Lauren Wenzel
George Wolff

PART II: More Questions About Bay Programs and Agriculture

Q 1B What is being done by your state and local governments to preserve private land in the Bay watershed in agriculture?

Land trusts

State or local land use controls

Q 2B What is being done in your state to improve the marketing of animal wastes, sludge, and other organic wastes?

Q 3B What are the current status and trends in the ways Chesapeake Bay ag NPS programs works in your state, as regards:

a. **private involvement** in planning the control and management of nutrients; and in the finance, design, construction, operation, and maintenance of BMP structures?

b. **regulation vs. voluntary** participation in programs?

Q 4B What incentives are there for farm land owners in your state to:

a. choose the least costly and most efficient practices for controlling nutrients?

b. operate BMPs after they are installed?

c. maintain BMP structures after they are installed?

Q 5B What evidence is there about the level of operation and maintenance of ag BMPs in your state?

Q 6B What evidence is there about the effects of Chesapeake Bay ag NPS programs on:

a. fertilizer use in your state?

b. surface and ground water quality in your state?

Part III
A Final Question for All States

Q 1C May I obtain copies of any reports you have submitted since 1988 to your legislature branch, executive branch, about Chesapeake Bay program organization, efforts (e.g., funding and resources), and progress (e.g., acres covered, BMP types and numbers, cost sharing participants, or impacts on water quality)?

Part I
Maryland Chesapeake Bay Programs

Q 1MD How have Maryland's philosophy and goals for Chesapeake Bay NPS management changed in recent years?

Tributary strategies

Other changes

Q 2MD How has the state's administrative structure, i.e., agencies responsible for Chesapeake Bay programs (p.53), evolved in recent years?

Q 3MD How, in recent years, has the Chesapeake Bay ag NPS control program in Maryland evolved in its:

a. goals (p.55)--

b. targeting approaches (p.55)--

non participant land owners?

types of farm operations?

certain locations?

certain pollutants?

c. cost share priorities (p.56)--

d. technical assistance (p.57)--

e. research and demonstration (p.57)--

f. education (p.59)--

g. enforcement (pp.59-60)--

Q 4MD How, in recent years, has the Bay related **urban** NPS control program evolved in its:

a. program approach (p.60)--

new emphases on stormwater management, runoff, septic tanks?

b. targeting approaches (p.60)--

c. implementation (p.61)--

d. research and development (pp.61-62)--

e. education and training--

f. enforcement--

Q 5MD How, in recent years, have these other Bay related NPS programs evolved:

a. critical areas (pp.62-64)--

b. forestry (p.64)--

c. shoreline protection (p.64)--

d. shoreline erosion control (p.64)--

e. surface mine reclamation (p.65)--

f. marine pumpout (p.65)--

g. innovative techniques for reducing nutrients (p.65)--

h. Act 319 programs--

i. other programs created in recent years--

Part I
Pennsylvania Chesapeake Bay Programs

Q 1PA How have Pennsylvania's philosophy and goals for Chesapeake Bay NPS management (p.39) changed during Governor Ridge's Administration?

Tributary strategies

Other changes

Q 2PA How has the state's Chesapeake Bay NPS administrative structure, i.e., agencies responsible for programs, (p.40) evolved in the Ridge Administration?

Q 3PA How, in the Ridge Administration, has the Chesapeake Bay ag NPS control program in Pennsylvania evolved in its:

a. goals (p.41)--

b. targeting approaches (p.42)--

non participant land owners?

types of farm operations?

certain locations?

certain pollutants?

c. BMP financing (p.46)--

d. technical assistance (p.46)--

e. research and demonstration (p.46)--

f. education (p.48)--

g. enforcement (p.49)--

h. other ag-related projects (p.49)--

Q 4PA How, in the Ridge Administration, has the Chesapeake Bay urban NPS control program evolved in its:

a. program approach (p.50)--

new emphases on stormwater management, runoff, septic tanks?

b. targeting approaches--

c. technical assistance in plan development (p.50)--

d. research and development--

e. education and training (p.51)--

f. enforcement (p.51)--

Q 5PA How, in the Ridge Administration, have other Bay related NPS control programs evolved:

a. Act 319 in the Chesapeake watershed (p.51)--

b. soil erosion and sedimentation (p.51)--

c. earthmoving in forestry operations (p.51)--

d. acid mine drainage (pp.51-52)--

e. solid waste management (p.52)--

f. Dam Safety and Encroachments Act (p.52)--

g. homeowner education (p.52)--

h. other programs created by the Ridge Administration--

Part I
Virginia Chesapeake Bay Programs

Q 1VA How have Virginia's philosophy and goals for Chesapeake Bay NPS management (p.22) changed during Governor Allen's Administration?

e.g. Tributary strategies

Other changes

Q 2VA How has the state's Chesapeake Bay NPS administrative structure, i.e., agencies responsible for programs, changed during the Allen Administration?

Q 3VA How, in the Allen Administration, has the Chesapeake Bay ag NPS control program in Virginia evolved in its:

a. history and approach (pp.24-25)--

b. targeting (pp.25-27)--

non participant land owners?

types of farm operations?

certain locations?

certain pollutants?

c. implementation and cost share priorities (pp.28-30)--

d. research and demonstration (pp.30-32)--

e. education and technical assistance (pp.32-33)--

f. enforcement (p.32)--

Q 4VA How, in the Allen Administration, has the Chesapeake Bay urban NPS control program evolved in its:

a. program goals and approach (pp.33-34)--

new emphases on stormwater management, runoff, septic tanks?

b. targeting (p.34)--

c. technical assistance (p.35)--

d. research and demonstration (pp.35-36)--

e. education (pp.36-37)--

f. enforcement (p.37)--

Q 5VA How, in the Allen Administration, have other Chesapeake Bay NPS programs evolved:

a. highway construction (p.37)--

b. mining (p.37)--

c. forestry (p.37)--

d. shoreline erosion (p.37)--

e. drainfields and other waste disposal systems (p.37)--

f. conservation easements (p.38)--

g. river basin committee (p.38)--

h. youth conservation (p.38)--

i. other programs created by the Allen Administration--

Appendix B
Interview Instrument: Nonpoint Source Control Programs in Md., Penn., and Va.

This questionnaire has three parts. The first part contains questions that refer to a publication by the Chesapeake Bay Implementation Committee, dated 1988 and called "Chesapeake Bay Nonpoint Source Programs." That publication, a copy of which is attached, provides descriptions of nonpoint source (NPS) Chesapeake Bay programs in the late 1980s in the three signatory bay states. Part I of the questionnaire is designed to update information in the publication. References (in parentheses) to page numbers in Part I are to the 1988 publication. Part II contains additional questions about Chesapeake Bay agricultural programs across the three states. Part III asks to obtain reports about Chesapeake Bay programs in the states.