CHAPTER TWO

Charting New Waters

Three challenges to further environmental progress have emerged in the 1990s:

- Remaining environmental problems tend to be diffuse in origin, and require the combined efforts of many parties to resolve;
- All the resources in a particular place—air, water, land, and living resources—need to be considered as interconnected parts of an ecosystem; and
- Not all parts of the country have the same problems or need the same kinds of solutions.

Wrestling with these problems has produced a variety of initiatives with different names but generally similar approaches— community-based environmental protection, watershed-based environmental protection, and ecosystem management.

All of these approaches have a few key points in common. One is a geographic focus that results in a comprehensive approach to environmental protection, identifying priority problems such as air, water, or land issues—or a combination of these concerns. Geographic boundaries also facilitate an approach that looks beyond facility-by-facility progress and identifies overall environmental improvements and trends.

These approaches rely heavily on partnerships and stakeholder involvement. Encouraging involvement by all levels of government, public interest groups, industry, academic institutions, private landowners, concerned citizens, and others is now widely viewed as an important factor in the success of any environmental protection effort. In many cases, several federal agencies are working together in these partnership efforts.

Since the 1980s, federal, state, tribal, and local governments have been adopting the watershed protection approach. The approach focuses on hydrologically defined drainage basins—watersheds—rather than areas defined by political boundaries (Box 2.1). It encompasses not only the water resource—streams, rivers, lakes, estuaries, and aquifers—but all the land from which water drains to the resource. Taking a watershed approach thus means thinking about the connection of all the land areas within that watershed to a basin's water resources.

An EPA effort, for example, began with several large-scale programs dealing with geographic areas, including the

Box 2.1
The Nation's Watersheds

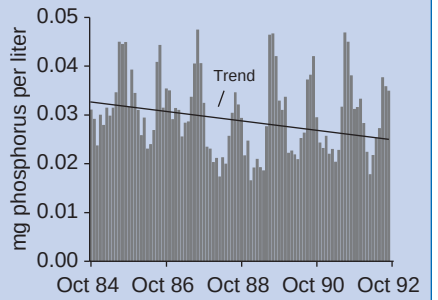
Under a system developed by the U.S. Geological Survey, the nation is divided into successively smaller hydrologic units, which are classified into four levels. The first level divides the nation into 21 major geographic regions, based on surface topography, and contain either the drainage area of a major river, such as the Missouri region, or the combined drainage areas of a series of rivers. The second classification divides the 21 regions into 222 subregions. A subregion includes the area drained by a river system, a reach of a river and its tributaries, a closed basin, or a group of streams forming a coastal drainage area. The third level further divides many of the subregions into accounting units. Cataloging units, the fourth and smallest level in the hierarchy, are a geographic area representing part or all of a surface drainage basin. Almost all cataloging units are larger than 700 square miles.

Chesapeake Bay Program, the Gulf of Mexico Program, the Great Lakes Program, and the National Estuary Program, and is evolving to a more pervasive application of watershed management through technical and institutional support.

The Chesapeake Bay Program identified nutrient over-enrichment in the Bay as a major cause of ecological and economic damage. In 1992, the states of Pennsylvania, Maryland, Virginia, and the District of Columbia committed to set specific nutrient reduction goals for each of the Bay's major tributaries and to develop strategies to achieve those goals. The overall goal is to reduce controllable nitrogen and phosphorus levels in the Bay by 40 percent below the 1985 level by the year 2000.

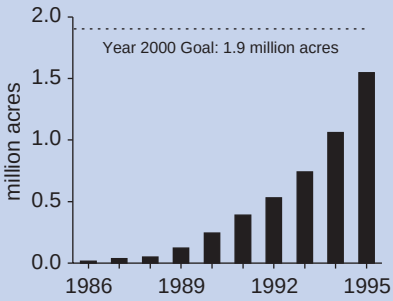
A ban on phosphate detergents in the Bay states has helped to reduced phosphorus entering the Bay by 16 percent since 1985 (Figure 2.1). Biological nutrient removal is currently being used to remove nitrogen at 33 sewage treatment plants throughout the Bay watershed. Between 1985 and 1995, nutrient management plans and erosion and runoff control measures were initiated on over 1.5 million acres of farmland in the Bay watershed in Maryland, Pennsylvania, and Virginia (Figure 2.2). In July 1994, 25 federal agencies made a variety of formal commitments, especially for federal lands within the watershed, to support pollution reduction in the Bay.

Figure 2.1 Mean Monthly Phosphorus Concentrations in Chesapeake Bay, 1984-1992



Source: U.S. Environmental Protection Agency, Chesapeake Bay Program, *Trends in P, N, Secchi Depth, and DO in the Chesapeake Bay, 1984-1992* (EPA, CBP Monitoring Subcommittee, Annapolis, MD, 1992-1995).

Figure 2.2 Acres Under Nutrient Management in Chesapeake Bay Watershed, 1986-1995



Source: U.S. Environmental Protection Agency, Chesapeake Bay Program Office (based on data provided by Maryland, Pennsylvania, and Virginia).

The Gulf of Mexico program includes projects to identify unique and important areas throughout the Gulf that need to be managed or protected to maintain their essential qualities. In Mobile Bay, several projects are underway to demonstrate how water quality can be improved by restoring salt marsh and sea grass habitats and to control nonpoint pollution affecting coastal shellfish waters.

For each of the five Great Lakes, the United States and Canada have agreed to develop and implement Lakewide Management Plans (LMPs). The primary goal of these plans is to reduce both point and nonpoint source pollution that threatens the lakes' primary uses. The plans emphasize pollution prevention and other issues such as habitat loss and threats to protected species. A key element of each plan is the integration of federal, state, provincial, and local programs. In addition, Remedial Action Plans (RAPs) are being developed for 43 specific areas of concern in the Great Lakes.

The National Estuary Program (NEP), established in 1987, is a voluntary program that brings communities together to protect and restore their estuaries. Currently, 28 estuaries are part of this program. Each local NEP includes participants from all levels of government, interest-group representatives, academia, the business community, and the general public to make decisions about their own estuaries through the development of a comprehensive management plan. A consensus-based process is used to help define each estuary's priority problems and the actions that can be taken to restore and protect the estuary's health. The Comprehensive Conservation and Management Plans (CCMPs) that each local program develops are blueprints for action, focusing on activities that occur within the watershed.

In developing the CCMP for Galveston Bay, Texas, compatible uses of the bay were considered with respect to the natural biological systems. The challenge was to manage human interaction with the bay, including commercial, industrial, agricultural, recreational, and municipal activities, so the long-range value of the resource can be maximized. Conflicting uses of the bay and the problems caused by these conflicts increase the need for comprehensive management. The coordination of scientific and management efforts resulted in a comprehensive plan that meets the environmental and economic needs of the estuary and its inhabitants.

Cooperation by governments and citizens is vital to protecting wildlife and wetland habitat such as this.

Photo Credit:
USDA—CS-5884

BUILDING WATERSHED PARTNERSHIPS

Traditional approaches to environmental management have some built-in limitations. For example, jurisdictions built along county and state lines have little relationship to ecological boundaries, making decisionmaking more complex and frustrating. Environmental agencies are often organized along sectoral lines such as air quality and water quality, which promotes decisionmaking in a single sector without consideration of all the sectors at once. Environmental regulators are often criticized for being inflexible, rejecting common-sense solutions that do not easily fit within the regulations. Finally, regulators have been criticized for insufficiently educating and involving the community in decisions that directly affect them.

Both at the federal and state levels, many efforts are underway that attempt to respond to these criticisms.

A key part of any integrated watershed protection effort is to devise an action plan that describes goals, objectives, and a general statement of what the effort hopes to accomplish over a 5- to 10-year period.

When the second Chesapeake Bay Agreement was signed in 1987, it included a clear goal. The goal was to develop, adopt, and begin implementation of a basin wide-strategy to equitably achieve, by the year 2000, at least a 40 percent reduction of nitrogen and phosphorus

entering the main stem of the Chesapeake Bay. The strategy was to be based on agreed-upon 1985 point source loads and on nonpoint loads in an average rainfall year.

The goal is notable for several reasons:

- It is based on a scientific consensus.
- The 40 percent reduction is the key to restoring the Bay ecosystem but is also linked to many other goals.
- It can be easily understood by the public and elected officials.
- It is specific, quantifiable, and can be allocated to particular political jurisdictions or river basins.
- It is fair, yet flexible; each jurisdiction is free to develop its own strategy to meet the goal.
- It has the political support of the Bay States and the EPA, as well as the broad support of local governments, the public, and an array of interest groups.

Meeting the 40-percent goal will be accomplished through the implementation of tributary strategies. These are watershed-based plans to reduce nutrient pollution through activities such as wastewater treatment plants, agricultural best management practices, resource protection, and growth management activities.

The emphasis has evolved from an initial focus on the main stem of the Bay to the actions taken by individuals and local governments throughout the watershed. Other goals have been established, including those for acres of submerged aquatic vegetation, number of fish passages, and miles of riparian forest.

Similarly, the National Estuary Program's Comprehensive Conservation and Management Plan for Tampa Bay stresses measurable goals that are realistic and achievable. A key goal of the plan is to cap nitrogen loadings at current levels (the average for the 1992-94 period) to encourage the recovery of sea grasses. Studies indicate that an additional 12,000 acres of sea grass can be recovered by preventing future increases in nitrogen loadings. The Nitrogen Management Consortium, a multi-stakeholder group, is working to identify individual or group projects that would reduce nitrogen loadings by about 11 tons annually, or about two thirds of the total goal. Local governments have agreed to reduce their total load by about 6 tons per year.

Leadership is a second important element of successful watershed protection efforts. Massachusetts, for example, has benefitted from effective leadership at several different levels. Integration between state and local efforts also is key. Besides reorienting their water quality programs to support watershed approaches, the state has reached out to form partnerships with locally based watershed associations. Citizen watershed associations have formed in almost all of Massachusetts' 28 major watershed basins, and more than 500 citizens' groups are active.

Having a coordinator at the watershed level also is desirable. Coordinators can provide a focal point for the watershed effort and help to ensure that someone is paying attention to moving group activities along. The coordinator can play a variety of roles, such as maintaining contact with members of the watershed

group; serving as liaison with interested parties beyond the group; calling, facilitating, and summarizing meetings; helping to secure funding and training; and ensuring that watershed plans are developed and implemented.

For example, Mike Adcock has been working as coordinator in the Tensas River watershed in Louisiana for over four years. His full-time position is supported by federal agencies (EPA and USDA), The Nature Conservancy, and several foundations. The major issue in the watershed is the severe loss of wetlands. Most remaining wetlands are on privately owned farms, and Mike's background as a lifelong Louisiana resident has helped him build trust with the farming community. He has identified farmers in the watershed who were willing to demonstrate the economic benefits of wetlands restoration and conservation tillage practices, and he works with farmers to point out the economic benefits of management practices such as precision farming and water quality control structures.

Another key element in successful community-based watershed protection efforts is to make sure that the watershed plan is designed at a manageable scale. In the past, many watershed plans were drawn up at too large a scale—50 square miles or more. The focus of the plans becomes blurred, too many stakeholders get involved, and the responsibility for implementing the plan becomes diffuse. Based on an analysis of first-generation watershed plans, the Center for Watershed Protection recommends that plans be developed around a subwatershed with a drainage area of 2 to 15 square miles. At this scale, mapping, monitoring, and the entire management plan can be completed within a year. The Center also emphasized the importance of having an authority, either at the subwatershed or watershed level, that has the primary responsibility for implementing the plan. Work undertaken at a small scale can be effectively coordinated to meet goals for larger basins, of which the small watershed is a component. The Chesapeake Bay Tributary Strategies and the Great Lakes LAMPs and RAPs mentioned earlier are good examples of this kind of "nesting" of watershed planning.

A recent study of community-based watershed management by the Western Water Policy Review Commission found that these initiatives are widespread and show tremendous variety in structure and function. The review found that a lack of formal authority for the watershed initiative usually does not hinder the effort, and that a reliance on "moral authority" was an important asset. Most initiatives in the West, according to the study, are not closely linked to management programs at the larger river basin scale. The review concluded that the performance of watershed initiatives is "sufficiently positive to merit guarded optimism, and to justify greater support from all levels of government."

Water quality issues are a concern to almost all watershed groups. Most of these groups include parties associated with both water and land management. Many federal agencies participate, including the Forest Service, Natural Resources Conservation Service, Environmental Protection Agency, Fish and

Wildlife Service, Corps of Engineers, and the U.S. Geological Survey. Most watershed initiatives are initially highly dependent on federal funds. As programs mature, they may attract additional sources of funding, but even the most successful normally continue to receive some federal support. Participating federal agencies generally provide both direct financial support and in-kind services.

According to the study, a major challenge for these initiatives is to find a focus that is both manageable and sufficiently broad to effectively address watershed issues. Many groups find that field-level activities help retain interest and participation and attract needed resources.

Case Study: San Miguel Watershed Coalition

Located in southwestern Colorado, the roughly million acres that encompass the San Miguel watershed is one of the largest remaining relatively undisturbed areas in North America. The San Miguel River, one of the few remaining free-flowing, ecologically intact rivers in Colorado, extends for about 80 miles from its high alpine headwaters above Telluride to its desert confluence with the Dolores River.

The region's fragile landscapes have come under increasing pressures in recent years, including a five-fold increase in non-skier recreational uses in the past decade and explosive resort and relocation growth. Traditional industries, such as mining, have declined. The region is going through a period of change in both social and economic patterns, including some tensions between the resort interests in the upper basin and ranching communities in the lower basin.

In 1993, Telluride Institute, a nonprofit environmental organization, convened a meeting on sustainable river management that included federal resource managers, elected officials, developers, and others engaged in activities directly affecting the health of the San Miguel River. The group eventually focused on the river-related impacts of summer recreation in the upper reaches of the San Miguel, and decided to hire a river ranger. This group, the San Miguel River Coalition, provided an early foundation for the eventual emergence of a larger coalition.

In the Fall of 1994, the National Park Service's Rivers, Trails, and Conservation Assistance Program (RTCA) was asked to facilitate the development of a management plan for the San Miguel River corridor. RTCA organized an issues workshop with broad participation of interested stakeholders in the region. Following the workshop, it became clear that the most appropriate scale for this effort was the entire watershed, not just the river corridor. Workshop participants generally agreed that broadening the effort to include the entire watershed would bring a greater diversity of perspectives and expertise to the process, could help build a stronger consensus about solutions, and was more likely to succeed. It would also give lower basin communities an opportunity to collaborate with the upper basin in regional decisionmaking.

The interest in developing a watershed approach drew broad support, helped by federal policy shifts towards ecosystem

management as well as local concerns over the region's rapid growth and resulting environmental degradation.

Facilitated by RTCA and the Telluride Institute, and with strong support from the Bureau of Land Management, the San Miguel Watershed Coalition was formed. The group developed a community-based concept of how to conduct a watershed planning effort, attaching particular importance to citizen involvement and responsiveness to local concerns. Workshops and focus groups identified five general issues: water, natural resources, recreation, education, and community growth and preservation.

With the information developed in the workshops and focus groups, a planning team began to reshape the information into a planning document. The first draft of the plan was completed in June 1997.

The Coalition plan included a vision of the future built upon five elements:

- A landscape maintained in good health through protection and responsible use of natural resources.
- Availability of a diversity of high quality recreational opportunities.
- A sustainable economy offering opportunities for growth and development guided by a strong sense of community identity.
- A cooperative atmosphere where agencies, organizations, and individuals collaborate on management decisions with an ecosystem mindset.
- A citizenry educated about the close connection between resource conservation, economic vitality, and quality of life and committed to good watershed stewardship.

In the discussion on water, the plan identified a variety of issues. Those include the reduction of instream flows and lake levels due to increasing water demands and consequent effects on the natural values of streams and lakes; depletion of groundwater resources; inadequate water conservation efforts; limitations on water available to the towns of Nucla, Norwood, Naturitia, and Telluride; increasing threats to water resources on public lands; impacts to water users from bypass flows required by the Forest Service; impacts of planned and existing water developments; and increasing levels of pollutants, including sediment, biological pathogens, nutrients, urban runoff, heavy metals, and hazardous materials.

The plan includes six basic recommendations for water, including actions that would help meet each recommendation. The first objective is to "manage groundwater and surface water sources for a sustained high quality water supply." To meet this objective, promising actions include: developing a water budget that quantifies historic and future water uses in relation to measured supply of groundwater and surface water; exploring opportunities to coordinate diversions and releases in order to minimize impacts on downstream riverine ecosystems; exploring opportunities for receiving or acquiring water from private entities for public benefit; instituting a surface water and wellhead protection program coordinated with the county; upgrading rural water

systems to accommodate future development; determining appropriate protection levels of the watershed to guide future growth plans; improving collaboration and communication among water interests; and developing a fact sheet on groundwater supply and limitations for public distribution.

The plan's other water-related potential actions include: conducting a comprehensive instream flow assessment; determining the water needs for public land management; developing and implementing a water conservation plan for the basin; metering all municipal water use and charging fees based on volume used; and developing and implementing a stormwater management plan covering developed recreation areas, highways, and municipalities.

Though only a few years old, the Coalition has succeeded in raising more than $200,000 in grants and $350,000 in in-kind services. The lion's share of the grant money came from several Environmental Protection Agency sources, and benefitted from a shift in focus at EPA to community-based ecosystem protection.

Yet to be resolved is the best permanent organizational structure to guide the watershed project, manage funds, and effectively involve public citizens.

LEARNING ABOUT WATERSHEDS

Powerful new tools such as Internet sites and geographic information systems are increasingly available to support watershed groups.

At the University of Connecticut Cooperative Extension, the Nonpoint Education for Municipal Officials (NEMO) project uses Geographic Information Systems (GIS) and remote sensing for watershed analysis. GIS maps can help educate local land use decision makers on the complexities of the land use/water quality connection. The maps are useful ways to illustrate the concept of watersheds, the role of land use in determining the health of watersheds, the relationship between watershed boundaries and political jurisdictions, and the location of key natural resources.

NEMO is particularly valuable in assessing trends in the extent of impervious surfaces, such as parking lots, which are a key indicator of watershed health. Project staff can develop a "build-out" analysis that looks at trends based on local zoning regulations. The analysis can help local officials think about current land use plans and ways to adjust plans to help protect water resources.

Save Our Streams, which operates out of Gaithersburg, Md., uses workshops, guides, and a 1-800 number to provide technical assistance on stream restoration and volunteer monitoring techniques for local watershed groups. With a database of over 4,000 projects, Save Our Streams can often refer callers to other projects across the nation who have tackled and solved similar watershed problems.

SOS encourages local groups to partner with federal and state agencies and private sector sponsors to bring costs down. Some groups can get enough outside funding to restore a stream with as little as $1,000 of their own money.

Know Your Watershed, a public-private partnership based in West Lafayette, Indiana, supports existing watershed partnerships and helps in the creation of new ones. The organization's goal is to have 2,000 watershed partnerships in the country by the year 2000; as of mid-1997, it had identified over 1,000. Know Your Watershed supports watershed-to-watershed networking, technology transfer efforts, and capacity building at the regional, state, and local levels. Another emerging and well-organized group is River Network.

Databases and modeling tools also are widely available. EPA sponsors Surf Your Watershed, an internet tool for managers and citizens to locate watershed information. In partnership with others, EPA also manages an Index of Watershed Indicators, which describes the condition of and threats to watersheds nationally, drawing upon data provided by states, tribes, several federal agencies (NOAA, NRCS, and the Corps of Engineers), and The Nature Conservancy.

STATE-BASED WATERSHED PROGRAMS

Several states are undertaking a large-scale revamping of their approach to environmental management.

Florida, for example, is emphasizing both management changes and the cultural changes needed in government institutions and the public to achieve ecosystem management. Wisconsin is reorganizing its management structure and approach to better fit existing ecosystems and watersheds. North Carolina is changing its approach to water quality planning, to emphasize assessing an entire river basin at one time.

Florida

In Florida, the Department of Environmental Protection is creating a management framework based on Ecosystem Management Areas (EMAs). These areas, which are often based on drainage or watershed boundaries, are large enough to effectively address major hydrological and ecological connections. The state is assembling management teams for each EMA and technical advisory committees to support the EMA teams' decisionmaking.

State officials recognize that success requires a cultural change on the part of both the agency and the public. At the agency level, the changes include: retraining to promote a results-oriented philosophy; developing a common-sense process; moving away from a philosophy based on reaction; reorganizing programs away from a concentration on a single media; facilitating cooperative and voluntary solutions to issues between the agency and private landowners; reallocating agency staff and budgets to support EMAs; incorporating ecosystem management principles into the department's programs, rules, and policies; and shifting program emphasis from pollution control to pollution prevention.

Another goal is to develop a public ethic of shared responsibility for the environment. The state is implementing a private lands initiative to foster stewardship on privately owned lands and has created

an awards program to recognize outstanding ecosystem management programs.

Another goal of the reorganization effort is "common-sense regulation." Common-sense regulation recognizes that each circumstance, each application, and each site is different. It looks for solutions that are based on consensus; based on pollution prevention, rather than end-of-pipe control; flexible, rather than rigid; and able to provide economic incentives to applicants.

The state is not replacing the current permitting program, but is proposing a new, voluntary, parallel permitting and approval process that will provide meaningful economic and regulatory incentives to applicants in return for better protection of ecosystems. Multidisciplinary teams from the department and other agencies will review all aspects—air, water, wildlife, land use, and other—of an application. Teams will include local, regional, state, and federal representatives, and will be open to interested third parties.

Finally, the department is continuing to develop alternative approaches to its enforcement program, encouraging programs such as no-penalty self-audits and the development of cooperative relationships with regulated interests. These actions are intended to supplement, not replace, traditional enforcement activities.

One component of Florida's program is based upon EPA's audit policy, which encourages regulated entitities to voluntarily discover, disclose, and correct

Rivers are often boundaries as well as resources. Great Falls on the Potomac River is valued by people of many states and communities.

Photo Credit:
Greg Baier/USGS

violations of environmental requirements. Incentives include eliminating or substantially reducing the gravity component of civil penalties and not recommending cases for criminal prosecution where specified conditions are met, for those who voluntarily self-disclose and promptly correct violations. The self-audit policy is one of a suite of incentives and compliance assistance activities Florida is using to supplement traditional enforcement and encourage voluntary compliance.

A second, newly developed component of Florida's program is the development of a four-tiered measurement system to evaluate the results of the agency's compliance and enforcement efforts. Tier 1 measures environmental results—things like improvements in air and water quality. Tier 2 measures cultural changes such as improvements in compliance rates, voluntary pollution prevention and use of improved technology—things indicating acceptance of responsibility for the environment by the regulated community. Tier 3 measures agency activities such as permits issued or denied, compliance inspections, enforcement actions, compliance assistance and public outreach—indicators of how much effort the agency is putting into various compliance and enforcement strategies. Tier 4 provides budget information to show the links between dollars spent and what the agency has accomplished. This data is updated in a quarterly report, which is made available to the public in both hard copy and on the Internet.

Lastly, Florida has adopted an environmental problem solving (EPS) methodology. EPS is a six-step process designed to identify important problems, design measurements to assess the impacts of those problems, develop solutions, and finally, using the measurement system, evaluate the effect of the management response.

In sum, the Florida effort is endeavoring to make citizens full partners in environmental protection, substitute cooperative problem solving for antagonistic legal wrangling, inject common sense into the regulatory process, develop enforcement alternatives and effectiveness measurements, require management based on ecological rather than administrative or political boundaries, and integrate efforts that were previously segregated by agency, program, or media.

Wisconsin

A similar effort is underway in Wisconsin. Like Florida, the changes underway in Wisconsin represent a response to key changes in understanding and approach to natural resources management. For example, officials at the State's Department of Natural Resources found that large businesses such as paper manufacturers had learned that eliminating pollution voluntarily cost less than complying with ever-stricter rules, and that the state needed to encourage these efforts with incentives rather than new regulations. A second new understanding was that people and communities wanted to solve local environmental problems, but preferred locally applied expertise and support to state mandates and rules. The Department also grasped that the science driving our understanding of natural resources was increasingly focusing on

the interdisciplinary study of interactions within an ecosystem, and that the public wanted less government but still valued a clean environment.

The Department is reorganizing to bring its institutional structure closer to the current realities of environmental protection. At the central office in Madison, a new six-division structure has fewer staff and supervisory layers and is intended to provide policy and other essential support for field operations. For example, the new water division consolidates five programs formerly located in three separate divisions, bringing together fisheries management and shoreline/wetland protection programs with water quality improvement programs.

The Department is replacing its old six-district field structure with five regions that are roughly aligned with natural ecological features. The Northern Region, for example, covers northern Wisconsin's forest and lake belt, while the new Northeastern Region encompasses the Fox-Wolf River basin.

Each of the five regions is divided into four to six geographic management units with boundaries based largely on major river basins. Most department staff are assigned to these units. The new structure emphasizes a team approach that brings together employees with different types of expertise who can collectively develop an interdisciplinary perspective on environmental issues. The team concept also is designed to encourage a higher level of community cooperation and citizen involvement.

For example, a river basin team might include an aquatic biologist, wastewater engineer, shoreline/wetland specialist, safe drinking-water engineer, fishery manager, and water resource planner. The team also could include representatives from civic groups, conservation clubs, environmental groups, business and industry, other government agencies, agriculture, and education. The team could be asked to assess the quality of water, fisheries and aquatic resources in a river basin; analyze and identify problems affecting water quality, aquatic life, and water uses; involve citizens in setting river basin goals and priorities and in finding and choosing solutions to problems; and regularly report progress toward goals and applaud partner successes.

Though initiated by the state, geographic management units are intended to address the mutal needs of all partners. State officials see their role as bringing regional and national perspectives to the discussions as well as an integrated, ecosystem view of the issues and trade-offs.

North Carolina

In North Carolina, population growth and development pressures—including changes in land use and the emergence of nonpoint sources as a significant cause of water pollution—pose a variety of critical water quality management issues. The issues include:

- How much waste assimilative capacity is left within the state's major receiving waters for new and expanding discharges?

- What should be done where capacity has been exhausted?
- Where capacity exists, how much should be set aside for new and expanding discharges?
- What impact will these decisions have on municipal growth and industrial development?
- Which waters warrant special consideration for protection of critical habitat or high quality values?
- Which waters are impaired, what are the causes and sources of impairment, and how can quality be restored?
- What is the relative contribution of nonpoint source loading to water quality problems and to what extent will it affect future point source allocations?
- How can amounts and sources of nonpoint source loadings be accurately determined?
- What opportunities are there to significantly reduce nonpoint source pollution?

North Carolina state officials found that traditional approaches to evaluating pollution discharge permits on a case-by-case basis did not adequately deal with these issues. A new approach was needed that would address the interactive and cumulative water quality impacts from multiple dischargers and nonpoint sources.

State officials decided that the best way to address these issues was to simultaneously assess water quality and aquatic resources throughout an entire river basin, and to use that information to guide subsequent decisions about discharge permitting, wasteload modeling, and nonpoint source pollution control.

The state Division of Water Quality is preparing basinwide plans for each of the state's 17 major river basins. The first round of plans is to be completed by August 1998, with each plan to be updated at five-year intervals. The first basinwide plan, for the Neuse River, was completed in 1993.

The state's basinwide approach provides a number of benefits. For example, evaluating an entire river system at the same time, rather than stream fragments or individual facilities, encourages managers to consider water quality problems where the problems are far removed from the source or where downstream impacts are caused by the cumulative effects of point and nonpoint sources.

The approach enables managers to issue permits for all dischargers in a basin at the same time. Under the old system, permits were reissued randomly across the state as they came up for renewal. Beginning with the Neuse River in 1993, all discharge permits for each basin are now scheduled to expire and be renewed in the same year. They will be reviewed and reissued at five-year intervals thereafter.

Basinwide management also better enables state officials to grapple with the relative contributions of point and nonpoint source pollution in a river basin. The state is using the total maximum daily load (TMDL) approach, as mandated by the Clean Water Act, to determine the total pollution loading that a water

body can assimilate while still maintaining its water quality classification and standards. Though technically difficult, the approach is useful for developing point source control strategies and targeting areas for nonpoint source management. Once a TMDL has been established for a river basin, or for certain waterbodies within the basin, point and nonpoint source control strategies can be developed to prevent overloading of the receiving waters, allow for a reasonable margin of safety, and optimize assimilative capacity.

The state's basinwide approach is intended to evolve over time, and can be used to help predict the long-range consequences of growth and development on water quality and develop long-range protection strategies. With more lead time and involvement in the planning process, local governments, industry, and others can better plan their activities to work in consonance with these strategies.

Another important development affecting the state's approach is the recent outbreaks of toxic *Pfiesteria* in tributaries of the Albemarle-Pamlico sounds, which are contributing to rising public anxiety about the safety of North Carolina's seafood in general and adversely affecting the state's seafood sales.

North Carolina's fisheries are overwhelmingly estuarine-dependent. Species must utilize estuaries to complete their life-cycle—spawning, nursery areas, feeding areas, and migration routes. The state ranks among the top 10 states in the nation in both commercial and recreational landings, which contribute more than $1 billion annually to the state's economy.

To address these public concerns, as well as to clean up North Carolina's waters to reduce or prevent future *Pfiesteria* outbreaks, the state is monitoring, evaluating and classifying more than 2.1 million acres of coastal waters to determine their safety for shellfish harvesting and consumption; and initiating a recreational water quality monitoring program to help allay mounting concerns about the safety of North Carolina waters for fishing, swimming, boating and other water-based activities.

The state also recognizes that too many nutrients (phosphorous and nitrogen) are getting into North Carolina waters and causing fish kills, algal blooms and degradation of waterways and estuaries. To address these problems, the state has:

- Passed the Clean Water Responsibility Act, a far-reaching, progressive and aggressive environmental law, which puts a two-year moratorium on hog farms in the state, reduces nutrient limits for wastewater dischargers and nonpoint sources and includes provisions for improved land-use management.
- Established a scientific advisory council on water resources and coastal fisheries management.
- Developed a strategy to reduce nutrients in the troubled Neuse River and continue basinwide planning efforts to address water quality concerns.

- Established a clean water management trust fund, which provides tens of millions of dollars each year to water quality protection initiatives.
- Established a wetlands restoration program.
- Toughened enforcement policies.
- Strengthened sedimentation and erosion control programs.
- Established a rapid response team to investigate fish kills in the Neuse River and expanded the coastal recreational water quality testing program to protect public health.
- Toughened siting, permitting and operating requirements for intensive livestock operations.
- Increased funding to the state agricultural cost share program, which assists farmers in controlling run-off from crops, fields and feedlots.
- Established a medical team to examine the health effects of *Pfiesteria* and a hotline for citizens to call for assistance.
- Stepped up environmental education efforts to inform citizens as to how their activities affect their river basins.

NEW STRATEGIES: WATERSHED-BASED TRADING

Watershed-based trading is an innovative way for stakeholders—including state and local governments, point-source dischargers, contributors to nonpoint source pollution, citizen groups, other federal agencies, and the public at large—to develop common sense, cost-effective solutions to water quality problems in their watersheds.

Trading can be an efficient, market-driven approach to meet the goals of the Clean Water Act. It can also provide substantial new flexibility for watershed managers. For example, it provides an opportunity to:

- Facilitate nonpoint source reductions where they otherwise might not occur.
- Meet the designated uses of a waterbody at a lower cost, or expand a waterbody's designated uses at the same cost.
- Allow an existing or new source to add new pollution to a waterbody, which would be offset by pollution reductions elsewhere in the waterbody.
- Accelerate the implementation of pollution control measures.

Trading generally takes the form of an agreement between two or more parties within a waterbody that alters the allocation of pollution reduction responsibilities among the parties. A "buyer" and "seller" agree to a trade in which the buyer compensates the seller to reduce pollutant loads. Buyers purchase pollutant reductions at a lower cost than what they would spend to achieve the reductions themselves. Sellers provide pollutant reductions and may receive compensation.

There are five general categories of watershed-based trading:

- Point/Point Source—a point source arranges for another point source to undertake greater-than-required reductions (beyond the minimum technology-based standards) in pollutant discharges in lieu of reducing its own discharge level.
- Intra-plant—a point source allocates pollutant discharges among its outfalls in a cost-effective manner, so long as the combined discharge is the same or less and each outfall complies with requirements to meet water quality standards without trading.
- Pretreatment—an industrial source that discharges to a treatment plant arranges for greater-than-required reductions in pollutant discharge (beyond the minimum technology-based discharge standards) by other indirect sources in lieu of upgrading its own pretreatment.
- Point/Nonpoint—a point source arranges for control of pollutants from nonpoint sources to undertake greater-than-required pollutant reductions (beyond the minimum technology-based discharge standards) in lieu of upgrading its own equipment.
- Nonpoint/Nonpoint—a nonpoint source arranges for more cost-effective control of other nonpoint sources in lieu of installing or upgrading its own controls.

These arrangements can vary in complexity and form and potentially include many partners. Hypothetically, for example, a food processor facing new pollutant reduction requirements (the buyer) could contract directly with another processor (the seller) to install additional control devices to reduce the seller's pollutant loads. The seller would maintain its own controls to achieve the required load reduction plus an additional load reduction credited to the buyer. The trade is incorporated into the NPDES permit and is approved by the permitting authority.

In another case, a nonpoint source tree farming operation purchases "water quality improvement shares" from a nonprofit environmental organization. The organization uses the proceeds from the sale of shares to conduct stream and habitat restoration projects, which provide water quality improvements. The tree farmers receive pollution reduction credits proportionate to their funding contribution to the water quality improvements.

In a real-life example, selected publicly owned treatment works on North Carolina's Tar Pamlico Basin pay into a state fund that supports implementation of best management practices on farms. The treatment plants achieve water quality goals less expensively than if each plant upgraded its facility independently. Trading in the Tar Pamlico Basin is described in more detail in Chapter Six.

In addition to the cost savings, trading can provide environmental benefits above and beyond those required by law. For example, the State of Maryland accepts fee-based compensation for mitigation requirements if it determines that creation, restoration, and enhancement of small nontidal wetlands is not feasible.

Fees are deposited into a trust fund that pays for larger restoration projects. The state believes consolidating small and isolated restoration project costs to fund larger ones is a more environmentally effective approach to mitigation and water quality protection.

Making pollution reduction more affordable means sources can be reduced more quickly or in greater amounts. In addition, cost savings can be used for other purposes, such as additional resource protection activities or community services such as education. Trading can also keep consumer costs down as industry and business save.

In New Jersey, the Environmental Protection Agency and the State Department of Environmental Protection are working with stakeholders to develop a trading mechanism, as a means for companies to meet new local limits for their metals discharges into publicly owned treatment works (POTWs). Companies that have met their basic technology-based requirements can use trading to help them meet additional locally-imposed limits on pollutants.

When controls for metals are instituted, facility managers often find they can reduce the levels of metals in effluent more than is required. Trading allows facilities in the same POTW service area to work together to achieve discharge reductions at a lower cost. A company with new controls that lower metals discharges below required levels could "sell" its excess reductions. A buying company and a selling company negotiate a price for the metals credits. The permits of the trading partners are then adjusted to reflect the amount of credits sold in the trade.

The pilot team is working with the Passaic Valley Sewerage Commissioners in Newark and its industrial permittees to facilitate a trade on local limits of metals. So far, two companies have negotiated a trade, signed a contract, and their permits have been adjusted to reflect the trade by Passaic Valley. Additional companies have expressed interest in trading and may negotiate trades in the future to help meet their metals discharge requirements.

The pilot team will document the benefits and challenges of this trade and then explore the applicability of trading to other pollutants and other POTWs.

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