Trading in the Tar-Pamlico

A watershed approach for coastal zone management

John C. Hall
Ciannat M. Howett

Watershed planning is clearly the wave of the future in water quality regulation. State and federal regulators are attempting to take a more holistic approach to water quality by integrating water quality and land use planning. The goal is to achieve improvements where past efforts, which focused almost solely on point-source impacts, have failed to adequately protect water quality.

In the Tar-Pamlico River Basin of North Carolina, one of the largest estuarine systems in the U.S., the first point and nonpoint source pollution credit trading program has been implemented, and it is expected to serve as a national model for how such programs can improve coastal water quality and reduce the costs of compliance.

Pollution credit trading has been applied in the air quality arena for several years, but only recently have these concepts been applied to water quality control. It is a significant example of an innovative and cost-effective water control strategy applied to an entire watershed.

The trend toward watershed regulation is occurring on both the federal and state levels. EPA has announced a major review of its nonpoint source program and a greater emphasis on watershed protection. Under the 1990 Coastal Zone Management Act, states with federally approved coastal zone management programs are required to submit nonpoint source pollution control programs to EPA, and final guidance for developing these programs was released in early 1993. Proposed amendments to the Clean Water Act reauthorization this year have made watershed planning the centerpiece of future water quality regulation. On the state level, North Carolina adopted a basinwide approach to water quality control, with the first basinwide permits issued in 1993. New Jersey is proposing to use the approach as well.

The Tar-Pamlico River Basin is typical of many large river and estuarine systems. The basin suffered significant nutrient loading due primarily to agricultural runoff, which causes excessive algal growth. To redirect pollution control priorities, the Tar-Pamlico River Basin Association (a group of point-source dischargers in the basin), the Environmental Defense Fund, the Pamlico Tar Foundation (a local citizens group), and the North Carolina Division of Environmental Management entered into an unprecedented agreement whereby the point source dischargers in the basin provide funds to the state to implement best management practices in the basin through the state's agricultural cost-sharing program.

The cost-effectiveness of this program is impressive. It was estimated that the cost of nutrient reductions for point sources in the basin would be approximately $70 million, while the cost of similar nutrient reductions through increased nonpoint source control is estimated at $11 million. The Tar-Pamlico project also

COURTESY OF N.C. DIV. OF ENVIRONMENTAL MANAGEMENT

The Tar-Pamlico River drains a large area of eastern North Carolina.

involves development of a geographic information system to track and target nonpoint source dischargers, development of a hydrodynamic nutrient model of the estuary to estimate algae growth, and implementation of best management practices at sites where significant nutrient reduction and restoration of wetlands can be achieved.

THE TRADING CONCEPT

Point and nonpoint source trading harnesses economic incentives to achieve water quality at a lower total cost. Trading systems are commonly used to control air pollution through the use of a plant "bubble." Under the bubble concept for air emissions, EPA sets a total level of allowable emissions for an entire plant, and allows the discharger to choose its least-cost method to control emissions. Any amount under this level can be sold or traded to other plants that cannot meet their levels. This approach is also readily applicable to water pollution problems.

For point and nonpoint source trading, the watershed is the bubble. A point source discharge can achieve further nutrient reductions through several methods:

- further point source controls at its facility,
- further point source controls at another facility, or
- providing funds for nonpoint source controls.

Under the terms of the Tar-Pamlico agreement, point source dischargers of the Tar-Pamlico River Basin Association are jointly responsible for meeting a steadily decreasing total nutrient limit during a 5-year period, rather than having individual nutrient permit limits. Association members may achieve this overall nutrient limit by reducing their own effluent levels, by trading individual discharge levels among themselves, or by paying a fixed cost ($56/kg) to a fund that implements nonpoint source controls thorough the state's agricultural cost-share program.

The program provides an economic incentive for association members to reduce their nutrient effluent levels as much as possible. If dischargers cannot reach required levels, nutrient reduction may be achieved through nonpoint source controls at less cost rather than through further point source treatment.

COST-EFFECTIVENESS OF TRADING

To establish a market for pollution reduction trading, numeric limits must be placed on the amount of pollution discharge allowed by point sources. The important first step is to determine the total nutrient pollution allocation for the watershed.

The second step is for the point source dis-

chargers in the watershed to determine the maximum level of nutrient reduction possible without significant additional point source control costs. Once the point source discharges know the baseline level of nutrient removal possible without significant additional cost, they can calculate whether other pollution control options are more cost-effective than traditional approaches.

To determine the proper limit for nutrient pollution in a watershed, the state must have accurate data on current loading levels and the impact of these nutrients in the watershed. As part of the Tar-Pamlico trading agreement, the dischargers' association is funding development of a geographic information system and water quality model of the watershed which will evaluate data on both point and nonpoint sources. The data will be used to assess the watershed's nutrient assimilative capacity, determine maximum allowable loading, and determine what loadings are attributable to various sources.

The trading system will allow point source dischargers the option of investing in the most cost-effective method.

In most states, nutrient regulations are based only on the imposition of technology requirements, not on water quality-based effluent permit limitations. The Tar-Pamlico agreement grew out of North Carolina's decision in 1989 to designate the entire Tar-Pamlico watershed as "nutrient sensitive waters" and to impose nutrient effluent limitations for new and expanding wastewater treatment plants. The state plan would have imposed technology-based phosphorus and nitrogen limitations, costing point source dischargers millions of dollars in advanced treatment technologies.

Another important step in creating the market is to optimize existing pollutant removal capabilities by point source dischargers. In order for point source dischargers to make a determination as to whether nonpoint source trading would be the most cost-effective option, point source dischargers must determine their base price for nutrient discharge removal. If the marginal cost of pollution reduction through advanced treatment is higher than the marginal cost of nonpoint source controls, then the trading system will allow point source dischargers the option of investing in the most cost-effective method of achieving nutrient reduction.

In the Tar-Pamlico watershed, an engineering evaluation was conducted on all of the member facilities as part of the trading agreement. The members found that they were able to reduce their nutrient loadings by making relatively inexpensive operational changes instead of additional expensive capital investments. In fact, the nutrient effluent levels of association members have been below the state nutrient limits every year since the agreement was signed. Because point source dischargers have been able to reduce their own pollution discharges at relatively low cost, pollution trades have been limited to demonstration projects funded at $800,000. This has provided the group with approximately 14,000 kg of nutrient credits. As facility growth occurs, the need for trading will become an important aspect in planning facilities.

IDENTIFYING NONPOINT SOURCES

If nonpoint source controls are to be a viable pollution control option, then the nonpoint sources must be identified, their impact quantified, and the relative effectiveness of various nonpoint source controls determined. The information system, which the association funded as part of the Tar-Pamlico agreement, is designed to establish the relationship between nonpoint source pollutant loadings and water quality and to aid in targeting nonpoint sources for pollution control.

The association agreed to fund the program so the state would have data on how effective the controls are in reducing nutrient pollution. Reliable nonpoint source controls for nutrient reduction are considered essential for a point and nonpoint source trading system to be considered a viable alternative to additional point source control. In addition, for nonpoint controls to be reliable, states must strengthen enforcement of these controls. Historically, enforcement activities against agricultural operations for failing to maintain best management practices has taken a low priority.

ESTABLISHING A TRADING RATIO

To establish a point and nonpoint trading system, it is necessary to set an appropriate trading ratio. The trading ratio is the amount of nonpoint source control that a point source discharger must undertake to create a credit unit of point source discharge. Under the Tar-Pamlico agreement, an association member must pay $56/kg of excess discharges to a nonpoint source control fund administered by the state's agricultural cost-sharing program. This figure is based on the state's experience with best management practices in the subwatersheds in the area. States will most likely want to set a trading ratio that incorporates a safety factor that takes a conservative view of the amount of nutrient discharges until actual reductions are better quantified. However, state regulators must not set the price so high that trading for nonpoint controls is no longer cost-effective, particularly where existing environmental degradation cannot be abated without substantial nonpoint source reduction.

POTENTIAL BARRIERS TO A TRADING SYSTEM

The greatest barrier to establishing a point and nonpoint source trading system may be relucatance of those involved to depart from traditional regulation and to undertake an experimental program. This reluctance is due, in part, to the uncertainties regarding accurate maximum loading levels and the effectiveness of nonpoint source controls. In watersheds where point sources contribute a relatively minor amount of nutrients, these uncertainties present minimal risks, particularly because the alternative is to impose substantial costs to point source dischargers with no reasonable likelihood of significant environmental improvement.

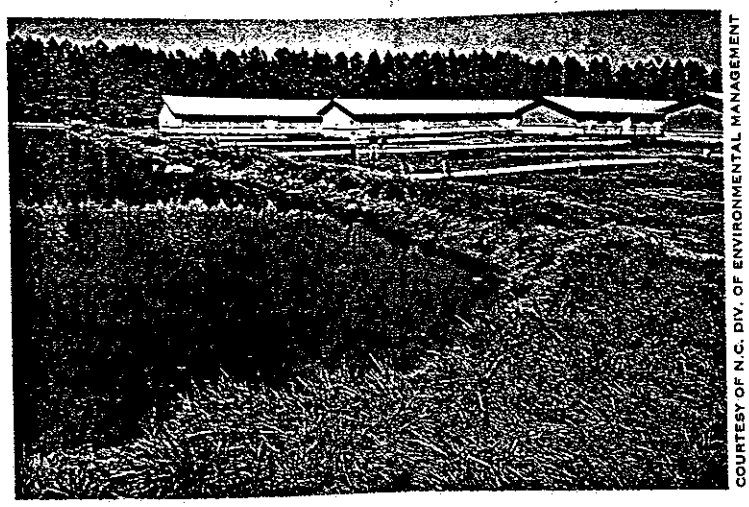
Logistical barriers also complicate the system. Factors such as geography of the region and the character of the pollution loading to the watershed are concerns. For a point and nonpoint source trading system to work, there must be enough quantities of a pollutant common to both sources. In the Tar-Pamlico watershed, nutrients were a major water quality concern because sources were widely dispersed.

Certain toxic pollutants also may be controlled through a trading system. Although toxics have historically been considered too highly localized for trading, recent scientific data suggests otherwise in some cases. For example, a toxics trading system may work to control acid mine drainage where the system uses a substantial percentage of the stream's assimilative capacity due to loadings of heavy metals.

Localized impacts must be considered, however, even in a nutrient trading system. A common criticism of trading systems is that they might allow one point source discharger to cause severe local impact without enforcement if the watershed as a whole did not exceed its overall water quality objective. In the Tar-Pamlico agreement, this concern is squarely addressed by a provision which states that the option of funding nonpoint source controls does not apply when there are local impacts from a point source.

BENEFITS OF THE TRADING PROGRAM

A trading system achieves pollution reduction at a reduced cost and promotes development of nonpoint program. Municipal and industrial dischargers are attracted to the concept by the potential cost savings and flexibility. In addition, a trading system may result in greater long term water quality improvement because it addresses the largest source of nutrient pollution—nonpoint sources. Point source dischargers are provided with incentives to optimize plant performance to trade with other dischargers in the watershed. Eventually, a nutrient reduction "banking" system may be developed to give dischargers even more incentive to reduce nutrient effluent levels.



COURTESY OF N.C. DIV. OF ENVIRONMENTAL MANAGEMENT

In the trading program, point source dischargers contribute to a fund to pay for agricultural best management practices.

When dischargers are given the options available with a trading system and a maximum total nutrient level, they may evaluate their own discharge levels more closely and discover that lower load levels are possible with only minor operational changes. In the Tar-Pamlico watershed, an engineering study of all association members indicated that dischargers could meet the state's initial nutrient reduction target of 425,000 kg/yr through relatively inexpensive operational changes instead of expensive capital investments. Most of the smaller municipalities in the associaton would never have been able to fund an engineering study on their own.

The trading agreement forged an unusual partnership among state officials, environmental groups, and municipal and industrial dischargers. Drawing together so many disparate interests to develop a new approach to water quality control was challenging, but rewarding. The compromise agreement will reduce nutrient pollution by an equal or greater amount as traditional approaches, with a cost savings that has been estimated as tens of millions of dollars. The main lesson learned from the experience is that in areas in which trading is feasible, it is both an environmentally and economically preferable approach. ■