

Nonpoint Source News-Notes

*The Condition of the Water-Related Environment
The Control of Nonpoint Sources of Water Pollution
The Ecological Management & Restoration of Watersheds*

Commentary

Community-Based Conservation on the Clinch — Partners, Pearlymussels, and Patience

by Leslie Colley, Clinch River Community Project Leader, The Nature Conservancy, Tennessee Chapter

Community-based conservation requires vision, perseverance, imagination, humor, and knowledge about a great number of topics, ranging from forage budgets to good salesmanship. For 18 months now, I have participated in such a challenging project in Tennessee's Hancock County. The Nature Conservancy's Clinch River Community Project provides the area's farmers with technical and financial support for pasture renovation, livestock exclusion fencing, alternate water sources, and streambank stabilization. Our ultimate goal in this agricultural county is to protect and preserve some of the richest freshwater mussel shoals in the world.

The county has minimal industry and little development, and agricultural runoff poses a significant problem for both aquatic fauna and farmers. Agriculture in Hancock County centers around tobacco and beef cattle. Farm size averages 80 acres, and farming practices are passed from generation to generation. This narrow river valley is surrounded by steep ridges: a beautiful, wild landscape with fertile alluvial soils along the river.

INSIDE THIS ISSUE

Commentary

Community-Based Conservation on the Clinch 1

Notes on the National Scene

Environmental Indicators Measure Progress toward National Water
Quality Objectives 2
Climate Change Implications for Water Managers 4
New Opportunities for Ag Conservation 5

Notes on Riparian and Watershed Management

Agroforestry — Land Management That Works 6
A New Horizon for PL-566 6
States Working Together to Solve NPS 7

Urban Runoff Notes

Industrial Waste a Hidden NPS 8

Notes on the Agricultural Environment

Water Quality Demonstration Project: East River 9
Can Changing Livestock Feed Reduce Nutrients in Waste? 10
The Netherlands' Strict New Manure Management Policy 12
South Carolina Offers Farmers Economical Ways
to Handle Manure 12

News from the States, Tribes, and Localities

California Utility Invests in Watershed Restoration 14
Peer Match Program Helps Tribes with Wastewater 15
Volunteer Solutions to Pollution in Maine's Coastal Watersheds . . . 16

A Tax Incentive for Installing Ag BMPs in the Everglades 17

Technical Notes

Getting the Best Results from Wet-Detention Ponds 18
Alternative On-Site Systems: A Viable Solution? 20

Notes on Education and Outreach

New Educational Resources 21
Education and Outreach in Action 21
Floating Down the Penobscot with a Message 22
Finally! Guidelines for Environmental Education 23
Can Community Education Reduce Water Pollution? 25
Farm*A*Syst Looks for Best Delivery Method 25
Nonpoint Source Outreach Conference 26

NPS Electronic Information Exchange News 26

Reviews and Announcements

America By Rivers — Review 26
New Breed of Watershed Management Tool 27
Watershed '96 Online 27
Video Explores "Visioning" for Consensus Building 28
Water Indicators Guide Updated 28

DATEBOOK 28

THE COUPON 31

Building Trust

Hancock County is geographically isolated, sparsely populated (6,700 residents), and one of the most financially strapped counties in the nation. Outsiders are viewed with suspicion. Building acceptance and the community's trust isn't easy, but it is the foundation of the Clinch River Community Project. Our work would be impossible without the confidence of the community.

Trust also depends on our willingness to be committed to, and involved in, the community. The Nature Conservancy understood early on that it would have a difficult time gaining entry into the area without a partner who already enjoyed a presence here. Lindy Turner, the Clinch-Powell Resource Conservation and Development Council's infinitely capable coordinator, is an indispensable contact and has provided invaluable guidance and expertise. She understands agriculture, and she knows how to move the project along gently and deliberately.

I have office space in the Hancock County courthouse and live in the project area. I spent my first three months just becoming familiar with the people and their way of life. The process, though logical, is complicated and slow, but I managed to meet a broad cross-section of people in the county, including respected farmers, local leaders, woman's club members, and the high school's Future Farmers of America.

Striking a Balance

At the forefront of our work is the importance of balancing science and people. Input from landowners regarding land use, future plans, concerns, and new ideas is paramount, and I approach each one from the standpoint of "What can I do to help you?" Farmers especially must believe that the work makes sense and that the land and their herds will benefit. The rarity of the birdwing pearl mussel (*Lemiox remosus*) or the spiny riversnail (*Io fluvialis*) is generally not a priority for them.

Whether it's moving six hogs out of the headwaters of a stream or providing pedestrian gates in a fence for river baptisms, dialog is frank, and individual history is respected. We participate in every aspect of the work on each farm, thus freeing the farmers from having to fill out ag program applications, hire subcontractors, or perform all the legwork. Landowners are encouraged, however, to contribute as much time, labor, and equipment as they choose. In other words, the program is voluntary, nonthreatening, easy, and beneficial for landowners — and it works! The finished product generates pride not only for farmers, but for the surrounding community as well.

During my first year in Hancock County, we helped build two miles of fence along the river, and we planted 5,000 trees, relocated a small hog lot, installed two alternate water troughs, hosted four successful community meetings, published articles in the local newspaper, and made a lot of friends.

Over the next three years, with the support of EPA section 319 funding, we will continue to work with landowners to implement BMPs. We also hope to expand the effort beyond building fences and planting trees to finding alternatives to beef cattle and tobacco farming (e.g., blueberry farming) that will improve the economic health of the community while protecting its resources.

The only way to protect some places, especially river systems with a history of small-scale agriculture like the Clinch, is to work with local landowners to get the job done. A local presence is the best investment. It engenders trust within the community and connects us to the people we are helping and the place we are trying to protect.

[For more information, contact Leslie Colley, Clinch River Community Project, Hancock County Courthouse, P.O. Box 347, Sneedville, TN 37869. Phone: (423) 733-2100; fax: (423) 733-4348.]

Notes on the National Scene

Environmental Indicators Measure Progress toward National Water Quality Objectives

Emphasizing the importance of documenting the nation's water quality improvements, U.S. EPA Administrator Carol Browner released the first national water quality indicators report, *Environmental Indicators of Water Quality in the United States*, at the Watershed '96 conference in Baltimore, Maryland, on June 12, 1996.

The report describes 18 water quality indicators that will be used to help evaluate the effectiveness of our water resource management programs and to illustrate trends in water quality over time. "For the first time," said Browner, "[this report] gives us a set of environmental measures — a baseline — showing that we are making progress in improving water quality."

Indicator Selection — Achievement through Collaboration

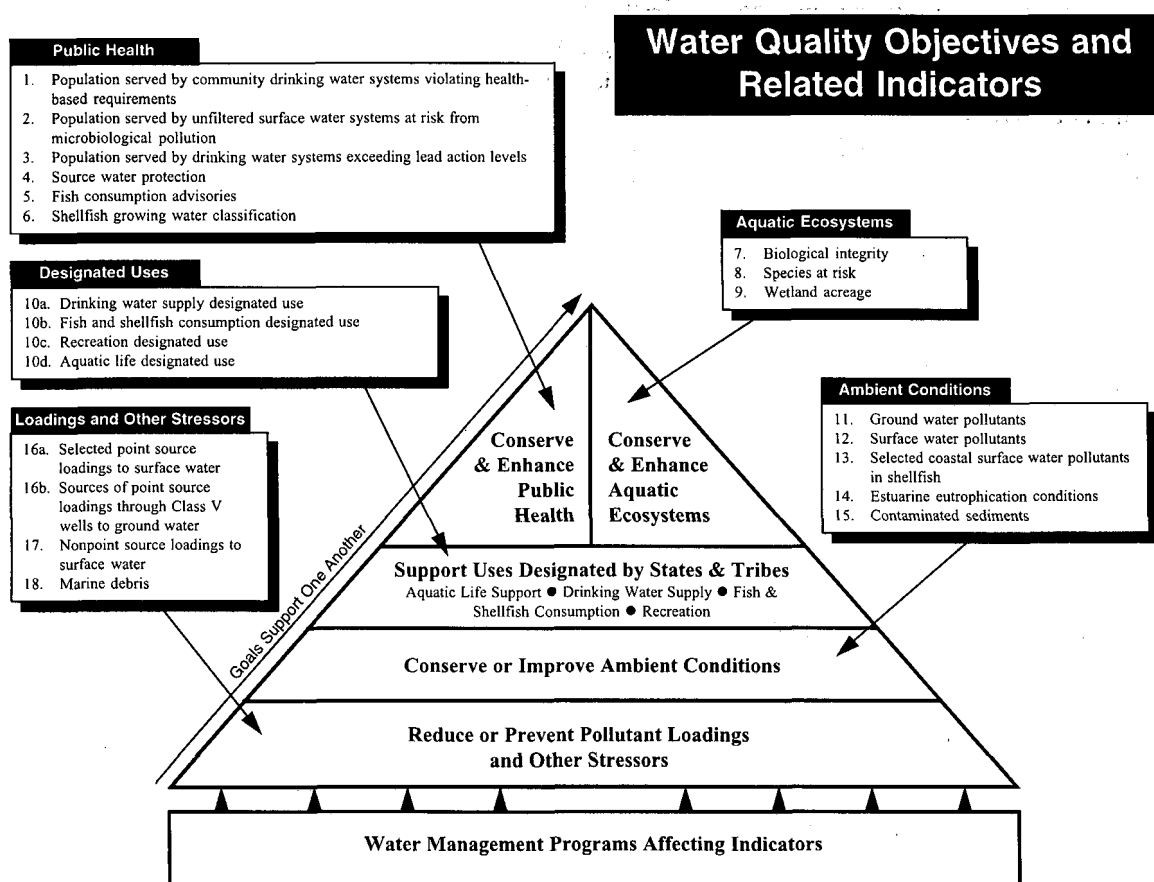
The report was developed through an intense multiyear process led by EPA's Office of Water. The process involved an EPA workgroup headed by Elizabeth Fellows of EPA's Office of Wetlands, Oceans, and Watersheds; a series of public meetings; and an intensive cooperative effort between EPA and several other agencies and organizations responsible for collecting the data used for the indicators. Participants included The Nature Conservancy, the National Oceanic and Atmospheric Administration, the U.S. Department of Agriculture, the U.S. Geological Survey, the U.S. Fish and Wildlife Service, the Intergovernmental Task Force on Monitoring Water Quality, and the Centers for Disease Control and Prevention.

Water Quality Objectives and Indicators

The conceptual foundation for the report centers on the relationship between water quality objectives and indicators (see Fig. 1). The 18 environmental indicators serve as measures of progress toward five water quality objectives by providing information on environmental and ecosystem conditions and reliable evidence of trends in quality. The indicators focus on measures such as the rate of wetland losses, the percentage of waters with fish consumption advisories, the percentage of assessed waterbodies that support safe drinking water, and trends in selected surface water pollutants.

The 18 measures support five water quality objectives that in turn directly support the goals of clean water and safe drinking water. The five water quality objectives are to (1) conserve and enhance public health; (2) conserve and enhance aquatic ecosystems; (3) support uses designated by the states and tribes in their water quality standards; (4) conserve and improve ambient conditions; and (5) reduce or prevent pollutant loadings and other stressors.

Figure 1— Objectives and indicators.



Data Quality and the Water Quality Indicators

Critical to the success of the indicators is data quality. Currently, many indicators are backed by sufficient data to serve as a baseline for reporting trends. They rely on well-established sources such as state-issued 305(b) reports, EPA's Permit Compliance System, and EPA's Safe Drinking Water Information System, and the U.S. Fish and Wildlife Service's National Wetlands Inventory. Other indicators, however, are supported by less sufficient data. As a result, EPA headquarters is working closely with EPA regional offices and other public and private actors to draft action plans for

each indicator. These action plans will identify data inadequacies and outline measures that can be taken to improve data collection and quality.

Regional, State, and Local Applications

In addition to improving the quality of the supporting data, geographic scale must also be considered in using the indicators. The report centers on the use of the indicators on a national scale, but as Robert Perciasepe, assistant administrator of the EPA Office of Water, notes: "The indicators also work at smaller geographic scales, for instance, state, tribal, and watershed."

Efforts to assess the applicability and implementation of the indicators at the regional and local levels are already underway. As part of EPA headquarters/regional office agreements, the 10 EPA regions are required to work with states and tribes to improve their data reports. In addition, EPA is supporting a series of pilot projects in eight states (Arizona, Delaware, Georgia, Maine, Maryland, Ohio, South Carolina, and Wisconsin) to test the use of the indicators to supplement existing measures. Preliminary results from the pilot projects are expected this fall.

While EPA and its partners are making progress in exploring the use of the indicators on regional and local scales, some issues are still outstanding. Among the unresolved questions and issues are

- the availability of resources to improve data collection for tracking the indicators in a meaningful way;
- the stability of the list of indicators;
- the ultimate use of the indicator information;
- the level of state participation in tracking, reporting, and improving the indicators; and
- the ultimate benefit to and impact on state and local water resource management programs.

Next Steps

EPA and its partners will address the unresolved issues and data quality improvements and build on the lessons of the state pilot projects. The goal is to improve and refine the indicators and their applicability at multiple geographic scales. EPA will also update this report on an annual basis to document improvements in the indicators and in meeting national water quality goals and objectives.

[To request the indicators report and accompanying fact sheets, contact Water Environmental Indicators, EPA Office of Water (4503F), 401 M Street, SW, Washington, DC 20460. The report and fact sheets are also available on the internet at <http://www.epa.gov/OW/indic>.]

Climate Change — Some Implications for Water Managers

Records spanning the past 95 years indicate that more rain has been falling in hard one-day rainfalls in the past 25 years, and the United States has averaged about 5 percent more rainfall since 1970. In addition, increased precipitation has been occurring in cold weather, especially in the fall. Local increases of nearly 20 percent are not uncommon, although annual precipitation has decreased in some states, including California, Montana, Wyoming, North Dakota, Maine, New Hampshire, Vermont, and parts of the southeast and central United States.

Are these changes due to human-induced "global climate change"? Scientists don't all agree, but if these changes are indications of long-term trends, then they pose challenges to water resources managers seeking to control nonpoint source pollution. Increased rainfall could change flow patterns and perhaps lead to increased flooding, streambank erosion, and changes in vegetation. On the other hand, some areas could experience decreased rainfall, which could affect water supply or change irrigation patterns.

Observing Changes

For example, a study for the city of Boston projects that the supply of water in its watershed will vary by location and season. Some areas may get rain increases that they need to serve the growing population. Other areas, however, may need to develop additional resources.

Other examples come from a study for the Environmental Protection Agency's Office of Policy, Planning and Evaluation, Climate Change Division. EPA Region 6, with offices in Dallas, Texas, is experiencing severe drought and has named a "Drought Czar" to cope with the problem; Region 5, headquartered in Chicago, has found that larger retention basins are needed to handle excessive rainfall; and Region 7 with offices in Kansas City, Kansas, is experiencing alternating drought and flooding.

Finally, the Intergovernmental Panel on Climate Change finds that the demand for irrigation may increase in areas that presently do not use extensive irrigation. This demand could exacerbate current water shortages and irrigation-related pollution problems.

Sorting through the Data

Statistically, a long-term change in climate appears to be the most likely explanation for the differences in rainfall. However, 20 to 25 years is too short a time to say with certainty that the change is not a normal fluctuation such as often occurs over decades. Even so, it is a situation that calls for careful monitoring. Climate and rainfall changes, whether temporary or permanent, are contingencies that test the practices water managers are using to protect quality.

Information for this article came from R. Karl Thomas, Richard W. Knight, David R. Easterling, and Robert G. Quayle, *Indices of Climate Change for the United States* (National Climatic Data Center, 1995); the U.S. Environmental Protection Agency's Climate Change Discussion Series; and other publications.

[For more information, contact Research Customer Service Group, National Climatic Data Center, 151 Patton Avenue, Asheville, NC 28801. Phone: (704) 271-4994; e-mail: research@ncdc.noaa.gov]

New Opportunities for Ag Conservation and Public Involvement

The 1996 Farm Bill creates new opportunities for solving water quality and other natural resource problems in selected priority watersheds or conservation areas. Authorized from 1995 through 2002, the Farm Bill provides funding to help agricultural producers in priority areas establish conservation practices, including livestock waste management, irrigation, grazing, and erosion control.

Under the Farm Bill, over \$2 billion is available each year for land retirement and conservation practices. The majority of these funds are used for the Conservation and Wetlands Reserve Programs. However, \$200 million is available annually to help agricultural producers establish conservation practices under the Environmental Quality Incentives Program.

How You Can Get Involved in Selecting Priority Areas

In each state, the USDA Natural Resources Conservation Service's state conservationist, assisted by state technical committees, will help select the priority areas. Membership on these committees, which have been expanded and given greater authority under the 1996 Farm Bill, is open to federal, state, and local representatives, agricultural producers, nonprofit organizations, and individuals with conservation expertise.

The Farm Bill also established other funding programs that may be useful to agricultural producers. Recently, USDA published regulations affecting some of these programs:

- Conservation Reserve Program (CRP): Interim Rule (*Federal Register*, 8/27/96);
- Wetlands Reserve Program (WRP): Final Rule (*Federal Register*, 8/14/96);
- Highly Erodible Land and Wetlands Conservation (Swampbuster) — Interim Rule (*Federal Register*, 9/6/96);
- Farmland Protection Program Notice for Proposals (*Federal Register*, 8/21/96);
- Task Force on Agricultural Air Quality: Request for Nominations (*Federal Register*, 8/22/96).

[For more information, contact your USDA/NRCS State Conservationist. Their names are available on the internet at <http://www.nrcs.usda.gov/state.html>. Or contact your local NRCS field office.]

Notes on Riparian and Watershed Management

Agroforestry — A Land Management Practice That Works

Improving water quality, controlling soil erosion and sedimentation, and protecting riparian areas are among the benefits of combining agriculture and forestry. Based on this holistic concept, agroforestry has the potential to increase productivity, profitability, and system sustainability. In spite of these benefits, it has yet to become a widespread tool for farms, ranches, and communities. But the agroforestry movement is kicking into high gear with a new collaboration between organizations.

I have seen firsthand the many landscape situations where agroforestry systems would benefit the natural resources, the farmer's profitability, and even the community's aesthetics and comfort. The reasons for their limited adoption are many, but principal among them has been the lack of widespread, focused cooperation, coordination, and collaboration in the delivery of agroforestry technology and assistance,

says Thomas Christensen, Illinois state conservationist for the USDA Natural Resources Conservation Service and author of *The Partnership Approach - A Must For More Widespread Agroforestry Adoption*.

To overcome this barrier, the National Agroforestry Center (NAC), home of the Agroforestry Institute, has enlisted the USDA Forest Service and the Natural Resources Conservation Service to help strengthen the Center's pioneering agroforestry program. The three organizations share a common interest in encouraging ecologically sound stewardship of the nation's natural resources. Together they can boost the development and application of agroforestry technologies in conservation and production systems.

Agroforestry combines agricultural and forestry practices by integrating different types of crops. It uses soil more efficiently and maximizes its use of growth factors: light, water, temperature, nutrients, soil, growing space, and the growing season.

William Farris, state forester for the Iowa Department of Natural Resources, believes that agroforestry is now gaining interest on a national scale and can benefit the environment and the farming industry. "The establishment of riparian buffer strips is one agroforestry practice that has great potential for agriculture," said Farris. The Iowa State University Agroforestry research team found, for example, that the correct design and placement of multispecies riparian buffer strips effectively prevent sediment, fertilizer, and pesticides from entering water courses.

The partnership among the Agroforestry Institute, the Forest Service and the NRCS will help provide evidence that working with the environment and not against it is an approach that will benefit future generations.

[For more information, contact Inside Agroforestry, USDA Forest Service, Rocky Mountain Station, USDA Natural Resources Conservation Service, National Agroforestry Center, East Campus-University of Nebraska at Lincoln, Lincoln, Nebraska 68583-0822. Phone: (402) 437-5178; fax: (402) 437-5712.]

A New Horizon for PL-566

For many years, Public Law 83-566 has authorized USDA to provide technical and financial assistance to small watersheds to protect agricultural lands from flooding. Historically, this has been accomplished with dams and levees. But the program is changing to reflect a move from structural to nonstructural methods and land treatment approaches to flood control and prevention. Today, half of all PL-566 projects considered for funding are for land treatment measures.

In March 1996, a committee of representatives from federal agencies and environmental and other interest groups established by USDA NRCS Chief Paul Johnson released an interim report on the program. The report explains the program's shift toward land treatment as a response to changes in the NRCS and the effect of the National Environmental Policy Act of 1969, which raised awareness of the consequences of altering the natural environment.

In continued response to these influences, the committee proposed changes to the PL-566 program that would expand its toolbox to include creating, protecting, restoring, and managing wetlands, floodplains, and fish and wildlife habitat. The "new" PL-566 program would provide water supplies for rural communities; address water quality, stormwater, and groundwater recharge issues; and support waterway restoration. The committee also suggested ways to reduce the program's \$811 million project backlog.

The revisions did not make it into the 1995-1996 farm bill signed into law this year, but they may be introduced again in the next session of Congress. Whether or not the specific revisions become law may depend on the political winds, but there is no turning back from the shift in attitude that they reflect.

[For more information, contact Ron Page, Watershed Planning Coordinator, USDA, NRCS, P.O. Box 2890, Washington, DC 20013-2890. Phone: (202) 690-4575; fax: (202) 690-1462; e-mail: rpage@usda.gov.]

Christina River Basin — States Work Together to Solve Nonpoint Source Pollution

A watershed program shared by Delaware and Pennsylvania resolves old state rivalries and establishes a common goal to preserve the beneficial uses of Christina River basin waters.

The basin's streams begin in Pennsylvania and Maryland and flow through the hills of northern New Castle County, Delaware, to the Delaware River. The four major streams, Brandywine Creek, White Clay Creek, Red Clay Creek, and the Christina River, currently have impaired water quality with higher than normal levels of sediment and bacteria. Nitrogen and phosphorous levels exceed acceptable limits during the summer and fall when streamflows are low. These conditions threaten the public drinking water supply for northern New Castle County.

Differences in State Government

For years, Delaware and Pennsylvania had different views on how to solve the basin's problems. The major differences involved water quality standards, perceptions of uniqueness, forms of government, and equal representation. Delaware regards the Christina Basin as a drinking water source and requires a higher degree of protection than Pennsylvania. In Pennsylvania, the Christina River is used for wastewater assimilation and water supply purposes.

Finally, the Delaware River Basin Commission (DRBC) established a committee with representatives from both states. The bistate Christina River Basin Water Sources Committee, chaired by DRBC, is made up of district, county, state, and federal agencies. Its principal purpose is to coordinate the water quality management policies of Pennsylvania and Delaware within the watershed.

After collecting watershed data from both states, the committee found that soil and geology maps differ across state lines. These inconsistencies point to the need for interstate consultation and a watershed-based approach to water problems.

Differences in water quality standards and government may be at the root of the problem. Delaware is made up of a small number of county governments, which permits easier administration of stormwater quality standards. But in Pennsylvania's portion of the basin, over 40 different jurisdictions each implement a different stormwater quality program. Gerald Kauffman, a water resources engineer for New Castle County, believes that coordinating water quality standards between the two states would be a step toward solving the problem.

Achieving Progress

The Christina Basin Water Resources Committee is now developing a unified strategy for improving the quality of streams that supply drinking water to residents on both sides of the Mason-Dixon line. The five-year cooperative effort will address point and nonpoint source pollution, beginning with monitoring and identifying various sources and types of pollutants.

A Total Maximum Daily Load approach will help control wastewater discharges and provide the foundation for a water quality management model of the watershed. Once this step is taken, an assessment and identification of nonpoint sources, such as sediment, road oils, fertilizers, and metals, will be incorporated into the model. Both Delaware and Pennsylvania will use the watershed model to develop projects to control stormwater runoff and reduce water quality impacts to the receiving streams.

The plans, which extend through 2000, include bioengineering and riparian restoration demonstration projects, public awareness programs, and stormwater detention retrofits. The Christina Basin Water Resources Committee is proving that states can look beyond their borders to work together.

[For more information, contact Gerald Kauffman, Water Resources Agency for New Castle County, 2701 Capitol Trail, Newark, DE 19711. Phone: (302) 731-7670]

Urban Runoff Notes

Industrial Waste in Septic Systems Poses Hidden Nonpoint Source Threat

EDITOR'S NOTE: This article is adapted from the *Groundwater Bulletin*, volume 5, number 3, Fall 1995.

Ever wonder how businesses in rural strip malls and industrial parks dispose of their used solvents, chemicals, and other wastewater? Most auto repair shops, dry cleaners, photo processors, and other light industries rely on recycling, authorized sewer hookups, holding tanks, and removal off-site as environmentally safe methods of disposal. But some use septic tanks for industrial waste disposal — a method that poses considerable risk of contaminating ground and surface waters.

Misusing septic systems to treat industrial-grade chemicals is a truly hidden, nonpoint source threat — hidden because it takes place underground, making it difficult to identify, and nonpoint because it can result in untreated septic system loads that can harm ground and surface waters.

Septic systems are not designed to treat industrial-grade chemicals. If these chemicals pass through the system untreated, they can contaminate groundwater. Industrial wastes can also harm the normal biota of septic systems, making it difficult for the systems to effectively treat their usual loads.

Disposal of industrial wastes through septic tanks is regulated under the Safe Drinking Water Act and is illegal when it poses a threat to existing or potential underground drinking water sources. However, the problem is not limited to groundwater. According to the U.S. Geological Survey, 40 percent of average annual streamflow in the United States comes from groundwater. Therefore, groundwater polluted by disposal of industrial wastes in septic systems is also a surface water issue.

A Link to Water Supply Contamination

EPA studies indicate that many of the nation's misused nonresidential septic systems belong to businesses such as dry cleaners, automotive repair shops, service stations, and car dealerships. These businesses inject into the ground as much as four million pounds of spilled gasoline, oil, engine cleaning solvents, brake and transmission fluids, antifreeze, and other industrial chemicals per year — enough to pollute trillions of gallons of drinking water.

The heavy metals, ethylene, glycol, and volatile organics contained in residues of these chemicals can leach into groundwater and remain for long periods of time. EPA estimates that clean-up costs associated with this type of groundwater contamination range from tens of thousands to millions of dollars per case.

EPA documentation of drinking water contamination from industrial waste disposal in nonresidential septic systems includes the following cases:

- Dry cleaning solvents disposed of through a septic system in Tacoma, Washington, contaminated two municipal water supply wells, forcing the city to switch 30,000

residents to alternative sources of drinking water. The capital cost to switch the water supply and clean up the contamination is expected to reach approximately \$1.5 million, not including operation and maintenance costs of \$85,000 per year.

- Tetrachloroethylene (PCE) from disposal wells at auto service stations and car washes contaminated community wells serving 45,000 people in Missoula, Montana. Three of the wells were closed and 15 show elevated levels of PCE. No remedial action has been taken.
- PCE originating from floor drains serving a garage, tire center, auto body shop, and U.S. Army Reserve maintenance shop contaminated an on-site water supply in Gilford, New Hampshire. The floor drains were sealed and the septic systems have been removed and replaced. Septic sludge removal, alone, totaled \$20,000.

Regulating Industrial Discharges to Septic Systems

Individual household septic systems used solely for sanitary waste disposal are regulated by state and local health departments. However, large septic systems used for disposing of sanitary waste in establishments serving more than 20 people per day and any septic system used for industrial wastewater disposal qualify as "underground injection wells" under EPA's Underground Injection Control (UIC) program. The Safe Drinking Water Act mandates that a federally approved UIC program be developed in every state. Those wanting to dispose of industrial waste in their septic system must apply for a permit from their state UIC director.

EPA is working to create federal regulations to help localities deal with industrial waste disposal, but this effort, alone, is not enough to control the problem. Septic systems and water supplies are local issues. Local water quality managers, public health departments, and elected officials must improve their understanding of the problem so that they can correctly identify and address this often overlooked NPS concern.

[For more information on industrial waste disposal in septic systems, contact Harriet Hubbard, Underground Injection Control Program (4602), U.S. EPA, 401 M Street, Washington, DC 20460. Phone: (202) 260-9554; fax: (202) 260-0732; e-mail: hubbard.harriet@epamail.epa.gov]

Notes on the Agricultural Environment

Water Quality Demonstration Project: East River

EDITOR'S NOTE: This is the first in a series of articles highlighting results from the USDA Water Quality Demonstration Projects. The 16 demonstration projects were part of the 1989 President's Water Quality Initiative.

Dairy farmers in Green Bay, Wisconsin, are reducing surface and groundwater contamination and saving money. Helped by the East River Water Quality Demonstration Project (WQDP) — more than 50 producers have reduced their use of commercial fertilizers and pesticides without decreasing crop yields. Their tool? Integrated crop management, or ICM.

How It Works

WQDP staff and consultants work with the farmers to help them plan their fertilizer and pest control strategies — usually a mix of chemical and nonchemical tools. First, the producer uses soil tests and an inventory of on-site nutrient sources such as manure to calculate the amount of commercial fertilizer needed to sustain crop yields. Then consultants help calibrate manure spreaders and make recommendations for crop rotations.

In the last three years, participating farmers have reduced fertilizer applications by nearly 2,500 tons and pesticide applications by 24 tons. And each farmer saved, on average, \$5,000 per year.

Fertilizer suppliers have also adapted their operations to support ICM. They have replaced lost fertilizer sales with services such as soil testing, pest scouting, and nutrient management planning. In Brown County, for example, the number of crop consultants has grown from six to nine in recent years.

Why It Works

The 50 or so farmers who benefit from their participation in the project are quick to point out the lessons they have learned. One of the keys to their success, they say, is good record keeping — of crops, pest management techniques, and fertilizer and manure applications. Another is frequent field monitoring by a professional crop consultant, who recommends treatment only if crop losses will exceed the cost of control. For example, if the cost per acre of spraying for an insect is \$10 and the insect is causing only \$8 in damage, the farmer saves money by not using a pesticide.

Project Background

The East River Water Quality Demonstration Project began in 1990. The goal of this five-year project was to encourage farmers to adopt research-based practices that protect and improve groundwater and surface water quality while maintaining or increasing farm profitability.

The East River WQDP is located in the Fox River Basin of the lower Green Bay, in Brown County, Wisconsin. The East River contributes more than 10 percent of the phosphorus that reaches the lower Green Bay and an equal amount of suspended solids. The overall land use in the lower Fox River is 69 percent agricultural, 13 percent urban, and 18 percent wooded/natural.

Outcomes Achieved

Now that the demonstration project has completed its activities, its impacts can be seen throughout northeastern Wisconsin. A number of the practices initially cost-shared or demonstrated by the WQDP-East River Project, including ICM, have become widely accepted. For example, farmers in seven counties have adopted a manure bartering program modeled after the WQDP-East River program, and information from its research projects has been requested nationally and internationally.

Clearly, ICM is improving the economic and environmental vitality of the East River rural community. Says nutrient management specialist Kevin Erb: "Integrated crop management represents a philosophical shift on the part of farmers and farm suppliers. Through ICM, they're taking a stake in the future of the family farm and the rural community with an understanding that ICM heralds the future of agricultural technology in Wisconsin."

[For additional information, contact Kevin Erb, University of Wisconsin-Extension, 1150 Bellevue Street, Green Bay, WI 54302. Phone: (414) 391-4610. e-mail: kevin.erb@ces.uwex.edu.]

Changes in Livestock Feed Reduce Nutrients in the Chesapeake Bay Watershed

EDITOR'S NOTE: Adapted from the January-February *Bay Journal*, with permission from Karl Blankenship, editor.

The Chesapeake Bay Commission and the Bay states are using new feed formulations to reduce animal waste in the watershed, maximizing milk and meat production and minimizing the amount of waste produced by livestock.

Until now, nutrient management techniques for reducing agricultural runoff were focused mainly on crops, but the same principle can be applied to feed formulas.

"These things are just coming into focus," said George Wolff, an agricultural consultant. "Just as it was important to do soil tests [for nutrient management], I think that we will now find that it's equally important to do feed tests and then mix the rations according to what the animal needs, just as [farmers] balance the nutrient loads going on the land for the various crops [they're] going to grow."

A Break in the Nitrogen Cycle

In a paper recently published in the *Journal of Production Agriculture*, Penn State researcher Les Lanyon explained that the advent of chemical fertilizers at the end of World War II led to feed crops being grown in one region and exported to another in a loop that leaves no room for recycling the nutrients in animal wastes.

On a crop farm, applied nitrogen goes mainly to produce a crop that is harvested and removed, Lanyon said. But on a farm specializing in animal production, only about 25 percent of the incoming nutrients are ultimately exported in the form of a product, such as milk. The other 75 percent stays behind in the form of manure, which must be managed.

Few livestock operations in the Chesapeake Bay watershed grow enough of their own feed to use the manure as fertilizer. Most of their feed comes from the Midwest, forcing producers to look for other solutions.

Amino Acids, Enzymes, and Animal Feed

In a recent study funded by the Chesapeake Bay Program, the Lebanon and Berks County Conservation Districts in Pennsylvania altered the nutritional mix of food and enzymes fed to 54 dairy cows. They achieved a 14.4 pound per cow per day decrease in the amount of waste produced, and they increased daily milk production by 2 pounds per cow per day. Because milk production generally decreases at intervals during a cow's 150-day lactation cycle, this gain was even more significant when measured over time. Adjusted to the 150-day cycle, the gain actually represented a 4.7 pound per cow per day increase.

Because only a portion of the phosphorus and nitrogen consumed in feed is nutritionally available to the animal, some nutrients continue to be excreted as waste. Researchers at the University of Pennsylvania's Center for Animal Health and Productivity are investigating the benefits of adding amino acids to feed to optimize nutrient uptake. The payoff, according to the center's director, Charles Ramberg, is that a dairy cow requires lower levels of nutrients in feed to produce the same amount or more of milk, while nitrogen in wastes can be reduced by 25 percent or more.

The approach is somewhat different for single-stomached animals such as hogs and chickens. Since these animals lack phytase, two-thirds of the phosphorus in plants is not available to them. To make this nutrient more accessible, farmers in the Netherlands add phytase to animal feed, a tactic that potentially reduces phosphorus in animal wastes by 40 percent.

Phytase was recently approved by the Food and Drug Administration for use in the United States, but its use may not be economical. Farmers in the Netherlands face financial penalties for exceeding nutrient production, giving them an incentive to purchase the additive (see "New Law in the Netherlands," this issue, p. 12).

George Robinson, a feed manufacturer, poultry and beef farm operator, and chair of the committee overseeing implementation of Pennsylvania's nutrient management law, notes that it wouldn't be economical for farmers to use it unless it were used nationwide. Other agribusiness firms see potential in the additive. Wenger Feeds in Rheems, Pennsylvania, is already marketing Natuphos (phytase) in poultry feed formulated for egg production.

Looking Forward

Ramberg predicts that some of the amino acid technologies developed at the Center for Animal Health and Productivity could be used on production farms in a year or so, although he agrees that making inroads will take time because of the complexities involved.

"It certainly is more work, but the payback is more milk for the same amount of feed . . . or conversely, lower feed cost for the same amount of milk. So you gain one way or the other," Ramberg concludes. Add in the management and water quality benefits to be gained from reductions in the nutrient content of waste, and feed formulation appears to be a management technique with a future.

[For more information on the Lebanon and Berks County Conservation Districts' study, contact Donald L. Bollinger, President, Lebanon County Conservation District, Millbach Road, Box 166, Newmanstown, PA 17073. Phone: (717) 949-3866; fax: (717) 949-2398.]

For more information on research at the Center for Animal Health and Productivity, contact Charles Ramberg, 382 West Street Road, Kennett Square, PA 19348. Phone: (610) 444-5800; fax (610) 444-0126.

For a copy of Does Nitrogen Cycle? Changes in the Spatial Dynamics of Nitrogen with Industrial Nitrogen Fixation, contact Les Lanyon, Pennsylvania State University, Department of Agronomy, 116 ASI Bldg., University Park, PA 16802. Phone: (814) 863-1614; fax: (814) 863-7043.]

New Law in the Netherlands — A Strict Manure Management Policy

EDITOR'S NOTE: Adapted from the January-February *Bay Journal*, with permission from Karl Blanken-ship, editor.

Farmers in the Netherlands will have about 15 years to eliminate the environmental burden caused by an agricultural manure surplus, according to a recently approved policy promulgated by the Dutch Ministers of Agriculture and the Environment.

In the Netherlands, 15 million people share a living area about a third the size of Pennsylvania with 4.7 million cattle, 13.4 million pigs, 44 million laying hens, 41 million broilers, and 1.7 million sheep. The manure produced by these animals is four times the amount needed for fertilizer in the country. To gain some perspective on the enormity of the problem, consider that a single 500-sow farm producing 20 piglets per sow per year produces about the same amount of effluent as a town of 25,000 people. The new policy targets large-scale farm operations, reducing the maximum animal/land ratio from 2.5 livestock units per hectare to 2.0 units per hectare in 2002.

David Brubaker, of the PennAg Industries Association and the Chesapeake Bay Program's Citizen Advisory Committee has studied the Netherlands' situation. "They have what we have, only worse," he explains. "Almost all feed is imported, . . . but the waste is left behind, so to speak."

The Dutch have been addressing manure surplus concerns since the 1980s. Another new law requires farmers with surpluses to develop a disposal plan. Those exceeding permitted levels face financial penalties, while innovators finding ways to market manure abroad, such as exporting pelletized poultry manure as lawn fertilizer, are rewarded. Dutch farmers also pay higher taxes on commercial feed, a strategy designed to reduce the influx of nutrients.

These and other laws regulating nutrient flows reflect the lessons Dutch policymakers have learned from their experience with manure-related problems. Brubaker highlights the central policy tenets that the Dutch have shared with him:

- Initially, a centralized approach to manure management should be employed; later, a local or "farm-oriented" policy can be employed (e.g., the Dutch large-scale manure factories have been closed in favor of on-farm processing).
- Policy goals must be clear, and the agricultural community must be included in the process from the beginning.
- There will always be "bad actors," so both positive and negative reinforcement is needed.

As the world's second largest exporter of agricultural products, the Netherlands must resolve its manure surplus problems. Its goal, Brubaker explains, is to balance ecological goals with economic needs, but its challenge is to make sure that Dutch products remain competitive in the European market.

[For more information, contact David Brubaker, Executive Vice President, PennAg Industries Association, 120 Lake Street, P.O. Box 329, Ephrata, PA 17522. Phone: (717) 733-2238; fax (717) 733-3083.]

South Carolina Project Reduces Nonpoint Source Pollution — Relies on Cooperation and Innovation

Six years ago, South Carolina's Bush River-Camping Creek Watershed was plagued by sediment, bacteria, and nutrients. And no wonder. The watershed houses over 15,000 beef cattle, 4,800 dairy cattle, 2,800 swine, and 1,000,000 poultry that produce about 75,000 tons of waste annually.

Thus, confined feeding operations and nutrient management are key objectives of an ongoing watershed project funded by USDA, an EPA 319 program grant, and matching state and local dollars. The Camping Creek/Bush River Agricultural Watershed Project is a coordinated effort among federal, state, and local agencies and landowners to improve water quality in the watershed.

Cleaning Up Confined Feeding Operations

In 1990, when the six-year project began, 48 of the watershed's confined feeding operations were out of compliance with South Carolina Department of Health and Environmental Control (DHEC) regulations. To address the problem, the South Carolina Department of Natural Resources (DNR), Land Resources and Conservation Districts Division, guided the development of a Geographic Information System showing the watershed's confined feeding operations.

Aided by the GIS, a DHEC agricultural specialist funded by the project inspected the operations and worked with landowners to bring their facilities into compliance. This approach successfully addressed violations such as illegal discharge pipes, overflows, runoff from animal housing, improper dead animal disposal, and lack of permits. By 1993, 26 of the 51 operations were in compliance, and the rest were actively working with the DHEC and the USDA Natural Resources Conservation Service (NRCS) to improve their operations.

Nurturing Nutrient Management

The project also employed a hands-on approach to nutrient management, installing best management practices (BMPs) such as proper land application on 3,600 acres and the construction of eight new agricultural waste lagoons. NRCS staff continue to work with landowners in the watershed to develop water quality contracts and assist in the design, layout, and construction of BMPs. The Clemson University Extension office is instrumental; it helps landowners understand the requirements of their water quality plans.

The results of these early efforts showed. The 129,700-acre Bush River-Camping Creek watershed drains into Lake Murray, a power, water, and recreational impoundment. Water quality samples taken at DHEC's monitoring station at the headwaters of Lake Murray two years into the project revealed a significant decrease in nutrients entering the lake. The project team will check future monitoring results to confirm these preliminary findings.

Introducing Innovative Services

The watershed partners expect to build on their successes in the project's final phase. This phase provides the agricultural community with innovative BMP services.

In 1994, with 319 project funding administered by DNR, the Newberry Soil and Water Conservation District (SWCD) purchased lagoon pumpout equipment to share with farmers in the watershed. Brian Smith of Clemson University Extension helped select the equipment, which livestock and poultry farmers can rent to maintain their lagoon levels in accordance with their waste management plans. The program saves farmers from investing \$20,000 in equipment and provides an additional benefit — the assistance of a SWCD staff person.

Beginning this fall, the project will also provide a mobile nutrient testing service for poultry litter. Clemson University is calibrating nutrient testing equipment to add to the South Carolina Department of Agriculture's mobile forage testing laboratory. Poultry farmers will be able to take litter samples to the lab on its regularly scheduled stops at local ag sale centers or extension offices and walk away with a nutrient analysis within 30 minutes. DNR's Chris LeMaster explains, "The mobile lab gives farmers an instant result, allowing them to spread litter the same day with an accurate application rate, rather than having to wait for test results that may be outdated by the time they are received."

A Worthwhile Approach

By coordinating their efforts and focusing on the needs of the agricultural community, the partners in the Camping Creek/Bush River Agricultural Watershed Project have created innovative and successful solutions to nonpoint source pollution problems that also benefit the agricultural community. "It's nice to hear farmers say that what we're doing is worthwhile," LeMaster observes. "We are actually providing services they need while saving them money. Meanwhile, pH and nitrogen levels have already dropped at Lake Murray, giving us an early indication of success." Any way you look at it, it's an approach that shines.

[For more information, contact Doug Fabel, State Nonpoint Source Coordinator, South Carolina Department of Health and Environmental Control, 2600 Bull Street, Columbia, SC 29201. Phone: (803) 734-4837; fax: (803) 734-5355.]

News from the States, Tribes, and Localities, Where the Action Is

California Utility Invests in Watershed Restoration

Watershed remediation efforts often take place upstream to benefit downstream consumers, but they are incomplete unless the costs as well as the benefits are equally shared.

The Natural Resources Conservation Service estimates that each year 1.1 million tons of eroded soil travel down the Feather River to Pacific Gas and Electric's (PG&E) Rock Creek Reservoir. The utility's Rock Creek and Cresta Reservoirs have already lost 46 and 56 percent respectively of their original storage capacities. This loss affects the 600,000 electricity consumers served by the reservoirs and the 20 million water consumers who also rely on the reservoirs. To protect its investment, PG&E turned its attention upstream; it began offering financial assistance for remediation efforts in the watershed.

Looking Upstream

Nearly 80 percent of the erosion in the watershed is attributed to human activity. Mining, grazing, timber harvesting, wildfire, rail and road construction and maintenance have led to the down cutting and widening of the watershed's tributaries. Many areas have lost the equivalent of 6 to 12 inches of topsoil since they were first settled. To find a solution, PG&E began a series of meetings with the government agencies responsible for erosion control upstream from the dams.

In 1985, the agencies involved organized the Feather River Coordinated Resource Management (CRM) group and signed a Memorandum of Understanding that established goals and guidelines for conducting erosion control projects in the watershed. The CRM concept has since expanded: over 30 CRM groups are currently working throughout California.

The Feather River CRM has completed 40 watershed projects. PG&E has invested \$1.1 million in the effort, anticipating that sediment deposits in the reservoirs will decrease by as much as 50 percent over time. The following projects are among those supported, in part, by PG&E:

- In 1990, PG&E supported construction of two erosion control rock drop dam structures in the Noble-Red Clover Creek watershed. The dams slow streamflow while willows planted by the project stabilize soil.
- More recently, in 1995, the Big Flat Meadow Rewatering Project moved Cottonwood Creek from its down-cut channel into 4,050 feet of new channel. The old channel had eroded down 15 feet and was dewatering a 47-acre meadow, allowing sagebrush to invade. PG&E provided financial support for the project and will monitor wells in the meadow over the next five years to track changes in groundwater levels.
- Since 1990, PG&E has also supported a Water Resources Technician Program at the Feather River Community College. Members of the CRM teach field methods and watershed management for credit toward a one-year certificate or a two-year Associate's degree.

Investing Upstream for Downstream Returns

Currently, the Feather River CRM is working on several priority projects in its erosion control strategy and pursuing new funding mechanisms. On behalf of the CRM and the Quincy Library Group (a nationally recognized forest health partnership that took its name from its original meeting place), the local Plumas County Board of Supervisors is exploring user fees or some other funding mechanism so that downstream users can invest in the watershed.

Leah Wills works for the Plumas Corporation, the nonprofit economic development corporation that coordinates funding requests for the Feather River CRM. She says that Plumas County — and 23 other northern California counties — have an overwhelming desire to promote watershed stewardship. But financial support for their efforts is not always available.

Investment from those who live downstream will help fill this void. It is a mutually beneficial approach. Upstream watershed restoration projects get the support they need, while investors downstream, such as the PG&E, gain an improved resource. It seems as plain as day, but making it work requires changing the way downstream users regard watershed resources.

"For some reason, California water users don't consider it a cost of doing business to maintain the natural water collection areas above dams," Wills explains. "They're used to maintaining [constructed] parts of the state's water delivery system, but not the God-given parts." Nevertheless, as the benefits of upstream investment begin to show, a new outlook is sure to follow.

[For more information, contact Leah Wills, Feather River CRM Coordinator, Plumas Corporation, P.O. Box 3880, Quincy, CA 95971. Phone: (916) 283-3739; fax: (916) 283-5465. To obtain a series of six fact sheets on the activities of the Feather River CRM, contact Susie Kocher or Michael DeLasaux, University of California Cooperative Extension, 208 Fairgrounds Road, Quincy, CA 95971. Phone: (916) 283-6270; fax: (916) 283-4210.]

Tribes Begin New Peer Match Program — Training and Technical Assistance Reach Small Communities

A recent inventory taken by the National Rural Community Assistance Program indicates that Native American communities are "usually small, isolated, lacking in both household and tribal resources, and removed from the network of training and technical assistance available to many nontribal governments." Approximately 14 percent of the 185,000 households inventoried were lacking indoor wastewater or other water facilities.

The National Tribal Environmental Council (NTEC), a nonprofit tribal membership organization, has taken a new approach to reverse these numbers: it seeks to improve wastewater management and drinking water in native communities using a "peer match" program to create cooperative relationships between tribal communities who are in the process of establishing similar, if not the same, wastewater or drinking water facilities. The peers will share information and ultimately, in addition to improving the communities' quality of life, the program will advance point and nonpoint source water management practices for Native American tribes and Alaskan Native villages. "The program will fill a niche for tribal communities who don't have access to information," said David Duffy, NTEC Peer Match Program coordinator.

Under the program, NTEC and the U.S. Environmental Protection Agency's Office of Wastewater Management will provide native communities with technical assistance, education, training, and special expertise from tribes, federal agencies, and the private sector. With a \$75,000 grant awarded in May 1995 and a second-year grant for an additional \$75,000 from EPA's Office of Wastewater Management, the program will assist 18 tribes.

Currently, tribes can apply to participate in the exchange program and in a specifically designed wastewater course. Bernadette Hundel, environmental director for the Mississippi Band of Choctaw, said the Peer Match Program is a good way for tribes to learn from each other and the programs they have conducted.

"We wanted to create our own water quality testing lab," Hundel said. So Mike Frost (Southern Ute) let her see his lab and the equipment and facilities the Choctaw would need to start its own. The information Frost provided helped the Mississippi Band of Choctaw outfit a wastewater and drinking water quality laboratory that tests for ammonium, salinity, pH, fecal coliform, biological oxygen demand, and macroinvertebrates, among other parameters.

In addition to the Peer Match Program, NTEC has also been working with the National Environmental Training Center for Small Communities (NETCSC). This EPA-funded training organization and sister organization of the National Small Flows Clearinghouse has created a wastewater short course and training for tribes. NETCSC has submitted a proposal for a \$20,000 EPA Environmental Education Grant to provide a tribal wastewater train-the-trainer session and two introductory workshops in cooperation with NTEC.

The Peer Match Program facilitates a natural partnership among tribes, Duffy says, one that "will improve the quality of life for many Native American communities."

[Since contributing to this article, David Duffy has taken a position with the Pueblo of Jemez. His former position at NTEC is vacant but expected to be filled in the near future. For more information, contact NTEC, 221 Rio Grande N.W., Albuquerque, NM 87104. Phone: (505) 242-2175 or (800) 727-2175.]

Volunteers Fill Void in Maine's Coastal Watersheds Survey

by Kathleen Leyden, Coordinator of Community Stewardship and Outreach, Maine State Planning Office.

Faced with limited resources and the need to evaluate and address coastal nonpoint source pollution, the Maine State Planning Office and the Maine Department of Environmental Protection (DEP) turned to the community for help. And got it. This summer, volunteers helped us identify nonpoint sources and educate watershed residents in four coastal areas.

We decided to enlist the aid of volunteers when we realized that involving the community in identifying sources of coastal nonpoint source pollution would stimulate ownership and build education and awareness. Our goals for these projects are to involve and educate the public about watershed management, to locate pollution sources, to obtain technical recommendations, to reduce or eliminate sources, and to qualify for state and federal funds for remediation projects.

Training

In preparation for the program, we developed *A Citizen's Guide to Coastal Watershed Surveys*. The guide explains the "how-to" aspects of survey designs and methods for identifying polluted runoff, setting site priorities, producing summary reports, and developing an action plan.

We then selected pilot projects based on their geographic distribution, the ability to coordinate training and field work, and the opportunity to focus on different coastal pollution issues. Because we were working on a tight schedule, we also looked for already organized and motivated volunteers. The Sheepscot Valley Conservation Association, for example, is a citizens water quality monitoring program that has been active for three years.

Our next step was training. We hired a contractor to develop the training program, train volunteers, and coordinate the surveys. We also included pilot projects in the budget, and assigned staff to help with training, setting priorities, and report writing.

The pilot projects are currently underway. Volunteers in Oyster River in Damariscotta and Weskeag River in St. George are mapping sources of bacteria that have closed shellfish flats and threatened aquaculture habitat; and volunteers on the west branch of the Sheepscot are searching for sources of erosion that threaten Atlantic salmon habitat. In Boothbay Harbor, volunteers are looking for sources of heavy metal contamination reflected in sediment and mussel tissue samples. Our partners in these projects include three land trusts, a high school, an informal coalition of shellfish harvesters, the University of Maine Cooperative Extension, local soil and water conservation districts, and Americorps.

Lessons Learned

A few months into the pilot projects, we have already begun to evaluate lessons learned as we prepare to launch additional survey projects next spring. It is clear, for example, that we need to provide more time for groups to organize and train. One of the initial pilot sites had to drop out of the program because our schedule was too tight. We also spent more time coordinating local activities than we anticipated. A better approach may be to fund local coordinators to take over once group training is complete.

Another possible improvement would combine our training with similar programs, such as Maine's Department of Marine Resources (DMR) volunteer training program. The DMR trains volunteers to conduct sanitary surveys of homes adjacent to shellfish growing areas to identify sources of bacteria. In contrast, our watershed survey program is more comprehensive, covers the entire watershed in addition to the shoreline, and addresses types and sources of pollution

other than bacteria. Combining the programs would eliminate duplication of effort and confusion among volunteers.

To date, volunteers in four locations are busy conducting field work. Final reports are due December 31, after which we believe the volunteer groups will be poised to continue working with landowners and state and federal agencies to implement solutions.

[For more information, contact Kathleen Leyden, Coordinator of Community Stewardship and Outreach, Maine State Planning Office, State House Station 38, Augusta, ME 04333. Phone: (207) 287-3144; fax: (207) 287-6489; e-mail: kathleen.leyden@state.me.us.]

A Tax Incentive for Installing Ag BMPs in the Everglades

South Florida agricultural producers have an added incentive to implement best management practices — namely, the ability to reduce a tax if they can exceed a 25-percent basinwide phosphorus reduction goal.

The product of the 1994 Everglades Forever Act, the Agricultural Privilege Tax is aimed at increasing the currently mandated 25 percent reduction in phosphorus loads discharging from the Everglades Agricultural Area (EAA). The EAA is located between Lake Okeechobee and the Everglades National Park, and its extensive sugar cane and vegetable farms have historically contributed 47 percent of the phosphorus load discharged to the Everglades.

BMPs and STAs — A Potent Mix Against Phosphorus

The Agricultural Privilege Tax supports a strategy that combines on-farm BMPs with the construction of six Stormwater Treatment Areas (STAs) to address phosphorus loadings to the Everglades.

Because the first step is to filter nutrients as they leave the farm, the Act required farmers to prepare plans and install BMPs by the beginning of 1995. The plans detail the BMPs that farmers will use to reduce nutrient runoff — for example, soil testing, applying fertilizer directly to crop roots, providing for longer drainage retention, sediment controls, and innovative crop location. The South Florida Water Management District (SFWMD) has already begun inspecting the farms for BMPs. In July, SFWMD reported that BMPs were implemented on all acres in the EAA in 1995-1996.

The Agricultural Privilege Tax provides an incentive for farmers to use BMPs. In November 1994, counties began adding the Agricultural Privilege Tax to their tax notices. Beginning at \$24.89 per acre, the tax will increase every four years to a maximum of \$35 per acre from 2006 through 2014, unless the farmers in the EAA exceed an overall 25 percent basinwide phosphorus reduction goal. Beginning in 1995-1996, phosphorus loadings will be compared to a baseline derived from loadings recorded from 1979-1988.

Revenue raised by the tax is earmarked for the STAs and will raise a minimum of \$233 million for their construction and an additional \$89 million if farmers in the EAA do not exceed the 25 percent basinwide phosphorus reduction goal. The STAs, essentially constructed wetlands, will be located where agricultural runoff discharges to the Everglades and will

Everglades Nutrient Removal Project

In 1994, the South Florida Water Management District began operating a prototype Stormwater Treatment Area, known as the Everglades Nutrient Removal Project (ENR). Under the ENR, the District transformed 3,700 acres of former agricultural fields into a constructed wetland designed to treat stormwater runoff.

The project gives the District the experience of designing, operating, and managing a Stormwater Treatment Area, while supporting the phosphorus removal effort in the Everglades Agricultural Area. In 1995, runoff monitoring indicated that the ENR was capable of removing more than 75 percent of the phosphorus contained in runoff leaving the Everglades Agricultural Area.

The ENR will ultimately be incorporated as the lower half of the 6,670-acre Stormwater Treatment Area 1, one of six constructed wetland systems planned to filter runoff from the Everglades Agricultural Area.

supplement on-farm nutrient treatment BMPs. Ranging in size from 812 to 16,480 acres, the STAs will be constructed between 1997 and 2003 on former EAA farmland purchased for the project.

The Outlook for Phosphorus in the EAA

A report, *Everglades BMP Program, Water Year 1995*, indicates that progress is already being made toward reducing phosphorus runoff from the EAA. In 1995-1996, the first year that compliance with the 25 percent phosphorus reduction goal was measured, BMPs were implemented on all acres in the EAA and phosphorus loadings decreased by 68 percent. This reduction considerably exceeds the tax goal.

This achievement does not, however, mark the story's end. "Realistically," acknowledges Paul J. Whalen, manager of SFWMD's Everglades Regulation Section and author of the report, "these numbers will fluctuate." The challenge for farmers in the EAA will be to maintain their success over time, despite changes in agricultural production levels and other obstacles.

The Agricultural Privilege Tax will encourage farmers in the EAA to implement effective BMPs, while providing the funding needed to construct the STAs. It's a promising approach that Whalen asserts, lies within reach, "I feel confident that the agricultural community will continue to meet the 25 percent goal."

[For more information, or to obtain a copy of *Everglades Best Management Practice Program — Water Year 1995*, contact Paul J. Whalen, Everglades Regulation Section, South Florida Water Management District, P.O. Box 24680, West Palm Beach, FL 33416-4680. Phone: (561) 687-6880; fax: (561) 687-6896.]

Technical Notes

Longer Detention Time Translates into Improved Water Quality in a Wet-Detention Stormwater Pond

EDITOR'S NOTE: Adapted from the American Water Resources Association (AWRA) proceedings for *Water Management in Urban Areas*, November 5-10, 1995, with permission from Kenneth D. Reid, Executive Vice President of the AWRA and Betty T. Rushton, abstract author.

What effect does residence time have on a wet-detention pond's ability to treat polluted runoff? The Southwest Florida Water Management District conducted a study from 1990-1994 to answer this question. The district reshaped a wet-detention pond built to treat runoff from one of its field service offices in Tampa, Florida to compare three different residence times. Of the three variations tested, the 14-day residence time (the longest tested) showed the greatest improvement in water quality.

Reshaping the Tampa Pond

The Southwest Florida Water Management District has regulated stormwater systems under state law since 1984. Part of their role is to research how well these systems meet state water quality objectives. Detention ponds are the most commonly used method of stormwater management in Florida, making them a likely candidate for study.

Supported, in part, by 205(j) grant funding from EPA, the district reshaped the wet-detention pond at its Tampa service office to compare the pollutant removal effectiveness of 2-, 5-, and 14-day residence times. The Tampa site is classified as light commercial use and provides office space and parking for roughly 150 employees, in addition to a vehicle compound and storage sheds.

Wet-detention ponds consist of a permanent pool of water; an overlying fluctuating pool; and a shallow, vegetated shelf called the littoral zone that serves as a biological filter. In 1986, when the Tampa site was developed, regulations required that the pond treat a minimum half-inch of runoff from the contributing area, restrict the fluctuating pool to no more than eight inches above the control elevation, and include a planted littoral zone that extended no further than three and one-half feet below the control elevation.

As a result, a 0.35 acre wet-detention pond was constructed to a depth of one foot below the control elevation (the lowest point where water can be released through the outfall structure) to treat runoff from the six-and-a-half-acre drainage basin. The pond was sized to discharge water within five days, with no more than half of the total volume being discharged in the first two-and-a-half days. However, calculations revealed that this pond actually had an average residence time of two days.

In 1993, the district reshaped the pond according to changes in stormwater design criteria that increased treatment volume requirements from one-half inch to one inch of the contributing area and raised the permitted height of the fluctuating pool from 8 to 18 inches. To meet these requirements, the district increased the depth of the permanent pool from one foot to a maximum of five feet, while leaving the surface area the same. This increased residence time to five days, but the pond was not quite large enough to meet the one-inch runoff treatment requirement.

The district reshaped the pond one last time in 1994. To achieve a 14-day residence time, the district increased the area of the pond to a half acre while maintaining the depth of the pond at five feet. The district originally planned to excavate the pond to nine feet, the maximum depth allowed in the 14-day design, however a shallow confining layer at the site prevented this, forcing the district to increase land area instead. This design lowered treatment requirements from one inch to one-half inch; reduced the height of the fluctuating pool from 18 inches to 10 inches; and limited the depth of the littoral zone to two feet, as opposed to three and a half feet, below the control elevation.

The 14-day Residence Time Prevails

For each of the three pond designs, the district collected composite water quality samples using automated sampling equipment placed at the pond's inflow and outflow. Water quality parameters included nitrate-nitrite, phosphorus, metals, and total suspended solids. By analyzing data collected between June and January for the two-day, five-day, and 14-day residence times, the district determined that the longest residence time produced the most significant improvement in water quality. In fact, the 14-day design was so effective that it was able to reduce pollutant levels (of most constituents) from the inflow to the outflow enough to regularly achieve the 80 percent state pollutant reduction goal for these systems.

The major change implemented with the 14-day design is that it allows stormwater to be detained in the permanent pool, rather than limiting detention to the fluctuating pool. By allowing credit for treatment in the permanent pool, the design eliminates the need for deep stormwater ponds designed to stack stormwater above the permanent pool. In general, this shallower pond design results in higher dissolved oxygen concentrations, providing better pollutant removal efficiencies and more desirable aquatic habitat. In addition, by limiting the range of fluctuation in the fluctuating pool to 10 inches, the design provides a more stable environment that promotes the establishment of diverse vegetation in the littoral zone.

The 14-day detention design also benefits developers. By reducing the requirement for detention in the fluctuating pool from one inch to one-half inch, the design reduces flood stage, allowing building elevations to be lowered and minimizing the need and expense of bringing in fill material. Allowing treatment in the permanent pool can also reduce the amount of land area needed for stormwater ponds from almost six percent to five percent (site conditions permitting).

The Tampa pond, with its 14-day detention design, continues to treat stormwater from the district's service office. Meanwhile, the district is pursuing future studies for this site and others focusing on the effectiveness and maintenance of these systems.

[For more information on the Tampa pond study, contact Betty T. Rushton, Ph.D., Resource Projects Department, Southwest Florida Water Management District, 2379 Broad Street, Brooksville, FL 34609-6899. Phone: (352) 796-7211; fax: (352) 754-6885. To obtain a copy of the American Water Resources Association (AWRA) proceedings for "Water Management in Urban Areas," for \$46 (including \$6.00 shipping), contact the AWRA, 950 Herndon Parkway, Suite 300, Herndon, VA 22070. Phone: (703) 904-1225; fax: (703) 904-1228.]

Alternative On-site Sewage Treatment Systems — Viable Solutions for Currently Failing Systems

by Shannon Cauley, Geologist/Certified Professional Soil Scientist

As development fans outward from densely populated areas, states and localities are exploring alternative on-site sewage treatment technologies. Outlying areas are often plagued by failing or inappropriately sited septic systems. For many of these communities, the cost of public wastewater systems is prohibitive. To address these issues, some states are developing guidelines for use of alternative systems. For example, Virginia's proposed Sewage Handling and Disposal Regulations explains how to "use, evaluate, and develop criteria for the use of new and innovative technology." Delaware is also heading in this direction, having recently approved the use of pretreatment systems. The increasing acceptance of alternative systems calls for a look at where these technologies are headed and what they can accomplish.

Approximately 25 percent of the U.S. population lives in areas that rely on individual on-site sewage treatment systems, and this percentage is increasing. Demand for technology that is more reliable and more appropriate for restrictive site conditions has led researchers to pioneer on-site sewage treatment alternatives such as sand mounds, constructed wetland treatment systems, and the recently developed peat biofilter system. These systems can provide solutions where conventional systems fail.

New Solutions to Conventional Problems

Conventional systems fail because of improper location, poor design, faulty construction, poor maintenance, and age. Depending on the cause, a locality has four choices when a conventional system fails: (1) repair the existing system or move it to another site on the property, (2) pump and haul the effluent or condemn the property, (3) construct public sewer conveyance and treatment systems, or (4) install an alternative on-site treatment system.

Moving a failing system is not always an option because the reserve area may be characterized by the same, or even less suitable, conditions. Among the remaining options, pump and haul and property condemnation are rarely regarded as viable solutions. By elimination, therefore, the choice is either a public sewer system or an alternative system.

Public sewer systems are costly, and small communities may not be able to construct and maintain them economically. Further, the physical setting (i.e., its geologic features and terrain) or a community's remoteness may also preclude a public sewer system.

Alternative on-site treatment systems can overcome these problems. For example, constructed wetlands can provide additional treatment to the effluent before it is released to the soil. This solution is useful in locations where poor soil conditions have overwhelmed conventional systems. Likewise, sand mounds and spray irrigation systems provide additional treatment above restrictive soil layers in areas where high groundwater tables or other limiting features have led to failures in conventional systems.

Alternative systems also offer the opportunity to pursue performance-oriented design codes. Unlike traditional prescriptive design codes that specify only how a system should be designed, performance designs establish pollutant targets (e.g., acceptable levels of nitrate).

The Flip Side

However, alternative systems, like public sewer systems, have their drawbacks. Many are based on new technologies that have no long-term records of success. Although such technologies could contribute to new failures, employing them on a limited basis that would allow further monitoring would help ascertain their usefulness. Virginia's proposed *Sewage Handling and Disposal Regulations* reflects this approach; in a new section on provisionally approved systems, it describes how to "review, evaluate, revise and refine all aspects of criteria" for innovative systems.

Maintenance is perhaps an issue of greater concern. Many conventional systems fail because of neglected maintenance. Current alternative system designs do not solve this problem, but some installers of alternative systems have developed maintenance contracts to accompany their systems. Local permitting agencies could devise similar maintenance contracts for other

systems. Improperly located, installed, or maintained systems — whether conventional or innovative — can never provide the level of treatment they were designed for and can even become sources of pollution.

Applying Alternative Technologies

To date, alternative treatment systems have often been reserved for use where conventional systems are failing. Alternative systems are usually more costly than conventional systems and become viable only in cases where a property owner must replace a failing conventional system.

This predicament currently forms the niche for alternative systems and a strong impetus for their development. However, as state and local permitting agencies broaden their approaches, developers must consider alternative systems not only to remedy failing conventional systems, but also in designing new projects.

[For more information contact, Shannon Cauley, Geologist/Certified Professional Soil Scientist, Tetra Tech, Inc., 10306 Eaton Place, Suite 340, Fairfax, VA 22030. Phone: (703) 385-6000; fax: (703) 385-6007.]

Notes on Education and Outreach

New Educational Resources

Posters Convert to Electronic Game Boards

Three posters — *Wetlands are Wonderlands!*, *River Environment*, and *Creek Critters* — produced by the Tennessee Valley Authority can be converted to electronic game boards to teach identification of water plants, animals and macroinvertebrates. The posters are free of charge, but the conversion kits are \$10 to \$12.50 each. Contact Ray Norris, 4021 Sunnybrook Drive, Nashville, TN 37205-3834.

Minnows Monitoring Storm Water

The Fort Worth Department of Environmental Management has produced a video and manual explaining how to construct and use the Stream Sentinel, a low cost, long-term method of monitoring storm drainage outfalls using six fathead minnows in a two-liter soda bottle. Both are available at no cost from Charles Howell, EPA Region 6, First Interstate Bank Tower at Fountain Place, 1445 Ross Avenue, 12th Floor, Suite 1200, Dallas, TX 75202-2733. Phone: (214) 665-8354. Or contact Brian Camp, Fort Worth DEM, 5000 Martin Luther King Highway, Fort Worth, TX 76119. Phone: (817) 871-5450.

Groundwater Education Curriculum Published

A new groundwater education program for secondary students is available from the Water Education Foundation. The 54-page booklet contains lesson plans and materials to teach students about groundwater and how to prevent, reduce, and eliminate groundwater pollution. The lesson plans include lectures, demonstrations, laboratory exercises, games, and assessment activities. Each lesson has clearly defined objectives and complete teacher instructions. Contact the Water Education Foundation, 717 K Street, Suite 517, Sacramento, CA 95814.

Education and Outreach in Action

■ **Coastal America Honors Student Conservation Association.** The Student Conservation Association awarded a certificate of recognition to students in Washington's Cascade Mountains for their watershed/habitat enhancement work in 1994. Contact Ray Auger, National High School Program Coordinator, Student Conservation Association, P.O. Box 550, Charlestown, NH 03603. Phone: (603) 543-1700.

■ **Christmas "Angels."** On their Christmas vacation, three 11-year old girls performed a "miracle" on a small stream near their Cullman, Alabama, home. Not satisfied with cleaning up trash from the stream, they composed a petition for concerned neighbors to sign. Armed with their signed petition, they called on the mayor of Cullman, who strongly supported the girls and directed the city to assist in removing items too large or dangerous for the girls to handle. The mayor commended the group for their initiative and for making him aware of the kinds of material that end up in the city's waters.

- **Creek Critters.** In a twist on the usual, the Berkeley Citizens for Creek Restoration stenciled "Creek Critters" on Berkeley, California, sidewalks to mark the locations of culverted streams.
- **Teacher Cadet Program.** Supported by a NPS 319 grant, high school students in an urban area near San Francisco, many of whom speak English as a second language, studied creeks and learned monitoring procedures. They then wrote lesson plans and taught elementary students the lessons they themselves had learned.
- **Wisconsin's Series of Water Education Resource Centers.** Wisconsin water educators have established five Water Education Resource Centers in local communities to put water education tools and resources within easy reach of the people. They expect to establish about 30 more centers. Contact Suzanne Wade, UWERC, 216 Agriculture Hall, 1450 Linden Drive, Madison, WI 53706-1562. e-mail: sswade@facstaff.wisc.edu.
- **Maryland Dedicates Mobile Teaching Lab.** A hands-on mobile laboratory designed to provide Maryland teachers and students with learning activities about the Chesapeake Bay, the environment, and aquaculture now serves three schools and 550 students. The lessons integrate environmental activities with science, mathematics, language arts, and social studies. The lab is hosting workshops for teachers in addition to a full schedule of student use. Contact Steve Connelly, Maryland Educational Center for Agriculture, Science, and Technology, 2101 East Fort Ave., Baltimore, MD 21230. Phone: (410) 783-0647.
- **Swamp Secrets Revealed in Zoo Exhibit.** The Swamp: Wonders of Our Wetlands is a new exhibit at Chicago's Brookfield Zoo. It is a naturalistic, mixed-species exhibit that immerses visitors in the mystery and splendor of two unique American ecosystems — a southern cypress swamp and an Illinois river scene. The zoo's objective is to help people understand the importance of protecting intact natural systems, not just the animals that inhabit them. Contact the Brookfield Zoo, (708) 485-0263.

Expedition Floats Down Penobscot River with NPS Message

The Penobscot Riverkeepers 2000 celebrated their fourth annual expedition traveling the river's 140-mile main stem through whitewater, wilderness, and city. The journey was an opportunity to share the river's lore, history, culture, and ecology with the people who live, work, and play on its shores.

Jo Eaton, director of the Penobscot Riverkeepers, said the expedition opened the communities' eyes to the wonders and history of this resource that winds its way through Maine. "Traveling down the river was a very personal and moving experience for the teachers and students who joined the expedition for each day. Being in the river and bay in a small boat is very different than being beside it," said Eaton. She believes that the expedition promotes stewardship, as the Riverkeepers share stories of the river with the people they meet.

Since January 1993, the Penobscot Riverkeepers have conducted programs on current issues, history, geography, and water quality. The Riverkeepers have reached over 20,000 students and community members this way. During this year's expedition, the Riverkeepers met with over 1,400 students, discussed water quality monitoring, and conducted four teacher workshops.

John Bear Mitchell, a Penobscot tribal member who joined in the expedition, still lives where he grew up on the Penobscot Nation reservation on Indian Island. He not only brought the history of his people and their traditions to the expedition, but also discussed the issues of the river's health. Riverkeepers works on these issues in conjunction with the Penobscot Nation's Department of Natural Resources.

Collaborators and supporters for this year's expedition included the University of Maine's Water Research Institute, Maine Bound, the state Department of Education and Natural Resources, the Penobscot Nation, the Bangor Daily News, and Unity College. The expedition was funded by Bangor Bank, Wal-Mart, National Recreational Trails Fund Act, International Paper, Shore Stewards, Bowater, and Merrill Merchants Bank.

The Penobscot Riverkeepers are keeping stewardship alive through school and community programs. "We encourage individuals to learn about how they can reduce nonpoint source pollution at home and in their community through the reduction of household toxic waste and

proper oil disposal. We also want to know more about where we live and what each of us can do to celebrate the beauty and history of the river and bay — and to take care of it for the future,” said Eaton.

[For more information or to order a sample Riverkeepers curriculum, contact Jo Eaton, Penobscot Riverkeepers 2000, 33 Howard St., Old Town, ME 04468. Phone: (207) 827-0369.]

Guidelines for Excellence in Environmental Education

Developers of activity guides, lesson plans, and other instructional materials, and the teachers who use them will soon have “what they have long wanted—a tool for evaluating the wide array of products available for environmental education,” says Bora Simmons, a professor at Northern Illinois University.

The North American Association for Environmental Education (NAAEE) founded the National Environmental Education Standards Project to propose a set of voluntary guidelines for developing and selecting quality environmental materials. The outcome, *Environmental Education Materials: Guidelines for Excellence*, which Simmons says, “is grounded in a common understanding of effective environmental education,” will be published in October 1996.

Guidelines recommends that environmental materials be judged on six key characteristics: fairness and accuracy, depth, emphasis on skills building, action orientation, instructional soundness, and usability. Several “indicators” will accompany the various guidelines listed for each characteristic. The indicators are clusters of attributes that can help educators determine whether one or more of the six characteristics are embodied in the materials being reviewed.

A second objective of the *Guidelines* is to help teachers of environmental education meet standards set by traditional disciplines. Quality environmental education can provide students with opportunities for synthesizing knowledge and experience across disciplines and facilitate the learning of science, civics, social studies, mathematics, geography, and the language arts. By using the *Guidelines*, educators can develop meaningful environmental education programs that build on and integrate traditional subjects.

Resource Guide to Follow

The National Environmental Education Standards Project is also developing a teacher’s resource guide to quality environmental education materials. The resource guide will include a broad range of education materials, including curriculum guides, CD-ROMs, laser disks, and videos.

Panels of classroom teachers, environmental educators, curriculum developers, and environmental specialists will review all material in the resource guide according to criteria drawn from *Environmental Education Materials: Guidelines for Excellence*. The first volume of the teacher’s resource guide is expected to be published in late 1996.

[For more information on the National Environmental Education Standards Project, contact Bora Simmons, Northern Illinois University, P.O. Box 299, Oregon, IL 61061. Phone: (815) 753-0205 x113; fax: (815) 732-4242.]

The Role of Community Education — Can It Reduce Water Pollution?

by Joan Drinkwin, condensed from the Fall 1995 *Volunteer Monitor*

EDITOR’S NOTE: The Volunteer Monitor is published yearly with funding from U.S. EPA. Subscriptions are free. To begin receiving the newsletter, contact Eleanor Ely, editor, Volunteer Monitor, 1318 Masonic Ave., San Francisco, CA 94117. Phone: (415) 255-8049.

Something’s going on in a small watershed in Austin, Texas, that could answer a big question about how to combat water pollution in the United States. In the East Bouldin Creek Project, volunteer monitors are using a sophisticated “paired watershed” monitoring design to find out if the community outreach and education programs being employed have actually improved water quality.

The question they’re trying to answer is this: can you see an improvement in water quality as a direct result of community outreach and public education?

While a lot is known about the effectiveness of many structural methods used to control nonpoint source pollution, practically nothing is known about the water quality benefits of most educational techniques.

Before-and-after surveys, in which the same questions are asked before and after a community education campaign, have traditionally been used to find out whether education efforts increase public awareness. Such a survey might ask local residents to rate the relative importance of various pollution sources. Unfortunately, this kind of survey doesn't tell us whether water quality has improved, or whether the education campaign has actually succeeded in keeping pollution out of the water.

The goal of East Bouldin Creek Project is to decrease the amount of nonpoint source pollution reaching East Bouldin Creek, which the city of Austin's Environmental Conservation Services Department identified as one of the most polluted creeks in urban Austin. To achieve this goal, an array of educational and restoration activities will be employed throughout the watershed. Local citizens, students, and businesses will adopt creek sections and carry out such projects as

1. revegetating stream banks for habitat restoration and erosion control;
2. placing signs to identify the creek and watershed (e.g., "Welcome to East Bouldin Creek Watershed"); and
3. stenciling storm drains to discourage illegal dumping of oil and yard waste.

In addition, a local elementary school class is developing a watershed education program which the students will present at other schools throughout the watershed. The program will include a teacher's handbook and a three-dimensional model of East Bouldin Creek watershed, complete with local landmarks.

Study Design

To determine whether all these activities are actually improving the water quality of East Bouldin Creek, volunteer monitors will use the paired-watershed monitoring design, which does not require that the watersheds be exactly the same, only that water quality in one creek can predict water quality in the others.

Volunteers will monitor East Bouldin Creek (the study creek) along with two control creeks — Blunn Creek and Harper's Branch. Since the three creeks are close together, weather is the same for all of them. The three watersheds are adjacent to each other, are similarly developed, and are all about the same size, so we expect that water quality in the three creeks will be related. For example, the level of dissolved oxygen in Blunn Creek may not be the same as that of East Bouldin Creek, but it should be predictably higher or lower at all times. Or we may find that conductivity in the creeks changes at the same rate relative to rainfall. Initial analysis of historical data indicates that the three creeks' water chemistry is related.

During the treatment phase, which will last about a year and a half, the educational pollution prevention activities described above will begin in the East Bouldin Creek watershed. However, no such activities will be implemented in the control creeks' watersheds. After the treatment phase is completed, the water quality of the three creeks will be compared. If the statistical relationship between the water quality of the study and control creeks changes, the change will be evidence that the pollution prevention activities did affect water quality.

Evaluating the effectiveness of community education is long overdue. This project will help to determine whether East Bouldin Creek's community outreach and public education had a direct impact on water quality. A second important aspect of the project is the use of volunteers to collect the water quality data. Since intensive monitoring projects conducted solely by professionals can be very expensive for many communities, demonstrating that volunteers can reliably perform a large part of such a study enhances our ability to monitor the effectiveness of urban nonpoint source pollution controls.

The East Bouldin Creek Project is being implemented by Texas Watch, the volunteer environmental monitoring program of the Texas Natural Resource Conservation Commission. The project is funded in part by U.S. EPA through Section 319(h) of the Clean Water Act.

[For more information contact, Joan Drinkwin, Outreach Specialist, Puget Sound Water Quality Action Team, P.O. Box 40900, Olympia, WA 98504-0900. Or contact Gregg Rogers, Texas Watch Nonpoint Source Project Coordinator, TNRCC, P.O. Box 13087, Austin, TX 78711. Phone: (512) 239-4742.]

Farm*A*Syst Study Looks for Best Delivery Methods

EDITOR'S NOTE: Adapted from *Farm and Home Pollution Prevention Update*, March 1996.

A pilot program designed to determine the most effective method of delivering Farm*A*Syst assessment publications suggests that a volunteer one-on-one approach may be the most effective method of delivering outreach materials.

North Dakota State University ran the project to test a variety of methods, including mailings, having materials available at the county extension office, displaying flyers at area banks and local livestock waste management meetings, and personal delivery by high school agricultural science students. All participants were also invited to evaluate Farm*A*Syst's recruitment materials.

Methods and Results

In the mail delivery method, a copy of the Farmstead Assessment checklist was mailed to all 259 rural residences in Bowman County, but only 34 percent completed the assessment. Other delivery methods reached only some of the rural residences, but the return rate was higher: 40 percent of those contacted through the county extension office returned the assessment, and 100 percent of those contacted by volunteer agricultural students completed the assessment.

The materials earned relatively high ratings from the respondents, suggesting that Farm*A*Syst information is user friendly. Time, however, seems to be a major deterrent; among those surveyed, 52.4 percent indicated that they did not have sufficient time to complete the groundwater assessment. In addition, nearly 25 percent doubted that the program would significantly affect groundwater quality.

Other Factors

The data from this study indicate that many respondents may not read the groundwater assessment materials sent to them in the mail. However, the unique groundwater hydrology in Bowman county may have affected this finding. Most of the county's private rural wells draw water from the Fox Hills and Hell's Creek aquifers, which are at least partially protected by 200 to 400 feet of silt- and claystone aquitards. Well owners tend to assume that these confined aquifers are safe from surface contamination.

[For more information, contact the Agricultural Engineering Department, Box 5626, North Dakota State University, Fargo, ND 58105. e-mail: jnowatzk@ndsuent.nodak.edu.]

An American Wetlands Month Celebration — A Work in Progress

Communities Working for Wetlands, An American Wetlands Month Celebration — and the first ever, national grassroots conference on wetlands, is scheduled for May 7-9, 1997, at the Radisson Plaza Hotel in Alexandria, Virginia. Centered on the values of wetlands and the importance of community-based partnerships, this conference will involve and encourage citizens — teachers, students, and school administrators; environmental groups, businesses, and environmental consultants; and the staffs of federal, state and local governments — to join in wetlands conservation and celebration.

The pivotal role of wetlands in nonpoint source management drives the conference agenda as it inspired the concept behind the annual American Wetlands Month Celebrations.

Innovative tools, programs, and partnerships will be included in exhibits and posters — and in practical, informative plenary sessions. Two half-day workshops: *A Wetlands Primer* and *Working with Your Corporate Partner* will precede the conference, and field trips are being planned, including one at the nearby Winkler Botanical Preserve.

Planning for the conference drew a host of sponsors and cosponsors (see the date book entry for May 7), and participants are encouraged to register early.

[For more information, contact Stacey Satagaj at the Terrene Institute. Phone 800-726-4853 or (703) 548-5473; fax: (703) 548-6299; e-mail: terrene@gnn.com.]

NPS Information Exchange

The NPS Information Exchange has evolved from a modem-based electronic bulletin board to a system of Internet resources. The NPS BBS closed December 31, 1995. Documents, including News-Notes issues 1-45, are now located on the NPS Information Exchange World Wide Web site: <http://www.epa.gov/OWOW/NPS/npsie.html>.

NPSINFO is the Information Exchange's e-mail discussion group.

To subscribe to this group, send an e-mail message to listserver@unixmail.rtpnc.epa.gov.

Include the following information in your message: subscribe NPSINFO yourfirstname yourlastname.

After you subscribe, you will receive a welcome message explaining the discussion list and how to post messages to it.

Reviews and Announcements

America by Rivers

by Elaine Bloom, *News-Notes* editor and writer

America by Rivers, Tim Palmer. Hardcover, 336 pages. Published by Island Press, Washington, DC

America by Rivers is an introduction to the nation's geography, ecology, hydrology, and culture as reflected by its waterways. Tim Palmer wrote the book to provide what he calls "a basic primer" describing this basic feature of the American landscape, but it is much more than a text book.

Brimming with facts, figures, and cubic feet per second, Palmer's excellent prose sweeps the reader through the 10 river regions he defines based on N.M. Fenneman's 1928 landform divisions. He begins in the Northeast, where an abundance of steep, glacier-paved waterways are studded with sharp rapids and falls and run alternately through second-growth forest and cities. Rivers in the Northeast are pocked by more dams (10,000) than the rivers in any other region, a legacy of their long "civilized" history.

And so Palmer takes us through Appalachia, the Coastal Plain and the South, Midwest, Great Plains, Rocky Mountains, Deserts and Drylands, Sierra Nevada, Northwest, and Alaska, celebrating the uniqueness of each river region and sketching its problems.

Chapter by chapter, the author carefully describes each region's major rivers and their tributaries — resulting in an almost overwhelming flow of evocative riverine names and statistics. Fortunately, a map accompanies each chapter, so readers can track their voyages. Others may elect, as I did, simply to float along, knowing that the maps and index are close by.

In each chapter, after the regional overview, Palmer invites the reader on a trip down a river of his choice, allowing glimpses of his experiences and insights. In the Appalachians, it's the historic Potomac; in the Desert region, the overtaxed Rio Grande; in the Northwest, the legendary Rogue. For an "armchair boater," this is the life — except when Palmer's recollections (like his description of a fox playing on a sandbar hundreds of miles from any road) elicit sharp envy.

Finally, we end our journey in Alaska, a land that seems all rock and ice, but where the short growing season magnifies any human impact. Floating down the as-yet-untouched Sheenjek River, Palmer imagines what will happen when more people come to visit and humbly asks himself, "Do people like us belong here at all?"

Tim Palmer is an old hand at both rivers and writing. He is the author of 10 other books about America's environment and has traveled more than 300 rivers by canoe or raft. Still, his sense of wonder at the natural marvels he describes is wide awake and infectious, as is his outrage when something beautiful and wild is ruined.

Palmer tends to be hard on dams, diversions, miners, loggers and politicians. A well-rounded list of 162 sources (without, however, formal text citations) and his own eyewitness accounts of

river conditions lend his assertions credibility. He is tough on agriculture, too, although not without empathy for American farmers, pinned between an economic rock and an environmental hard place by the changing times.

Rivers is not a comprehensive explanation of the many impacts on American waters, but woven through the text is enough information to pique the curiosity of the uninitiated reader. Is it also a book that will enlighten the American public about the need to protect our waters? Probably not. Rather, it is a book for the choir — one to remind us of the usefulness and wonders of the resources we are working for.

BASINS Debut Imminent — A Software Tool for Managing Watersheds

A new breed of desktop mapping and modeling software designed for water quality analysts and watershed managers is helping resource managers access large amounts of point and nonpoint source data. EPA's BASINS is one such system.

Developers of the program envision BASINS as an invaluable tool for watershed planning and for developing cost-effective approaches to environmental protection. Because many factors affect water quality in a watershed, and because each watershed is different, BASINS users will be able to review large amounts of pollutant source information, chemical discharge data, and streamflow information for every watershed in the continental United States. They will also be able to add to the data contained in the BASINS software, thus ensuring that it will remain a source of current and reliable data for each watershed.

A Powerful Watershed Management Tool

BASINS software, designed to be used on a personal computer, will bring together information collected by many federal, state, and local government and private agencies. This makes it possible for users to locate potential sources of pollutants and estimate the effects of pollutants on drinking water supplies, recreational waters, aquatic life, wildlife habitat, and other critical uses of waters in a watershed. Users can focus on selected stream sites or an entire watershed, evaluating a number of "what if" scenarios and predicting how discharges of pollutants from industrial and municipal point sources and agricultural, urban, and other nonpoint sources impact downstream water quality, aquatic communities, and wildlife.

The software contains two water quality models. One model combines nonpoint source discharges with facility discharges and calculates changes in pollutant concentrations as they are diluted and flow downstream. The other model uses the weather data that is stored in the software to calculate runoff of sediment, nutrients, bacteria, and toxic substances from mixed land use areas and also calculates how this runoff affects water quality.

System Requirements

BASINS requires a 486 (or better) IBM-compatible PC with a CD-ROM and ArcView 2.1 software; 16 MB of RAM is required. A user's guide contains background information on the supporting databases and instructions on how to install, navigate, and use the various BASINS modules.

EPA is currently involved in training regional and state staff to use the program effectively. Release of the program to others is expected in late 1996.

[For additional information, contact Jerry LaVeck, Office of Science and Technology, Standards and Applied Science Division (4305), U.S. EPA, 401 M Street, SW, Washington, DC 20460. Phone: (202) 260-7771; fax: (202) 260-9830; e-mail: laveck.jerry@epamail.epa.gov]

Watershed '96 Online

Thanks to the power of the Internet, you can now access highlights of *Watershed '96* in cyberspace. To peruse the plenary topics, browse a photo album, or link to a related Web site, direct your browser to the World Wide Web:

<http://www.epa.gov/OWOW/watershed/w96index.html>.

Chattanooga Venture — A Vision for the Future

Chattanooga, Tennessee, is pioneering a consensus building, participatory process called "visioning" that it hopes will result in a shared environmental vision of the future.

In 1984, citizens created a nonprofit organization, Chattanooga Venture, to identify goals that everyone could support. They hired a professional consultant, created a large pool of volunteers adept at facilitating and organizing, and began a planning process in four phases:

- Community Brainstorming.
- Establishing Goals, Developing a Vision.
- Committing to the Vision.
- Implementing the Vision.

[A \$30 video showing how the community of Chattanooga, Tennessee, used the visioning process to alter the city's course from "the dirtiest City in America" to a "green city" is available. To order contact, Chattanooga Venture, phone: (423) 267-8687.]

Water Indicators Guide Issued in Second Edition

Originally published in 1989, the second edition (1996) of the Water Quality Indicators Guide: Surface Waters, by C.R. Ternell and P.B. Perfetti is now available. Produced by the Terrene Institute in cooperation with Kendall/Hunt Publishing Company, this edition has been completely updated by Ternell, coauthor of the first edition, and Perfetti, NRCS's national environmental coordinator.

Designed as an inexpensive screening tool for use by USDA field personnel, the guide immediately appeals as well to educators, water quality monitors, environmental professionals, and local governments, because it recommends observing environmental conditions rather than complicated chemical testing to assess the potential for agricultural nonpoint source pollution.

Essentially a method to quickly identify and remedy water quality problems, this book identifies the five major sources of agricultural pollution (sediment, nutrients, pesticides, animal wastes, and salts); discusses the ecology of freshwater systems; and provides field sheets for observers to use on land and receiving waters.

Observations are recorded, weighted, and ranked on the field sheets to assess conditions; then, when a particular nonpoint source pollutant is identified, it can be correlated with conservation and best management practices to determine — and enact — possible solutions. The method is suitable for neighborhood streams and larger areas, and the accuracy of the method improves with use.

[To order, send \$29.95 plus \$5.50 shipping and handling to the Terrene Institute, Attn: Order Department, P.O. Box 605, Herndon, VA 20172-0605. Phone: (703) 661-1582; fax: (703) 661-1501.]

Datebook

DATEBOOK is prepared with the cooperation of our readers. If you would like a meeting or event placed in the DATEBOOK, contact the *NPS NEWS-NOTES* editors. Notices should be in our hands at least two months in advance to ensure timely publication. A more complete listing is available on the NPS Information Exchange World Wide Web Site (see the NPS Information Exchange box in this issue for directions on how to get on).

Meetings and Events

1996

November

5

Symposium on Agricultural Phosphorus and Eutrophication, Indianapolis, IN. Sponsored by the American Society of Agronomy in cooperation with the Soil Science Society of America. Contact T.C. Daniel, Department of Agronomy. (501) 575-5720. Fax: (501) 575-7465. E-Mail: tdaniel@comp.uark.edu.

1996

November

- 13-15 *Seventh Annual Conference Mapping the Future of Composting*, Arlington, VA. This conference will focus on innovation, new products and technology, and seeking out new opportunities in organics recovery and composting. Contact Rebecca Roe, the Composting Council. (703) 739-2401. Fax: (703) 739-2407. E-Mail: comcouncil@aol.com.
- 13-16 *People, Lakes and Land: Puzzling Relationships*, NALMS' 16th Annual International Symposium, Radisson Hotel South, Minneapolis, MN. For conference information or registration, contact NALMS, P.O. Box 101294, Denver, CO 80250. Phone: (303) 781-8287; Fax: (303) 781-6538.
- 14 *Barnegat Bay Ecosystem Workshop*, Toms River, NJ. The workshop will focus on how to protect and preserve this valuable estuary. Contact Cook College Office of Continuing Education, P.O. Box 231, New Brunswick, NJ 08903-0231. (908) 932-9271. Fax: (908) 932-1187.
- 15-17 *Urban Streams Conference*, Arcata, CA. Sponsored by the city of Arcata, the conference will include sessions on treating streams in urban areas and working with the natural properties of streams. Contact Susan Schramm, Conference Coordinator, Environmental Services Department, City of Arcata. (707) 822-8184. E-Mail: creeksconf@aol.com.
- 18-19 *Corporations, Conservation and Collaborations*, the Wildlife Habitat Council's Eighth Annual Symposium, Washington Marriott Hotel, Washington, DC. Contact: Wildlife Habitat Council, 1010 Wayne Avenue, Suite 920, Silver Spring, MD 20910. Phone: (301) 588-8994; fax: (301) 588-4629.
- 19-22 *Practical Approaches for Effective Erosion and Sediment Control*; and *Bioengineering Techniques for Streambank and Lakeshore Erosion Control* are two of several courses sponsored by the International Erosion Control Association in New Orleans, LA. Participants receive a course notebook, information about certification, and continuing education credits. For more information on these workshops in New Orleans — and to learn about the availability of these courses on other days in other cities — contact IECA at (800) 455-4322 or (970) 879-3010; fax: (970) 879-8563.
- 24-26 *Citizens Make the Difference - Groundwater Guardian National Designation Conference & Banquet*, Oak Brook, IL. The conference will focus on teaching citizens how to make a difference when it comes to local groundwater strategies. Contact The Groundwater Foundation, P.O. Box 22558, Lincoln, NE 68542. (800) 858-4844.

December

- 1-5 *Third Marine and Estuarine Shallow Water Conference: The Interrelationship Among Habitats and Their Management*, Atlantic City, NJ. Organized by federal, regional, and state agencies and private and non-profit environmental organizations. Contact Phyllis Walker, Assistant Director, Estuarine Research Federation, 240 Carriage Lane, Huntingtown, MD 20639. (410) 535-0051. E-mail: walker@chesapeake.net.
- 5 *Eleventh Annual Grazing Lands Forum, Sustaining the Landscape -Sustaining the Lifestyle*, Washington, D.C. Organized by the National Capital Section, Society for Range Management in cooperation with natural resource agencies and private organizations interested in the management of grazing land resources. Contact Ralph Giffen. (202) 205-1455. Fax: (202) 205-1096.

1997

January

- 17-18 *Short Course on Lake Management*, Cook College, New Brunswick, NJ. Contact Cook College Office of Continuing Education, P.O. Box 231, New Brunswick, NJ 08903-0231. (908) 932-9271. Fax: (908) 932-1187.
- 28-30 *Working with Wetlands and Wildlife*, Houston, TX. Sponsored by the Wildlife Habitat Council (WHC). A workshop offered in six U.S. cities to establish dialogue among land managers, government regulators, and conservationist on managing wetlands resources for maximum ecological and human benefit. Contact WHC. (301) 588-8994. Fax (301) 588-4629. E-mail: WHC@cais.com.
- 29-30 *Short Course on Stabilization and Restoration of Disturbed Sites*, Cook College, New Brunswick, NJ. Contact Cook College Office of Continuing Education, P.O. Box 231, New Brunswick, NJ 08903-0231. (908) 932-9271. Fax: (908) 932-1187.

1997

February

- 25-27 *Working with Wetlands and Wildlife*, Atlanta, GA. Sponsored by the Wildlife Habitat Council (WHC). (See January 28-30 for description and contact information.)
- 25-28 *28th Annual International Erosion Control Association Conference and Trade Exposition*, Nashville, TN. The conference participants will present new technologies, exchange ideas, and describe useful applications of erosion and sediment control practices. Contact IECA, P.O. Box 4904, Steamboat Springs, CO 80477-4904. (800) 455-4322 or (970) 879-3010. Fax: (970) 879-8563. E-Mail: ecinfo@ieca.org.

March

- 2-5 *International Symposium on Waterborne Cryptosporidium*, Newport Beach, CA. Sponsored by 11 regional, national, and international agencies with an interest in water issues. Contact Brian Murphy, AWWA Water Quality Engineer, 6666 W. Quincy Ave., Denver, CO 80235. (303) 347-6194. Fax: (303) 794-8915. E-Mail: bmurphy@awwa.org.
- 3-5 *Second Annual Region 6 Nonpoint Source Conference*, Austin, TX, on the theme, "Protecting Our Water Resources: Pointed Solutions to Pointless Problems." This conference will focus on partnerships and successes in solving NPS pollution problems in rural and urban settings. For more information, contact Suzanne Cardwell, Texas Soil and Water Conservation Board. Phone: (817) 773-2205.
- 3-14 *13th Annual International Program for Port Planning and Management*, New Orleans, LA. Sponsored by Board of Commissioners of the Port of New Orleans, World Trade Center of New Orleans, Louisiana State University National Ports and Waterways Institute, and University of New Orleans. Contact Timothy E. Joder, CUPA/LUTAC, University of New Orleans, New Orleans, LA 70148. (504) 280-6519. Fax: (504) 280-6272. Telex: 58-7496. Cable: CENTROPORT.

May

- 7-9 *An American Wetlands Month Celebration: Communities Working for Wetlands*, Alexandria, VA. Sponsored by U.S. Army Corps of Engineers; Bureau of Reclamation and Office of Surface Mining, U.S. Department of Interior; U.S. Environmental Protection Agency, Wetlands Division, Headquarters and Region 5; Federal Highway Administration, U.S. Department of Transportation; National Oceanic and Atmospheric Administration, U.S. Department of Commerce; Natural Resources Conservation Service, U.S. Department of Agriculture; Tennessee Valley Authority; Terrene Institute; Wildlife Habitat Council; World Wildlife Fund; and other co-sponsors. Contact Stacey Satagaj, Terrene Institute, 4 Herbert Street, Alexandria, VA 22305. (703) 548-5473. Fax (703) 548-6299. E-Mail: terrene@gnn.com.
- 15-16 *Second Biennial Great Lakes Student Summit International Conference*, Buffalo, NY. Sponsored by the County of Erie, Erie County Environmental Education Institute, in cooperation with New York Sea Grant, Great Lakes Program at the University of Buffalo, and the Great Lakes Center at Buffalo State College. Contact Great Lakes Student Summit, 95 Franklin Street, Room 1077, Buffalo, NY 14202. (716) 858-6370. Fax: (716) 858-7713. E-Mail: ecdep@moran.com.
- 25-28 *GW8, the Eighth Global Warming International Conference and Expo*, in New York City. Hosted by Columbia University and the Global Warming International Center USA. Contact: Global Warming International Center, P.O. Box 5275, Woodridge, IL 60517. Phone: (630) 910-1551; fax: (630) 910-1561.

August

- 24-27 *Collection System Rehabilitation and Operations & Maintenance: Solving Today's Problems and Meeting Tomorrow's Needs*, in Kansas City, MO. For more information, contact the Water Environment Federation at 1-800 666-0206 or (703) 684-2452; e-mail: confinfo@wef.org. For instant information, call WEF's Fax-on-Demand service at 1-800-444-2933.

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