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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

This issue, originally scheduled for January 1996, was delayed during the prolonged budget negotiations.

Commentary

Do Changing Attitudes Mean Changing Practices?

by Jim Meek, former U.S. Environmental Protection Agency liaison to the U.S. Department of Agriculture

Having just returned from a three day conference and workshop on Ecosystem Management relating to agriculture, I wonder if we might pause in this new year to consider how the watershed approach is working to prevent nonpoint source pollution.

The conference, held December 11-15, 1995, was put on by the Conservation Technology Information Center (CTIC) and sponsored by the USDA Natural Resources Conservation Service, U.S. Environmental Protection Agency, and industry groups. Its purpose was technology/information transfer — and it was aimed at helping resource managers develop local initiatives.

For me, the conference was also a time of stocktaking — a summary, so to speak, of where we have been and where we are going in terms of understanding and dealing with environmental issues on the ecosystem level.

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All issues of *News-Notes* are accessible on the *NPS Information Exchange* on EPA's World Wide Web Site: http://www.epa.gov. See page 24 for log-on information.

Do Changing Attitudes Mean Changing Practices? (continued)

The theme struck time and again by various presenters at the conference was a positive one; namely, that more and more farmers understand their relationship to the watershed. However, it is also clear that a great number of farmers have yet to externalize this awareness in changed behavior. Although the spotlight at this conference was on agriculture, this issue applies to each of us and our everyday activities. We can appreciate our connectedness to the ecosystem, but we also need to change our behavior to better harmonize with the environment.

Not long ago, I read an article in the *Washington Post* that made the same point. In "Disasters Aren't the Problem — The Real Environmental Catastrophe Is the Slow Creep of Crud," author Michael Parfit argued that "ruination" proceeds from "small events — the spraying of lawns; the dumping of oil; the demand for wormless apples, beachfront cottages, shrimp and layers of packaging — in which we all partake."

So the theme I heard at the conference isn't new or profound. Indeed we have been talking about our relationship to the watershed and hearing these phrases for a long time. The difference is that we are now internalizing the concept behind the words. People in the field are incorporating pollution prevention practices on the ground. The words we use may be subject to new turns and twists, but new jargon cannot obscure the fact that actions are also being done, now more than before.

Our challenge is to sustain this progress and ensure that it is adequately maintained and supported over the long haul. We must enter a new phase in which we follow through on past and current projects to ensure that they become part of the fabric of the watershed/community.

From Concept to Action

Speakers at the conference pointed out that ecosystems are a study of connectedness. To establish a new human use in them requires a trade-off — between the ecosystem and the use, or between the new use and other human uses. For example, we may want a trade-off between using a water resource for drinking water and using it for irrigation; or we may want to trade off both uses for the advantages of an undisturbed or less disturbed ecosystem. There are no winners, only trade-offs. All interests are equal. Each is as worthy as the other; but we must choose to enhance one and diminish the other to accomplish the trade.

We can analyze an ecosystem, but it is difficult to predict what effect our activities will have on it. We address this uncertainty, however, by paying continual attention to the watershed's health through adequate monitoring and observation, and by modifying our practices if and when they have undesirable or adverse effects. None of us alone can manage an ecosystem — it's a community responsibility.

Several presenters spoke about getting all stakeholders in a watershed together to put their needs on the table — their needs and visions for the future. By embracing the totality of these concerns rather than staking out a position based on individual fears, we pave the way for trade-offs to be made and agreements to be reached.

One presenter referred to this strategy as consensus planning, and suggested that it is a role for conservation districts to fulfill. Others argued that this strategy is impossible unless trust is built up through a caring and sharing process. When people talk openly about their *needs* rather than their *position*, they become vulnerable to one another. If their openness is respected, trust develops and trade-offs can be proposed that incorporate their needs and visions of the future. We won't make real progress until we gain this respect and trust for one another's needs.

What do we managers and policymakers do to support this process? We can make sure that research is focused on real needs and that appropriate technical assistance is offered up and down the line to fulfill them. Databases must be developed and maintained on a national and regional level, and the data must be available. We must ensure a good delivery and exchange of information.

We can analyze watershed concerns for their regional and national significance so that resources and legislation can be quickly funneled to support local efforts. Such matters are our responsibility, but remember, too, that in every project or effort the time comes when we must simply bypass the bureaucratic process — the endless planning and analysis — and just get on with it.

Notes on the National Scene

DuPont Volunteers to Phase Out Cyanazine

The DuPont Company, maker of the herbicide cyanazine, has struck an agreement with the U.S. Environmental Protection Agency: the company will voluntarily cease production of cyanazine for use in the United States.

The phase out, which will occur over a four-year period, is not expected to disrupt crop production, although an estimated 36 million pounds of cyanazine are currently applied each year to corn, cotton, and sorghum. Cyanazine is one of the most widely used pesticides in the United States. It effectively controls broadleaf weeds and grasses; about 95 percent of all cyanazine used each year is applied to corn.

Phase-Out Protects Human and Environmental Health

A special review by the EPA concludes that cyanazine causes cancer in laboratory animals. It may also pose significant risks to human health through residues in food and drinking water. Farm and factory workers risk exposure when mixing, loading, or applying the pesticide. The phase-out agreement includes terms and conditions to reduce exposure, and thereby risk, during the phase-out.

The potential for pesticides to wash into streams and rivers or to seep into groundwater is well known, and cyanazine has been found along with other pesticides in nonpoint source runoff, though generally not in amounts exceeding health advisory limits. The risks posed by this contamination are uncertain, but new pesticide chemistry, new and improved pesticide management practices, and agreements like DuPont's help protect the environment and human health.

Substitutes for Cyanazine

The phase-out will give growers time to adopt appropriate substitutes. Since major alternatives at comparable prices are currently registered and available and other pesticides are under review by the EPA, growers are not expected to incur additional costs as a result of this action.

DuPont's decision avoids time-consuming and potentially costly additional review that might have resulted in changes to the product or its uses — or even cancellation. Instead, says DuPont, "we will focus our resources on new products, technologies, and services."

EPA believes that the voluntary phase-out will reduce risks to human health and the environment and commends DuPont's initiative.

[For more information, call Al Heier, U.S. Environmental Protection Agency Press Office, 401 M St. SW (1703), Washington, DC 20460. Phone: (202) 260-4374.]

Risk Policy Could Reawaken Concern About Illness Linked to Nitrates in Well Water

Noting that children are at a higher risk than most adults for exposure to contaminants from fresh produce, tap water, milk, and juice, EPA Administrator Carol Browner recently announced a new policy that will explicitly consider environmental dangers to infants and children.

The new policy, which took effect November 1, 1995, requires EPA to develop separate risk assessments for infants and children. "We expect that this policy will encourage new, much-needed research to provide the child-specific data we need to thoroughly evaluate the health risks children and infants face from pollution in our air, land, water, and food," Browner said.

The policy prompts renewed awareness of a threat to children that is often overlooked. In March 1981, a six-week old South Dakota boy became ill from formula prepared with water drawn from a shallow well on his family's farm. Recognizing the symptoms of methemoglobinemia, a condition linked to nitrates in water, the family doctor recommended testing the well.

Although the infant recovered quickly after the doctor prescribed bottled water, the South Dakota Department of Environmental and Natural Resources (DENR) found that the well's

Risk Policy Could Reawaken Concern About Illness Linked to Nitrates in Well Water (continued)

water contained a nitrate level 12 times higher than the 10 mg/L safe drinking standard established by the EPA. DENR reported that runoff from nearby hog confinements was the primary nitrate source.

Methemoglobinemia and its Nonpoint Source Connection

Methemoglobinemia occurs when bacteria in the stomach convert nitrate to nitrite. The nitrite then passes into the bloodstream where it oxidizes iron in the hemoglobin, thereby inhibiting the blood's ability to carry oxygen. Humans older than six months usually develop stomach acids that prevent the nitrate breakdown, but the disease can be fatal to young infants and adults who lack certain enzymes. The condition, also referred to as "blue-baby disease," gives a characteristic blue cast to the person's lips and fingernails.

Nonpoint sources of nitrate, such as animal waste and commercial fertilizer, are primary well contaminants. Human sewage from septic systems located in the vicinity of wells is another, though less likely, source of nitrate.

The first cases of infant methemoglobinemia caused by nitrate-contaminated wells were reported by Dr. Hunter Comly of Iowa in 1945. These 17 cases were associated with shallow wells located near barnyards or outhouses. Public supply wells, however, are not immune to the problem. In 1962, a case of methemoglobinemia was linked to a Colorado public supply well with a nitrate level of 63 mg/L.

Studies Confirm the Presence of Nitrate in Wells

In response to the 1981 case, the South Dakota DENR surveyed doctors in the Big Sioux aquifer basin about the frequency of cases of the disease. The results of the survey, released in 1986, showed that 80 cases of the disease occurred in the basin between 1956 and 1986.

Mike Meyer, a former hydrologist with the South Dakota DENR, participated in the 1981 investigation, and his concern increased when he learned that reporting methemoglobinemia cases is not required. "There is a widespread perception in the environmental community that methemoglobinemia is rare. My review of the record suggests that many more cases occur each year in the United States than are reported as public information."

Meyer's nitrate study in the Big Sioux basin revealed that 27 percent of wells exceed the nitrate limit. This finding is significantly higher than nitrate levels nationwide. A 1990 U.S. EPA report documents national nitrate levels exceeding the 10 mg/L standard in 1.2 percent of public wells and 2.4 percent of rural domestic wells. However, studies in the Midwest frequently report that 10 to 20 percent of rural wells exceed the standard.

Studies on the occurrence of methemoglobinemia are rare in comparison to documented nitrate levels in well water. A 1950 national survey revealed 278 cases and 39 fatalities resulting from the disease, but fewer cases have been reported in the United States since 1950, and no surveys on the disease have been completed during the past 40 years. Meyer's analysis suggests that as many as 100 cases of methemoglobinemia may occur in the United States each year, mostly involving private wells.

This lack of awareness can have devastating consequences. In 1986, a six-week old South Dakota girl became sick of the disease after drinking formula mixed with well water containing 150 mg/L of nitrate. When the family's physician did not recognize the symptoms of the disease and referred the family to a specialist in another town, the infant died en route. The case garnered national attention as the first reported methemoglobinemia death in more than 30 years.

Meyer characterizes the dilemma that methemoglobinemia poses:

> *"If it is not recognized and reported by the medical community, the environmental community will not become aware of it. On the other hand, if surveys are not undertaken and reported by the environmental community, the medical community will tend to assume the disease occurs rarely."*

Meyer suggests that increased recognition of the disease may encourage states to make it a reportable disease. However, even if no reports are mandated, "the medical and environmental communities should work together in a broad effort to examine and publish the nitrate contamination-methemoglobinemia connection."

Risk Policy Could Reawaken Concern About Illness Linked to Nitrates in Well Water (continued)

As EPA Administrator Browner acknowledged in announcing the new risk assessment policy, "Traditionally, many environmental standards have been based on *adult* risks, adult exposures. Yet, when it comes to environmental hazards, children are not just little adults." Few environmental hazards illustrate this dichotomy more fully than the risk posed by nitrates in well water.

[For a copy of Meyer's paper on this topic presented at the 1994 Annual Midwest Groundwater Conference in Bismarck, North Dakota, contact Mike Meyer, PG CGWP, Geotek Engineering and Testing Services, Inc., 501 East 52nd St. North, Sioux Falls, SD 57104. Phone: (605) 335-5512; Fax: (605) 335-0773. A summary of the paper appeared in the Iowa Groundwater Quarterly *6(3): Fall 1995.]*

USGS Releases Report on Nation's Water Quality

The U.S. Geological Survey (USGS) has released its most extensive report to date on nutrients in the nation's water resources. The first national compilation of data analyzed under the USGS National Water Quality Assessment (NAWQA) program, the report includes data from 12,000 groundwater and 22,000 surface water samples.

The study reviewed data obtained from USGS and state agency records for 20 watersheds across the nation, each encompassing approximately 25,000 to 30,000 square miles. Analysis of the data revealed links between environmental factors, such as land use and soil type, and nitrate concentrations in surface and groundwater.

Nutrients in Groundwater

Wells in agricultural areas, including stock and irrigation wells, were more likely to exceed EPA's Maximum Contaminant Level (MCL) of 10 mg/L of nitrate nitrogen (see also the preceding article). Of the agricultural wells tested, 21 percent exceeded the MCL for nitrate. Several wells in areas dominated by rangeland (8.5%), urban land (7.0%), and forest land (3.0%) also exceeded the MCL.

Areas with well-drained, sandy soils were more susceptible to increased nitrate concentrations because these soils have little capacity to hold water and nutrients. These soil types are widespread in regions of the Northeast, Midwest, and West Coast, where irrigation and fertilizer applications are common.

Overall, public water supply wells were less likely to be affected by nitrate contamination, the study showed. Of the public water supplies surveyed, 1 percent exceeded the nitrate standard, in comparison to 9 percent of domestic wells. Dennis Helsel, USGS hydrologist and contributing author, observes that "what people are drinking from domestic wells is different from public water supplies."

Public water supplies are generally provided by deep, well-protected wells, Helsel explains, while domestic wells are shallower and tap into "younger" water, thus making them more susceptible to contamination. The study found that nitrate concentrations exceeded the MCL in roughly 21 percent of wells 100 feet deep or less. Regular testing and the regulation of public water supplies also serve to protect against nitrate problems.

Nutrients in Surface Water

The study found that nitrate concentrations in surface water were not as high as the nitrate levels in groundwater and rarely exceeded the drinking-water standard. However, data analysis did reveal that nitrate concentrations were higher in areas of agricultural drainage. In the Midwest, tile used to drain agricultural fields is a likely conduit for nitrate from fertilized cropland. In the Northeast, the report identifies acid rain as the primary source of nitrate pollution of surface waters.

Urban areas did not escape the study's scrutiny, and data showed that urban runoff was second only to agriculture as a nutrient source. Data from urban areas revealed concentrations of ammonia and phosphorus high enough to pose a toxicity threat to fish and accelerate eutrophication downstream from the source.

Improvements in wastewater treatment are used to address the problem of urban runoff. However, as some efforts to combat toxicity by upgrading sewage treatment plants merely convert ammonia to nitrate, this tactic may be exacerbating eutrophication. Because the study included data from previous years, it was able to identify shifts from ammonia to nitrate in urban surface waters across the nation.

USGS Releases Report on Nation's Water Quality (continued)

The Surface Water, Groundwater Interface

The study showed a correlation between surface and groundwater nitrate concentrations. Land uses and characteristics appeared to play a role in this interface. In well-drained Northeast, Midwest, and West Coast regions, both surface and groundwater nitrate concentrations were high.

A Useful Guide for Future Planning

NAWQA's report on nutrients in the nation's water identifies a connection between characteristics unique to different regions— such as land use and soil type — and the potential for pollution, and it underscores the vital nature of this link in relation to water protection efforts: "Understanding the regional patterns and environmental factors that affect nutrient concentrations in ground water and surface water is critical for designing programs to manage and protect water resources."

In all, NAWQA will conduct three years of intensive nitrate, ammonia, and phosphorus sampling in the 20 study watersheds before releasing a final follow-up report. Helsel explains how the current analysis will guide the sampling effort: "The data review helps us to find out what others have learned, so that we don't duplicate their effort. It also allows us to tailor sampling under the NAWQA program to include areas where there are no data, or where problems have been identified."

The watersheds will be revisited once every 10 years to help the NAWQA program fulfill its long-term goals: (1) to assess current surface and groundwater quality, (2) to identify changes over time, (3) to determine the effects of water quality on biological communities, and (4) to communicate results to water managers at the state and local level. Future NAWQA studies will focus on pesticides and volatile organic compounds.

[For a copy of Nutrients in Ground Water and Surface Water of the United States — An Analysis of Data Through 1992, *call USGS at (703) 648-5716. For more information, contact Dennis Helsel, Hydrologist, USGS, 413 National Center, Reston, VA 22092. Phone: (703) 648-5713; Fax: (703) 648-6693.]*

Notes on Riparian and Watershed Management

Land and Water Stewardship Becomes a Boardroom Topic

Some say it's a roadmap to the future of environmental protection. Others claim it still needs the backup of strong federal regulation. But whether it's a stepping stone or a superhighway, businesses and commodity groups are embracing the concept of private environmental stewardship.

Last year, *News-Notes* reported on several special interest initiatives endorsing voluntary environmental responsibility. Virginia's poultry industry, for example, got tough with its producers about waste management. Pork producers' and wheat growers' associations developed BMPs for their constituents. Since then, as this story shows, a host of other private interests have followed suit.

- **Forestry Association Adds Muscle to Principles.** In 1994, the American Forestry and Paper Association (AF&PA) adopted the Sustainable Forestry Initiative Principles and Guidelines. Starting this year, the association requires its more than 400 corporate and organizational members to comply with these guidelines as a condition of membership.

  Members account for 84 percent of the paper production, 50 percent of the solid wood production, and 90 percent of the industrial forestland in the United States. All must adhere to performance measures on their own lands and promote sustainable forestry on other private and public lands.

  Besides strongly encouraging overall forest health, ecosystem management, and public involvement, the guidelines contain several objectives and performance measures that specifically address water resources. One set of measures prescribes meeting or exceeding all BMPs, all applicable state water quality laws and regulations, and the requirements of the Clean Water Act for forestland.

Land and Water Stewardship Becomes a Boardroom Topic (continued)

Members will have to establish riparian protection for all perennial streams and lakes and contribute funding for water quality research. Clear-cutting will be better managed, with size limitations and a "green up" requirement forbidding clear-cutting until adjacent areas have regrown.

AF&PA members also encourage good stewardship of all forestland by working with other landowners, contractors, and loggers — primarily by their support for education and training. Some members have even gone beyond this measure with programs like Champion Industry's "preferred supplier program," which purchases timber from loggers who have completed special training courses, according to Champion's Paul Krick.

AF&PA's sustainable forestry initiative sets out specific reporting requirements to measure members' compliance, and the organization itself will issue an annual report reviewed by an independent expert review panel.

[For more information, contact Rick Cantrell, AF&PA, 1111 19th St. NW, Washington, DC 20036. Phone: (202) 463-2432; Fax: (202) 463-2708.]

■ **Corporations Restore Riparian Areas.** As members of the Wildlife Habitat Council (WHC), more than 100 corporations are now collaboratively managing over 340,000 acres of open space. The nonprofit WHC, created in 1988, encourages corporations to protect the environmental values of their lands and enhance them as wildlife habitats. So far, most WHC members are involved in upland habitat improvement projects, but some are also interested in the Waterways for Wildlife program that emphasizes riparian areas and wetlands.

Last year, Detroit Edison gave WHC a grant to coordinate the development of a management plan for the St. Clair River ecosystem shared by Michigan and Ontario. The plan will involve corporate, private, and public landowners in wetland, riparian, and upland habitat restoration projects.

Habitat enhancement is especially important to ecosystem or watershed-based approaches, say WHC representatives, because habitat affects water quality and biotic integrity. Another example of Waterways for Wildlife is the Cooper River Corridor Project in South Carolina, underway since 1993. Participation in the project, which is being led by Amoco Corporation, has ballooned to include 43 public, private, and corporate landowners working to improve water quality and enhance biodiversity on 70,000 acres along the river.

Currently, WHC says, 15 industrialized rivers bordered by 450 square miles of wildlife habitat are targeted for corporate collaboration on restoration or enhancement projects in the next five years.

WHC gives special awards for Rookie of the Year and Corporate Habitat of the Year. General Electric's Burkville, Alabama, plant and DuPont's Victoria, Texas, plant won 1995 Wildlife Habitat Council awards for stewardship. In addition, any WHC member companies who make a documented commitment to wildlife enhancement or environmental education are eligible for certification.

[For more information, contact WHC, 1010 Wayne Ave, Suite 920, Silver Spring, MD 20910. Phone: (301) 588-894; e-mail: whc@cais.com.]

■ **Cattlemen's Association Recognizes Good Stewards.** Seven cattle producers won regional environmental stewardship awards in 1995 in the fifth annual recognition of good environmental stewardship sponsored by the National Cattlemen's Association (NCA) in partnership with Pfizer Animal Health. Much of the award-winning work used innovative methods to protect water resources while making businesses more profitable.

- The owners of Sitz Angus Ranch near Harrison, Montana, won an NCA regional award for helping the state improve an important trout-spawning area. They also diverted a creek that ran through their feedlot back to its original course to avoid contamination. They limit cattle access to the stream and have planted thousands of trees and shrubs along streambanks.
- Maryland's Antietam Meadows Farms near Sharpsburg, Maryland, set an example for Chesapeake Bay producers with their commitment to water quality. Antietam Meadows cattle drink only from troughs — never directly from the nearby Potomac

Land and Water Stewardship Becomes a Boardroom Topic (continued)

River — to ensure the integrity of the river's banks. The Poffenbergers, who manage the farm, have created a riparian buffer zone and turned 125 acres of tilled, highly erodible cropland into productive permanent pasture, eliminating nearly all erosion on their farm.

- The Mortenson family of Pierre, South Dakota, used a managed grazing system, among other things, to reduce soil erosion from runoff and increase the ranch's scarce water supply. Forage production has increased eightfold. "We've been able to improve the condition of the rangelands because we've managed the soil and water," said Clarence Mortenson.

Other regional winners were G.W. Jones and Sons Farm, Huntsville, Alabama; David Williams Farm, Vilisca, Iowa; and Babbitt Ranches, Flagstaff, Arizona. All seven winners were selected by a panel of experts, including representatives of the U.S. EPA, American Farmland Trust, Natural Resources Conservation Service, The Nature Conservancy, Texas Tech University, South Utah State University, Texas Agricultural Extension, NCA, and Pfizer Animal Health.

The Heritage Beef Cattle Company of Wheeler, Texas, won the national NCA Stewardship Award in January 1996.

[For more information, contact Jamie Kaestner or Wendy Radakovich, National Cattlemen's Association, 5420 S. Quebec St., P.O. Box 3469, Englewood, CO 80155. Phone: (303) 694-0305; Fax: (303) 694-2851; e-mail: jak@ncanet.org or http://www.cowtown.org.]

■ **Organization Promotes On-Farm Environmental Protection.** Foundation E.A.R.T.H., a new organization that takes its name from its mission — Earth, Agriculture, Research, and Technology in Harmony — is a nonprofit partnership of farmers and others dedicated to protecting the environment by supporting the adoption of technologically advanced, environmentally sound farming practices.

Formed only a year ago, Foundation E.A.R.T.H. revolves around the Harmony Farms Program. "If we can provide hard evidence of agriculture's environmentally responsible approach, we can begin to increase the public understanding of, and confidence in, food production," say the foundation's charter members. To yield that evidence, the program will depend on three types of projects:

- "Demonstration Farms" open to a wide range of invited groups will provide the why and how of environmentally friendly farming practices;
- "Development Farms" operated by farmers who work actively with established agronomic advisory groups will develop, manage, and monitor new technologies and farming practices; and
- "Self-Audit Farms," which may be any agricultural operation in the country that is willing to carry out a yearly environmental audit reassessing their farming practices in crucial areas.

[For more information, contact Foundation E.A.R.T.H., 676 St. Clair, Suite 2000, Chicago, IL 60611.]

These and other efforts undertaken to promote private stewardship set a new direction for America's relationship with the environment. As NCA regional award winner Clarence Mortenson explained, "We realize we must coexist with the land. It's not in our contract with the land to abuse it."

Urban Runoff Notes

Maintenance Is Main Message of Stormwater Management Guide

In Rhode Island, as elsewhere, neglected maintenance is causing some stormwater best management practices (BMPs) to fail despite a growing collection of management technologies. To respond to this dilemma, Rhode Island is using EPA 319 funds to develop a guide for integrating BMP maintenance into local stormwater management ordinances.

Maintenance Is Main Message of Stormwater Management Guide (continued)

"Maintenance is a critical element of design," according to Scott Millar of the Rhode Island Department of Environmental Management, so "we are looking to incorporate the how-to aspect of maintenance into BMP design." Millar is overseeing development of the guide; A. Eric Offenberg, district engineer with the Rhode Island Conservation Districts, is the primary author.

Pollutant-laden runoff reaches BMPs quickly in developed watersheds. Whether the stormwater flows into a pond, pipe, ditch, or tank, these BMP receptacles require regular maintenance to remove accumulated pollutants and restore their functions. The guide encourages localities to mandate the development of clear maintenance plans for BMPs, including the frequency and type of maintenance, cost estimates, and performance standards.

Key Stormwater Runoff Concerns

Stormwater runoff is responsible for 70 percent of Rhode Island's nonpoint source pollution. Stormwater carries sediment, oil, metals, nutrients, pesticides, road salt, or bacteria into surface water, has adverse impacts on aquatic life, and represents a potential public health threat.

Flooding is another key stormwater management concern. About 500 percent more stormwater flows through developed watersheds than through undeveloped watersheds. This increased runoff causes streams to be bankfull four times a year on average as opposed to the average predevelopment pattern of roughly once every two years. It can also widen streambanks two to four times more than their predevelopment width and straighten meanders that previously slowed flow and allowed pollutants to settle.

Rhode Island relies on BMPs to prevent flood damages and reduce total suspended solids in stormwater as much as 80 percent. Hence, the concern over recent BMP failures, and the guide's assertion that more attentive maintenance is the solution. In this vein, it provides maintenance standards for specific BMPs, including ponds, pipes, tanks, and catch basins.

For example, to maintain the storage area of ponds receiving sediment, the standards for pond maintenance indicate that accumulated sediment should be removed when it exceeds 10 percent of the designed pond depth. Roughly, this standard corresponds to a pond cleanout every two years. The guide also supplies cost estimates for pond maintenance labor.

Five Axioms of Stormwater Management Planning

According to Rhode Island's stormwater ordinance guide, five axioms or philosophies are key to achieving stormwater management success:

- ✔ Storm and surface water management should be as fundamental as water supply services, wastewater treatment, and refuse management. However, policies should be based on watershed, as opposed to jurisdictional, boundaries.
- ✔ Don't build what you can't maintain. Maintenance is fundamental.
- ✔ Don't put a pipe in it and forget it. Evaluate the downstream impacts of both the volume and peak rate of runoff.
- ✔ Use and protect the natural environment. Consider the impacts of runoff on the natural environment and integrate natural and constructed facilities into the drainage system.
- ✔ Responsibility should be shared equitably by everyone. Everyone benefits from the responsible management of storm and surface waters.

Maintenance Planning

A vital component of a successful BMP maintenance plan is complete information on who is responsible for implementing it. Homeowner associations and localities responsible for BMPs must be fully aware of their responsibility and have access to maintenance specifications and costs directly associated with BMP design.

In addition to the principles for comprehensive BMP maintenance, the guide provides a sample ordinance adaptable to Rhode Island communities, suggests site plan requirements, explains the elements of a stormwater management program, offers funding examples, and includes guidance on how to avoid legal challenges.

The guide contains valuable information on stormwater programs that take a forward approach to BMP problems associated with neglected maintenance. Millar envisions that the guide "will bring local ordinances [in Rhode Island] closer to state requirements by offering localities the structure and tools needed to organize and implement a successful stormwater management program."

[For more information, contact Scott Millar, Supervising Environmental Scientist, Rhode Island Department of Environmental Management, Office of Environmental Coordination, 83 Park Street, Providence, RI 02903. Phone: (401) 277-3434, ext. 4419; Fax: (401) 277-2591.]

Maintenance Is Main Message of Stormwater Management Guide (continued)

A Helpful Tool for Developing Local Ordinances

In April 1995, Terrene Institute in cooperation with the U.S. Environmental Protection Agency, Region 5 Water Division released *Local Ordinances: A User's Guide.*

Preparing local ordinances and regulating new development is the theme of this comprehensive guide for local planners, a full chapter of which is dedicated to comprehending urban runoff and reporting recent study findings, for example, that stormwater runoff is the source of 90 percent, or more, of the iron, total nitrogen, and fecal coliform bacteria found in water.

This chapter also explores the aquatic and public health effects of stormwater pollutants, provides legislative background and current requirements, identifies urban vegetative and structural BMPs, poses questions to reveal potential ordinance requirements, and recommends funding options.

In addition to stormwater management, the guide provides scientific, environmental, and regulatory background complete with ordinance ideas for controlling on-site disposal systems, maintaining vegetative buffer zones, establishing wildlife corridors, stabilizing shorelines, protecting wetlands, and planning docks and marinas.

[Copies of *Local Ordinances: A User's Guide* are available for $14.95 + $4 shipping each from the Terrene Institute, 1717 K Street, NW, Suite 801, Washington, DC 20006. Phone: (202) 833-8317; Fax (202) 296-4071.]

Rockville Mall Redevelopment Offers Opportunity for Stormwater Retrofit

When the Rockville (Maryland) Mall Project was conceived in the late 1960s, conveyance was the primary function of stormwater systems. Since then, stormwater management has evolved considerably, and in the mall's redevelopment, the latest in stormwater management technology will achieve a combination of stormwater control and pollutant treatment.

Previous efforts to market the retail facility were unsuccessful to the extent that the Rockville Mall project "never really got off the ground at all," according to Ed Duffy, assistant chief of economic development with the Rockville Community Development Office. When the structure began to show the effects of salt damage, mall owner Rockville Center, Inc. (RCI), decided to start fresh. Demolition of the mall was completed in October 1995. RCI is using financial assistance from the city, county, and state to redevelop the site.

The redevelopment of the mall provides an opportunity to improve existing stormwater systems. Redevelopment is the primary avenue for improving the quality of runoff in urban areas. Effective and economical new technology enables planners to incorporate retrofitted stormwater management systems into redevelopment projects such as Rockville Mall.

Incorporating the New Stormwater System

"In 1978, when Rockville established stormwater management regulations, more than 75 percent of the city was already built-out," according to Janette Fearon, civil engineer with the city's Department of Public Works. The city's retrofit requirements are now distinguished as the most demanding in the state.

Retrofits are required if (1) a redevelopment project exceeding 2,500 square feet replaces one that lacked stormwater management, even if existing impervious area is merely being replaced; (2) a project will double impervious area; or (3) a project disturbs 50 percent of the existing site.

These regulations did not affect the Rockville Mall project during prior renovations because work on the site was only cosmetic. "The mall had a storm drain system, but it didn't provide quality or quantity control," Fearon said. The city's regulations now require the project to address these issues.

New Technology Offers Feasible Options

"The existing storm drain systems at the RCI project site are too shallow to achieve the design specifications of oil/grit separators," says Fearon. Commonly used for stormwater control,

Rockville Mall Redevelopment Offers Opportunity for Stormwater Retrofit (continued)

oil/grit separator designs call for a rise between the inlet and outlet of the structures, necessitating a deep stormwater system. Scott Roser, senior engineer with Marcis, Hendricks, and Glasock, the firm hired to design a retrofitted stormwater system for the mall redevelopment, decided that Stormceptor, a relatively new technology, would work better in this case.

Space constraints also influenced Roser's choice. Existing streets, utilities, and underground parking garages abutting the right-of-way presented obstacles for installing a retrofit. "Stormceptor has a fairly small footprint, and in this case, we were dealing with a limited lateral area," explained Roser.

Essentially a precast concrete structure with stormwater removal and treatment capability, Stormceptor is installed as a source control in the vicinity of stormwater inlets. Prefabricated in various sizes, up to 12 feet in diameter and six to eight feet deep, it provides stormwater pollutant treatment for areas from one-half to eight acres. Field tests show that it can treat 60 to 80 percent of suspended sediment and 70 to 90 percent of floatable oil and grease.

Channelized flow enters the concrete structure via stormwater piping. Once inside, the water enters what Roser terms "a fiberglass doughnut"—a weir that forces stormwater down a six-to-12-inch pipe into the lower portion of the chamber. The system fully treats 1.68 inches of runoff from a 24-hour uniform storm, which accounts for 95 percent of all rain events. Excess stormwater flows over the weir and continues through the stormwater system. The depth of the chamber and the weir design prevent resuspension of previously captured pollutants.

John Pressel, the contractor for the Rockville job, lauds the ease of installing the retrofit structures in comparison to stormwater options such as sand filters. "It's a one shot deal, much more convenient from a contractor standpoint." Ease of installation is critical in redevelopment projects so that daily business and traffic patterns are not disrupted for extended periods of time.

Cost and maintenance are also key components of the successful design and implementation of stormwater retrofits. Using this structure to treat a one-acre drainage area costs $9,000, compared to $30,000 or $40,000 for a sand filter system. The Rockville Mall structures are also fairly easy and inexpensive to maintain. Vacuuming once or twice per year at approximately $600 per structure ensures their ability to control stormwater flows and treat pollutants.

Redevelopment projects such as Rockville Mall are prime opportunities to implement the latest technology in stormwater flow and quality control in urban areas. Whether or not this concept is incorporated into local law, new, cost-effective, pollutant removal tools are enabling water quality managers and planners across the nation to ensure that stormwater retrofits will be a routine component of urban redevelopment projects.

[For more information on the stormwater retrofit at the Rockville Mall Project, contact Janette Fearon, City of Rockville, Department of Public Works, 111 Maryland Avenue, Rockville, MD 20850. Phone: (301) 309-3217; Fax: (301) 762-7153. For more information on Stormceptor, contact Vince Berg, Stormceptor Corporation, 600 Jefferson Plaza, Suite 304, Rockville, MD 20852. Phone: 1-800-762-4703; Fax: (301) 762-4190.]

Sprawl versus Traditional Town Development — How Do They Compare?

EDITOR'S NOTE: This article is excerpted from the *South Carolina Coastal Conservation League Land Development Bulletin*, No. 7, Fall 1995. It presents the results of a study comparing "sprawl" development with "traditional town" or "town and country" type development.

The conventional way to control runoff is to use BMPs such as detention ponds, which, according to some, are unlikely to adequately protect against runoff impacts. Now, many are coming to see the development pattern itself as part of the problem — and part of the solution.

As an alternative to sprawl, the "traditional town" model of development produces compact, mixed-use, pedestrian-oriented traditional towns. Traditional towns have coherent and well-defined boundaries and are surrounded by rural areas. This alternative to sprawl has a number of advantages, but until recently, little was known about the relationship between the traditional development pattern and runoff.

The Belle Hall Study

Last fall, the Charleston Harbor Project, funded by the National Oceanic and Atmospheric Administration, and administered by the South Carolina Department of Health and Environmental Control, began a study to compare the water quality impacts of sprawl and the traditional town alternative. The research team was an eclectic group of architects, local government planners, private and public sector engineers, state regulators, resource managers, and citizens. The researchers tested the hypothesis that traditional town development generates less total runoff than sprawl because it disturbs less land.

First, the team designed two prototype developments — one representing sprawl and one representing the traditional town. Second, a group of scientists and computer modelers evaluated the runoff loadings associated with the two designs.

The Design Phase

The design team "developed" Belle Hall, a 583-acre site in Mt. Pleasant bordered by the Mark Clark Expressway and the Wando River, under both sprawl and traditional town scenarios. This work was led by Victor Dover and Joseph Kohl, principals in the South Miami, Florida, urban design firm Dover, Kohl & Partners.

Under the sprawl scenario, all of the land available for development was used — as is typical in conventional development. Single family homes on relatively large lots were planned in "pods" separated from the planned commercial areas. Conventional lot sizes, street widths, and parking configurations were assumed.

Under the traditional town scenario, the design team matched the amount of residential, commercial, office, and industrial space in the sprawl development. These same land uses, however, were organized differently. Residential densities rose, residential and commercial land uses were blended together, and street and parking configurations followed local traditions seen in the village of Mt. Pleasant and the city of Charleston.

The land area consumed by the traditional town scenario is an order of magnitude lower than under the sprawl scenario. At build-out, the sprawl scenario offers about 30 acres of open space. The traditional town scenario offers about 400 acres of open space and greens.

The Modeling Phase

Dr. Elizabeth Blood, of the Jones Ecological Research Center in Newton, Georgia, took these two development options and analyzed their runoff implications. She and her team of graduate students used a computer model (based on a modification of the Universal Soil Loss Equation and local hydrology) to predict a number of runoff variables:

- the volume of water leaving the site during a storm;
- the amount of sediment in the runoff, which can alter the ecological balance of a receiving water body by clouding the water;
- the levels of phosphorous and nitrogen, important nutrients that in large amounts can alter the biological balance; and
- chemical oxygen demand, or COD, an indicator of the additional stress runoff can place on surface waters' limited supply of oxygen.

The traditional town scenario performed better than the sprawl scenario across the board. The volume of runoff from the sprawl scenario was 43 percent higher than from the town scenario. Sediment loads were three times higher under the sprawl scenario. Nitrogen and phosphorous loadings, as well as chemical oxygen demand, associated with sprawl were also higher.

Because estimates of phosphorous and nitrogen loadings were conservative, the model results may even underestimate the disparity between the sprawl and traditional town scenarios. The model did not account for the application of lawn fertilizers, which normally would be higher on the expansive lawns of the conventional subdivision. Also, the model did not account for the fact that residents of a traditional neighborhood are likely to drive less because some of their trips (to the corner store, the doctor's office, or a local park) could be made on foot or by bicycle. Fewer car trips mean fewer pollutants collected on roadways and parking lots — and less polluted runoff.

Sprawl vs. Traditional Town Development — How Do They Compare? (continued)

Regional Implications and Policy Responses

The results of the Belle Hall study provide an important analogy for development on the regional level. According to the Berkeley/Charleston/Dorchester Council of Governments, the region's population will increase by about 170,000 people between 1990 and 2015. Knowing this, the important questions become "where will these people settle?" and "how will these new developments be designed?"

There are two options. This new growth could continue to sprawl out into the countryside, or it could be concentrated along traditional lines, leaving the bulk of the region in timber and other rural land uses. From a water quality standpoint, the Belle Hall study suggests that the latter is clearly the best option.

Ironically, the development pattern that is best for water quality, the traditional town form, is also illegal to build under most local zoning codes. Conventional zoning requires low density residential development; separates residences from commercial and employment centers; and relies almost exclusively on the car for transportation. In a nutshell, conventional zoning requires sprawl. The Belle Hall study indicates that local zoning codes should be changed to allow developers to build along traditional lines and, ideally, local governments would give developers incentives to do so.

[For more information, contact James Hackett, Charleston Harbor Project, 4130 Faber Place, Suite 302, Charleston, SC 29405. Or contact Sam Passmore, Land Use Program, South Carolina Coastal Conservation League, P.O. Box 1765, 456 King St., Charleston, SC 29402-9940. Phone: (803) 723-8035; Fax: (803) 723-8308.]

Notes on the Agricultural Environment

Vermont Agriculture under New Regulation

Starting December 15, 1995, Vermont farmers faced a major change in how they do business. A new agricultural nonpoint source law requires all farmers to follow a set of "accepted agricultural practices," or AAPs. The statewide restrictions are designed to reduce nonpoint source pollution through improved farming practices rather than through structures and equipment.

According to Phil Benedict of the Vermont Department of Agriculture, Food, and Markets (DAF&M), the most far-reaching of these changes is the ban on winter manure spreading that kicked in late last year. "There are about 1,900 dairy farms in the state," said Benedict, who estimates that 600 or 700 of these farms will need to change their normal manure applications to conform to the new regulation.

Other AAPs forbid nonpermitted discharges, prescribe nutrient (including manure) and pesticide storage practices, nutrient and pesticide application, agricultural waste management, vegetative buffer zones, and soil conservation. Still others concern the construction of farm structures. According to the law, AAPs must be technically feasible as well as cost effective for farmers to implement without government financial assistance. Farmers who follow the practices are presumed to be in compliance with water quality rules.

The main problem in Vermont's two major drainage basins is phosphorus, and requiring AAPs on all farms is the first of three levels in the approach to solving it. Benedict hopes that a financial assistance program under the state Agricultural Nonpoint Source Pollution Reduction Law will encourage farmers to go beyond the AAPs to the second level, the voluntary installation of additional BMPs as needed. That way, he is optimistic that the third level, the required installation of BMPs on a case-by-case basis to protect water quality, will rarely be needed.

Best management practices are stricter than AAPs, and will be prescribed to correct problems on specific farms. BMPs typically require the installation of structures such as manure storage systems, and most Vermont farmers will likely be unable to implement them without cost sharing.

In a 1993 Memorandum of Understanding, the DAF&M and the Vermont Agency of Natural Resources (ANR) agreed to coordinate the state's NPS program, with DAF&M managing the

Vermont Agriculture under New Regulation (continued)

agricultural side of things and ANR managing and enforcing all other NPS statutes. DAF&M will lead enforcement of the AAP rules.

The Vermont agricultural community has been generally supportive of the new regulation, largely because they believe that the rule will work to protect water quality without imposing unrealistic demands. The wet weather in late fall provided ample opportunity for the program to demonstrate that flexibility, said Benedict. "It was a difficult year to begin this program. Farmers couldn't get into their fields to spread manure early, so I expect we'll be granting some exemptions."

[For more information, contact Phil Benedict, Vermont Department of Agriculture, Food and Markets, 116 State Street, Drawer 20, Montpelier, VT 05620-2901. Phone: (802) 828-2500; Fax: (802) 828-2361; e-mail phil@agr.state.vt.us.]

Ecolotree Stream Buffer Filters Runoff, Provides Cash Crop

EDITOR'S NOTE: See *Nonpoint Source News-Notes* #37, July 1994, for a description of another buffer design.

Last spring, volunteers from "Keep Fauquier Clean" and students from a Central Elementary School fourth-grade class worked all day at the St. Leonard's Farm cattle operation in Warrenton, Virginia, to plant 1,400 poplar trees along Great Run. Modeled after a buffer developed by Louis Licht at the University of Iowa, the poplars will reduce sedimentation and nutrient loading of the stream. A valuable commodity crop, the trees can also be harvested after five years as a cash crop for paper, construction material, or fuel.

The Ecolotree Design

Licht began research on the ability of hybrid *Populus spp.* (poplar) riparian buffers to remove nutrients from runoff in 1986. In 1991, with funding from the USDA Forest Service, the Center for Global and Regional Environmental Research, the University of Iowa, and the U.S. EPA, Licht began a paired watershed study of the pollutant removal capabilities of a riparian Ecolotree Buffer at Amana Farms. Licht trademarked the design used in his research, calling it the Ecolotree Buffer, to differentiate it from Natural Resources Conservation Service grass or mixed-tree buffers.

Paired Watershed Study Reveals Ecolotree's Benefits

The 1991 Amana Farms study compared two watersheds draining to a first-order stream on the Iowa farm. Watershed 1 was 103 acres, included 80 acres of cropland, and did not have a buffer along the stream. Watershed 3 was 283 acres, included 174 acres of cropland, and had a four-row riparian buffer with 15,000 poplar trees on each side of the stream. Native prairie species were planted in the understory of the buffers, and annual grasses and weeds were managed by mowing.

Measurements of sediment and nitrate nitrogen concentrations in runoff from both watersheds revealed the benefits of the riparian buffer. Sediment concentration of runoff measured during rain events was 647 percent greater from Watershed 1 than Watershed 3. Soil loss per row-cropped acre topped off at 3,408 pounds in Watershed 1, in comparison to a 568-pound loss from Watershed 3.

Testing of in-stream nitrate nitrogen revealed that only the unbuffered segment had nitrate concentrations in excess of the Maximum Contaminant Limit (10 mg/L) established by EPA. Nitrate nitrogen concentration in runoff was 69 percent less in Watershed 3.

Because the riparian buffers are designed as borders that follow the contour of the land and adjacent stream, they also provide a valuable edge-type habitat for wildlife. As perennials, the poplars develop into a more mature ecosystem than annual crops. Licht says the buffer can "develop soil structure, deep plant root systems, dense surface stem structure, and a diversity of life."

Ecolotree Stream Buffer Filters Runoff, Provides Cash Crop (continued)

Poplar Tree Buffers as an Energy Commodity Crop

"The Ecolotree Buffer design makes it possible for farmers to grow a new commodity crop from perennial plants that require few pesticides, scavenge excess nutrients, and stabilize eroding soils," Licht explains. "It serves as a final filter for air, water, and soil between built and natural ecosystems." In addition, the buffer allows farmers to diversify from food commodities into other economic markets, including the energy/fuel commodity market.

Virginia's Buffer Experiment

In Virginia, the Governor's office has embraced the St. Leonard's Farm riparian buffer project. It will be watched closely in coming years to determine if the poplars grow well in Fauquier County soils, if they make a difference in the water quality of Great Run, and if the harvested trees are economically valuable. And no one will be watching more closely than Central Elementary's former fourth graders.

[For more information on the Ecolotree Buffer, contact Louis A. Licht, P.E., Associate Research Scientist, A102 Oakdale Hall, Technology Innovation Center, Iowa City, IA 52319. For more information on the St. Leonard's Farm riparian buffer project in Fauquier County, Virginia, contact Paddy Katzen, Special Assistant to the Secretary of Natural Resources, Commonwealth of Virginia, Office of the Governor, Ninth Street Office Building, Room 733, 202 North Ninth Street, Richmond, VA 23219. Phone: (804) 786-0044; Fax: (804) 371-8333.]

*Farm*A*Syst Moves Boldly into New Areas*

Farm*A*Syst, the familiar farmstead water quality assessment aid, has recently ventured into unfamiliar territory. It is showing up in the Pacific Basin, the Yakima Indian Nation, lending institutions, local governments, and even in cyberspace.

- **Pacific Basin.** Guam's drinking water comes primarily from an aquifer located on the north end of the island — the same area that provides much of its agricultural produce. Shallow soils, volcanic rock, and on-site wastewater facilities are some of the challenges presented by the island. The local Guam Farm*A*Syst team met last year at the University of Guam to review development of a program that could be modified for the entire Pacific Basin to protect both surface and groundwater.

- **The Yakima Indian Nation.** The Yakima Indian Nation in Washington state is testing a pilot generic version of Farm*A*Syst/Home*A*Syst. The project is a cooperative one, also involving the Washington State Cooperative Extension, EPA Region 10, and AmeriCorps volunteers.

- **Lending Organizations.** Farm*A*Syst served a different purpose last year when AgriBank of St. Paul, Minnesota, a regional funding bank for Farm Credit Services (FCS), incorporated the program into the bank's due diligence process. Gary Hansen, the bank's credit policy administrator and environmental officer said, "We can be reasonably assured that customers who have used the program to assess risks on their properties have responsible attitudes toward environmental concerns." The bank has provided procedural guidance for using Farm*A*Syst to supplement or replace the FCS environmental inspection report. In addition, FCS associations in some areas are offering lower interest rates to farmers who voluntarily implement and maintain BMPs.

- **Local Government.** Farm*A*Syst is also beginning to appear in local government. Eau Claire County, Wisconsin, policymakers approved the use of county money to help landowners properly close abandoned wells after seeing aggregated farm assessment results in the watershed. They also cost-shared secondary containment for aboveground petroleum storage and helped pay for demonstration projects.

- **Cyberspace.** People who want to learn more about Farm*A*Syst can travel the information superhighway to the system's new World Wide Web Home Page. Visitors to the home page can directly access Farm*A*Syst text files on a gopher site; or they may click on an electronic version of the new brochure. An overview slide show is also on-line, complete with slides and script. The World Wide Web address for these features is http://www.wisc.edu/farmasyst.

*[For more information, contact Farm*A*Syst/Home*A*Syst Program, B142 Steenbock Library, 550 Babcock Dr., Madison, WI 53706-1293.]*

Yardsticks: A Tool for Protecting Our Water Resources

by Mark Ritchie, Institute for Agriculture and Trade Policy

In the Netherlands, where the average altitude is 50 feet below sea level, water is central to all aspects of life. The entire nation's drinking water supplies are at the surface or within a few yards of the surface, making them extremely vulnerable to contamination from agrichemicals and manure from the Netherlands' intensive dairy production.

Radical measures have been taken to tackle this problem, including the banning of many chemicals, strict regulation on chemical application, and limitations on livestock operations. But these actions have been only a partial solution.

The Center for Agriculture and the Environment, based in Utrecht, Netherlands, has developed a series of simple, elegant, and extremely effective farm management tools to help farmers reduce the negative impacts of pesticides and fertilizers. Farmers use these yardsticks to measure the environmental impacts of their current farming practices and to select production methods with fewer negative effects on the environment.

Now in widespread use by farmers in the Netherlands, the nutrient balance yardstick is becoming part of Dutch national farm policy, and the voluntary use of the pesticide yardstick has led to reductions of 70 percent or more in environmental impacts. This year, the tools will be adapted for use in other European countries, and the Institute for Agriculture and Trade Policy will begin experimenting with their use in the United States. Here's how they work.

Reaching Farmers through the Heart, Head, and Pocketbook

Farmers keep records of their pesticide and fertilizer (including manure) application practices. They record the kinds of chemicals used, the amount of applications per acre, time of year of applications, and the methods of application. Each factor is then assigned a numeric score that signifies its estimated negative impact on the environment. Scores are adjusted for seasonal impact and soil type. At the end of each growing season, farmers add up their total scores for a numeric baseline of information on how their current farming practices are affecting the environment.

The Dutch often describe this process of establishing a baseline as a way to reach farmers "through the heart." When farmers can measure the impact of their farming practices, they can be motivated to act.

Once the baseline is determined, farmers can make rational decisions about how much to reduce the per-acre loss of fertilizer nutrients (nitrogen, phosphorus, potassium) or by what percent they can reduce their pesticide use score. Although the yardsticks are primarily measurement tools, the pesticide yardstick can also be used to guide choices among different farming options. If a farm family decides to reduce its pesticide score by 10 percent in the next crop year, the yardstick can help them evaluate alternative farming practices, such as using different pesticides, making fewer applications, or applying more mechanical tillage, to find the most cost-effective way to achieve their goal.

At the end of the season, the farmers use the yardsticks to measure their progress in reducing nutrient losses or pesticide use. The Dutch describe this process of goal setting and measuring performance as a way to "reach farmers through the head" because it is both challenging and practical.

This system has had remarkable results over four years. In fact, water companies that supply drinking water to towns and cities have begun to pay farmers a bonus for achieving specific reductions in their pesticide uses or for specific levels of reduction in nutrient loss.

The Dutch talk about this aspect of the program as "reaching farmers through the pocketbook." It takes time and money to make these changes, and they involve a certain amount of risk to the farmer. Given that all of society benefits, it is only fair that the costs are shared.

Bringing the Yardsticks to the United States

In March 1995, the Institute for Agriculture and Trade Policy (IATP) invited officials of the Netherlands Center for Agriculture and the Environment (CLM) to Minnesota to discuss the

Yardsticks: A Tool for Protecting Our Water Resources (continued)

possibility of introducing these tools in the United States. Farmers, policymakers, and other groups working on sustainable agriculture in Minnesota were invited to explore these ideas.

Based on these discussions, CLM agreed with IATP that the time was right to adapt the pesticide and fertilizer yardsticks for use in the United States. The CLM is now working with IATP to develop the program over several years, starting with a number of small, local pilot projects. In addition, the Institute is looking for other collaborators in all regions of the country.

[For more information, contact Mark Ritchie, Executive Director, or Emily Green, Project Director, Institute for Agriculture and Trade Policy, 1313 Fifth Street, SE, Suite 303, Minneapolis, MN 55414. Phone: (612) 379-5980; Fax: (612) 379-5982; e-mail: mritchie@iatp.org.]

SRF Fuels Missouri Animal Waste Treatment Loan Program

Independent livestock and poultry producers in Missouri can now finance animal waste treatment systems at below conventional interest rates. Funded by the State Revolving Loan Fund, the sale of water pollution control bonds, and federal capitalization grants, the loan program is a cooperative venture. Partners include the U.S. Environmental Protection Agency, the Missouri departments of Agriculture and Natural Resources, the state Clean Water Commission, and the state Agriculture and Small Business Authority.

Producers can get 10-year loans for financing up to 100 percent of the cost of an eligible system — less the amount of any cost-share grant the borrower may have received. Concentrated animal feeding operations and operations exceeding 1,000 animal units per site are not eligible.

[For more information, contact the Missouri Agricultural and Small Business Development Authority, P.O. Box 630, Jefferson City, MO 65102-0630. Phone: (314) 751-2129.]

New Software Helps Farmers MAP Manure Application Strategy

"Developing manure management plans is one of the hottest topics these days for livestock producers," says Mike Schmitt, a University of Minnesota soil scientist. Many livestock producers are concerned about the environmental impact of their operations. But they are equally concerned about the financial status of their businesses.

A new software tool from the University of Minnesota gives farmers the edge in addressing these concerns. Developed by the University's Center for Farm Financial Management, the Manure Application Planner (MAP), version 3.0, helps farmers develop environmentally sound and economically viable manure application plans. Based on individual farm data, the program generates a cost-effective plan that does not overapply nutrients. It also compares the cost of applying manure versus the cost of applying commercial fertilizer and selects the optimal application method.

[For more information, contact Wynn Richardson, University of Minnesota, 1994 Buford Avenue, 249 COB, St. Paul, MN 55108. Phone: (800) 234-1111 or (612) 625-1964.]

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

California Pays NPS Bill in Lost Tourism Revenue

In California, nonpoint source pollution has a significant impact on tourism, deterring more than 20 million visitors from its world-famous beaches and causing the decline of a multimillion-dollar sportfishing industry, according to *Changing the Course of California's Water,* a report recently released by the Lindsay Museum.

One of the oldest and largest wildlife rehabilitation centers in the United States, the Lindsay Museum prepared this report as part of a public education campaign to teach Californians about polluted runoff. According to a 1991 State Water Resources Control Board report, 50 to 80 percent of California's water quality problems result from NPS pollution. *Changing the Course of*

California Pays NPS Bill in Lost Tourism Revenue (continued)

California's Water focuses on urban areas, which are second only to agriculture as the source of California's nonpoint source pollution.

California Tourism and NPS Pollution

Tourism is one of California's key growth industries. Currently, tourism generates $52 billion a year and provides 750,000 jobs. Economists forecast that the industry will expand in the future to fill shortfalls resulting from military base closures and a shrinking aerospace industry. The outlook for California's tourism industry is bright — that is, if it can contend with the formidable threat posed by NPS pollution.

The opportunity for fun in the sun and surf lures tourists to California's beaches. Over 140 million visitor days are logged each year, yet urban storm drain outfalls located adjacent to beaches are discharging runoff polluted with bacteria and viruses, posing a health risk that may deter tourists.

In southern California, NPS pollution also threatens the longevity of the $500 million per year sportfishing industry by depleting fish populations. Fish contamination is another issue that may cause tourists to think twice before planning their next fishing trip to California waters.

The Case of Clear Lake

The report cites Clear Lake as evidence of the connection between NPS pollution and reduced tourism revenue. Thought to be the oldest lake in North America, Clear Lake is plagued by algae problems linked to human activity in the watershed. Using information from a 1994 Natural Resources Conservation Service report, *Changing the Course of California's Water* points out that algae is reducing the clarity of Clear Lake and costing businesses more than $7 million a year in lost tourism revenue. Meanwhile, lake businesses seeking to remedy the situation face the burdens associated with combatting the algae, including the challenge of affecting human behavior in the watershed to reduce nonpoint source pollution.

Shared Responsibility

Funded by a 319 grant from the U.S. Environmental Protection Agency, the museum's report seeks to bring the issue of polluted runoff and the responsibility that each of us shares in its creation to the forefront of California's attention. The report was written to give "writers, reporters, and storytellers" the information needed "to ask questions, stir curiosity, and inspire stories." In that sense, the report is about more than California's tourism industry, and its appeal is larger than California's borders.

[For more information, or a copy of Changing the Course of California's Water, *contact Jennifer Kaiser, Communications Director, The Lindsay Museum, 1931 First Avenue, Walnut Creek, CA 94596. Phone: (510) 935-1978, ext. 26; Fax: (510) 935-8015.]*

Habitat Improvement—Leave It to Beavers

Excerpted from *Idaho Wildlife*, Fall 1994. Reprinted courtesy of Diane Ronayne, editor.

When the Lewis and Clark Expedition entered what is now the state of Idaho in 1805, beavers were present in virtually every stream valley with suitable habitat.

Those days will never return now that people and other activities have taken over most of our furbearing forerunners' streamside habitat. But in some places where those waterways need TLC, teams of farmers and ranchers, soil conservation specialists, and wildlife biologists are putting beavers back to work doing what they do best—repairing damage and building good riparian habitat.

What Beavers Do Best

The presence or absence of beavers, especially in small headwaters streams can result in dramatic differences in stream valley vegetation and in-stream habitat due to the modifications beavers make in streams as they go about their business.

One familiar beaver activity is dam-building, which raises the elevation of water in the stream as well as the adjacent groundwater. Beaver dams reduce the stream's energy by slowing its velocity. Spring runoff is retarded, and its scouring effect reduced. Instead of streambank

erosion, sediment is deposited. Responding to new water elevations, channels are constantly forming and old ones are filling in. Both geologically and biologically, these processes have been going on for as long as beavers and streams have existed together.

Beavers provide a number of benefits to riparian ecosystems. Higher water tables due to beaver dams change vegetation adjacent to streams. Without beavers, sagebrush communities often dominate riparian areas [in the West]. With beavers, the same areas can become lush with grasses and sedges. In summer, increased woody vegetation shades the land, which helps livestock and cools water, aiding fish. Consequently, even though some land is lost to inundation, streams and streamsides are more productive for livestock grazing and wildlife habitat, simply due to beavers at work.

Wildlife habitat is enhanced by beaver activity in many ways. Additional riparian vegetation creates more and better habitat for many species. Pools behind beaver dams provide more living space for trout even as they improve water quality in the stream. Water is reoxygenated as it falls over beaver dams. By backing up and deepening water, beaver dams help keep it from freezing solid in winter and reduce its temperature in summer. They also allow cooler groundwater to enter the stream from adjacent land. It percolates back into the stream during low-flow periods, increasing water in the channel and thereby providing more for downstream uses. In winter, shrubs and trees next to the stream help insulate the water and reduce the buildup of anchor ice along the bottom, which can harm aquatic life by interrupting its food supply, feeding, and movement.

Putting Beavers to Work

Such beaver-produced benefits are the goal of an erosion control project that began in the Big Wood River drainage in 1986. It involves finding sites with suitable habitat, releasing beaver there, and evaluating their effects on both streambank erosion and riparian vegetation. The project, called the Wood River Resource Conservation and Development (RC&D) Area, is a U.S. Department of Agriculture program administered by the U.S. Natural Resources Conservation Service. Some beneficial effects are already evident.

In all instances, using beavers for erosion control costs much less than traditional methods — and overall results are usually better. Building a series of riprap or concrete dams to slow water in downcutting streams costs thousands of dollars. It's also doomed to failure since streams are dynamic, not static. For about $250, the Wood River RC&D Beaver Committee will install enough beavers to colonize the stream. The hard-working rodents move fast to plug holes and dam side channels, keeping up with the whims of flowing water.

To date, about 130 beaver have been planted in 30 streams in this project. Similar programs are being started in other parts of Idaho. Ranchers and land managers who add beaver to their management scheme must be willing to make other changes such as more intensive grazing management systems designed to allow food and building material for beavers to be established and maintained along the stream.

The Downside

Beavers in the wrong location can cause problems, however, primarily by damming irrigation ditches and culverts. Idaho conservation officers spend countless hours each year attempting to solve problems where beaver are causing property damage. It may be that the beaver causing trouble at one spot could be solving a problem at another. Conservation officers work with the farmer or rancher and a soil conservation expert to choose the best option.

A Happy Ending

Since Lewis and Clark, beaver have been a mixed blessing for Idahoans, but we have learned how to appreciate this native mammal for what it does best and how to manage it when problems arise. The current joint venture between Wood River Valley landowners, the Bureau of Land Management, U.S. Forest Service, Natural Resources Conservation Service, Idaho Department of Lands, and Idaho Department of Fish and Game is another chapter in the beaver book — one that seems to have a happy ending.

[For more information, contact Lew Pence, RC&D Project Coordinator, 215 University Drive, Gooding, ID 83330. Phone: (208) 934-4149. Or contact John Heimer. Phone: (208) 334-2597; Fax: (208) 334-2148; e-mail: jheimer@idfg.state.id.us.]

Technical Notes

Dairy Waste Recycled into Fertilizer . . . And Energy?

EDITOR'S NOTE: This article is adapted from a story on Oregon's effort to recycle animal waste into useful products first reported in *Coastlines* 5(3): Summer 1995. Although the technology may not be novel, the extent to which it is being developed by the MEAD Project merits attention.

In Tillamook County, Oregon, manure from more than 10,000 cows will soon be recycled to control pollution and produce energy and other products.

Located in northwestern Oregon bordering the Pacific Ocean, Tillamook County has four large bays. Tillamook Bay, alone, has five major tributaries within the county's jurisdiction. Tillamook County is dominated by the dairy industry, with a significantly larger number of cows than people. Nutrients and pathogens associated with animal waste are key nonpoint source pollution concerns.

Digester Devours Waste, Develops Products

A cooperative effort between the People's Utility Districts and Soil and Water Conservation Districts, the MEAD (Methane Energy and Agricultural Development) Project addresses NPS and energy issues while creating new, marketable products. As participants in the MEAD Project, 40 or more local farms with more than 10,000 head of dairy cattle will deliver animal waste to a treatment facility operated by the Tillamook County Soil and Water Conservation District. Slated to open as early as summer 1996, the facility will receive tanker trucks delivering 145,000 gallons of waste slurry each day.

At the treatment facility, the slurry will be injected into digester tanks and mixed with food waste, allowing natural bacteria to convert the waste products into biogas. Methane from the biogas will fuel a generator, producing approximately 10 million kilowatts of electricity annually for customers of the Tillamook People's Utility District.

Students at Tillamook High School have already operated a test digester under the direction of MEAD technical advisor Richard Mattlocks to test assumptions and screen fiber for compost. Horticultural researchers from Oregon State University are working with the compost to develop commercial fertilizer products as part of the MEAD Project. Plans include a fertilizer plant that will dry the remaining slurry and convert it to commercial fertilizer, potting material, and other garden products.

Sanitized Liquid Benefits Forage Production and Water Quality

In addition to renewable energy and garden products, the digestion process produces a sanitized liquid organic nutrient that will be distributed to participating farmers for pasture land fertilization. Compared to spreading manure directly, the sanitized liquid has several advantages:

- The liquid's solids content declines from 12 percent entering the digester to 4 or 5 percent. Reduced solids are easier to handle and facilitate plant uptake.
- Passage through the digester kills any pathogens in the liquid, thereby protecting bay shellfish beds.
- The digester converts most of the nitrogen in the slurry to ammonia, which is readily absorbed by dairy forage plants.
- Weed seeds entering the digester are eliminated, reducing the need for herbicides.

In addition, the sanitized liquid organic nutrient has a less pronounced odor. Or as MEAD Project Manager Greg Booth quips, "It no longer stinks, it just smells."

Funding MEAD

A conveniently located industrial park and property belonging to the Creamery Association offer potential sites for the digester. Raising money to get the project off the ground is, however, a more imposing challenge. Currently, Booth explains, financial input or co-ownership of the digester is being presented to area dairy farmers who stand to benefit by applying the processed liquid nutrient to their pastures.

Dairy Waste Recycled into Fertilizer . . . And Energy? (continued)

Once under way, the garden by-products will provide a source of revenue for the project. "I think it's going to keep us in business," said Ed Myers, board member of the Tillamook County Creamery Association. "Not only that, I think we might make a few dollars."

With similar waste systems in Denmark as an example and financial backing from the Oregon Department of Energy and the U.S. EPA, the MEAD Project has promise. It is an effort that combines the priorities of several interests in a blend that bodes well — renewable energy for utilities, animal waste recycling to improve plant nutrient uptake and reduce NPS pollution, and new, marketable goods for the private sector.

[For more information, contact Gregory A. Booth, MEAD Project Manager, P.O. Box 433, Tillamook, OR 97141. Phone: (800) 422-2535, or (503) 842-2535; Fax: (503) 842-4161.]

Sediment and Nutrient Removal with Vegetated and Riparian Buffers

by J.E. Parsons, J.W. Gilliam, R.B. Daniels, T.A. Dillaha, and R. Munoz-Carpena

Nonpoint source pollution, whether from urban housing developments, industrial parks, or agricultural fields, is a major problem for surface water resources. However, it has been successfully demonstrated that the volume of sediment and nutrients in such runoff can be reduced by placing a land buffer between the pollution source and the water.

This study was initiated in 1990 to provide quantitative data on the effectiveness of vegetative buffers on removing sediment and nutrients as influenced by (1) soil and geomorphic conditions: (2) type of vegetation; and (3) hydrologic features of the site and runoff events. Two sites were chosen for the study — one in the Piedmont, the other in the Coastal Plain of North Carolina. At each site, an agricultural field was divided into six source areas: two were representative of the surface water flow, sediment, and chemical movement. The other four areas drained to grass buffers.

Two of the grass buffers were 14 feet wide; two were 28 feet wide and runoff from the field edges was dispersed at the top of two riparian plots. During a storm event, multiple samples were taken (up to 24) based on the runoff flow rate from the plots. These samples were analyzed for sediment and nutrient content, then matched with flow rates from the runoff to determine the flow-weighted average concentrations along with mass losses of sediment and nutrients.

A number of parameters had to be considered: surface conditions, including vegetative cover, land slope, and topography; and soil types. Data were collected on more than 50 storms in the Piedmont, and or more than 60 in the Coastal Plain — all dealing with runoff hydrographs and sediment concentrations. Nutrient concentrations were analyzed for more than 25 storms.

None of the storm events have so far been large enough to inundate the grass buffers. On small rainfalls (one or two inches), no runoff resulted from the downslope edge of the grass buffers. Runoff through the shorter, 14-foot buffers was reduced by nearly 80 percent; sediment was also generally reduced by 80 percent or more; and more than 50 percent of the sediment-bound nutrients were filtered by the grass buffers. Little or no runoff was measured during many of these events in the 28-foot buffers.

Runoff did occur on both lengths of grass buffers during larger storms (greater than two inches), but less in general from the 28 foot buffers. Sediment yield was less from the longer buffer length. The riparian buffers reduced both sediment and nutrients over levels measured in the field. The riparian buffers at the Piedmont site were forested and relatively steep so the flow tended to channelize during larger storms, resulting in little or no runoff reduction.

The Coastal Plain riparian buffer had a smaller slope and showed similar trends. This buffer was dominated by dog fennel, which offered little resistance to flow in summer and disappeared during the winter months. Even so, more than 50 percent of the sediment was removed during most storms and removal of nutrients in the runoff was almost as high.

[For more information, see pages 155-158 in Clean Water, Clean Environment, 21st Century, Team Agriculture Working to Protect Water Resources. *Volume 2, Nutrients. Or contact J.E. Parsons, Department of Biological and Agricultural Engineering, North Carolina State University, Raleigh, NC 27695-7619. Phone: (919) 515-6750; Fax: (919) 515-7760.]*

Notes on Education and Outreach

Educational Resources

EDITOR'S NOTE: Environmental education thrives when the concepts are freshly stated or presented in different media. The following resources, briefly described, may provide additional learning opportunities for your students. Use them if you can, or send along your own reviews for inclusion in future issues. Note, however, that mention of a particular resource does not constitute an endorsement.

Videos

- *The Moon's Prayer.* A beautiful expression of the American Indians' perspective on the environment. Several Indian leaders present scenes of their homelands. Contact the Northwest Indian Fisheries Commission, 6730 Martin Way East, Olympia, WA 98506. Phone: (206) 438-1180.
- *The Return of the Salmon.* A half-hour educational video about salmon and watershed restoration by Oregon Sea Grant. Cost: $30. To order, call 1-800-375-9360.
- *Day by Day: Caring for Our Bay.* A 10-minute introduction to Grand Traverse Bay and an explanation of the Watershed Initiative. Cost $10. Call the Northwest Michigan Council of Governments at (616) 929-5000.

Self-check questionnaires (mixed media)

- *Water Quality.* Questions and answers to help farmers and gardeners determine if their actions are contributing to pollution. Both a three-fold brochure and a place mat are available. Includes the addresses of helpful contacts. For copies, contact Jim Chandler at Oxford County Soil and Water Conservation District, 1 Main Street, South Paris, ME 04218. Phone: (207) 743-7019.
- *Water Pollution IQ.* A poster depicting a yardstick helps homeowners "measure" their own pollution control index based on a point system for each environmentally friendly practice used around the home. Cost $1.00. Available from Helen Hurlburt, Ohio Department of Natural Resources, Division of Soil and Water Conservation, 1939 Fountain Square Court, Building E-2, Columbus, OH 43224.

Short Takes in Print

- *Wastewater and Runoff.* The San Francisco Water Pollution Prevention Program has compiled a collection of public information and technical assistance publications addressing sanitary wastewater and urban runoff. The collection includes brochures, folders, booklets, and doorhangers printed in English, Spanish, and Japanese. For more information, contact Paula Kehoe, City and County of San Francisco, Department of Public Works, Bureau of Environmental Regulation and Management, 3801 Third Street, Suite 600, San Francisco, CA 94124. Phone: (415) 695-7317.

Guides and Teacher Resources

- *Restoring the Range.* A practical guide to the restoration and sustainable management of riparian areas that have been degraded by years of overgrazing. This guide is a supplement to the *Citizen's Streambank Restoration Handbook.* Cost for both: $20. Contact the Izaak Walton League of America, 707 Conservation Lane, Gaithersburg, MD 20878. Phone: (301) 548-0150.
- *Water Quality Handbook.* Video and handbook showing eight everyday activities that explain the effect each of us has on the water quality of streams, lakes, and groundwater. Includes references for further study and descriptions of several career choices. Produced by the Cuyahoga Soil and Water Conservation District. For more information, call Jim Storer at (216) 534-6580.
- *Chesapeake Bay Primer.* A new edition of the Chesapeake Bay Program's popular *Introduction to an Ecosystem.* Geared for teachers and students, this text outlines the geologic history of the bay and the complex web of interactions between soil, water, air, plants, and animals. Problems facing the bay and ways individuals can help are proposed. Available free of charge. Call (800) YOUR-BAY.

Educational Resources (continued)

Posters

- *Welcome to the Wetlands* is a new poster from EPA Region 5 for children to color. Common plants and animals are discussed in the text as well as benefits of and threats to wetlands. Copies are available from CTIC in a package of 10 for $3. Call (317) 494-9555.
- *Healthy Lakes Need Wise Lake and Watershed Management*. This colorful poster of a watershed under polluted conditions and then again in a "clean" condition is both artful and realistic. Icons identify activities that contribute to pollution, control practices, and environmental benefits. Students of all ages will enjoy matching the icons to scenes in the two watersheds. The poster, which unfolds to approximately 26 inches by 39 inches, encourages a watershed approach to pollution prevention. It is the result of a cooperative program between the U.S. EPA's Office of Wetlands, Oceans, and Watersheds, EPA Region 5 Water Division's Watershed and Nonpoint Source Branch, and the Terrene Institute. For copies, contact the Terrene Institute, 1717 K Street, NW, Suite 801, Washington, DC 20006. Phone: (202) 833-8317; Fax: (202) 296-4071. Each poster costs $5 + $2 shipping; volume discounts are available.

Software

- *NASA Kennedy Space Center Wildlife CD-ROMs*. Three new CD-ROMs describe NASA's efforts to protect and promote wildlife endemic to the Kennedy Space Center: "Protect and Preserve the NASA Kennedy Space Center Environment;" "Amazing Sites at NASA Kennedy Space Center;" and "Space for Wildlife at the Kennedy Space Center." Computer requirements for these CDs are PC-compatible (386, 486, or pentium preferred) systems with MS Windows 3.0, SVGA color graphics, and 2 Mbytes of RAM. Price is $24.95 each. For more information, contact ISEE, Inc., 1291 Cumberland, Suite G100B, West Lafayette, IN 47906. Phone: (317) 497-0928; Fax: (317) 463-7004.
- *Environmental Hypermedia/Multimedia CD-ROM* contains over 35 interactive personal computer programs providing information on a variety of environmental topics. Most programs are best suited for junior high age through adult. Computer requirements for most of the programs are PC-compatible (386 and up) systems with DOS 4.0, VGA color graphics, and 640K of RAM. A mouse is recommended. Some of the programs require MS Windows 3.0, SVGA color graphics, and 2 Mbytes of RAM. For more information, contact ISEE, Inc., 1291 Cumberland, Suite G100B, West Lafayette, IN 47906. Phone: (317) 497-0928; Fax: (317) 463-7004.

Animas River Curriculum Project

The Animas River Basin provides the setting for the latest in a series of curriculum guides published in Colorado. The guide studies the watershed as a part of a larger system that has relevance for everyone. For example, the guide explores the history and impacts of mining in the watershed, but provides a chart indicating the mineral resources in each of the 50 states. Similarly, Western water issues are examined in light of the Earth's limited supply of fresh water.

Linda Herz, a middle school teacher in Durango, Colorado, took sabbatical leave to write this curriculum guide. She compiled a large number of resources and completed extensive research to create this comprehensive, cross-disciplinary curriculum guide. Many people and agencies contributed information and activities.

Beginning with the earliest cultural history of Native Americans, 15 study units cover geologic history, mining, water issues, properties of rivers, the river in art and literature, political action, and communication.

The activities are many and varied and are suitable for students in grades 5 through 12. Unit 5 alone contains six watershed-related activities:

- a water distribution demonstration,
- the "gee whiz" water quiz,
- a water uses section,
- a water audit,
- a wastewater treatment exercise, and
- an "Adopt-a-Treatment-System" activity.

Animas River Curriculum Project (continued)

The guide can be adapted for the study of other river basins. The author hopes that as the guide is used in classrooms, teachers will develop and add their own units of study. New units can be shared at teacher workshops and lead to an even broader scope.

The Colorado Division of Wildlife and the Colorado Water Conservation Board sponsored the curriculum guide. Materials may be reproduced for classroom use; requests for all other uses should be submitted to the sponsors.

[For information about obtaining copies of the guide write: Chris Bridges, Colorado Water Conservation Board, 1313 Sherman, Denver, Colorado 80203.]

News from Students and Volunteers

■ **Alabama Watchdog Campaign Works.** In Alabama, citizen volunteers are reporting environmental problems that would not be detected otherwise. From July 1994 through July 1995, the volunteer Watchdog Campaign investigated 340 cases. Illegal dumping was the most often reported category followed by nonpoint source pollution problems. For more information, contact Hendrik Snow at 205-322-3126.

■ **Mangrove Planting.** Nearly 80 volunteers placed mangrove plantings in plastic piping in the water to control shoreline erosion along the Indian River Lagoon at Cape Canaveral. For more information, contact Bob Riley at 407-722-2955.

■ **Secchi Dip-In Update.** A progress report on the 1995 Great Secchi Dip-In: 2,056 volunteers provided information on more than 2,000 lakes in 37 states and two Canadian provinces in the second year of the event. For more information contact, Bob Carlson at 216-672-3849.

■ **Student Outfall Discovery Program.** Over the past three years, students in Jefferson County, Kentucky, have been walking streams with an engineering technician to inventory stormwater outfalls. The information helps the county stay in compliance with EPA's NPDES program and the existing stormwater permit. It has become a model program and the experience has inspired students to pursue environmental work or higher education. For more information, contact Robert F. Smith at 502-540-6206.

■ **Students in ESL Classes Spread the Word.** The Puget Sound Water Quality Authority recruited students studying English as a second language (ESL) to take water quality information to business owners and others in the community who either do not speak English, or who speak it as a second language. Information was distributed in Korean, Chinese, Vietnamese, and Spanish. For more information, contact Deborah Dahling at 206-451-4497.

■ **The Little Wetland That Could.** Four years ago fifth grade students in Las Vegas, New Mexico, transformed a muddy drainage area adjacent to their school into a miniature wetland. They named it El Charco de la Cienaga, "The Mud Puddle." Because caring for it involves a long-term commitment, they wrote a pledge to remind them of their responsibility (*Building My America*, a publication of New Castle Communications, Inc., 229 King Street, Chappaqua, NY 10514.)

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 1-44, 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

Gaining Media Attention for Polluted Runoff Issues

National Public Radio commentator Daniel Schorr once said, "If you don't exist in the media, for all practical purposes, you don't exist." Although often overlooked, this insight applies to water quality protection and nonpoint source pollution.

Unlike point source pollution that originates from relatively few sources, nonpoint source pollution has widespread origins, making it a pervasive public issue. But how can we convince the media that this message is newsworthy? How can water quality professionals work with the media to inform the public of nonpoint source pollution problems and recruit their assistance in implementing solutions?

According to a new media guide written by Jennifer Kaiser of the Lindsay Museum in California, environmental stories are receiving fewer "column inches" of press than they did five years ago. This space is being filled primarily by crime stories, the prevailing distinction being "If it bleeds, it leads." In comparison, as Kaiser adeptly describes it: "Our issue is chronic, rarely acute, difficult to see, and, let's face it, not that exciting. We need to work hard and smart. We need to not waste anyone's time, and we need to make the media's job easier."

Kaiser employs the savvy wit of an experienced media relations coordinator to introduce water quality professionals to a bag of tricks molded by her media involvement. She leads by example, referencing actual materials used by the Lindsay Museum to implement an EPA 319 grant project highlighting polluted runoff in California.

The primary product of this grant was a report titled *Changing the Course of California's Water* (see the related story in this issue: "California Pays NPS Bill"). The media guide outlines each step of the strategy used to promote the report. Copies of press releases, pitch letters, media advisories, editorials, and public service announcements are fully supported with the how-to's needed to replicate the effort. Additional guidance is given for creating a media list, compiling press kits, talking to media representatives, and even dressing for a television interview.

Funded by a U.S. EPA 319 grant, a California Public Interest Research Group agreement with Shell Oil, and the Strong Foundation for Environmental Values, the media guide is a textbook for those looking to reach the public with water protection messages. It describes the professionalism, strategy, and tools needed to build successful media campaigns — skills that water quality managers can apply to all their outreach efforts.

[For a copy of Culvert Action: How to Interest your Local Media in Polluted Runoff Issues, *contact Jennifer Kaiser, Communications Director, The Lindsay Museum, 1931 First Avenue, Walnut Creek, CA 94596. Phone: (510) 935-1978, ext. 26; Fax: (510) 935-8015.]*

Characterization Is Critical to Mine Clean-Up

The Rocky Mountain Headwaters Mining Waste Initiative in EPA Region 8 has produced two publications about efforts to restore water quality impaired by hardrock mining in Colorado.

Produced in cooperation with the Colorado Department of Natural Resources, Division of Minerals and Geology, the first publication is a four-page exploration of the sources of water pollution related to mining metals, their potential aquatic and human health effects, and an overview of efforts to remediate damages. The story is replete with pictures of bright red and white-gray creek flows caused by metals picked up by runoff as it passes over and through abandoned mining areas.

The other publication contains this overview and an additional eight pages detailing efforts to reclaim Colorado's Chalk Creek and French Gulch. Fish kills in these watersheds had revealed a highly toxic aquatic environment with an abundance of metals leached from abandoned mines.

The detail leads the reader through efforts to improve the condition of the watersheds; it also reveals the importance of thorough site characterization to determine how to address pollution problems. In French Gulch, for example, efforts to eliminate seepage of mine water into creek alluvium centered around sealing a mine shaft. Further investigation, however, revealed that

Characterization Is Critical to Mine Clean-Up (continued)

highly fractured rock in the area had penetrated the mine and the water table, presenting a source of seepage to the creek.

Such findings justify characterization studies to identify the pathways that metals from mining activity travel to enter streams. The studies conclude: "Observing and quantifying the impacts of contaminants may be quite straightforward, but determining exact pollutant sources is much more involved."

[Copies of Historic Hardrock Mining: The West's Toxic Legacy *are available (either the four-page overview or the 12-page expanded edition). Contact Jim Dunn at EPA Region 8, 999 18th Street, Suite 500 (8WM-WQ), Denver, CO 80202-2466. Phone: (303) 312-6788; Fax: (303) 312-6131.]*

Nation Prepares for American Wetlands Month '96

Americans of all ages will celebrate the sixth annual American Wetlands Month during May.

Stickers and pins, suggested activities and contacts, educational materials, and fact sheets are available from the Terrene Institute, American Wetlands Month national coordinator. An American Wetlands Month packet is free with the purchase of materials ($5 by itself).

American Wetlands Month '96 sponsors include the U.S. Department of Agriculture, Natural Resources Conservation Service; the U.S. Environmental Protection Agency; the U.S. Bureau of Reclamation; and the U.S. Army Corps of Engineers.

[For further information or to order materials, contact Terrene at 1717 K St. NW, Washington, DC 20006. Phone: (202) 833-8317; Fax 202/296-4071; e-mail: awm.terrene@e2b2.com.]

Watershed '96

Between 2,000 and 3,000 people are expected to attend Watershed '96: Moving Ahead Together, June 8-12 in Baltimore, Maryland. Building on the momentum generated by Watershed '93, this year's conference will feature interactive sessions during working breakfasts that will examine the balances and trade-offs that occur in the process of setting watershed priorities.

Out of 850 abstracts submitted, more than 300 have been chosen for the technical sessions, which include a variety of formats such as informal discussions, panels, and presentations. Attendees will have the opportunity to attend plenary sessions each morning, and part of Wednesday morning's session will be telecast to locations throughout the country. Current and future technologies, including computer software and hardware tools for watershed management will be featured at a resource fair that will run during the conference.

[For more information, call (703) 684-2400, extension 6018.]

Agriculture and Environment Fact Sheets for 23 States

EPA's Renewable and Natural Resources Staff has produced a series of four-page fact sheets that illustrate how agricultural production within a state influences the quality of natural resources.

Fact sheets are available for the following states:

Arkansas	Kentucky	North Carolina
California	Indiana	North Dakota
Colorado	Louisiana	South Dakota
Florida	Mississippi	Tennessee
Idaho	Missouri	Texas
Illinois	Nebraska	Vermont
Iowa	New Mexico	Wisconsin
Kansas	New York	

[To order (please specify which state fact sheets you would like), contact Chris Lewicki, EPA (MC 2124), 401 M St., SW, Washington, DC 20460. Fax: (202) 260-2300; e-mail: lewicki.chris@epamail.epa.gov.]

Clean Lakes Program Report Out

According to EPA's most recent Clean Lakes Program Annual Report, the federal Clean Lakes Program awarded $9 million in 1993 and 1994. Almost half the monies funded statewide assessments of lake water quality; about a third funded projects on specific lakes to characterize pollution and recommend restoration methods; 19 percent of the funds went to actual lake restoration; and 4 percent funded postrestoration monitoring. The 171 projects, many of which are featured in the report, represent a diverse array of undertakings. States, territories, localities, and Indian tribes took on such challenges as developing livestock watering sites to keep cattle out of lakes, implementing manure management at a zoo, and combining Clean Water Act 319 monies with a CLP grant to protect a city's water supply reservoir.

The Clean Lakes Program, begun in 1972, is often described as a prototype for the watershed protection approach. As this report illustrates, it has matured and is bearing fruit.

[For a copy of the report (EPA 841-S-95-003), contact NCEPI, 11029 Kenwood Rd., Bldg. 5, Cincinnati, OH 45242; Fax: (513) 489-8695.]

Watershed Decision Support System on Internet

The North Carolina State University Water Quality Group is developing a computer tool to aid in NPS pollution control decisions at the watershed level. The system, available on the Internet's World Wide Web, helps watershed managers and land treatment personnel select appropriate best management practices and BMP locations.

WATERSHEDSS has six components:

- *Hypertext expert-systems-like user interface* that serves as the watershed assessment and evaluation framework for the decision support system,
- *Education component,*
- *Annotated bibliography of NPS literature,*
- *Agricultural BMP database,*
- *Linked GIS and spatially distributed water quality model,* and
- *Pollutant budget spreadsheet.*

Upon entering WATERSHEDSS, the user can either access information about watershed management or evaluate alternative land treatment scenarios.

Information and Evaluation Options

The information option provides facts and case studies about the effects of land use and BMPs on water quality from a watershed perspective. Extensive information on water quality topics, such as nutrients, pathogens, and wetlands, is also available.

The evaluation option helps the user determine the appropriate BMPs for a particular water quality impairment. Users answer a series of questions about their watersheds, including type of surface waterbody, designated uses of the waterbody, water impairment, pollutants, and pollution sources. Based on this and other information, alternative BMPs are suggested, and users can then choose the most beneficial practices for reducing NPS pollution.

Users can make decisions about the placement of BMPs that reduce or mitigate pollutants with the aid of a spatially distributed water quality model (AGNPS) linked to a GIS (GRASS). To use the AGNPS-GRASS interface, users must have digital watershed data. Maps generated by the GIS will allow users to evaluate the impact on water quality of different land treatment practices and their placement on the landscape. The evaluation portion of WATERSHEDSS has been designed as an interactive system requiring the user to both provide information and make decisions throughout the watershed evaluation process.

WATERSHEDSS is accessible via the Internet as part of the World Wide Web at http://www.bae.ncsu.edu/bae/programs/extension/wqg (the NCSU Water Quality Group Home Page) or http://h2osparc.wq.ncsu.edu (the WATERSHEDSS Home Page).

Watershed Decision Support System on Internet (continued)

WATERSHEDSS has been funded under a three-year cooperative agreement between the U.S. EPA Environmental Research Laboratory in Athens, Georgia, and the North Carolina State University Water Quality Group. Cooperators at the Pennsylvania State University Environmental Resources Research Institute have also contributed.

[For more information, contact Deanna Osmond, Water Quality Extension Specialist, (e-mail: deanna_osmond@ncsu.edu) or Judith Gale, Water Quality Extension Specialist (e-mail: judith_gale@ncsu.edu), NCSU Water Quality Group, 615 Oberlin Rd., Suite 100, Raleigh, NC 27605-1126. Phone: (919) 515-3723; Fax: (919) 515-7448.]

NPPC directory of P2 in Higher Education: Faculty and Programs

An update —

The National Pollution Prevention Center for Higher Education (NPPC) is updating its *Directory of Pollution Prevention in Higher Education: Faculty and Programs*. If you are an educator and would like to be featured in the directory, or if you are affiliated with a P2 center and want your center publicized in the directory, please contact the NPPC by May 30, 1996.

The directory is a great tool for faculty who want to identify and locate colleagues with whom they can share information on teaching and research, pollution prevention concepts, ideas, and success stories. It describes activities of faculty currently involved in integrating pollution prevention concepts into curricula of various disciplines, including engineering, law, business, environmental studies, agriculture, architecture, public health, and chemistry. Detailed contact information is provided for each entry. The 1996 *Directory* will feature a new section with contact information about other pollution prevention centers that focus on curriculum development. For those not familiar with the NPPC, a complete list of resources is available by request or through the World Wide Web. All entries received after May 30, 1996, will be included in the 1998 edition of the directory. Contact NPPC, University of Michigan, 430 East University, Ann Arbor, MI 48109-1115. Phone: (313) 764-1412; Fax: (313) 936-2195; e-mail: nppc@umich.edu. NPPC's World Wide Web address is http://www.snre.umich.edu/nppc/.

And a correction —

Please make a note of NPPC's correct World Wide Web address and fax number as listed here! This information was incorrectly transcribed in *News-Notes*, #43.

Datebook

DATEBOOK is produced 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

April

18-20 *North American Lake Management Society Region 6* (TX, LA, AR, OK, and NM) *Workshop and Texas Watch "Meeting of the Monitors,"* Fort Worth, TX. Partially funded by an EPA Region 6 grant. Focus on watershed partnerships. Contact Tom Conry. (817) 772-6010. Fax: (817) 772-7935.

21 *Communicating Drinking Water Issues to Small Communities,* Lake Tahoe, Incline Village, Nevada. Cosponsored by the Rural Community Assistance Corporation and the National Environmental Training Center for Small Communities, this one-day workshop is a separate, preconference event to the RCAC 1996 conference, Building Rural Communities: Models for Development. Contact Kay Mulligan or Linda Petta at RCAC. (916) 447-2854.

1996

April

21-26 *Hydrology and Hydrogeology of Urban and Urbanizing Areas,* Boston, MA. Contact Helen Klose, American Institute of Hydrology, 3416 University Ave. SE, Minneapolis, MN 55414. (612) 379-1030. Fax: 379-0169. E-mail: AlHydro@aol.com.

May

6-9 *The National Weather Service Floodwave Model,* Cook College, Rutgers University, New Brunswick, NJ. Contact Suzanne Soules, Cook College Office of Continuing Professional Education, P.O. Box 231, New Brunswick, NJ 08903-0231. (908) 932-9271.

14-16 *19th Annual EPA/WEF Conference on Analysis of Pollutants in the Environment,* Norfolk, VA. Contact Nancy Blatt or Dave Trouba at WEF. 1-800-666-0206. E-mail: dtrouba@wef.org.

15-18 *Second National Workshop on Constructed Wetlands for Animal Waste Management,* Fort Worth, TX. Sponsored by Texas State Soil and Water Conservation Board, U.S. EPA, Texas Agricultural Experiment Station, and Texas A&M University Department of Wildlife and Fisheries Sciences. Researchers from across the country will meet to discuss current issues, ongoing research, and regulatory aspects of constructed wetlands for the remediation of livestock, dairy, and aquaculture wastewater. Contact Paul J. DuBowy, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, TX 77843-2258. (409) 845-5765. E-mail: pdubowy@tamu.edu.

21-23 *Stormwater Management for Engineers,* Cook College, Rutgers University, New Brunswick, NJ. Contact Suzanne Soules, Cook College Office of Continuing Professional Education, P.O. Box 231, New Brunswick, NJ 08903-0231. (908) 932-9271.

22-24 *7th Annual Florida Lake Management Society Conference,* Ocala, FL. Contact Mark Hoyer, Florida Lake Management Society, UF Department of Fisheries, 7922 NW 71 Street, Gainesville, FL 32653. (904) 392-9617.

June

2-6 *Practical Environmental Directions: A Changing Agenda,* the 21st Annual Conference for the National Association of Environmental Professionals, Wyndam Greenspoint Hotel, Houston, TX. Contact: NAEP, 5165 MacArthur Blvd, NW, Washington, DC, 20016. (202) 966-1500.

5-6 *9th Annual Geographic Information Systems Conference,* Towson State University, Towson, MD. Contact: School of Graduate and Continuing Studies, Towson State University, (410) 830-2964.

8-12 *Watershed '96: Moving Ahead Together,* Baltimore, MD. Cosponsored by WEF and 13 U.S. federal agencies. Program will reflect the variety of individuals and organizations involved in watershed management, including land owners and managers, environmentalists, educators, planners, and technical experts. Contact Nancy Blatt or Dave Trouba, Water Environment Federation, 601 Wythe Street, Alexandria, VA 22314-1994. (703) 684-2400. Fax: 684-2492.

9-14 *From Small Streams to Big Rivers,* the 17th Annual Meeting of the Society of Wetland Scientists, Kansas City, MO. Contact: Thomas Taylor. (913) 551-7226; E-mail: taylor.thomas@epamail.epa.gov

10-14 *Coast to Coast, 20 Years of Progress.* Association of Floodplain Managers' 20th Annual National Conference, Catamaran Hotel, San Diego, CA. (608) 274-0123.

16-19 *Urban Wet Weather Pollution from the Stream's Perspective,* Quebec City, Canada. Topics range from regulations to information management, to water quality impacts in both large and small communities. Contact Nancy Blatt or Dave Trouba, Water Environment Federation, 601 Wythe Street, Alexandria, VA 22314-1994. (703) 684-2400. Fax: 684-2492.

16-29 *NATO Advanced Study Institute on Hydroinformatics in Planning, Design, Operation, and Rehabilitation of Sewer Systems,* Harrachov, Czech Republic. This is an advanced-level, tutorial meeting aimed at promoting the use of hydroinformatics in urban drainage. Contact Jiri Marsalek, National Water Research Institute, 867 Lakeshore Road, Burlington, Ontario, Canada L7R 4A6. Fax: (905) 336-4420. E-mail: jiri.marsalek@cciw.ca.

18-20 *Conference on Coast Redwood Forest Ecology and Management,* Humbolt State University, CA. Contact Kim Rodrigues, UC Cooperative Extension, Humboldt County Agriculture Center, 5630 South Broadway, Eureka, CA 95503-6999. (707) 445-7351. E-Mail: cdhumboldt@ucdavis.edu.

1996
June

19-21 *Annual Conference of the Florida Association for Water Quality Control*, Registry Resort, Naples, FL. Contact: Fred Crabill. (813) 752-1289

22-24 *Building Rural Communities: Models for the Future*, Incline Village, Nevada (Lake Tahoe). Sponsored by the Rural Community Assistance Corporation for rural development and preservation professionals, local community organizers, and local, county, state, and federal officials. Call RCAC's conference voice mailbox. (916) 447-9832, ext. 197.

22-28 *1996 North American Water and Environment Congress*, Anaheim Hilton Hotel and Towers, Anaheim, CA. Contact: American Society of Civil Engineers. (212) 705-7071

23-28 *89th Annual Meeting and Exposition*, Opryland Hotel, Nashville, TN. Contact: Air and Waste Management Association. (412) 232-3444.

July

9-12 *Wetlands '96,: Forming Fair and Effective Partnerships and Workshop on Wetland, Floodplain and River Online Services and GIS Applications*, Washington, DC. Contact: Association of State Wetland Managers, (518) 872-1804

10-12 *GREEN Conference of the Americas: Educating for Sustainable Watersheds*, Ann Arbor, MI. Contact: Global Rivers Environmental Education Network. (313) 761-8142

14-17 *Watershed Restoration Management: Physical, Chemical and Biological Considerations*, Hotel Syracuse, NY. Contact: American Water Resources Association, (703) 904-1225.

15-19 *River Morphology and Applications*, Inn at the Pass Conference Center, Pagosa Springs, CO. Contact: Wildland Hydrology, (970) 264-7120.

August

3-7 *Fifth National Volunteer Environmental Monitoring Conference*, University of Wisconsin—Madison, WI. Contact: Celeste Moen, Wisconsin Self-Help Lake Monitoring Program. (608) 264-8878.

11-13 *Seventh National Conference on Drinking Water: "Balancing Risks and Reason,"* Prince Edward Hotel—Charlottetown, Prince Edward Island, Canada. Contact: T. Duncan Ellison. (613) 241-5692.

15-19 *International Conference on Wetland Systems for Water Pollution Control*, Vienna, Austria. Contact: ICWS, Vienna 1996, Attn: Mrs. Eva Brauman, Nussdorfer Laende 11, A-1190, Vienna, Austria

1997
June

18-20 *Fourth International Conference on Water Pollution Modeling, Measuring, and Prediction* (WATER POLLUTION '97), Grand Hotel Toplice, Bled, Slovenia. Organized by the Wessex Institute of Technology, UK; the University of Ljubljana, faculty of Civil Engineering; and Geodesy, Slovenia. Sponsored by the Ministry of Environment and Physical Planning, Ministry of Science and Technology of the Republic of Slovenia, and the United Nations Environmental Programme, Mediterranean Action Plan. For more information, contact Liz Kerr, WATER POLLUTION '97 Secretariat, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton SO40 7AA, United Kingdom. Phone: 44 1703 293 223; Fax: 44 1703 292 853; e-mail: wit@wessex.witcmi.ac.uk. Or visit the Web page: http://www.witcmi.ac.uk/ and click on the conference information link.

Calls for Papers—Deadlines

1996
August

30 *Fourth International Conference on Water Pollution Modeling, Measuring and Prediction* (WATER POLLUTION '97), Grand Hotel Toplice, Bled, Slovenia. Organized by the Wessex Institute of Technology, UK; the University of Ljubljana, faculty of Civil Engineering; and Geodesy, Slovenia. Submit 3 copies of abstracts of 300 words or less to Liz Kerr, WATER POLLUTION '97 Secretariat, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton SO40 7AA, United Kingdom. Phone: 44 1703 293 223; Fax: 44 1703 292 853; e-mail: wit@wessex.witcmi.ac.uk. Abstracts should clearly state the purpose, results, and conclusion of the work to be described in the final paper.

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