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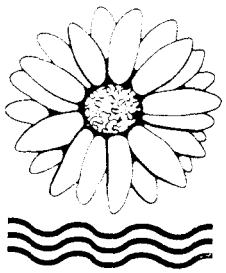

Nonpoint Source
News-Notes
The Condition of the Water-Related Environment
The Control of Nonpoint Sources of Water Pollution
The Ecological Management & Restoration of Watersheds

Commentary

Upstream Impacts Accumulate in Gulf "Dead Zone"

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

After the recent national symposium, *Assessing the Cumulative Impacts of Watershed Development on Aquatic Ecosystems and Water Quality* (March 18-21, Chicago, Illinois), I wondered how to drive home the idea that we are all contributing our bit to pollutant loads. I found a good example of the problems and the beginning of the answer to my question in a fact sheet on the problem of oxygen-depleted (hypoxic) areas in the Gulf of Mexico.

In brief, the Mississippi River basin is receiving greater inputs of nitrogen from many sources — fertilizers, sewage, atmospheric deposition, to name a few — and is delivering these inputs to the Gulf of Mexico. The increased nitrogen sparks an explosion in phytoplankton growth. The massive phytoplankton blooms eventually decompose and consume nearly all the oxygen in the water. Add to this event the stratification of fresh and salt water and the result is a "dead zone" of up to 15,000 square kilometers with very few fish and shellfish. (See the accompanying box for more information on the effort to combat this problem.)

Just before the conference, *Science News* (vol. 149; February 10, 1996) published a piece on hypoxic waters around the world. Other known low oxygen zones are in North Carolina's New River estuary; the Chesapeake Bay; Sommone Bay, France; Kattegat, an arm of the North Sea;

INSIDE THIS ISSUE

Commentary
Upstream Impacts Accumulate in Gulf "Dead Zone" 1

Notes on the National Scene
Biocriteria Programs Enhance Water Resource Evaluation 2
EPA Supports Watershed-based "Trading" 4
EPA Reports on National Water Quality Inventory 5
Response to Conservation Provisions in Ag Reform Act 6

Notes on Riparian and Watershed Management
Monitoring Isolates Barnyard Runoff 8
Knitting a Watershed Together 8
One Lake + Two Counties = Single Management Plan 9
Canada's Bay of Quinte Considers Phosphorus "Trading" 10

Urban Runoff Notes
CSO Controls Due in January 12

Notes on the Agricultural Environment
BMPs Reduce Pesticides in Groundwater 13
Alum-treated Poultry Litter has Dual Benefits 14
Paraplowing Complements No-till 15

News from the States, Tribes, and Localities
Is Runoff Pollution Threatening Lake Superior 16
Strategy to Reduce Polluted Runoff from Federal Lands in D.C. . . . 17
Evaluating Wisconsin's Atrazine Rule 19
Wisconsin Survey Depicts Fate of Contaminated Wells 19

Notes on Education and Outreach
What's New in Education and Outreach Resources 20
Creek Maintenance Course Meets Ranchers' Needs 21
Finding the Fun in Stream Restoration 23

NPS Electronic Information Exchange News 24

Reviews and Announcements
Guidance Specifies BMPs for Forested Wetlands 24
Please Don't Feed the Geese and Other "Lake Tips" 25
Urban Watersheds Planning Series 26
Directory of Watershed Tools 26
New Pubs From EPA 27
Planning and Design of Rural Communities 27
Award Established for Watershed Leadership 28
New Guidance on State NPS Programs 28

DATEBOOK 29
THE COUPON 31

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.

Upstream Impacts Accumulate in Gulf "Dead Zone" (continued)

and the Black Sea. According to the article, the Gulf Coast is the most likely U.S. area to develop hypoxia severe enough to wipe out the commercial fishery.

The situation is much more complex than these simple words suggest, but it illustrates how potential devastation can result from the combined impact of numerous sources of pollution, both large and small. The roles of our nonpoint source programs and local watershed efforts have never been more urgent.

EPA and Environmental Council of States Tackle Gulf-Bound Nitrogen

The 14 states bordering the Mississippi and Ohio Rivers are joining hands with EPA to stem the plume of nitrogen-enriched water creating a deadly hypoxic zone in the Gulf of Mexico. According to Gulf researchers, many ecosystems that are severely stressed by hypoxia appear to be near collapse, that is, to be losing their fisheries and biodiversity.

The problem has been building for many years. The U.S. Geological Survey estimates that the average nitrate-nitrogen concentration in the Mississippi River has doubled since 1950. Not surprisingly, commercial fertilizers are the largest source of nitrogen in the Mississippi River basin, followed by manure, legumes, municipal and domestic waste, and atmospheric deposition. U.S. Geological Survey data indicate that most of the nitrogen comes from streams draining the upper Mississippi and the lower Ohio river basins.

The Gulf of Mexico Program is facilitating the expansion of existing, multistate, multiagency cooperative efforts. Participation of scientists, policymakers, and land managers is critical. The key elements of the initial 12-month plan include

- ✔ improving overall water quality and restoring, protecting, and enhancing local fish and wildlife habitats;
- ✔ identifying and implementing cost-effective solutions;
- ✔ building on current state programs, focusing on local, state, and federal support for funding;
- ✔ focusing on BMPs or other treatments that are economically advantageous for local communities and, collectively, will significantly reduce the inputs of nutrients into the Gulf;
- ✔ conducting research to fill in the scientific and technical gaps related to hypoxia; and
- ✔ measuring and reporting environmental results in terms of load reductions to the Mississippi watershed and reductions in the size of the hypoxic zone.

The Gulf of Mexico Program's role is to provide information so stakeholders can make knowledgeable decisions.

[For more information, contact Larinda Tervelt, Hypoxia Project Coordinator, U.S. EPA Gulf of Mexico Program, Building 1103, Room 202, Stennis Space Center, MS 39529-6000; e-mail: tervelt.larinda@epamail.epa.gov]

Notes on the National Scene

Biocriteria Programs Enhance Water Resource Evaluation

Evaluating water quality in the past has meant testing water samples for chemicals such as nitrate, phosphorus, and dissolved oxygen. But chemical testing alone cannot give a full picture of nonpoint source pollution — the effects, for example, of sedimentation, nutrient enrichment, and habitat loss. Thus, EPA is encouraging states and tribes to add biocriteria to their water quality evaluation programs.

The Clean Water Act specifies "chemical, physical, and biological integrity" as primary water quality protection objectives. However, many early federal and state efforts focused first on chemical integrity, then on physical integrity. As a result, chemical, end-of-pipe pollution decreased, leaving nonpoint source pollution as a major negative impact on aquatic organisms. Having realized that meeting chemical criteria alone does not always protect water resources, EPA and many states and tribes now believe that water monitoring should rely on a suite of tools, including chemical, physical, and biological assessments.

EPA's working definition of biological integrity is "a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of the natural habitat of the region."

The Fort Peck Tribes' Monitoring Toolbox

Montana's Fort Peck Tribes have designed a monitoring program that addresses all three Clean Water Act objectives. In 1988, the tribes attended a EPA-sponsored workshop on Rapid

Biocriteria Programs Enhance Water Resource Evaluation (continued)

Bioassessment Protocols for Streams and Rivers. They quickly realized the value of adding biocriteria to their water quality monitoring program.

The Tribes had conducted chemical and physical sampling for seven years prior to attending the workshop. But chemical and physical parameters did not portray a complete picture of stream impacts in the agricultural watershed. As Deb Madison of the Fort Peck Tribes explains, the tribes recognized that adding biocriteria to their program would help them identify the effects of sedimentation, nutrient enrichment, and habitat loss.

During the 1989 sampling season, a year after attending the conference, the Fort Peck Tribes began a biosurvey program using Rapid Bioassessment Protocols (RBPs) II and V. The different RBP levels offer a range of monitoring choices. "RBP II was selected because it uses family-level identification of macroinvertebrates," Madison explains, and RBP V uses the same procedure for fish. The advantage of using these protocols is, according to Madison, "that the tribes' technical staff can train to identify macroinvertebrates and fish to the family level, thereby eliminating the need for a full-time biologist and developing the tribes' in-house technical capabilities."

"Results from the first year of sampling were intriguing and exciting," Madison recalls. Since initiating biological monitoring, the Fort Peck Tribes have incorporated biocriteria into their water quality standards and completed a nonpoint source assessment using biocriteria characterizations to prioritize streams on the reservation. After EPA approved the assessment, the tribes became eligible to apply for Clean Water Act section 319 funding to complete nonpoint source abatement projects on the reservation.

The tribes have since used biological data in a number of management projects. For example, they have identified nonpoint source pollution problems linked to ranching and worked with ranchers to implement Best Management Practices (BMPs).

Currently, the tribes are analyzing data to determine what a balanced and healthy aquatic community on the reservation should look like. They will use these "reference conditions" to evaluate the health of the reservation's 640 stream miles.

No Single Solution

No single monitoring tool can provide a comprehensive picture of the condition of surface waters. Chemical, physical, and biological data contribute pieces to the puzzle that finally depicts the quality of the nation's waters. As Madison explains, the function of biocriteria is to enhance, not command, water quality monitoring programs:

> *Biological monitoring has added a level of sophistication to the tribes' water quality program, allowing staff to make qualified decisions about the water resources of the Fort Peck Tribes. The Rapid Bioassessment Protocols fill in the missing pieces. Using these results, we are able to determine stream quality using chemical, physical, and, now, biological data.*

[For more information on implementing biocriteria in a water quality management program, contact Candace Stoughton (4304), U.S. EPA, 401 M Street, SW, Washington, DC 20460. Phone: (202) 260-1036; fax: (202) 260-1737; e-mail: stoughton.candace@epamail.epa.gov. For more information on the Fort Peck Tribes' biocriteria program, contact Deb Madison, Fort Peck Tribes, P.O. Box 1027, Poplar, MT 59255. Phone: (406) 768-5155, ext. 399; fax: (406) 768-5544.]

Additional Resources

Biological Criteria: Technical Guidance for Streams and Small Rivers. 1996. EPA 822/B-96-001. U.S. Environmental Protection Agency, Washington, DC.

Biological Criteria: National Program Guidance for Surface Waters. 1990. EPA 440/5-90-004. U.S. Environmental Protection Agency, Washington, DC.

Biological Criteria: Research and Regulation — Proceedings of a Symposium, 1991. EPA 440/5-91-005. U.S. Environmental Protection Agency, Washington, DC.

Policy on Biological Assessments and Criteria, 1991. EPA 822/R-91-101. U.S. Environmental Protection Agency, Washington, DC.

Procedures for Initiating Narrative Biological Criteria, 1992. EPA 822/B-92-002. U.S. Environmental Protection Agency, Washington, DC.

An SAB Report: Evaluation of Draft Technical Guidance on Biological Criteria, 1993. EPA SAB/EPEC-94-003. U.S. Environmental Protection Agency, Washington, DC.

Rapid Bioassessment Protocols for Use in Streams and Rivers: Benthic Macroinvertebrates and Fish. EPA 440/4-89-001. U.S. Environmental Protection Agency, Washington, DC.

[To obtain copies of these documents, contact the Water Resource Center (RC4100), U.S. EPA, 401 M St., SW, Washington, DC 20460. Phone: (202) 260-7786; e-mail: waterpubs@epamail.epa.gov]

Related Documents

Summary of State Biological Assessment Programs for Streams and Rivers, 1996. EPA 230-R-96-007.

Biological Assessment Methods, Biocriteria, and Biological Indicators: Bibliography of Selected Technical, Policy, and Regulatory Literature, 1996. EPA 230-B-96-001.

[Available from Wayne Davis, (2162), U.S. EPA, 401 M St., SW, Washington, DC 20460. E-mail: davis.wayne@epamail.epa.gov.]

EPA Supports Watershed-based Trading — A New Opportunity for Nonpoint Sources

By Theresa Tuaño, *Aquatic Biologist, U.S. Environmental Protection Agency, Office of Wetlands, Oceans, and Watersheds.*

In January, EPA announced its intent to promote watershed-based trading. The agency's new policy reiterates the Administration's commitment to trading as a means of achieving water quality objectives more quickly and cost-effectively.

In a nutshell, trading means that dischargers can sell or barter their ability to reduce pollution with other sources that are unable to reduce their pollutant loads as economically. For example, selected publicly owned treatment works on North Carolina's Tar-Pamlico Basin pay into a state fund that supports implementation of best management practices on farms. This way, the plants achieve water quality goals less expensively than if they had upgraded their facilities independently. (See page 11 in this issue for news on a trading project in Canada.)

EPA has identified five basic types of trading: (1) between point and nonpoint sources, (2) between nonpoint sources, (3) between pretreaters that discharge to publicly owned treatment works (POTWs), (4) between point sources, and (5) between more than one outfall within a single facility (intraplant). EPA is also open to the possibility of other types of watershed-based trades.

A companion framework to the January policy, EPA's *Draft Framework for Watershed-Based Trading,* recently released for public comment, explains watershed-based trading and the benefits it offers. It describes the conditions necessary for trading that will ensure water quality protection. Worksheets and checklists in the document help readers identify and evaluate trading opportunities in terms of economic, regulatory, data, technical, scientific, institutional, administrative, accountability, and enforcement factors.

Two of the proposed trading schemes are of particular interest for the nonpoint source community. Point/nonpoint trading allows point source dischargers to arrange to control nonpoint source pollution in lieu of upgrading their own point source treatments. Nonpoint/nonpoint trading allows producers of nonpoint source pollution to control other nonpoint sources rather than installing or upgrading their own pollution prevention practices. Both types of trading offer opportunities for producers of nonpoint source pollution to receive assistance in implementing best management practices.

Nonpoint sources are attractive to trading partners for a number of reasons. Trades involving nonpoint sources can result in greater pollutant reductions than those achievable without trades. As a general rule, nonpoint source loads are less expensive to reduce per unit than point source loads. And controlling NPS pollution can provide broad ecological benefits, such as stream, wetland, and other habitat improvements.

For these reasons and others, many point source producers are likely to pursue trades with NPS producers — particularly in watersheds where in-stream water quality goals have not yet been achieved. Rather than implementing expensive upgrades to meet the more stringent effluent limits, point source dischargers may choose to pay for nonpoint source controls as a less expensive means of achieving the required reductions.

By offsetting new pollution sources in a watershed, trading can also allow growth in communities that are otherwise constrained because nearby waterbodies already have water quality problems or could soon develop problems. Trading provides a mechanism for new and expanding sources to offset additional loading by obtaining reductions from other sources.

Watershed-based Trading Resources

The following resources are available to those interested in learning more about watershed-based trading:

- ✔ EPA's policy statement on trading was published in the February 9 *Federal Register.* It is also available on EPA's Internet homepage at http://www.epa.gov/OW/watershed/tradetble.html.
- ✔ "A TMDL Case Study of Boulder Creek Colorado" (EPA 841-F-94-006) describes how Boulder's Publicly Owned Treatment Works (POTWs) contributed funds to a riparian enhancement project on a nearby creek to alleviate ammonia problems, augment stream flow, and defer expensive plant modifications. To obtain a copy, contact NCEPI.
- ✔ "A TMDL Case Study of Tar-Pamlico Basin, North Carolina" (EPA 841-F-93-010) describes an innovative, cost-effective trading program between municipal dischargers and agricultural operators as a tool for meeting nutrient reduction goals. To obtain a copy, contact NCEPI.

Watershed-based Trading A New Opportunity for Nonpoint Sources (continued)

The policy offers new opportunities for additional nonpoint source pollution control in watersheds. EPA will soon be conducting stakeholder meetings to discuss the draft framework document and implementation issues. The agency is seeking input from those involved in trading programs and information on specific locations where trading could be considered. *News-Notes* will keep you updated as the framework process continues to unfold.

[The Draft Framework for Watershed-Based Trading is available for public comment until September 9. Request a copy of the document, publication number EPA 800-R-96-001, by faxing to NCEPI (513) 569-7186. It can also be accessed on the EPA Office of Water Home Page at http://www.epa.gov/OW/watershed. Comments may be sent to Comment Clerk, Water Docket (MC-4101), U.S. EPA, 401 M Street, SW, Washington, DC 20460, or e-mail: ow-docket@epamail.epa.gov.]

EPA Reports on National Water Quality Inventory

Nearly 40 percent of U.S. waterbodies assessed in 1992-1993 remain too polluted for fishing, swimming, and other uses, according to EPA's biennial report to Congress on the nation's water. The 1994 National Water Quality Inventory report includes data submitted from states, tribes, and other jurisdictions for 17 percent of the nation's rivers, 42 percent of lakes, and 78 percent of estuaries. The results of the most recent assessment are consistent with data from the last report in 1992, demonstrating that much work is still needed.

The Clean Water Act 305(b) reporting process began in 1975, and the current report marks the tenth presented to Congress. According to the 1994 report, nonpoint source pollution is the leading cause of impairment in all types of waterbodies.

- **Rivers** — Bacteria is the leading *cause* of pollution, followed by siltation. Agriculture is the primary *source* of pollution, followed by municipal sewage treatment plants;
- **Lakes** — Nutrients are the leading *cause* of pollution, followed by siltation. Agriculture is the primary *source* of pollution, followed by municipal sewage treatment plants; and
- **Estuaries** — Nutrients are the leading *cause* of pollution, followed by bacteria. Urban runoff/storm sewers is the primary *source* of pollution, followed by municipal sewage treatment plants.

EPA, which compiled the report under section 305(b) of the Clean Water Act, emphasizes that the results reported in the biyearly document reflect only a general characterization of water quality across the country. Few states have the resources to assess every river, stream, lake, pond, reservoir, and estuary within their boundaries, so they often focus on major perennial rivers, estuaries, and public lakes with suspected pollution problems. Not all states use identical survey methods and criteria to rate their water quality — a trade-off between flexibility and consistency, the report acknowledges.

The report also cautions that the states identify causes and sources on only a small subset of the waters that are surveyed. For instance, causes and sources were identified for only 36 percent of the river miles assessed — about 6 percent of all the miles of rivers in the United States. EPA, other government agencies, and the states hope to improve reporting consistency by implementing actions recommended by the National 305(b) Consistency Workgroup.

Vigilance Needed Browner Tells the Nation

EPA Administrator Carol M. Browner released the executive summary of the report in conjunction with a recent address from Vice President Al Gore, Jr. Summarizing the implications of the report's findings on water quality, Browner said:

> *We are holding our own in controlling water pollution, but we need to make more progress. Half of all Americans receive their drinking water from rivers, lakes, and streams. To protect public health, we must be vigilant in protecting our waterways.*

Several versions of the report are available at no cost from NCEPI, 11029 Kenwood Rd., Bldg. 5, Cincinnati, OH 45242. Fax: (513) 569-7186; e-mail: OWOW-PUBS-NCEPI@epamail.epa.gov. Please include the EPA number for the document you would like.

- National Water Quality Inventory: 1994 Report to Congress. EPA 841-R-95-005 (572 pages).

EPA Reports on National Water Quality Inventory (continued)

- Appendices of the National Water Quality Inventory: 1994 Report to Congress. EPA 841-R-95-006 (212 pages).
- The Quality of Our Nation's Water: 1994. EPA 841-S-95-004 (200-page summary).
- Fact Sheet on the National Water Quality Inventory: 1994 Report to Congress. EPA 841-F-95-011 (12 pages).

The report is also available on the Internet: http://www.epa.gov/OWOW/305b.

Response to Conservation Provisions in Ag Reform Act Largely Positive

The Federal Agriculture Improvement and Reform (FAIR) Act of 1996, signed into law April 4, is considered by some to be the most powerful environmental legislation of the year. While much of the law concerns commodity programs and an orderly seven-year phase-down of government payments to farmers, its environmental provisions are significant.

FAIR creates several new programs to address high priority environmental protection goals. The new law provides federal matching funds to state and local farmland protection programs for the first time. It also reauthorizes the wetlands programs, establishes an agricultural air quality task force and a private, nonprofit foundation for natural resources research and education, authorizes $200 million for purchasing and restoring sensitive Everglades lands, authorizes funding to preserve farmland, and integrates several environmental programs.

The Environmental Conservation Acreage Reserve Program (ECARP) will now encompass the Conservation Reserve Program, the new Environmental Qualities Incentives Program, and the Wetland Reserve Program.

■ **CRP:** The Conservation Reserve Program will continue to protect highly erodible and environmentally sensitive lands with grass, trees, and long-term cover. As many as 36.4 million acres can be enrolled in the CRP as new contracts replace expired or terminated contracts. Contracts can be terminated after five years, but lands with high environmental values are not eligible for the early out.

■ **EQIP:** The Environmental Quality Incentives Program combines the functions of the Agricultural Conservation Program, Water Quality Incentives Program, the Great Plains Conservation Program and the Colorado River Basin Salinity Control Program.

EQIP has $130 million in 1996 and $200 million annually thereafter for cost-sharing conservation practices. It allocates half for crop production and half for small- to medium-size livestock operations (although the maximum size eligible has yet to be defined) and requires that the participants use a conservation plan. Individual cost-share contracts will be limited to $10,000 annually, and to $50,000 for the life of the contract.

■ **Wetlands Programs:** The law reauthorizes the Wetlands Reserve Program through 2002, with broader eligibility requirements and an enrollment cap of 975,000 acres. One-third of the total program acres must be placed in permanent easements; one-third in 30-year easements; and one-third in restoration-only cost-share programs.

The reauthorized Swampbuster provisions expand options for using mitigation and allow the NRCS to expedite activities identified as having a "minimal effect" on the environment. The Act also accepts wetlands conversions permitted under section 404 to allow agricultural production, "providing that the wetlands were adequately mitigated" and authorizes USDA to establish a pilot wetlands mitigation banking program.

The Swampbuster provision excludes farmers who drain wetlands from receiving farm program benefits, but wetlands converted before 1985 can now permanently keep their agricultural status. This portion of the Act also expands the definition of agricultural land contained in the 1994 interagency wetlands memorandum of agreement to include not only cropland and pastures, but also tree farms, rangeland, native pasture lands, and other land used for livestock.

Other changes in the conservation compliance provisions of the Act include

- giving landowners one year to take corrective actions when potential compliance problems are observed,

- encouraging farmers to maintain records of residue measurement, and
- ensuring that penalties are commensurate with violations.

A further important change requires farm operators to abide by Conservation Compliance and Wetlands Conservation provisions in order to qualify for the market transition payments that will gradually replace traditional farm subsidies.

FAIR also initiates a new program for funding technical assistance to landowners on 642 million acres of private grazing land.

Concerned Partners Respond

The conservation and other environmental provisions of the bill seem to have passed muster with major interest groups, although a few concerns remain. In the words of Geoff Grubbs, Director of EPA's Assessment and Watershed Protection Division,

> *We are thrilled with the conservation provisions of this law. Financial and technical assistance is largely directed to the places with water quality problems, including livestock-related problems. The conservation provisions fit very well with Clean Water Act section 319 nonpoint source programs and will certainly help improve water quality.*

American Farm Bureau Federation President Dean Kleckner agreed, calling the law as a whole "the best possible outcome for all concerned." Kleckner said that the bill's "planting flexibility will increase crop rotation, resulting in enhanced environmental stewardship," and "although we didn't get everything that we wanted, the conservation provisions . . . largely avoid the punitive approaches that have raised farmers' ire."

The National Association of Conservation Districts (NACD) praised FAIR as a "major victory for the environment and for the conservation movement." The NACD said that the bill "marks a watershed in terms of our nation's commitment to voluntary resource conservation efforts on private lands."

The NACD praised Congress for acknowledging the importance of conservation districts and allowing NACD to work with them on the bill's language. A number of key conservation provisions reflect NACD's input. The organization also supports the new Wildlife Habitat Incentives Program, a new task force on agricultural air quality, and flood risk reduction and floodplain easement measures.

The American Farmland Trust (AFT) also applauded the "historic and long overdue recognition by Congress of the need for more federal support of the state and local programs that protect agricultural land from rampant development." AFT president Ralph Grossi, a third generation Northern California farmer, said that the "farmland protection measure, coupled with the bill's other conservation provisions, show conservation is an essential part of farm policy and key to maintaining public financial support for agriculture."

AFT echoed the Farm Bureau's support for providing farmers complete planting flexibility. The latter provision will "generate numerous environmental benefits by promoting more diverse cropping patterns and encouraging production on the most productive land," the AFT concluded.

Robin Marks, a senior program analyst for the Natural Resources Defense Council (NRDC) said that the council was "encouraged by the CRP reauthorization — the new enrollments, and the inclusion of filter strips and tracts of land for wildlife habitat — and pleased with other water quality driven programs like EQIP and the livestock program."

"On the other hand," she said, "we are concerned about the issue of herd size [in the program for cost-sharing livestock-related conservation practices], . . . and we would have liked stronger conservation compliance and swampbuster measures. . . . We are also concerned that flexibility may translate into less wetland protection and less erosion control."

However, Marks said, "the NRDC is excited about the permanent easements in wetlands and the flood prevention provisions . . . [and] happy to see the Fund for Rural America, which could be used to support research on sustainable agriculture. This law provides plenty of opportunity for farmers who are interested in conservation."

Notes on Riparian and Watershed Management

Monitoring Technology Isolates Barnyard Runoff from Other NPS

The U.S. Geological Survey (USGS) has incorporated a monitoring mechanism triggered by rainfall into Wisconsin's Critical Sites Monitoring program. This new technology provides a more sensitive and precise way to gauge pollutant loading than mechanisms dependant on rising stream levels.

USGS and the Wisconsin Department of Natural Resources (DNR) cooperatively conduct the Critical Sites Monitoring Program. The program identifies critical NPS sites — in this case, barnyards — and monitors water quality upstream and downstream for a year prior to and a year after installation of BMPs at the site. USGS collects field data for the program, and DNR's state lab analyzes the data. DNR also administers the BMP program, cost-sharing between 70 and 90 percent of each BMP.

Traditionally, the program has relied on monitoring devices activated by the rise and fall of streams. The new, rainfall-activated systems collect water samples before stream levels are heightened by upstream runoff. This technique isolates barnyard runoff from other upstream nonpoint source pollution. The system also allows USGS staff to collect samples during small storms when runoff from a barnyard is likely to reach the stream without detectable changes in overall stream stage height.

Putting Technology to Work on Halfway Prairie Creek

During the spring storms of 1995, USGS collected water samples above and below a barnyard on Halfway Prairie Creek using the new, rainfall-activated systems. The south-central Wisconsin watershed is 60 percent agricultural, with over 16 square miles draining to the downstream monitoring location.

USGS established a direct electrical connection between the upstream and downstream monitoring devices to allow DNR to improve statistical comparisons of samples collected simultaneously at both locations, another tool useful in detecting barnyard impacts.

Sample analysis at Halfway Prairie Creek revealed that concentrations of total phosphorus, ammonia nitrogen, and BOD were significantly higher at sites downstream from the barnyard. DNR will use this information as a basis for assessing the effectiveness of BMPs recently installed at the site.

"Critical Sites Monitoring is an effort to quantify pollutants from agricultural sources to show legislators and landowners that barnyards and feedlots adjacent to streams are significant pollutant sources. The program also documents the effectiveness of various best management practices in controlling NPS pollution," explains Michael Miller, a DNR water resources specialist. Techniques like the USGS rainfall-activated system help fine tune monitoring efforts, ultimately translating into improved watershed planning.

[For more information on rainfall-activated monitoring technologies, contact Todd Stuntebeck, U.S Geological Survey, Water Resources Division, 6417 Normandy Lane, Madison, WI 53719. Phone: (608) 276-3872. For more information on Wisconsin's Critical Sites Monitoring program, contact Mike Miller, Water Resources Specialist, Bureau of Water Resources Management, Wisconsin Department of Natural Resources, 101 S. Webster Street, P.O. Box 7921, Madison, WI 53707-7921. Phone: (608) 267-2753; fax: (608) 267-2800.]

Knitting a Watershed Together

EDITOR'S NOTE: Based on an interview published in *California Coast & Ocean*, the quarterly magazine of the California State Coastal Conservancy, Vol. 11, no. 3, Winter 1995. Our thanks to editor Rasa Gustaitis for this article.

Huichica Creek, in Napa County, California, is home to the endangered freshwater shrimp *(Syncaris pacifica)* and the scene of a quiet little success story. The story starts with a typical

Knitting a Watershed Together (continued)

conflict — agricultural interests versus environmental interests — but it ends with a watershed knit together by community interests.

The shrimp's habitat had been degraded by sediments washing down into the creek from hillside vineyards. Grape growers tilled and planted straight up and down hills, and some environmental groups wanted regulations to stop this practice. Yet because of the soil structure in this watershed, "if they had cut sideways into the hill, they would have had massive sliding," said Dennis Bowker, a resource conservationist with the Napa County Resource Conservation District (RCD).

To ward off regulation, Bowker encouraged landowners to get together and find a way to solve the problem that the regulation would have addressed: sedimentation in Huichica Creek. (The RCD's motto is "Get the government off your back by shouldering a little responsibility.") They did, and their joint effort led to other site-specific actions that not only improved the habitat for shrimp and other species, but also brought economic benefits to grape growers.

Instead of changing the way they tilled, the growers planted native grasses between the rows and elsewhere to act as filters for water running off their land into the creek. This practice not only kept soil in place, it also helped improve the quality of grapes. "When a plant's foliage is too vigorous, the grape may have a flavor like canned peas or mown hay," said Bowker. "By planting grass between the rows, we were able to keep the leaf cover in balance with the fruit and get away from a grassy flavor. With just the right mix of cover crop, we were able to make a grassy sauvignon blanc taste more like melons or papayas."

The landowners, working with the RCD, also developed their own strategy with regard to pesticides. "They sat down," Bowker says, "with EPA pesticide regulators, and drew up their own restrictions on the use of chemicals," which EPA found acceptable.

These and other locally grown conservation measures have improved Huichica Creek. Gravel beds have reappeared, providing spawning grounds for steelhead trout. The shrimp's future looks brighter. "The growers in the watershed have adopted the shrimp, not out of altruism," said Bowker, "but because they realize that the shrimp are like a gauge. As long as their habitat is in good shape, the growers can keep on producing."

Bowker believes that as people come to see their place in the watershed in terms of self-interest, they will become effective stewards. As this happens, their attitudes and ways of living change. "It's like having a healthy diet," he says. "The changes in attitudes, in the way we move everyday, are far more significant in the long run than streambank armor and planting trees. Those things will happen in due time."

[For more information, contact Dennis Bowker, Napa County Resource Conservation District, 1303 Jefferson Street, Suite 500B, Napa, CA 94559. Phone: (707) 252-4188; fax: (707) 252-4219.]

Stakeholders Guide Development for Western North Carolina Lake

A "management by consensus" approach has brought divergent interests in two North Carolina counties together to make decisions about the future of the lake they share. The result — a single management plan for the lake, developed and endorsed by both counties — wasn't easy to come by, but it was worth the effort. "This plan was critical to ensuring the long-term viability of the area," said Mike Struve of the Western Piedmont Council of Governments.

Until the 1989 opening of Lake James State Park, few people had enjoyed the beauty of the Blue Ridge foothills in North Carolina's Burke and McDowell Counties or seen the deep, clear, 6,510-acre reservoir that yields hydropower for Duke Power Company. But by 1992, more than 900,000 people were visiting the park annually — more than seven times the combined population of the two counties. Increased residential development along the lake's shoreline sparked debate among the area's residents over how to balance development with preservation of the lake's water quality and aesthetics.

"Both counties were reluctant to adopt land-use controls to protect the lake and its watershed. Neither Burke nor McDowell County had ever had zoning or subdivision regulations. In

Stakeholders Guide Development for Western North Carolina Lake (continued)

addition, neither county wanted to be at a competitive disadvantage to the other economically," recalled Struve.

"The first step was empowering representatives from various interest groups to outline their concerns and goals for the lake," he explained. The Lake James Stakeholders Committee took that first step last year, drafting a set of recommendations to guide future development along the lake. Then, representatives from the two counties began meeting regularly with Duke Power Company (and its subsidiary, Crescent Resources), area environmental groups, and Lake James State Park to discuss water quality, demographics, infrastructure, and recreation. As nonvoting members, the Western Piedmont Council of Governments and the Isothermal Planning and Development Commission facilitated the process. Achieving consensus on several key issues was crucial to the development of the Lake James Comprehensive Plan.

All committee members agreed that protecting water quality was their top priority. And most agreed that a buffer around the lake in which development was restricted would be the primary tool for protecting it. But they disagreed on the appropriate setback distance. The 65-foot setback eventually adopted was a compromise between one group supporting a 50-foot setback and another advocating a 100-foot setback. Another facet of the final plan is a restriction on planting turf grass within 50 feet of the lake.

Protecting Open Spaces

Committee members also recognized that large areas of undeveloped shoreline attract visitors and new home owners to the lake. Consensus on this issue is reflected in recommendations that restrict tree removal within 100 feet of the lake, create and maintain open spaces near the lake, and identify environmentally sensitive areas requiring special protection.

Disagreements arose over how to secure or finance the purchase of these lands. For example, some members argued that Duke Power and Crescent Resources, which currently own and manage 90 percent of the land surrounding Lake James, have a corporate responsibility to donate some of their shoreline properties for this purpose.

All committee members supported the development of a regional comprehensive sewerage plan, though for different reasons. Some members emphasized that moving from septic systems to sewerage would help protect water quality; others emphasized that providing sewerage would encourage desirable commercial development near the lake.

Educating residents about environmentally sound practices and building pump-out stations for house boats were two other issues that all committee members backed.

"Both counties approached these issues proactively and not in response to a looming crisis," McDowell County Manager Charles Abernathy noted. "By working cooperatively with several key stakeholder groups, the counties were able to develop a supportable plan that neither county independently would have embraced."

In the end, the committee recommended a single shoreline management plan, which was endorsed by each county board in February. The counties are now implementing the plan through zoning and expect to have consistent land-use regulations and enforcement for the Lake James watershed across both counties this summer.

[For more information, contact Mike Struve, Water Quality Administrator, Western Piedmont Council of Governments, 317 First Avenue, NW, Hickory, NC 28601. Phone: (704) 322-9191.]

Bay of Quinte Partners Consider Permit Trading to Cap Phosphorus Loadings

by Fred Stride, *Program Coordinator, Quinte Remedial Action Plan Program*

The governments of Canada and the Province of Ontario are seeking innovative and cost-effective solutions to implement the 1994 Canada-Ontario Agreement to restore water quality and sustain ecosystem health in the Bay of Quinte. Among their considerations: the feasibility of phosphorus effluent permit trading as a market-driven option to control phosphorus inputs.

Bay of Quinte Partners Consider Permit Trading to Cap Phosphorus Loadings (continued)

A History of Too Much Phosphorus

Located in the northeast corner of Lake Ontario, the Bay of Quinte is approximately 100 km long and drains a watershed of about 18,000 square km. In 1985, it was designated a Great Lakes Area of Concern by the International Joint Commission. Pollution problems in the Bay include eutrophication, bacterial contamination, toxic contaminants, and the destruction of natural shoreline features. However, its hypereutrophic state is largely a result of excessive nutrient inputs from point (e.g. sewage treatment plants, industrial discharges) and nonpoint (e.g., agricultural runoff, urban stormwater runoff) sources of pollution.

Actions to reduce point source phosphorus inputs have already been successful. At sewage treatment plants bordering the Bay, inputs have been reduced from over 200 kg per day in 1972 to less than 20 kg per day in 1994. Expansions and upgrades have also reduced the phosphorus loadings at plants farther upstream from the Bay. Sewage treatment plants now contribute about 5 percent of the total watershed phosphorus load.

Nonpoint source controls have also been successfully implemented. Since 1993, the Bay of Quinte Remedial Action Plan (RAP) Rural Water Quality Program and the Ontario Ministry of Environment and Energy's Clean Up Rural Beaches (CURB) program, among others, have provided financial partnerships and incentives to rural landowners to reduce phosphorus inputs by almost 3.4 tonnes per year.

The work has included converting over 160,000 ha of farmland to conservation tillage, repairing over 130 faulty septic systems, erecting fences along 16 km of shoreline to restrict livestock access, retiring fragile lands at several sites, and constructing milkhouse waste treatment systems at 10 sites. Some 26 manure storage projects and two rill erosion control projects have also been implemented. But despite these and other "rural cleanup" actions, nonpoint sources still provide over 70 percent of the current total phosphorus load to the Bay of Quinte.

The Quinte RAP Team and the Public Advisory Committee recommend that phosphorus concentrations be lowered from 40 micrograms per liter (µg/L) to 30 µg/L and that additional actions be taken to reduce phosphorus inputs to the Bay from all sources. In 1995, the RAP team hired D.W. Draper and Associates Ltd. to design and model a permit trading program that would provide for trading among point sources and between point and nonpoint sources. Results are being released as the study progresses, and the final report is due later this year.

The Feasibility of Permit Trading

In general, a permit trading program would allow an input source exceeding its cap to trade — in effect, to buy — the unused portion of a cap from a source discharging less that its cap. The program would be market-driven; that is, traders would seek, buy, and sell the most cost-effective reduction options. The Bay of Quinte Watershed has many of the conditions needed to successfully implement a permit trading program:

- a large capacity to implement inexpensive nonpoint source controls,
- a sufficient number of traders,
- stringent phosphorus targets and pollution regulations, and
- a comprehensive database of loading sources.

Preliminary economic modeling shows that trading can achieve significant reductions in phosphorus inputs at a much lower overall cost. For example, the incremental unit cost of phosphorus reduction at some sewage treatment plants is several hundreds of dollars per kg of phosphorus reduction while the unit cost for phosphorus reduction by conservation tillage or the retirement of fragile lands can be as low a $33 per kg and $7 per kg, respectively, depending on the source's location within the watershed. The potential savings are in the millions of dollars. Thus, the development and implementation of permit trading can be expected to help balance and sustain environmental protection and economic growth in the Bay of Quinte area.

[For more information, contact Fred Stride, Quinte RAP Program, Ministry of Environment and Energy, 133 Dalton Avenue, P.O. Box 820, Kingston Ontario K7L4X6. Phone: (613) 549-4000.]

Urban Runoff Notes

Combined Sewer Overflows — Technology-based Controls Due in January

EDITOR'S NOTE: Combined sewer overflows (CSOs) caused by rainfall and snowmelt are classified as point sources of pollution under the Clean Water Act, yet the resulting overflows of sanitary waste and stormwater runoff are responsible for pollutant loadings similar to those from nonpoint sources, particularly nutrients and pathogens. Those involved in efforts to control NPS loadings from agriculture, septic systems, and urban runoff will be interested to read about EPA's CSO Control Program.

CSO Policy and the Nine Minimum Controls

Combined sewer systems serve approximately 43 million people in nearly 1,100 municipalities. They carry sanitary wastewater and stormwater runoff in a single pipe to treatment facilities. Overflows occur when the volume of stormwater exceeds the capacity of the conveyance system so that both sanitary waste and stormwater bypass treatment facilities and flow directly into waterbodies. These overflows contain human and industrial waste, toxic materials, debris and — like nonpoint source pollution from agriculture and septic systems — are a prime cause of beach closings and shellfish harvesting restrictions in the Northeast and Great Lakes regions.

EPA's CSO Control Policy calls for communities to take both immediate and long-term actions to address CSOs. January 1, 1997, marks a major milestone. By that date, communities are expected to report on the implementation of "nine minimum controls," or technology-based measures, outlined by the policy (see box). These controls include pollution prevention programs aimed at improving runoff quality, a goal shared by NPS efforts.

EPA estimates that as many as 75 percent of all combined sewer communities have made progress toward meeting the January 1 deadline. Far fewer communities have completed their long-term CSO planning. Michigan is a leader in this aspect of CSO control.

Nine Minimum Controls

EPA released guidance in May 1995 outlining nine minimum CSO controls:

1. Proper operation and regular maintenance programs for the sewer system and CSO outfalls.
2. Maximum use of the collection system for storage.
3. Review and modification of pretreatment requirements to ensure that CSO impacts are minimized.
4. Maximization of flow to publicly owned treatment works for treatment.
5. Elimination of CSOs during dry weather.
6. Control of solid and floatable materials in CSOs.
7. Pollution prevention programs to reduce contaminants in CSOs.
8. Public notification to ensure that the public receives adequate notification of CSO occurrences and CSO impacts.
9. Monitoring to effectively characterize CSO impacts and the efficacy of CSO controls.

[For a copy of the Guidance for Combined Sewer Overflows: Nine Minimum Controls, *EPA 832-B-95-003, contact the Water Resource Center. Phone: (202) 260-7786; fax: (202) 260-4383. Copies are also available from NCEPI, fax: (513) 489-8695. Please include the document's name and number with your order.]*

CSOs in Michigan

In Michigan, NPDES discharge permitting addresses CSOs. Permits include minimum technology-based requirements that align closely with EPA's nine minimum controls. Once communities have completed these Phase I requirements, they are expected to pursue Phase II's more demanding infrastructure-related requirements. The long-term plans go "above and beyond minimization to address elimination, treatment, and disinfection of CSOs," according to Peter Swenson, EPA Region 5 CSO Coordinator.

Long-term planning in Michigan is designed to protect the designated uses of receiving streams and to ensure that discharges meet state water quality standards. The Michigan Department of Natural Resources works closely with communities to develop the long-term plans on a case-by-case basis. To help finance CSO projects, communities are eligible for low interest loans from the State Revolving Fund.

Some of these long-term controls are already in place in Michigan's Grand River watershed, where CSOs have resulted in public health advisories warning against body contact with the river.

- **Grand Ledge,** Michigan, which did not record any CSO events last year, has separated its combined sewer system and is currently in the final stages of project certification.

Combined Sewer Overflows Mimic Nonpoint Sources (continued)

- **Lansing,** now in the process of separating its combined systems, has already reduced CSOs by nearly 3 percent despite heavy rains.
- **East Lansing** is boring a tunnel under its primary commercial district to collect, store, and transfer its combined flows to a wastewater treatment plant. The city is also separating combined sewers in other areas.
- **Grand Rapids** has completed construction of a 30-million gallon retention/treatment basin, and its sewer separation on the west side is approximately 90 percent complete. The city has reduced its CSO discharges by over 95 percent in the last five years.

Although not all combined sewer communities are as far along as these Michigan cities, many are on their way. By working to achieve the January 1, 1997, deadline for implementing the nine minimum controls, combined sewer communities are actively working to improve the quality of surface runoff, whether it ends up in a pipe or not.

[For more information on EPA's CSO Control Policy, contact Ross Brennan, National CSO Program Manager, U.S. EPA, 401 M Street, SW (4203), Washington, DC 20460. Phone: (202) 260-6928; fax: (202) 260-1460. For more information on CSO control in EPA Region 5, including Michigan, contact Peter Swenson, U.S. EPA Region 5, 77 West Jackson Blvd., Chicago, IL 60604. Phone: (312) 886-0236; fax: (312) 886-7804.]

Notes on the Agricultural Environment

Nomini Creek BMPs Reduce Pesticides in Groundwater

Early results from a 10-year project using BMPs to reduce the frequency and concentration of pesticides in groundwater are promising.

Sponsored by the Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation (DCR-DSWC), the Nomini Creek watershed/water quality monitoring project evaluates the impacts of agricultural activities on nonpoint source pollution and quantifies the benefits of agricultural BMPs. The agency will use the results of this effort to help shape its agricultural BMP cost-share program.

Located in Westmoreland County, Virginia, Nomini Creek drains 3,718 acres of predominantly sandy loam soil. Woodland covers over half of the watershed and row-cropped corn, soybean, and small grains (wheat and barley) cover most of the rest.

The Monitoring Setup

Researchers from Virginia Tech's Biological Systems Engineering Department designed and implemented the monitoring system, which incorporates both pre- and post-BMP monitoring. In addition to collecting data from a weather station and runoff and precipitation monitoring stations, researchers monitor groundwater at eight sites. Monitoring wells ranging from 11.9 to 16.5 meters deep are paired, 100 to 150 meters apart, with one well located downgradient of the other. Researchers use the wells to monitor ammonia, nitrate, nitrite, total kjeldahl nitrogen, orthophosphorus, total phosphorus, total suspended solids, and 21 different pesticides.

From 1986 through spring 1989, during the pre-BMP phase, researchers collected baseline information that identified sediment, nitrogen, and phosphorus problems in the watershed. Based on this information, farmers moved cropland into federally funded Conservation Reserve Program (CRP) set-asides and DCR-DSWC funded agricultural BMPs, including conservation tillage, nutrient management, grade stabilization structures, and strip cropping. The researchers continued to collect hydrologic, land use, and water quality data throughout the post-BMP phase, to study the long-term effects of the BMPs on water quality.

BMP Effects on Pesticides in Groundwater

To date, the researchers have identified 20 pesticides in the groundwater monitoring wells, mostly at very low concentrations. In general, samples collected in late spring and late fall

Nomini Creek BMPs Reduce Pesticides in Groundwater (continued)

contained pesticides more frequently than the rest of the year. Atrazine was, by far, the most frequently detected of all pesticides, showing up in 25 percent of all samples collected during the last nine years. However, less than 2 percent of the samples contained atrazine at levels greater than the EPA Maximum Contaminant Level (MCL) of 3 parts per billion (ppb).

Saied Mostaghimi and P.W. McClellan, of the Biological Systems Engineering Department of Virginia Polytechnic Institute and State University, are leading the data analysis. "Collectively, the BMPs were quite effective in reducing both the frequency of detection and peak concentrations of atrazine in the groundwater samples," Mostaghimi noted. The frequency of atrazine detection declined from 28.1 to 19.2 percent as a direct result of BMP implementation. The percentage of samples with atrazine concentrations in excess of the MCL also declined from 2 percent to less than 0.4 percent.

Researchers are now beginning to quantify the impacts of the BMPs on groundwater. By supporting BMP studies such as Nomini Creek, DCR-DSWC will improve its agricultural cost-share program to ensure its support of BMPs that have the most bang for the buck.

[For more information, contact Saied Mostaghimi, Biological Systems Engineering Department, Virginia Polytechnic Institute and State University, 308 Seitz Hall, Biological Systems Engineering Department, Virginia Tech, Blacksburg, VA 24061. Phone: (540) 231-7605; fax: (540) 231-3199; e-mail: agewq@vtvmi.cc.tv.edu.]

Alum Improves Poultry Litter — Farmers and Environment Share Benefits

EDITOR'S NOTE: The results of this research into alum as a poultry litter additive were first reported in the November 1995 *Conservation Impact*. The combined emphasis of the research on environmental and economic benefits is noteworthy.

Lab and field studies at the University of Arkansas have shown that adding aluminum sulfate to poultry litter has both environmental and economic benefits. Adding alum to poultry litter reduces the transport of phosphorus in poultry litter fertilizer runoff, increases the amount of nitrogen available to plants, decreases energy requirements for chicken-house ventilation, and even adds weight to birds. These benefits more than off-set the cost of adding alum to the litter.

Alum provides benefits for the farmer and the environment. Fescue plots fertilized with alum-treated chicken litter produced higher yields. Alum traps the nitrogen in the fertilizer (as ammonium sulfate) so more nitrogen is available to the plants and less is lost through ammonia volatilization. In addition, alum reacts with phosphorus to form nonsoluble aluminum phosphate minerals. Fescue plots fertilized with alum produced 87 percent less phosphorus in runoff.

The same properties that benefit crop farmers and prevent ammonia volatilization also make alum economically beneficial for chicken producers. Since alum limits gaseous ammonia in chicken houses, it allows producers to decrease their dependence on electric and propane ventilation systems. Researchers found that producers using alum decreased their propane use by 11 percent and their use of electricity by 13 percent.

Reducing ammonia gas in the chicken houses had another positive side effect: increased weight gain among birds. Birds housed with alum-treated litter weighed 3.86 pounds as compared to 3.75 pounds for those housed with nontreated litter. In general, higher ammonia levels mean reduced feed conversion in birds. Birds housed under conditions of high ammonia are also more susceptible to disease.

The Arkansas studies recommend that alum be applied at a rate of 10 percent according to litter weight. For example, if 20,000 birds produce 20 tons of litter, then two tons of alum should be applied. Once a flock of birds leaves the house, producers use a de-caker to remove caked litter, spread alum, and till it into the litter. Tilling is crucial in preventing the new flock from ingesting the alum.

Alum's metal content was also an issue of concern. Additional studies found that alum does not increase aluminum levels in runoff or plants. Poultry house litter treated with alum has a pH of 7.5, while aluminum becomes soluble at a pH of 5.

Alum Improves Poultry Litter — Farmers and Environment Share Benefits (continued)

Philip Moore, Jr., of the USDA Agricultural Research Service and an adjunct professor with the University of Arkansas agronomy department, directed the studies. He sums up alum's benefits by noting, "The alum treatment is a cost-effective best management practice that reduces nonpoint source water pollution . . . while increasing ag productivity."

[For more information, contact Philip Moore, Jr., Ph.D., USDA Agricultural Research Service, Plant Sciences, Room 115, University of Arkansas, Fayetteville, AR 72701. Phone: (501) 575-5724; fax: (501) 575-7465; e-mail: philipm@comp.uark.edu.]

Paraplowing in Kentucky Reduces Soil Erosion, Improves Crop Yields

Researchers at the University of Kentucky have found a new way to deal with compacted soil and improve crop yields without causing erosion. The method combines paraplowing and no-till planting. Traditional tilling turns the soil over, but paraplow equipment reaches beneath the soil and loosens compacted layers without disturbing crop residues on the surface.

No-till Methods and Problems

In a no-till planting rotation, new crops are planted through the residue of the previous crop using a no-till seeder. The soil is always covered to prevent it from eroding. No-till regimes are widely recommended and widely used in Kentucky.

Over time, heavy equipment traffic on wet soil during planting, fertilizing, and harvesting causes the soil to compact eight to 15 inches below the surface. Then, because compacted soils can inhibit crop growth, farmers must plow, using equipment called subsoilers to turn the soil over and break up the compacted layer. But subsoiling buries crop residues left by no-till planting, exposing the soil to erosion.

Thus, dealing with compaction while maintaining the benefits of no-till planting is a dilemma for farmers. As University of Kentucky researcher Lloyd Murdock explains: "Most of Kentucky's crop acres are no-tilled — and we want to do all that we can to maintain that environment." To protect the no-till advantage, Murdock conducted research on compaction using an alternative subsoiling technique known as paraplowing.

Paraplows as Subsoilers

Paraplows differ from other types of subsoilers. Each shank of the plow is equipped with wings on either side that sink into the soil and shatter the compacted subsoil while leaving the crop residue and surface intact. In an ideal no-till planting schedule, fields would be paraplowed in the fall when soil is dry enough to shatter, and crops would be planted in the spring using a no-till seeder.

Murdock tested paraplowing on no-tilled cropland in 1993 and 1994. The study compared crop yields on plots of no-till corn and soybean. Some of the corn and soybean plots were subsoiled using a paraplow, others were not.

Corn yields improved on the paraplowed segments: 229 bushels per acre on the paraplowed fields in one trial versus 206 bushels per acre on the nonparaplowed segments; and 121 bushels per acre on the paraplowed fields in another trial versus 95 bushels per acre on the nonparaplowed segments. Soybean production, however, gained little from paraplowing. Research in other states supports this result: compacted subsoil is more likely to damage corn than soybeans.

Murdock acknowledges that paraplowing equipment is not innovative. Of English origin, paraplows have been used for subsoiling in the United States for some time. What is innovative is the application of this equipment to no-till planting. Paraplows allow farmers using no-till to combat compaction while maintaining the erosion control benefits of a crop residue cover. These attributes make no-till and paraplowing a winning combination in reducing agricultural sediment pollution.

[For more information on paraplowing, contact Lloyd Murdock at the University of Kentucky, University of Kentucky, Box 469, Princeton, KY 42445. Phone: (502) 365-7541, ext. 207; fax: (502) 365-2667; e-mail: lmurdock@ca.uky.edu.]

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

Is Runoff Pollution Threatening Lake Superior?

Condensed and adapted from an article by Bridget Waite Appleberry in Wisconsin's *Field and Streets* newsletter, December 1995.

The Jewel of the North — that's how many in Wisconsin view Lake Superior. And for the most part, it's true. However, researchers with the Wisconsin Department of Natural Resources (DNR) are finding that this jewel is in danger of losing some of its luster.

Through a special grant from U.S. EPA, water resources officials from three states and the U.S. Geological Survey are collaborating in a three-year study to identify pollutants entering Lake Superior via stormwater runoff. Wisconsin DNR organized the effort and is conducting most of the research.

"We know a lot about what goes into the lake from *point* sources," says DNR's Jeff Prey, who helps coordinate the study. "But no one has ever looked in depth at the pollution coming into the lake from rain and snowmelt runoff."

Monitoring results from the first two years show that the lake, which many consider a pristine resource, is not immune to the sometimes elusive effects of higher traffic volumes, new home construction, agriculture, and urbanization. In fact, says Prey, stormwater runoff from city streets, parking lots, driveways, and lawns is more polluted than any of the industrial discharges that are permitted in the lake.

Forty-nine pollutants were found flowing in storm sewers, streams, and culverts in 11 urban areas in Lake Superior's U.S. drainage basin. Several pollutants were found in quantities exceeding levels set to protect public health and the environment: zinc, polycyclic aromatic hydrocarbons (PAHs), total solids, fecal coliform, mercury, and dioxin.

Zinc, PAHs, and total solids exceeded water quality standards in 90 percent or more of the samples.

Collecting the data

Researchers use "sheet flow samplers" to identify and differentiate pollutants before they reach nearby lakes or streams, rather than analyzing the stream or lake water. The pollutants from disparate sources combine in the lakes or streams, so their origins become untraceable at that point. "We looked at everything from rooftops to taconite piles," says Roger Bannerman, water quality monitoring evaluation specialist for the DNR. Sheet flow samplers were placed at a golf course, a storage/salvage yard, coal piles, gas stations, streets, lawns, parking lots, a shopping center, and driveways.

Putting the Data to Work

The study is part of the Lake Superior Bi-National Program, a United States-Canada cooperative organization that is compiling the results of several studies. The data will be used to improve runoff pollution prevention efforts underway in many shoreline cities and to develop stormwater management recommendations for the Lake Superior basin. Research will continue through 1996 in a scaled-down mode.

"The ultimate goal is zero discharge into Lake Superior," Prey says. To achieve the zero-discharge goal, a regionwide stormwater plan will be initiated by each shoreline city. Some cities have already started. Public works officials in Marquette ask residents to pay (through their water bills) for stormwater pollution prevention efforts such as street sweeping and better storm sewer routing. On the southwestern end of the lake, the city of Duluth requires that construction sites include temporary runoff retaining ponds.

Is Runoff Pollution Threatening Lake Superior? (continued)

In addition to its collection of scientific data, the Lake Superior monitoring project has an educational component that includes public service announcements, videos and slide programs, storm-drain stenciling programs, and GIS-generated maps showing stormwater routes and land uses.

"We've received great cooperation from all the municipalities," Prey says, adding that the same cities and villages have much to lose if the lake becomes polluted. "We can't be cavalier with a lake like Superior," adds Bannerman. "Jewel that it is, we can't afford to tarnish it."

[For more information about stormwater monitoring in the Lake Superior basin, contact Jeff Prey, Wisconsin DNR, 101 S. Webster St., P.O. Box 7921, Madison, WI. Phone: (608) 267-9351. If you'd like to know more about stormwater education materials, contact Carol Holden, DNR, at the same address. Phone: (608) 267-0160.]

Feds Agree on Strategy to Reduce NPS from Federal Lands in the District of Columbia

The first comprehensive effort to improve stormwater runoff controls on the 15,750 acres of federal lands in the District of Columbia began this March when federal officials agreed to implement a special strategy for these lands. The federal government owns approximately 40 percent of land in the District of Columbia. Their location on the banks of the Potomac and Anacostia rivers makes the District and these federal lands important contributors to pollution in the Chesapeake Bay.

The strategy follows up on the 1994 commitment to reduce the federal government's share of nutrient loadings to the Bay. Each of the Chesapeake Bay Program jurisdictions of Virginia, Maryland, Pennsylvania, and the District of Columbia have their own strategies to reduce nutrients in the Bay's tributaries by 40 percent by the year 2000, but the District needed this special federal strategy to complement its own.

Federally owned land, including landmarks like the White House, the Capitol, and the Smithsonian Institute's many facilities, contribute 300 million gallons of runoff each year to the District's combined sewer system. During heavy storm events, this runoff often overwhelms the city's overflow system and allows pollutants — including nutrients and toxics — to bypass wastewater treatment facilities and flow directly into local streams and rivers (see related story on page 12). The stormwater controls called for under the special strategy will reduce long-term costs and provide immediate environmental benefits. At the same time, wetland and stream restoration work will create wildlife habitat, reduce stream scouring, and help control flash flooding.

The strategy entails reviews of stormwater pollution prevention actions and completion of detailed nutrient management plans on federal lands in the District. The federal government has agreed to develop economical and environmentally beneficial landscaping practices and designs for federal lands. As part of the strategy, the federal government will examine what federal financial assistance may be available to fund a joint effort with the District to abate combined sewer overflows, upgrade wastewater treatment, and construct best management practices retrofits. Yearly assessments of runoff from federal properties in the District of Columbia will be conducted to track progress. The assessment results, as well as innovative technologies and practices, will be shared between federal agencies and the District.

Activities Already Underway in Some Agencies

According to the April 1996 issue of the *Bay Journal*, a publication of the Alliance for the Chesapeake Bay, many activities already flourish as part of the special tributary strategy. The Smithsonian Institute plans to improve the management of animal wastes at the National Zoo, and the Postal Service has converted 120 vehicles to run on natural gas, which will reduce air emissions contributing to the Bay's pollutant load.

National Arboretum Director Thomas Elias noted that the 444-acre landmark has reduced its use of pesticides 75 percent in the past two years by using integrated pest management, a set of practices that emphasizes alternatives to pesticide use. The Arboretum has also cleared 1,500 tons of debris from an old gravel pit and is restoring the site as a beech/maple forest. It has

Feds Agree on Strategy to Reduce NPS (continued)

moved a composting pile (which includes bedding and manure from the National Zoo) away from the Anacostia River. Arboretum staff members have also removed more than 25 tons of trash from two creeks that flow through the property. "We hope that we can serve as a model for other urban and suburban lands," Elias said.

Landscape Management and Restoration

National Park Service Resource Management Specialist Stephen Syphax, of National Capital Parks East, reports that many new projects are underway along the Anacostia River in addition to ongoing efforts such as integrated pest management and reducing fertilizer use. Using native plants as groundcovers reduces runoff and the pollution caused by mowing and fertilizing, at the same time increasing habitat and saving money. Where lawn is desired in high impact areas, managers are seeking a balance—using only enough fertilizer to maintain the healthy growth that prevents soil erosion, without an excess to wash off into streams.

As always, education is critical. Occasionally, park visitors have been critical of the new procedures. For example, when native grasses and wildflowers were planted in meadow areas, park rangers had to explain that lack of mowing is not neglect but beneficial management.

Syphax also described the Kenilworth Marsh Project, an interagency effort in 1993 to reconstruct 32 acres of tidal wetlands along the Anacostia River. Now the newly restored environment — which is home to amphibians, reptiles, birds, and waterfowl — is closely monitored by the Park Service and other agencies to determine if the restoration methods used at Kenilworth can be fine-tuned for use at other Anacostia wetlands such as Kingman Lake.

The National Park Service has also been working with Potomac Electric and Power Company and the D.C. government to create meadows and river fringe wetlands in areas bordering the installation of a new water intake system at the power company's Benning Road Plant.

The agreement signed in March at the National Arboretum will undergird and expand these efforts as the federal government commits to doing its part.

[For more information, contact Peter Marx, Chesapeake Bay Program Office, U.S. Environmental Protection Agency, 410 Severn Avenue, Suite 109, Annapolis, MD 21403. Phone: (410) 267-5700, or Stephen Syphax, National Capital Park East, National Park Service, 1900 Anacostia Drive S.E., Washington, DC 20020. Phone: (202) 690-5185.]

Chesapeake Bay Nutrient Report Card

Nine years ago, Maryland, Virginia, Pennsylvania, and the District of Columbia voluntarily agreed to reduce nutrients flowing into the Chesapeake Bay 40 percent by the year 2000. With only four years remaining in the timetable, what kind of progress have they made?

- **Maryland's** strategy should reduce inputs of nutrients from its Chesapeake Bay tributaries by 22.7 million pounds of nitrogen and 2.1 million pounds of phosphorus per year by 2000. The state reports that steps taken during the last 10 years will achieve a "23 percent decrease in controllable nitrogen and a 38 percent decrease in phosphorus reaching tidal waters." Maryland farmers now have nutrient management plans on over 735,000 acres of cropland — more than 60 percent of its goal of 1.2 million acres.

- **Virginia** has promised to complete a strategy for its Potomac River basin by next January. Strategies for the two other major Chesapeake Bay tributaries should be complete by January 1998, and strategies for smaller tributaries are due in 1999. To date, the state has 432,115 acres of farmland under nutrient management plans. Between 1985 and 1994, NPS phosphorus was reduced by about 313,000 thousand pounds per year (21 percent of the NPS load), and nitrogen was reduced by more than 1.7 million pounds per year (16.8 percent of the NPS load).

- **Pennsylvania** has completed a strategy that will bring it within casting distance (94 percent) of its phosphorus reduction goal, though the nitrogen goal remains somewhat more elusive (91 percent). Since 1985, NPS nitrogen and phosphorus have been reduced by over 4.1 million pounds and 1.2 million pounds, respectively. In 1992, the state passed a nutrient management law requiring farms in the Chesapeake Bay basin to prepare and implement nutrient management plans. Since that time, Pennsylvania farmers have placed 288,819 cropland acres in the Chesapeake Bay basin under nutrient management planning.

- The heavily urbanized **District of Columbia** has completed planning for its nutrient reduction strategy, which concentrates on upgrading its wastewater treatment systems. The District's strategy will reduce nitrogen loading beyond the 40 percent goal but may not achieve the phosphorus goal without resorting to "trading" (see the articles on trading, pages 4–5 and 11–12, this issue.)

Overall, since 1987, phosphorus levels in the bay have declined. Nitrogen levels, however, have remained steady or increased, despite improvements in sewage treatment plants and new farming techniques designed specifically to reduce nitrogen levels in the bay. The reason is not entirely clear. Complex ecosystem interactions and natural events may combine with other factors, such as how nitrogen is monitored, to obscure the answer currently.

[For more information, contact the Chesapeake Bay Program Office, 410 Severn Ave., Suite 109, Annapolis, MD 21403 or read its home page at http://www.epa.gov/r3chespk/.]

EDITOR'S NOTE: The next two stories highlight reports from Wisconsin that look at pesticide contamination of groundwater drinking wells from different angles.

Evaluating Wisconsin's Atrazine Rule

In April 1995, Wisconsin's Department of Agriculture, Trade and Consumer Protection released a unique report that estimates state-wide concentrations of herbicides and other agrichemicals in groundwater.

The report covers a study of contaminant levels in Wisconsin wells before implementation of the state's Atrazine Rule. The rule established statewide maximum allowable atrazine use rates and site-specific and regional use prohibitions and requires the Department of Agriculture, Trade and Consumer Protection to evaluate its impact. A second study now underway was initiated after implementation of the rule.

Levels of Contamination

The 1995 report details the findings of a 1994 survey of atrazine and other agrichemicals in wells. The analysis is based on a stratified, random sampling of 289 water samples collected from private water supplies. Of groundwater available for private water supplies statewide, the report estimates that between

- 10 and 19 percent contain residues of one or more herbicides or herbicide metabolites.
- 8 and 16 percent contain residues of atrazine and its metabolites.
- 0.6 and 2.8 percent contain atrazine or metabolites above the enforcement standard (3 micrograms per liter).
- 4.2 and 9.4 percent contain alachlor ethane sulfonic acid, a metabolite of alachlor.
- 6.7 and 13 percent contain nitrate-nitrogen at or above the enforcement standard of 10 mg/L.

The department also calculated the statewide average concentration of atrazine in contaminated wells to be between 0.98 and 1.35 micrograms per liter. This figure is based on data from wells that contained a detectable level of atrazine or its metabolites (59 samples). The department will compare this statewide result to that from the study being completed this year to help determine the impacts of the Atrazine Rule.

In addition, the department will use pesticide use surveys and other parameters to continue to evaluate the effects of the rule. Gary LeMasters has been closely involved in the evaluation process and puts the anticipated outcome into perspective. "As long as atrazine levels do not increase, then we can call it a victory," he says, "but, of course, we would prefer to find a decline."

[For more information on Wisconsin's atrazine programs, or to receive a copy of A Survey of Atrazine in Wisconsin Groundwater: Phase One Report, *April 1995, contact Gary LeMasters, Wisconsin Department of Agriculture, Trade and Consumer Protection, Division of Agricultural Resource Management, P.O. Box 2811, Madison, WI 53708-8911. Phone: (608) 224-4502; fax: (608) 224-4656; e-mail: lemasgs@wheel.datcp.state.wi.us.]*

The Fate of Atrazine-Contaminated Wells

In February of this year, the Department of Agriculture, Trade and Consumer Protection issued a report on the status of wells previously contaminated with atrazine and how well owners have responded to the problem.

Using its Groundwater Unit database, the department generated a list of contaminated wells to revisit. Of the 111 wells that had been contaminated by atrazine, 48 still exceed the enforcement standard, while 63 are now below the standard.

The department also conducted phone interviews with 195 well owners whose water supply previously exceeded enforcement standards. The intent of the interviews was to determine

The Fate of Atrazine-Contaminated Wells (continued)

what, if any, changes well owners had made to their water supply after being advised that it was unsafe for drinking or cooking. Of the well owners surveyed:

- 50 percent continue to use the original well;
- 23 percent drilled a new well;
- 6.5 percent drink bottled water;
- 5.6 percent haul water from another source;
- 6 percent have installed water treatment systems;
- 2 well owners deepened their wells;
- 2 well owners connected to municipal water systems;
- 14 well owners use the original well for uses other than drinking.

The survey also revealed that the average cost of installing a new well was $6,300. Twenty-one well owners received financial assistance from the Wisconsin Well Compensation Program to drill new wells; another four owners received assistance from a pesticide manufacturer, and six received assistance from both.

[For more information on Wisconsin's atrazine programs, or to receive a copy of the Exceedence Survey: Resampling Wells that Previously Exceeded a Pesticide Enforcement Standard, *February 1996, contact Gary LeMasters, Wisconsin Department of Agriculture, Trade and Consumer Protection, Division of Agricultural Resource Management, P.O. Box 2811, Madison, WI 53708-8911. Phone: (608) 224-4502; fax: (608) 224-4656; e-mail: lemasgs@wheel.datcp.state.wi.us.]*

Notes on Education and Outreach

Educational Resources

Videos

- *Reversing the Tide.* This video presents Louisiana's wetlands loss in a national perspective. Contact Phyllis Darensbourg, Louisiana Department of Natural Resources. Phone: (504) 342-8955.
- *Tomki Creek Watershed Project.* This 20-minute video on the Tomki Project in California focuses on watershed interaction, common erosion problems, and stabilization and restoration methods. The purchase price is $14.95, including tax, shipping, and handling. Contact Mendocino County Resource Conservation District, 405 Orchard Avenue, Ukiah, CA 95482. Phone: (707) 468-9223.
- *We All Live Downstream.* The greatest threat to America's drinking water supplies — nonpoint source pollution, from both urban and rural sources — is documented in a new half-hour educational video released by the Oregon State University Extension Service. The cost is $30. Contact Publication Orders, Agricultural Communications Office, Oregon State University, A422 Administrative Services Building, Corvallis, OR 97331-2119.
- *Little Pollute.* Winner of the prestigious National Academy of Cable Programming Award, this eight-minute video was designed for primary-school-age children, but it charms people of all ages. The cost is $10, payable to Pierce County. Contact Heather Kibbey, Pierce County Surface Water Management Department, 4910 Bristonwood Drive West, Tacoma, WA 98467-1299. Phone: (206) 596-2725.
- *Careers in Florida's Freshwater Environments.* Presenting information about jobs in wildlife, fisheries, botany, water chemistry, recreation, information, and teaching, this 26-minute video is free to seventh- and eighth-grade teachers and career counselors in Florida. For others, the cost is $15 plus tax, shipping, and handling. Order from IFAS Publications, University of Florida, IFAS Building 664, Gainesville, FL 32611-0001. Phone (352) 392-1764.
- *Day By Day — Caring for Our Bay: Grand Traverse Bay in Michigan.* The Grand Traverse Bay Initiative developed this 10-minute video to enlist public support to manage growth and protect the environment. Contact Chris Wright. Phone: (616) 935-1514.

Educational Resources (continued)

Booklets

- *Your Lake and You.* Designed to help people better understand how to care for their lakes. 8 pages. Contact your state lake organization or NALMS, P.O. Box 5443, Madison, WI 53705-5443.
- *Lakewalk Manual: A Guidebook for Citizen Participation.* This EPA manual comes with a workbook that shows citizens how to learn about lakes and how to collect observed information. Contact NCEPI, 11029 Kenwood Road, Building 5, Cincinnati, OH 45242.
- *Reflecting on Lakes.* The latest in CTIC's Know Your Watershed series was developed to promote an understanding of lakes and to encourage local voluntary watershed partnerships to address natural resource concerns. Contact Conservation Technology Information Center, 1220 Potter Drive, Room 170, West Lafayette, IN 47906. Phone: (317) 494-9555.
- *The Nation's Lake Resources: Their Value, Uniqueness, and Need for Wise Management.* This poster–brochure celebrates the beauty and usefulness of lakes and presents keys to wise lake management. It includes a chart of pollution sources, effects, and controls. The cost is $3.95, plus $3 shipping/handling. Contact Terrene Institute, 4 Herbert Street, Alexandria, VA 22305. Phone: (703) 548-5473; Fax (703) 548-6299.

Posters

- *Healthy Lakes Need Wise Lake and Watershed Management.* This poster is one in a series that encourages community commitment to water quality protection by highlighting pollution sources and controls in lakes and watersheds. Cost: $5 plus $3 shipping and handling. Contact Terrene Institute, 4 Herbert Street, Alexandria, Virginia 22305. Phone: (703) 548-5473; Fax (703) 548-6299.
- *Views from Your Lake: A Choice, an Action.* From the shoreline to wooded areas beyond the lake, from swimming docks to deeper waters, and from the upland slopes to the nearshore, a watershed perspective makes for good lake management. Cost: $5 plus $3 shipping and handling. Contact Terrene Institute, 4 Herbert Street, Alexandria, Virginia 22305. Phone: (703) 548-5473; Fax (703) 548-6299.

Curriculum Guides

- *California Adopt-A-Watershed Curriculum Guides.* A set of K-12 curriculum guides that build on one another to allow students to develop a sense of stewardship and help them gain an understanding of their place in the environment. Contact Kim Stokely, Adopt-A-Watershed, P.O. Box 356, Hayfork, CA 96041. Phone: (916) 628-5334.
- *Lake Education Curriculum.* Developed for K-12 use in hands-on classroom and field demonstrations. Copies of the full curriculum are available for $30 a set. Contact Clifford R. Lundin, c/o Lake Hopatcong Regional Planning Board, P.O. Box 254, Succasunna, NJ 07876.
- *Colorado Water Wise.* Produced by the Central Colorado Water Conservancy District for grades Pre-K through 12, this curriculum consists of a document, computer software, and field laboratory kits. The material moves from basic academic skills to decision making. Contact the Central Colorado Water Conservancy District, 3209 West 28th Street, Greeley, CO 80631. Phone: (303) 330-4540.

Creek Maintenance Certification Course Tailored to Farmer and Rancher Needs

When Laurel Graham-Holsman thought about an education component for her watershed's 319 demonstration project, a stream restoration course seemed like a logical complement to on-the-ground BMPs like erosion control, rotational grazing, and riparian fencing.

Decades of logging and agriculture on the highly erodible land of central California's Pescadero-Butano Creek watershed had destroyed salmon and steelhead trout spawning areas, exacerbated flooding, and caused bank erosion. The Pescadero-Butano Creek Coordinated Resource Management and Planning project aspired to reverse these changes, and public education was part of the plan.

Creek Maintenance Certification Course Tailored to Farmer and Rancher Needs (continued)

But the closer the time came to offer the course, the more project director Graham-Holsman suspected that stream restoration was not what the watershed's residents most needed to learn. Most creek residents were farmers and ranchers whose livelihoods often depended on the temperamental creek.

Over seven or more years of drought, very low flows had deposited tons of sediment in the streambed. Trees growing out of the new mid-stream bars clogged the watercourse by catching still more sediment and debris. Just this past winter, a log jam during a severe storm accumulated over 3,500 cubic yards of debris, resulting in floods and badly eroded streambanks.

Farmers told Graham-Holsman that if they had been allowed to "clean up" the creek, flooding and erosion would have been significantly reduced. They wanted to clear the creeks of debris, remove fallen trees, stabilize failing banks, or cut the trees on the mid-stream bars that were catching and holding huge logs coming down the creek. But uncertainty about acceptable practices made farmers wary about applying for permits to carry out maintenance activities.

"We wondered how we could meet both the perceived needs of the farmers and the objective of reducing nonpoint source pollution through best management practices," Graham-Holsman remembered. The answer proved easy enough. Change the volunteer-oriented "Stream Restoration Training" to practical stream management training for those who live on the land. Inspired by the Montana Forest Stewardship workshop developed by Bob Logan, Graham-Holsman came up with the Creek Maintenance Certification Workshop.

Course Description

Sponsored by the San Mateo County Farm Bureau, the pilot workshop's two three-hour classroom sessions familiarized farmers with the watershed's natural history, problems, and appropriate BMPs. Discussions of permitting and work plan development led to preparing documentation on real projects the farmers felt were needed. Each participant completed property descriptions and identified resource problems, best management practices, costs, and resources, finally producing a viable work plan.

During a single eight-hour Saturday session, each participant, armed with completed worksheets, compiled an individual permitting packet. To this, each person attached the work plan, location maps, overflight views of project areas, and site sketches.

The course culminated in an open-book exam and submission of the permitting packages. The farmers and ranchers who completed the course earned certificates.

Says Graham-Holsman, "The participants have developed a more integrated knowledge of the land and the treatments than most county planners or game wardens." After taking the course, permit applicants are also well aware of which activities are appropriate and which are not.

Five large agricultural operations were represented in the pilot workshop, and as a result, over 24,700 linear feet of creek in the lower Pescadero and Butano Creek Watershed will be covered under management plans. Some of the planned activities require permits, and others don't. Farmers wrote plans that included removing farm equipment from floodplains, topping or removing unstable trees from streambanks while still retaining appropriate canopy, revegetating streambanks, planting willows, diverting runoff from fields, removing garbage from the stream, and seeding and winterizing farm roads adjacent to the stream.

The one gap remaining, according to Graham-Holsman, is permitting. She has been working with the state Fish and Game department to streamline the permitting procedures for those completing the course. It would be worthwhile for the department, she says, because they need to maintain the natural floodways of the central California coast in an environmentally appropriate manner.

What was the most important lesson that Graham-Holsman learned from the experience? "Most grant programs require a public education or public information participation component, " she said. "If doing the environmentally appropriate thing is not enough to motivate people, then the project director needs to find a value that will support learning new, different activities. In this case, private property rights were honored and combined with private property responsibility."

[For more information on the Creek Maintenance Certification Workshop, contact Laurel Graham-Holsman, Natural Resources Program Management, 20005 Lackman Loop, Frenchtown, MT 59834. Phone: (406) 626-2484; e-mail: mayasleca@aol.com.]

Finding the Fun in Stream Restoration

Combining youthful energy with federal money can provide some surprising results. The town of China, Maine, did it and got a newly restored stream where trout can spawn.

Last fall, only four months after Erskine Academy high school students began restoration work in Jones Brook, a local game warden noted an increase in gravel in the streambed. He also spotted spawning brown trout. This summer, the students are continuing their project by planting vegetation on the banks.

The Kennebec Soil and Water Conservation District says the work in the tributary to China Lake has decreased the amount of soil and phosphorus being deposited in the lake and increased the number of native trout and smelt in China Lake.

Using a U.S. EPA 319 grant, Ken Hollowel, a teacher at the Academy, and his students repaired and restored trout spawning habitat in the stream. Gradual forest clearing for development and highway upgrades had created a "flashy stream" with increased runoff that eroded soil from the banks, silting the gravel bottom.

Hollowell worked with George Lord, executive director of the China Region Lakes Alliance, to put the project together. China Region Lakes Alliance is a nonprofit organization representing three towns, three lake associations, and the Kennebec Soil and Water Conservation District.

Lord and the Conservation District's Reb Manthey directed the students' work. They stabilized several sites using willow wattles — clumps of willow branches set into the banks. The willows sprouted within three weeks, and Lord estimated that more than 90 percent grew into shrubs during the summer, their roots holding the soil in place.

At other sites, the students treated eroding banks with fascines—giant sausages of coconut fiber held together with nylon netting and staked into place at the bottom of steep slopes. The slopes continue to slump, but the fascines stay in place, holding the soil. Over time the coconut fiber will rot, but in the meantime new vegetation will become established and stabilize the bank.

At one bend in the brook, students constructed a trout shelter that provides a stable, shady place for trout to rest.

Bioengineering: Streambank Stabilization

Several techniques can help establish vegetative plantings on streambanks and prevent erosion. Some examples:

- **Live staking:** Live, rootable vegetative cuttings are inserted and tamped into the ground perpendicular to the slope. Most willow species root rapidly.
- **Live fascine:** Long bundles of live branch cuttings are placed in shallow trenches dug on the contour of the slope. They are held by stout dead stakes driven through the fascines and stout live stakes inserted directly below the bundles. The fascines are then almost covered by moist earth and mulch is placed between rows.
- **Brushlayering:** Live branch cuttings are placed on small benches two to three feet wide, excavated at a slight tilt into the slope. Brushlayered branches serve as reinforcing units, retarding runoff and reducing surface erosion, aiding seed germination and natural regeneration.
- **Branchpacking:** Alternating layers of live branch cuttings and compacted backfill repair small localized slumps, holes in slopes, and gullies.
- **Live cribwall:** A hollow, box-like interlocking arrangement of untreated log or timber members is filled with suitable backfill material and layers of live branch cuttings. The cuttings root inside the crib structure and extend into the slope, gradually taking over the structural functions of the wood members.
- **Vegetated rock gabions:** Rectangular containers of triple twisted, hexagonal steel mesh are placed in position, wired to adjoining gabions, filled with stones; then folded shut and wired at the ends and sides. Live branches placed on each layer between the rock-filled baskets will take root inside the gabion baskets and in the soil behind the structures, consolidating the structure and, in time, binding it to the slope.
- **Vegetated rock wall:** A combination of rock and live branch cuttings that differ from conventional retaining structures in that they are placed against relatively undisturbed earth and are not intended to resist large lateral earth pressures.
- **Joint planting:** Live cuttings are tamped into soil between open spaces in rocks that have been previously placed on a slope.

[Taken from the USDA Natural Resources Conservation Service Engineering Field Handbook *(210-EFH, 10/92), Chapter 18: "Soil Bioengineering for Upland Slope Protection and Erosion Reduction."]*

Finding the Fun in Stream Restoration (continued)

Hollowell said the project has given his students an opportunity to learn more about water quality and erosion through practical application. Dov Weitman, chief of the U.S. EPA Nonpoint Source Branch, who visited the site last summer with officials from Maine's Department of Environmental Protection, said, "There are many winners in the China Lake project. The students have provided an important service to their community by helping to stabilize the stream. In the process of doing so, they have learned a good deal about hydrology. Besides being fun and educational, this project is worthy of emulation in other areas of the United States."

[For more information, contact George Lord, China Region Lakes Alliance, Box 970, South China, ME 04358. Phone: (207) 445-5021.]

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

Guidance Specifies BMPs for Forested Wetlands

In November 1995, EPA and the Army Corps of Engineers issued guidance describing BMPs to protect water quality and hydrologic functions when establishing pine plantations in wetlands. The guidance, developed with input from the forest industry, environmental organizations, and state and federal agencies, clarifies the circumstances under which certain silvicultural activities are allowed in forested wetlands.

The first part of the guidance describes which wetland types require a 404 permit for mechanical site preparation for pine plantations.

Establishing pine plantations in wetlands is common in the Southeast. Ongoing agricultural and silvicultural activities are considered exempt from permitting under Section 404(f) of the Clean Water Act, unless they pose environmental problems. However, preparation of a site often includes land-clearing activities that can compact and erode soil and cause turbidity and hydrologic changes in wetlands. EPA and the Corps expect the BMPs described in the second part of the guidance to protect wetland functions as well as water quality.

The selected practices are a composite of those developed by states in the Southeast. They include

- avoiding excessive soil disturbance and compaction;
- placing windrows to limit erosion, overland flow, and runoff;
- avoiding disposal of logs or debris adjacent to water;
- maintaining the natural contours of the site and ensuring that activities do not immediately or gradually convert the wetland to a nonwetland; and
- conducting activities with appropriate water management mechanisms to minimize off-site water quality impacts.

Guidance Specifies BMPs for Forested Wetlands (continued)

In a related matter, industry and environmental groups reached an agreement that ended years of litigation over the conversion of a forested wetland into a pine plantation in North Carolina. Environmental groups claimed the Weyerhauser Corporation improperly converted a forested wetland known as the Parker Tract into a pine planation, but Weyerhauser said the conversion was exempt under the Clean Water Act.

Other terms of the agreement included managing the Parker Tract to protect certain natural values. Industry representatives have also committed to working together to protect rare wetlands throughout the Southeast.

[For a copy of the guidance, call EPA's Wetlands Information Hotline at 800-832-7828.]

Related Resource for Forested Wetland BMPs

Federal agencies with wetland-related responsibilities worked together to develop *Forested Wetlands: Functions, Benefits, and Best Management Practices*, a 62-page manual that explains the environmental processes of various wetlands and describes forestry BMPs to protect them.

To obtain a copy of publication #NA-PR-01-95, contact USDA Forest Service, Northeastern Area, 100 Matsonford Rd., 5 Radnor Corp. Center, Suite 200, Radnor, PA 19087-4585.

Please Don't Feed the Geese . . . New Jersey Planning Boards Release "Lake Tips" Pamphlet Series

Nonpoint source pollution from stormwater runoff and septic systems accounts for 80 percent of the pollution in New Jersey's Upper Musconetcong watershed. In an effort to tackle the watershed's NPS problem, the Lake Hopatcong and Lake Musconetcong regional planning boards together created a series of informational pamphlets on NPS. The series is the outreach component of a federal 205(j) Clean Water Act grant awarded by the New Jersey Department of Environmental Protection to assist the boards in developing a regional nonpoint source strategy.

To help educate property owners about the sources and impacts of NPS in their watershed, the planning boards — volunteers from towns, counties, and the state who represent the interests of nearly 4,000 lakefront property owners — developed seven "Lake Tips" pamphlets, each targeting a specific aspect of NPS pollution:

- **Detergents and Phosphates** explains how one pound of phosphorus added to cleaning products can cause 500 pounds of algae to grow. The average person contributes four pounds of phosphorus to wastewater each year. The pamphlet provides a list of phosphate-free cleaning agents for lakefront property owners to use.
- **A Homeowner's Guide to Reducing Nonpoint Source Pollution** encourages lakefront homeowners to establish vegetated buffers between their lawns and the lake, minimize paved surfaces, use native plants, stabilize soil, compost yard waste, and prevent automotive and boat maintenance products from entering the lake.
- **Water Conservation** illustrates how reducing water use prevents septic system failure.
- **Please Don't Feed the Geese** explains that feeding ducks and geese can discourage migration, resulting in excess nutrients and fecal bacteria in the lake. This problem is so significant that the watershed now has an ordinance against feeding geese.
- **Septic Management: Four Steps to Minimize Septic Impacts** outlines how property owners can keep septic systems functioning smoothly to protect the lake.
- **Your Lawn and Your Lake** describes how fertilizers can impact the lake and why organic fertilizers that release nutrients slowly are preferred over inorganic fertilizers that may leach rapidly through the soil.
- **Preventing Nonpoint Source Pollution** provides an introduction to NPS.

Please Don't Feed the Geese . . . (continued)

The planning boards have used targeted mailings to distribute the pamphlets. They are also distributing them at Save the Lake Days, marinas, and municipal buildings.

Representatives from towns, counties, and states in each watershed volunteer their time to serve on the planning boards as advisors representing the interests of lakefront property owners. Hopatcong Borough Mayor Clifford L. Lundin represents his borough on the Lake Hopatcong Regional Planning Board. Explaining what fueled his interest and sparked the educational effort, Lundin said, "The lake is our resource — we're preserving it for the future."

The comprehensive approach taken by the planning boards in the NPS awareness series is enhanced by the realization that their effort grows out of the interest of concerned lake residents.

[For more information on the nonpoint source investigation and analysis of the Upper Musconetcong River watershed, or to obtain copies of individual sets of the pamphlet series (no charge), contact Clifford R. Lundin, c/o the Lake Hopatcong Regional Planning Board, P.O. Box 254, Succasunna, NJ 07876. Fax: (201) 770-0301.]

Planning Tools for Urban Watersheds — New Handbook Series

The first three handbooks in a new Environmental Land Planning Series funded by an EPA Assessment and Watershed Protection Division grant to the Metropolitan Washington Council of Governments provide guidelines for different aspects of urban stream protection:

- **Site Planning for Urban Stream Protection.** Authored by Tom Schueler of the Center for Watershed Protection, this handbook presents a watershed approach to site planning. It examines nonstructural approaches to reducing pollutant loads and protecting aquatic resources. *Site Planning* offers insight into the importance of imperviousness, watershed-based zoning, concentration of development, and other land planning topics (232 pages, $35).

- **Clearing and Grading Strategies for Urban Watersheds.** Authored by Kathleen A. Corish of the Metropolitan Washington Council of Governments, this handbook examines the water quality impacts of clearing and grading in urban watersheds. Its primary focus is on minimizing sediment loading to urban streams (107 pages, $25).

- **Riparian Buffer Strategies for Urban Watersheds**. Authored by Lorraine M. Herson-Jones, Maureen Heraty, and Brian Jordan of the Metropolitan Washington Council of Governments, this handbook provides guidelines for using riparian buffers to mitigate stream impacts in urban areas. It investigates pollutant removal potential and prevention techniques associated with chemical, biological, and physical processes in buffers and offers design recommendations (112 pages, $20).

Two additional handbooks in the Environmental Land Planning Series are scheduled for release later this year: *Cluster Development Strategies for Urban Watersheds*, and *Residential Street Strategies for Urban Watersheds.*

[Copies of the Environmental Land Planning Series handbooks are available from the Metropolitan Washington Council of Governments, 777 North Capitol Street, NE, Suite 300, Washington, DC 20002-4226. Phone: (202) 962-3200; fax: (202) 962-3201. Site Planning for Urban Stream Protection, *the first handbook in the series, is also available from the Center for Watershed Protection ($35), 8737 Colesville Road, Suite 300, Silver Spring, MD 20910. Phone: (301) 589-1890; fax: (301) 589-8745.]*

New Directory Puts Watershed Tools at Your Fingertips

EPA's new *Watershed Tools Directory* is a useful collection of 250 watershed tool summaries canvassed from EPA headquarters and regions, other federal agencies, states, and watershed organizations. The watershed tools described in the document include those for conducting

New Directory Puts Watershed Tools at Your Fingertips (continued)

modeling and assessments. Each summary includes a description of the tool, contact names and phone numbers, and information about intended uses.

The Directory can be accessed on-line at http://www.epa.gov/OW/watershed/tools

A form is provided for adding your own watershed management tool to the directory. Updates will be completed as new tools are received.

For more information, contact Chris Laabs, Watershed Branch (4503F), U.S. EPA, 401 M St., SW, Washington, DC 20460. Phone: (202) 260-7030. A copy of Watershed Tools Directory *(841-B-95-005) can also be obtained from NCEPI, 11029 Kenwood Road, Building 5, Cincinnati, OH 45242. Phone: (513) 489-8695.*

New Pubs from EPA Target Lakes, TMDL Development, Ecological Restoration

■ **Clean Lakes.** EPA recently published two new case studies to highlight lake management techniques used successfully in projects sponsored by the federal Clean Lakes Program:

Phosphorus Inactivation and Wetland Manipulation Improve Kezar Lake, New Hampshire (EPA/841-F-95-002)

Watershed and Inlake Practices Improve Green Valley Lake, Iowa (EPA/841-F-95-003)

The case studies are available on the Internet at http://www.epa.gov/OWOW/LAKES or from NCEPI (see ordering information below).

■ **TMDL Development.** Released in May, *TMDL Development Cost Estimates: Case Studies of 14 TMDLs* (EPA/R-96-001) presents the results of a study of Total Maximum Daily Loads initiated by EPA's Office of Water to provide information to state and local water pollution control agencies. (See ordering information below.)

■ **Ecological Restoration Guide.** *Ecological Restoration: A Tool To Manage Stream Quality* (EPA/841-F-95-007) has four related objectives: (1) to explain and clarify Clean Water Act authorities for stream restoration, (2) to examine linkages between restoration techniques and state water quality parameters, (3) to help water program managers determine when to pursue restoration, and (4) to compare the cost-effectiveness of restoration with traditional water quality management tools.

Ecological Restoration can be browsed on the Office of Water's web site: http://www/epa.gov/OWOW/watershed.html.

To order copies of these three documents, contact NCEPI, 11029 Kenwood Road, Building 5, Cincinnati, OH 45242. Fax: (513) 489-8695. Include the appropriate EPA publication number in your request.

■ **Report Links Water Quality to Economic Improvements.** *Liquid Assets*, an EPA report released Memorial Day weekend, examines water's importance in five key industrial sectors. It shows how clean water brings billions of dollars into the American economy and brings jobs and profits to local communities. Free from U.S.EPA's Water Resources Center, (202) 260-7786. Or look on EPA's web site at http://www.epa.gov

Managing Change in Rural Communities — The Role of Planning and Design

This report describes a study of rural communities in which landscape architects helped local people take advantage of resources and opportunities to promote sustainable development and solve environmental problems. It contains case studies of communities in Georgia, Iowa, and Utah, and was developed by the National Endowment for the Arts and the USDA Natural Resources Conservation Service. For free copies, call the Soil and Water Conservation Society at 1-800-THE-SOIL.

National Award Will Honor Watershed Protection Leaders — Applications due August 15, 1996

CF Industries, one of North America's largest interregional farmer-owned cooperatives, has established the nation's first national watershed award. Each year, three communities and one corporation will be honored for their innovative, nonregulatory approaches to protect America's watersheds.

Particular emphasis will be placed on local partnerships that demonstrate the success of economic incentives, voluntary initiatives, and education. Nominations for the first CF Industries Watershed Award are due August 15, 1996.

The award, administered by The Conservation Fund, is an outgrowth of the National Forum on Nonpoint Source Pollution, which identified and implemented nonregulatory approaches to problems arising from nonpoint source pollution.

To be eligible, programs must have been operating for six months, exceed legal requirements or existing regulations, and be willing to make all nonproprietary information available to others wishing to emulate the program. Each entry will be judged on five criteria:

- stakeholder representation,
- community outreach,
- innovative nonregulatory action,
- interdisciplinary approach, and
- achievement of measurable goals.

Application forms are available from the Terrene Institute. They should be submitted along with a two-page program narrative, three independent references (evaluations), and any supporting documents such as photographs, videotapes, newspaper articles, illustrations, or graphs depicting the program's achievements. The supporting documents may not substitute for the two-page narrative, and the evaluations must be received with the application.

"The National Forum succeeded because it brought all sectors together to focus on consensus-based solutions," said Robert C. Liuzzi, CF Industries president and chief operating officer. "By honoring outstanding partnerships that balance a watershed's economic and environmental needs, we hope this award will serve as an incentive for many similar success stories at the local level."

CF Industries is owned by and serves 11 regional cooperatives. Its nitrogen, phosphate, and potash fertilizer products reach over one million farmers and ranchers in 46 states and two Canadian provinces. The Conservation Fund is an national nonprofit organization that seeks innovative long-term measures to conserve land and water.

For an application or additional information, write to CF Industries National Watershed Award, c/o the Terrene Institute, 4 Herbert Street, Alexandria, VA 22305; e-mail: terrene@gnn.com. Phone: (703) 548-5473; fax: (703) 548-6299; http://www.e2b2.com.

New Guidance on State NPS Programs

U.S. EPA and state agencies have collaborated on a new streamlined approach for state nonpoint source programs. Detailed in the *Nonpoint Source Program and Grants Guidance for Fiscal Year 1997 and Future Years*, the revised guidance:

- Encourages states to upgrade their NPS programs to achieve key program elements.
- Eliminates competitive grants and provides predictable funding levels based on Congressional appropriations.
- Streamlines the grant award and reporting process by giving states more flexibility in how they use 319 funds and by reducing their reporting responsibilities.
- Rewards "nonpoint source enhanced benefits states" that achieve all key program elements by further streamlining grant award and reporting procedures for those states.

The guidance can be obtained from the Nonpoint Source Control Branch (4503F), U.S. EPA, 401 M St. SW, Washington, DC 20460; fax: (202) 260-7024 or it can be accessed on the World Wide Web at http://www.epa.gov/OWOW.

Datebook

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

Meetings and Events

1996

July

17-20 — *Northwest Aquatic & Marine Educators Regional Conference,* Seattle, WA. Sponsored by Northwest Aquatic and Marine Educators (NAME). Contact Mike Spranger, Sea Grant. (206) 695-9261.

23-26 — *Courses to Advance Knowledge of Erosion Control,* Santa Barbara, CA. Sponsored by the International Erosion Control Association (IECA). Contact IECA, P.O. Box 774904, Steamboat Springs, CO 80477-4904. (800) 455-4322. or (970) 879-3010. Fax: (970) 879-8563.

25-28 — *Courses to Advance Knowledge of Erosion Control,* Indianapolis, IN. Sponsored by the International Erosion Control Association (IECA). Contact IECA, P.O. Box 774904, Steamboat Springs, CO 80477-4904. (800) 455-4322 or (970) 879-3010. Fax: (970) 879-8563.

August

3-7 — *The Fifth National Volunteer Monitoring Conference Promoting Watershed Stewardship,* Madison, WI. Sponsored by the U.S. EPA, Wisconsin Department of Natural Resources, and the University of Wisconsin-Madison. Contact Celeste Moen, Wisconsin DNR, WR2, P.O. Box 7921, Madison, WI 53707. Fax: (608) 267-2800. E-Mail: moenc@dnr.state.wi.us.

5-7 — *Working with Wetlands and Wildlife,* Denver, CO. Sponsored by the Wildlife Habitat Council. A workshop offered in six U.S. cities to establish dialog among land managers, government regulators, and conservationists on managing wetlands resources for maximum ecological and human benefit. Contact WHC, 1010 Wayne Avenue, Suite 920, Silver Spring, MD 20910. (301) 588-8994. Fax: (301) 588-4629. E-Mail: WHC@cais.com.

6-9 — *Design of Stormwater, Sediment, and Erosion Control Systems,* Oklahoma State University. Workshop in the field of erosion control. Contact George Collington, Oklahoma State University Engineering Extension. (405) 744-5714. Fax: (405) 744-5369.

11-13 — *Seventh National Conference on Drinking Water: "Balancing Risks and Reasons,"* 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.

29-30 — *Stormwater Management Modeling Workshop with the USEPA SWMM4 model,* Halifax, NS. Sponsored by the Canadian society of Civil Engineering. Contact Lyn James, CHI, 36 Stuart St., Guelph, ON, Canada, N1E 4S5. (519) 767-0197. Fax: (519) 767-2770. E-Mail: info@chl.on.ca.

September

9-11 — *Texas Water Monitoring Congress,* Austin, TX. Sponsored by Army Corps of Engineers, USGS, TX Natural Resource Conservation Commission, TX Water Development Board, TX Parks and Wildlife Department, TX Water Resources Institute, Brazos River Authority. Contact Cindy Billington, USGS. (713) 718-3655, ext. 10. E-Mail: ccbillin@usgs.gov.

11 — *Watershed Protection Seminar for Water Supplies,* Westford, Massachusetts. Contact Eileen Pannetier, Comprehensive Environmental Inc. (CEI). (508) 470-3310. or Jacqueline Morris at NEWIPCC. (508) 658-0500.

22-25 — Yesterday's Investment, Tommorrow's Protection: A Look at the Condition of Small Watershed Improvements in the U.S., Oklahoma City, OK. contact: National Watershed Coalition, 9150 W. Jewell Avenue, Suite 102, Lakewood, CO 80232. (303) 988-1810.

1996
September

22-26 — *32nd Annual Conference and Symposium on GIS & Water Resources,* Fort Lauderdale, FL. Sponsored by the American Water Resources Association and others. Contact American Water Resources Association, 950 Herndon Parkway, Suite 300, Herndon, VA 20170-5531. (703) 904-1225. Fax: (703) 904-1228. E-Mail: awrahq@aol.com.

23-25 — *Working with Wetlands and Wildlife,* San Francisco, CA. Sponsored by the Wildlife Habitat Council (WHC). (See August 5-7 for description and contact information.)

October

22-23 — *Agriculture and Water Quality in the Pacific Northwest: Understanding Each Other and Working Together,* Yakima, WA. Sponsored by WSU and OSU Cooperative Extensions, USGS, USDA, DOE, and others. (509) 838-6685.

22-24 — *National NPS Pollution Information/Education Conference,* Chicago, IL. Sponsored by Illinois Environmental Protection Agency, in cooperation with USEPA and the Northeastern Illinois Planning Commission. The conference will focus on providing examples of successful outreach programs and materials dealing with nonpoint source pollution. Contact Christy Trutter, Illinois EPA, Bureau of Water, 2200 Churchill Road, P.O. Box 19276, Springfield, IL 62794-9276. (217) 782-3362. Fax: (217) 785-1225.

23-25 — *Sixth Biennial Watershed Management Conference,* Stateline, NV. Contact Gina Ferrell, University of California, Davis, Centers for Water and Wildland Resources, 1323 Academic Surge, Davis, CA 95616-8750. (916) 752-7999. E-Mail: gmferr@ucdavis.edu

November

5 — *Symposium on Agricultural Phosphorus and Eutrophication,* Indianapolis, IN. Sponsored by the American Society of Agronomy in cooperation with the Soil Science Society of America. Contact T.C. Daniel, 115 Plant Science Building, Department of Agronomy, University of Arkansas, Fayetteville, AR 72701. (501) 575-5720. Fax: (501) 575-7465. E-Mail: tdaniel@comp.uark.edu.

15-17 — *Urban Streams Conference,* Arcata, CA. Sponsored by the city of Arcata, the conference will include sessions on treating streams in urban areas and working with the natural properties of streams. Contact Susan Schramm, Conference Coordinator, Environmental Services Department, City of Arcata, 736 F Street, Arcata, CA 95521. (707) 822-8184. E-Mail: creeksconf@aol.com.

Call for Papers—Deadlines

1996
July

29 — *Fourth International Conference on Remote Sensing for Marine and Coastal Environments,* Orlando, FL, March 17-19, 1997. Sponsored by ERIM, NOAA, Environment Canada, RadarSat International, Florida Region of ASPRS, MTS, and others. Contact ERIM/Marine Conference. (313) 994-1200, ext. 3234. Fax: (313) 994-5123. Web: http://www.erim.org/CONF/conf.html.

August

30 — *Fourth International Conference on Water Pollution Modeling, Measuring, and Prediction,* Bled, Slovenia. June 18-20, 1997. Organized by the Wessex Institute of Technology, UK; the University of Ljubljana, faculty of Civil Engineering; and Geodesy, Slovenia. Contact Liz Kerr, WATER POLLUTION '97 Secretariat, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton SO4O 7AA, United Kingdom. Phone: 44-1703-293-223. Fax: 44-1703-292-853. E-Mail: wit@wessex.witcmi.ac.uk.

September

1 — *Charting the Future of Coastal Zone Management,* Boston, MA. July 20–26, 1997. Contact Dr. Martin C. Miller. USACE Waterways Experiment Station, ATTN: CEWES-CR-O, 3909 Halls Ferry Road, Vicksburg, MS 39180.

Coupon

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Nonpoint Source NEWS-NOTES is an occasional bulletin dealing with the condition of the water-related environment, the control of nonpoint sources of water pollution, and the ecosystem-driven management and restoration of watersheds. NPS pollution comes from many sources and is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural pollutants and pollutants resulting from human activity, finally depositing them into lakes, rivers, wetlands, coastal waters, and groundwater. NPS pollution is associated with land management practices involving agriculture, silviculture, mining, and urban runoff. Hydrologic modification is a form of NPS pollution that often adversely affects the biological integrity of surface waters.

Editorial contributions from our readers sharing knowledge, experiences, and/or opinions are invited and welcomed. (Use the COUPON on page 31.) However, *NEWS-NOTES* cannot assume any responsibility for publication or nonpublication of unsolicited material or for statements and opinions expressed by contributors. All material in *NEWS-NOTES* has been prepared by the staff unless otherwise attributed. For inquiries on editorial matters, call (202) 260-3665 or FAX (202) 260-1517.

For additions or changes to the mailing list, please use the COUPON on page 31 and mail or fax it in. We are not equipped to accept mailing list additions or changes over the telephone.

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