



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*

Notes on the National Scene

Weather Reports and Watershed Protection: A Winning Combination

There's a saying that "Everyone talks about the weather, but nobody ever does anything about it." Well, that might not be quite true anymore. The National Environmental Education and Training Foundation (NEETF) has teamed up with a number of public and private partners, including River Network, the Metropolitan Washington Council of Governments, the Environmental Protection Agency, the National Ocean Service, the Forest Service, and several foundations, on an innovative project to use local TV weather reports to educate the public about watersheds. It will start with a pilot on the Chesapeake Bay and could eventually bring environmental education into nearly everyone's living room. Consider the following:

- More people tune into the weather report on television than any other segment of local news—including sports.
- Weather reports use visual images to communicate complex scientific terms and ideas. "Satellite data" and "Doppler radar" are two such terms that now are part of the mainstream vernacular.
- Web sites affiliated with local news broadcasts receive millions of hits each month.
- Weather broadcasts and watersheds are a match in other ways as well. The very functioning of a watershed begins with the weather. A regional watershed, such as the Potomac watershed in the Washington, D.C., area, often mirrors the viewing area of the local TV station. Every community is part of a watershed. And watersheds are, after all, based on water—the essence of life and the major topic of most weather reports.

Inside This Issue

Notes on the National Scene

Weather Reports and Watershed Protection: A Winning Combination . . .	1
New National Garden to Include Rooftop Runoff Recycling	3
State/EPA Partnership Adding to Knowledge About Nonpoint Source Management	4
National Highway Research Study Says Highway Leachate Not Likely to Degrade Water Quality.	6

News from the States, Tribes, and Localities

Study Sparks Interest in Increasing Houston's Urban Forests	7
New Pennsylvania Program Paves the Way in Dirt and Gravel Road Maintenance	9
Manual on Maintaining Unpaved Roads Available	10

Notes on Watershed Management

Teaching Outdoor Recreationists to Tread Lightly	11
Workshop Explores the "New" Watershed Approach	12
Beyond Water Chemistry: Utah Shows Good Watershed Chemistry. . . .	14
What's New at Nippersink? Something Old	16
Landscaped Rain Gardens Offer Stormwater Control	18
Urban Growth Leaves Its PAH Signature in Lake Sediments.	20

Agricultural Notes

Got [Environmentally Friendly] Milk?	21
--	----

Technical Notes

Unique Gel Is an Unconventional Way to Water	23
Soybean Hulls Eyed for Wastewater Filtering.	24
San Diego's Innovative Approach to Improve Detection of Sewer Spills . .	25

Notes on Education

Second National Information and Education Conference a Success	25
Research Station Teaches Watershed Stewardship	26

Reviews and Announcements

Secret Agent Worms Teach About Erosion in <i>The Disappearing Earth</i> . . .	28
<i>Demonstrations in Soil Science</i> Manual Available	28
Greening School Grounds: Creating Habitat for Learning	28
Bird Conservation Plans Available	28
2001 Educator's Guide Helps Explore Nature in Your Neighborhood . . .	29
New Nonpoint Source Posters Released	29
New Video Demonstrates Streamside Planting Techniques	29
New Watershed Academy Web Module Available	29
EPA Watershed Training Opportunities Updated	29

Web Sites Worth a Bookmark

River Network's Library of Resources.	29
Pennsylvania Organization for Watersheds and Rivers	30

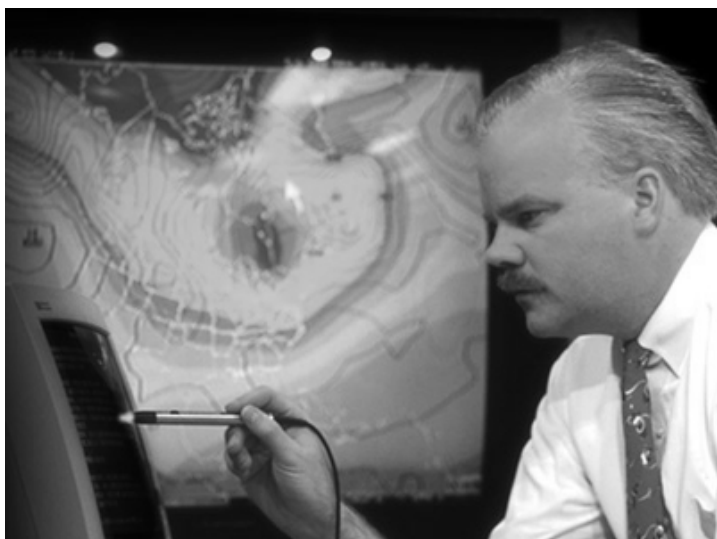
DATEBOOK	30
---------------------------	----

THE COUPON	31
-----------------------------	----

To understand watersheds, it helps to know that what comes from the tap actually is drawn from the ground or a nearby water body. This might seem pretty elementary, but an NEETF/Roper survey in 1998 (*The National Report Card on Safe Drinking Water Knowledge, Attitudes and Behaviors: A Survey of Adult Americans*) found that fewer than a third of American adults could select the definition of a watershed from a simple multiple choice quiz, and there is reason to believe that fewer than 1 percent could define one if you asked them directly. Just 25 percent of Americans know where their water originates, but the vast majority consume water directly from the tap—from sources other than their own land.

Weather reports provide a unique opportunity to help people understand complex natural systems. Moreover, a TV meteorologist could easily incorporate succinct “dos and don’ts” and tips for “green” practices into a weather report:

- What to do with used oil after changing a car’s oil or the best way to dispose of leaves in the fall.
- Cause-and-effect relationships—the way poor land use can result in dangerous flooding, how grease from parking lots winds up in adjacent streams, or what happens to the trash thrown into street gutters.
- Pre-storm advice to viewers encouraging them to avoid applying lawn chemicals or engaging in activities that might lead to soil erosion.



NEETF is joined in testing this approach by NBC’s WRC-TV (Channel 4) in Washington, D.C., and stormcenter.com, which is headed by highly regarded meteorologist Dave Jones. The system Jones has developed displays high-resolution, three-dimensional maps of local watersheds for use by TV meteorologists on WRC-TV and for the station’s WeatherNet4 web site at nbc4.com. The maps are compiled from existing satellite and radar technology and are displayed in a manner that replicates a moving “fly over” of the region. Jones sees the watershed pilot as step one in a broader effort to remake the average TV *weather* report into a useful local *environmental* report.

The on-air graphics program will be supplemented by WRC-TV’s popular web site, nbc4.com, which receives 2 to 3 million hits a month. To actively involve the

community, two new sections of the WeatherNet4 web site—*Interactive Environment* and *Watershed Watchers*—will be developed. Providing inquisitive people with the opportunity to “drill down” and obtain progressively more detailed information should significantly increase the public’s understanding of watersheds.

The *Interactive Environment* web site will give the public information on the condition of watersheds and land-use issues in their local area and subwatersheds. Thanks to a grant from EPA’s EMPACT (Environmental Monitoring for Public Access and Community Tracking) program, continuous monitoring data from several sites in the Chesapeake Bay will be presented, including data related to critical submerged aquatic vegetation, fish kills, and the toxic microbe *Pfiesteria*. Maryland’s Department of Natural Resources, the National Aquarium in Baltimore, the Chesapeake Bay Biological Laboratory, and the Virginia Institute of Marine Sciences—other EMPACT program partners—will assist with data collection, transmission, and display. In addition, water quality data collected by volunteer monitoring groups and local school groups will be posted on the *Watershed Watchers* site, modeled after WRC-TV’s popular Weather Watchers Network.

The WeatherNet4 web site will also provide watershed conservation tip sheets, examples of watershed curricula for use by schools, and links to community groups, local watershed organizations, and government agencies engaged in watershed protection.

The outlook for the project is promising. NEETF is confident that this year's prototype will prove to be a positive and effective way to raise the bar on the environmental knowledge and habits of the average American. Look for the first on-air watershed reports in early 2002!

[If you would like a copy of the National Report Card or would like more information, contact Susanna Spencer, NEETF, (202) 833-2933; web site www.neetf.org.]

New National Garden to Include Rooftop Runoff Recycling

Along Independence Avenue near the Capitol, George Washington's influence is embodied in the United States Botanic Garden (USBG), the oldest continuously operating botanical garden in the county. Our first president believed a botanical garden would help educate people about the science of raising plants. To help keep Washington's original vision alive in the 21st century, the USBG is planning a new addition to the Botanic Garden Conservatory—the National Garden. The National Garden will serve as a hands-on, living laboratory for environmental, horticultural, and botanical education for visitors of all ages. Through displays, exhibits, and educational programs, the new facility will help visitors understand their role in preserving and protecting the environment.

The 3-acre National Garden site will incorporate many design elements that demonstrate environmental stewardship in action. One example is the capture and storage of rooftop runoff in a two-part cistern underground. One side of the fully automated cistern will carry the roof water to the Showcase Garden, a display of flowers, trees, shrubs, grasses, and herbs that flourish in the Mid-Atlantic region. In drought conditions the water supply of this side of the cistern will be supplemented by tap water. The other side of the cistern, however, is dedicated solely to providing water to the Showcase Garden bog, which requires a pure water source of low pH (clean rainwater). Tap water will not be added to this side of the cistern during drought conditions. "The bog plants are resistant to occasional drought, so we won't lose the plantings if it doesn't happen too often," explains Christine Flanagan, Public Programs Coordinator at the USBG. The cistern is sized to accommodate most of the runoff in an average year's rainfall. If heavy rains fill up both cisterns, the bog, and water features of the garden, the excess roof runoff will be directed into the sewer system.

In addition to providing a source of water for the National Garden, recycling rooftop runoff reduces the amount of stormwater flowing into the city's storm drain network. Without on-site treatment, roofs in urban areas typically function like any other impervious surface in the landscape. That is, water flows off the roof, travels through drain pipes into the street, and then flows downslope into a storm drain. Because the National Garden will store runoff for later use, the rooftop will be disconnected from this chain of impervious surfaces leading to the storm drain. Developed areas that incorporate on-site practices that reuse, infiltrate (e.g., through the use of dry wells), or divert runoff to pervious areas are desirable because they reduce the peak flows of small storms. This, in turn, reduces costs associated with storage requirements downstream as well as possible impacts on wetlands and natural areas. In addition, treating rainwater on-site generally promotes ground water recharge.

Visitors to the National Garden will learn more about the movement of water in the landscape by following a succession of features that mirror a natural drainage. Included in the walk are a bog, a braided stream, and a slow-moving riverine habitat. In addition, the garden will feature

- The First Ladies' Water Garden, honoring the First Ladies' contributions to the nation.
- The Rose Garden, featuring historical, popular, and relatively low maintenance varieties from all eight classes of the ornamental rose, our national flower.
- The Butterfly Garden, showcasing scented and nectar-producing plants.
- The Lawn Terrace, a manicured expanse of grass intended for picnics and special events.
- The Garden Pergolas, featuring arbors and trellises of ornamental plants.
- The Showcase Garden, highlighting water features, a bog wetland habitat, and native plants.
- The Senator John Heinz Environmental Learning Center, designed to educate the public.

The Environmental Learning Center will include a multipurpose lecture hall, a classroom, a library, and an outdoor amphitheater. "The Center is meant to be a general learning facility for the botanic garden. We will have gardening lectures, professional conferences, children's programs, teacher training, school field trips, distance learning, certificate classes, and other educational services," notes Flanagan. Through some of its educational events, the Center will bring together teachers, leaders, policy makers, scientists, law makers, and others who affect the nation's environmental policy and environmental education, math, and science literacy programs.

Construction on the USBG's National Garden will begin in the summer of 2001 and should be completed in 2003 at an estimated cost of \$14 million. The project is being funded entirely by private donations raised through the National Fund for the U.S. Botanic Garden, a nonprofit organization established to raise and administer funds for the development and construction of the National Garden. Key donors have included corporations, individuals, and organizations. For example, the National Council of State Garden Clubs coordinated with their 350 clubs across the country to arrange for each to purchase a \$1000 paving stone to be included in a walkway leading to the butterfly garden. These funds made the construction of the butterfly garden possible. Through generous donations such as this, the National Fund has already raised \$15 million. Any funds in excess of the project cost will be placed in an endowment to be used for educational programs at the garden.

[For more information, contact Christine Flanagan, Public Programs Coordinator, United States Botanical Garden, 245 First Street, SW, Washington, DC 20024. Phone: (202) 225-1269; e-mail: cflanaga@aoc.gov; web site: www.nationalgarden.org/what.]

State/EPA Partnership Adding to Knowledge About Nonpoint Source Management

The workgroups of the State/EPA Nonpoint Source Management Partnership have been making progress in implementing their action plans to address priority nonpoint source problems. Formed in April 2000 at a national nonpoint source meeting sponsored jointly by the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA) and EPA, the Partnership aims to provide states with tools to address nonpoint source pollution problems at a watershed scale. (For more information on the Partnership, see the December 2000 issue of *Nonpoint Source News-Notes*.) Below is a synopsis of the workgroups' current activities.

Watershed Planning and Implementation Workgroup

The workgroup has begun to review a variety of TMDLs from around the country to identify successful examples and post information about them on both ASIWPCA's and EPA's web sites. For each TMDL, a summary will be developed along with a hot link to a state web site that explains the TMDL.

EPA-sponsored workshops were held around the nation to present information about the TMDL process. In addition, the Agency has created a detailed set of outreach and education opportunities and is developing additional technical workshops to meet the needs of state technical staff and other TMDL practitioners.

Information on water quality and other watershed health indicators is available at a sub-basin scale for most of the nation on EPA's Surf Your Watershed web site. Although this web site is useful for sharing national watershed information, it is less useful to those within the sub-basin that typically plan and work at smaller scales. EPA, together with other federal agencies, is examining ways to make information available and acceptable in greater detail to improve the usefulness of the web site.

Workgroup Contacts: David Roberts, Washington Department of Ecology, (360) 407-6414; Fred Suffian, EPA Region 3, (215) 814-5753; Stuart Lehman, EPA HQ, (202) 260-0494.

Rural Nonpoint Sources Workgroup

The workgroup is analyzing several important aspects of animal waste management that will provide the basis for more detailed discussions. Issues being studied include the barriers to

comprehensive nutrient management plan development and implementation and the benefits of comprehensive nutrient management plans for the agriculture community.

The group is also analyzing measures of success for animal feeding operations (AFOs) and concentrated animal feeding operations (CAFOs) in relation to several categories of measures, including programmatic, environmental, direct, surrogate, and short- and long-term measures. Alternative manure technologies and uses are also being explored.

The workgroup is reviewing data and tools available to state decision makers regarding the pollutant removal efficiency of rural BMPs and evaluating technical reports on BMP effectiveness.

Workgroup Contacts: Don Ostler, Utah DEQ, (801) 538-6381; Hank Zygmunt, EPA Region 3, (215) 814-5750.

National Management Measure Guidance Documents in the Works

- *National Management Measures to Control Nonpoint Source Pollution from Agriculture.* This draft technical guidance was announced in the *Federal Register* on October 17, 2000, and EPA is now addressing public comments. A final guidance is expected this fall. For more information contact Stuart Lehman, U.S. EPA (4503F), 1200 Pennsylvania Avenue, NW, Washington, DC 20460, or e-mail lehman.stuart@epa.gov.
- *National Management Measures to Control Nonpoint Source Pollution from Forestry.* This draft technical guidance was announced in the *Federal Register* in July 2001. For more information contact Chris Solloway, U.S. EPA (4503F), 1200 Pennsylvania Avenue, NW, Washington, DC 20460, or e-mail solloway.chris@epa.gov.
- *National Urban Nonpoint Source Management Measures Guidance.* This draft technical guidance is under development. It is expected to be announced in the *Federal Register* this fall. For more information contact Robert Goo or Rod Frederick, U.S. EPA (4503F), 1200 Pennsylvania Avenue, NW, Washington, DC 20460, or e-mail goo.robert@epa.gov or frederick.rod@epa.gov.
- *National Management Measures Guidance to Control Nonpoint Source Pollution from Marinas and Recreational Boating.* This draft technical guidance was announced in the *Federal Register* on December 4, 2000, and EPA is currently addressing public comments. A final guidance is expected this fall. For more information contact Ed Drabkowski, U.S. EPA (4503F), 1200 Pennsylvania Avenue, NW, Washington, DC 20460, or e-mail drabkowski.ed@epa.gov.
- *National Management Measures to Protect and Restore Wetlands and Riparian Areas for the Abatement of Nonpoint Source Pollution.* This draft technical guidance is under development. For more information contact Chris Solloway, U.S. EPA (4503F), 1200 Pennsylvania Avenue, NW, Washington, DC 20460, or e-mail solloway.chris@epa.gov.
- *National Management Measures for Hydromodification.* This draft technical guidance is under development. For more information contact Chris Solloway, U.S. EPA (4503F), 1200 Pennsylvania Avenue, NW, Washington, DC 20460, or solloway.chris@epa.gov.

Urban Nonpoint Sources Workgroup

The Section 319 Stormwater Phase II workgroup is exploring various options for funding nonpoint source activities and projects in Stormwater Phase II areas. The workgroup seeks to provide as much flexibility as is legally allowable for use of Section 319 funds to implement stormwater control activities. EPA's Office of General Counsel is currently analyzing the workgroup's Phase II issues.

The BMP Effectiveness workgroup is conducting technical reviews of various urban BMPs. The workgroup has also begun developing urban stormwater management and nonpoint source control training that will benefit those who will be regulated under Phase II, those implementing NPS TMDLs, and those trying to identify more results-oriented Section 319 projects.

Workgroup Contacts: Liz Rosenblatt, New Jersey DEP, (609) 633-1349; Donna Somboonlakana, EPA Region 2, (212) 637-3700.

Nonpoint Source Grants Management Workgroup

The workgroup is revisiting the annual grant award process to explore opportunities to expedite the processes for awarding funds to states and to subrecipients and will make recommendations to improve that process.

The workgroup is also comparing how states across the country are funding implementation projects through the request for proposal (RFP) process and will highlight common themes and innovative approaches.

The workgroup is developing a "how-to" guide to clarify federal requirements and provide good examples of state processes for funding subrecipients to implement local NPS projects.

Another document, which highlights how many states have used mini-grants to fund local projects, has been completed.

Workgroup contacts: Norm Marcotte, Maine DEP, (207) 287-7727; Audrey Shileikis, EPA Region 9, (415) 744-1968.

Nonpoint Source Capacity Building and Funding Workgroup

Recognizing that local organizations need to bring together their resource base, technical tools, and legal authority to more effectively manage their land and water resources and prevent nonpoint source pollution, the workgroup will develop an annotated bibliography of some of the best resource materials currently produced. Once the compendium is completed, the

workgroup plans to make it available on the State-EPA NPS Partnership web site at www.epa.gov/owow/nps/partnership.html.

Workgroup contacts: Jim Riordan, Rhode Island DEM, (401) 222-4700, ext. 4421; Mark Nuhfer, EPA Region 4, (404) 562-9390.

Information Transfer and Outreach Workgroup

The workgroup has studied options for conducting a national mass media campaign to educate the public about nonpoint source pollution. It is now planning a campaign that will focus on personal stewardship issues and actions people can take to prevent nonpoint source pollution around the home (e.g., monitoring fertilizer applications, preventing spills into stormdrains).

The workgroup is also compiling a library of successful print and video advertisements and public service announcements. The workgroup will conduct focus group sessions around the country this summer to determine the most effective means of communicating environmental information.

The workgroup is researching existing water curricula used by schools.

Workgroup contacts: Jack Wilbur, Utah Department of Agriculture and Food, (801) 538-7098; Stacie Craddock, EPA HQ, (202) 260-3788.

Nonpoint Source Results Workgroup

The workgroup has reviewed a variety of means by which States could provide to the public better information on the accomplishments being achieved with the use of nonpoint source grants. As a result of this work, EPA has begun work to revise the Section 319 Grants Reporting and Tracking System (GRTS) to incorporate the following new reporting elements, beginning in FY 2002:

- States will precisely geo-locate in GRTS each project funded under Section 319 to provide the public with specific information on where the project is located and what watershed is being restored or protected by the project.
- States will include a project description in GRTS for each project, enabling the public to understand the purpose and goals of the project, and also helping professionals to search (using a built-in word-search capability) for projects that have addressed particular nonpoint source issues or technologies of interest.
- States will use simplified models to estimate the reductions in nutrients and sediments achieved by each project that addresses those pollutants. They will also estimate the amount of wetland acres and riparian miles that are protected or restored.

EPA is issuing final guidance that will spell out the details of these changes to GRTS; the guidance will be available for review at www.epa.gov/owow/nps.

Workgroup contacts: Alan Vicory, ORSANCO, (513) 231-7719; Romell Nandi, EPA HQ, (202) 260-2324.

National Highway Research Study Says Leachate from Cured Construction Materials Not Likely to Degrade Water Quality

Have you ever wondered whether road construction materials like asphalt and concrete additives can affect surface or ground water quality? Thanks to a recent National Cooperative Highway Research Program (NCHRP) study, transportation agencies now have the resources to help answer that question. Funded by the American Association of State Highway and Transportation and the Federal Highway Administration, the \$1.3 million, 6-year study showed that indeed some constituents can leach from construction and repair materials, but in most cases the leachate is benign. Compiling leachate data generated on an array of highway construction materials, a research team from Oregon State University developed an easy-to-use environmental screening methodology that gives highway agencies and industries a way to quickly evaluate specific construction and repair materials (whether new or recycled) that might leach into surface or ground water.

The study, known as NCHRP Project 25-09 (Environmental Impact of Construction and Repair Materials on Surface and Ground Waters), included the testing of six types of asphalt cement, four

types of Portland cement, two types of air-entraining agents, and four types of water reducers. Industrial by-products tested include mine waste and slag, scrap tires, wood preservative, dust palliatives, aggregate, and fly/bottom ash. The team found that some recycled materials, including foundry sand, crumb rubber, and roofing shingles, could be harmful to aquatic organisms in their pure form. In most cases, environmental risk dropped sharply once the pure form of the material was mixed with other components such as aggregate.

Study results showed that materials used in highway construction bind to the other material in the highway and leach out slowly, if at all. Toxicity from leaching that did occur was, in some cases, reduced by soil sorption and degradation processes. The study concludes that for all conventional materials, as well as most recycled materials, the leachate from the highway materials has little or no environmental impact.

New Resources Available

Based on their study, the research team developed a series of tools that transportation agencies can use to measure how highway construction and repair materials could affect surface and ground waters in environments surrounding highway rights-of-way. These technologies include the following:

- Laboratory methods that simulate the leaching of constituents from construction and repair materials in typical highway environments.
- Laboratory methods that evaluate the removal, reduction, and retardation of leached constituents by environmental processes in the highway right-of-way.
- A database of laboratory test results, expressed as both aquatic toxicity and chemical concentrations, for tests on materials ranging from common construction and repair products to waste and recycled materials proposed for use in highway construction.
- A software program, IMPACT, that estimates the fate and transport of such leachates in the environment surrounding the highway right-of-way. The IMPACT software draws primarily on the laboratory test results database. In cases where a material was not tested by the researchers, the software can help determine that material's contamination potential.

To communicate the study results, the Oregon State University research team summarized its findings and methodology tools in a comprehensive five-volume guidance report. The team also prepared a 17-page primer (*Primer: Environmental Impact of Construction and Repair Materials on Surface and Ground Waters*, NR 443) that explains the basics of the study. All five volumes, the primer, and the IMPACT software will be available on CD-ROM from the Transportation Research Board, National Research Council, 2101 Constitution Avenue, NW, Washington, DC 20418 and can be ordered on-line at www.nationalacademies.org/trb/bookstore (search on report number).

The tools provided by the study not only will help highway agencies protect the environment but also will help agencies explain to the public why they are using—or not using—a particular material in a construction and repair project. The leachate data and assessment methodology will serve as a management and decision-making tool for state highway engineers and managers, public interest groups, environmental advocacy groups, and regulatory agencies that are involved in reviewing new materials for highway construction and rehabilitation.

[For more information, contact Ed Drabkowski, U.S. EPA Liaison Representative to the Transportation Research Board, U.S. EPA (4503F), 1200 Pennsylvania Avenue, NW, Washington, DC 20460. Phone: (202) 260-7009; e-mail: drabkowski.ed@epa.gov.]

News from the States, Tribes, and Localities

Study Sparks Interest in Increasing Houston's Urban Forests

Tree cover in Houston, Texas, is decreasing, according to a study released in December 2000 by American Forests (www.americanforests.org), the nation's oldest nonprofit conservation organization. The city's average tree canopy cover is currently at 30 percent, down from 46 percent coverage

measured in 1972. This tree cover loss has reduced the presence of vegetation to intercept, store, and absorb precipitation, which in turn has increased stormwater runoff and decreased ground-water recharge. American Forests estimated that the annual economic benefit of the tree canopy's stormwater detention capacity, based on the avoided cost of managing the stormwater, was \$1.33 billion in 1999, compared to \$1.56 billion in 1972. The loss in tree canopy has also reduced the amount of sulfur dioxide, carbon monoxide, ozone, and particulate matter removed from the atmosphere by approximately 15.3 million pounds annually since 1972—a value of \$38 million per year.

American Forests also explored the benefits of energy savings resulting from shade. Currently, the average cost to cool a Houston residence is more than \$700 per year. American Forests estimated that the temperature reduction afforded by shade trees now saves an average of \$72 per residence year in cooling costs—an overall residential savings of \$26 million. More trees could substantially reduce Houston's temperature and the costs associated with air conditioning.

To reach their conclusions, American Forests studied satellite images of 3.2 million acres within a 50-mile radius of Houston over the time period 1972 to 1999. The organization applied the data to the organization's computer software program called CITYgreen, which they had developed as a tool for policy makers, planners, urban foresters, and citizens to enable them to map and measure the ecological and economic benefits of urban forests.

After determining the current status of Houston's tree canopy, American Forests took the study one step further. Using the CITYgreen software, they estimated the environmental benefits that could be regained if Houston increased its average tree canopy to a reasonable 40 percent. American Forests found that the city could realize a 163 percent increase in stormwater collection benefits, a 25 percent increase in the removal of conventional air pollutants, and a 55 percent increase in carbon dioxide removal. "By increasing the tree cover, Houston residents will enjoy a better quality of life. The city will be cooler, and the air and water will be cleaner," explains Kathy Lord of Trees for Houston, a local nonprofit group involved in Houston's reforestation effort.

The American Forests study was funded by a coalition of local groups, known collectively as Houston Green, that are committed to increasing the number of trees in the city and improving the quality of life for Houston residents. Members of Houston Green include Trees for Houston, U.S. Forest Service, Texas Forest Service, Bayou Preservation Association, Houston-Galveston Area Council, Park People, University of Texas Health Science Center, and Galveston-Houston Association for Smog Prevention.

Can Houston Reverse the Trend?

"We are already working toward the 40 percent goal suggested by American Forests," says Lord. "We are partnering with other Houston Green organizations to apply for a grant from the Department of Transportation to plant trees on the freeways. We are also working with neighborhood groups, city councils, and others to increase awareness and encourage tree planting."

These efforts are but a few under way by Houston Green. The coalition has developed an ambitious action plan dedicated to increasing tree cover and improving the quality of life for Houston residents. One large element of the plan includes planting 5 million trees in the Houston area by 2012 and at least 100,000 trees each year after that. To meet this goal, Houston Green plans to work closely with city and county governments to create or amend landscaping ordinances, plant trees along city streets and freeways, develop better master plans, create or expand urban parks, and develop incentives for planting trees on private property. Coalition members will also work closely with the public to encourage tree planting in neighborhoods. The coalition's action plan also includes improving recreational facilities, removing or modifying billboards and other signs, and controlling litter and graffiti.

[For more information, contact Kathy Lord, Trees for Houston, P.O. Box 13096, Houston, TX 77219-3096. Phone: (713) 840-8733; e-mail: info@treesforhouston.org.]

New Pennsylvania Program Paves the Way in Dirt and Gravel Road Maintenance

Pennsylvania's four-year-old Dirt and Gravel Road Maintenance Program is an innovative effort to fund environmentally sound maintenance on portions of unpaved roadways that have been identified as sources of dust and sediment pollution. Although its overriding goal is to prevent sediment pollution from unpaved roads, the program has proven to be remarkable because of the many additional benefits it provides (e.g., better roads, lower maintenance cost, increased environmental awareness, and a dedicated funding source for local municipalities).

Unpaved roads are an important component of the transportation system in Pennsylvania because they serve the heavy hauling industries of agriculture, mining, and logging at the lowest cost to government and industry. Dirt and gravel roads can be properly maintained at a minimal cost, whereas paved roads require periodic costly repairs to maintain. Over time, and with certain traffic volumes, paved roads are far more expensive to maintain than dirt or gravel roads. Also, in addition to being used by the state's largest industries, unpaved roads provide another asset to many rural communities: they benefit the tourism industry. Sixty-five of the state's sixty-seven counties have dirt roads and are involved in the Dirt and Gravel Road Maintenance Program because of sediment pollution. County staff have verified sediment pollution problems due to erosion of dirt and gravel roads at 11,000 sites across the state. Originally, volunteers identified 900 sites to document the state's need for a dirt and gravel road maintenance program.

Overall, the program can be described as a county-level grant program designed to work directly with townships and other municipal or local governments that own unpaved roads that are open to the public. The state legislature intended for the local governments to make decisions on what sediment problems should be fixed, and how they are to be fixed, within guidelines provided through the education of local government officials. Empowering and educating local government officials are two key elements of the program.

As of December 31, 2000, 494 projects had been completed through the Pennsylvania Dirt and Gravel Road Maintenance Program, including the following:

- ◆ Stabilization of 32,200 square feet of ditch drain outlets
- ◆ Stabilization of 69,525 square feet of stream bank
- ◆ Stabilization of 732,848 square feet of ditch
- ◆ Stabilization of 734,573 square feet of road bank
- ◆ Stabilization of 9,992,565 square feet of road
- ◆ Use of 800,250 square feet of fabric
- ◆ Addition of 100,190 cubic yards of road base
- ◆ Addition of 1,700 cross pipes

In addition to the roadwork projects, the DGRMP staff delivered 2-day Environmentally Sensitive Road Maintenance training courses to staff from more than 800 townships. Of those, 220 townships went on to complete at least one project.

The Pennsylvania State Conservation Commission (PASCC) is the state agency that oversees and approves general program policy and makes funding allocations. The PASCC receives \$4 million annually through a dedicated appropriation from the Pennsylvania Motor License Fund for distribution to participating county programs. (Actually, \$5 million is provided for dirt and gravel road maintenance from the Pennsylvania Motor License Fund, but \$1 million automatically goes to the state Department of Conservation and Natural Resources' Bureau of Forestry for use on its 2,500 miles of unpaved roads.) At the local level, the county conservation district is the program administrator. Working together, eligible townships and their county conservation districts make decisions on what to do and how to prevent pollution.

The program is designed to work the same way in each county, according to this general process:

1. The county's conservation district staff is trained to identify (or verify) sections of unpaved public roads with pollution trouble spots (called "work sites") and record them on customized GIS software. That software then generates maps, reports, and grant forms about each site. It also can generate reports about the countywide program, and the data can be analyzed in many ways.
2. County municipalities with identified trouble sites make a project proposal to a four-member advisory Quality Assurance Board (QAB). The QAB consists of a nonvoting chairperson and three voting members: one is from the state Fish and Boat Commission,

another is from the local office of USDA's Natural Resources Conservation Service, and the third is the conservation district's Dirt and Gravel Road Maintenance Program specialist. Considering the recommendations of the QAB and a one-page grant application, the conservation district approves project plans.



This model project was completed under the Pennsylvania Dirt and Gravel Road Pollution Prevention Maintenance Program. The entire area in view had drained large amounts of roadborne sediment directly into the stream at the bridge. The road was raised in places and lowered in others. Roadsides were filled with natural materials. The design of the improvements also now protects the bridge from washing out. In addition to understanding stream flows and energies relating to erosion, one of the key principles conveyed in Environmentally Sensitive Road Maintenance training is to make the end product look as natural as possible.

The 11-member PASCC is the agency responsible for ensuring fair and equitable distribution of the \$4 million. Funds distributed to each conservation district include a portion earmarked for training, research, and education. The final distribution to counties is made according to a formula that takes into account the number of miles of unpaved road in a county, the number of miles of work sites, the local cost of limestone surface aggregate, and the number of miles of work sites originally targeted by the program. There is no application process. The county conservation district, however, does require a single-page, handwritten grant application from participants as part of the contract.

Progress made to date as a result of the program is a direct result of the training of local decisionmakers and project managers. Members of the conservation district staff attend training on environmentally sensitive road maintenance, on the Dirt and Gravel Road Maintenance Program, and on the GIS software that has been specially modified for the program. To qualify for program eligibility, municipal officials attend a 2-day session of Environmentally Sensitive Road Maintenance training. This training includes all aspects of dirt and gravel road maintenance and provides a new way for municipal road officials to think about road maintenance.

[For more information, contact Woodrow Colbert, Program Coordinator, Pennsylvania State Conservation Commission, Dirt and Gravel Road Maintenance Program, Agriculture Building, Room 407, 2301 North Cameron Street, Harrisburg, PA 17110-9408. Phone: (717) 787-2103, e-mail: wcolbert@state.pa.us.]

Manual on Maintaining Unpaved Roads Available

More than 25 percent of the roads in southeast Alabama's and northwest Florida's Choctawhatchee, Pea, and Yellow River watersheds are unpaved. Although it might seem likely that these types of roads would not need much attention, in fact they require constant vigilance and maintenance to fight the number one enemy of dirt roads—erosion. Unfortunately, solutions are not always easy to identify and implement because of the wide variety of conditions and circumstances that can cause erosion. In some areas a roadbed might erode because of poor compaction; in other areas erosion might be caused by inadequate runoff discharge outlets; and in still other areas traffic patterns that loosen soil particles might cause erosion.

Recognizing the need to comprehensively address erosion and other problems associated with unpaved roads, the Choctawhatchee, Pea, and Yellow River Watershed Management Authority (CPYRWMA) worked with a private contractor and local and federal government agencies to develop the *Recommended Practices Manual: A Guideline for Maintenance and Service of Unpaved Roads* (February 2000). The manual, funded in part by an EPA Section 319 grant, describes cost-effective techniques and practices for enhancing the stability and maintenance of unpaved roadways while reducing sedimentation and improving the quality of surface waters in these watersheds. Although developed for the CPYRWMA area, the information presented in the manual is applicable to the management of unpaved roads elsewhere.

Manual Contents

The 60-page manual covers a wide range of construction and maintenance issues, including

- Properly maintaining road surfaces
- Building and maintaining ditches and culverts

- Selecting outlet structures for ditches and culverts that have the least environmental impact
- Stabilizing banks using bank grading techniques, vegetation, and structures
- Incorporating sediment and erosion control tools into the road system
- Considering aesthetics

By providing detailed guidance on how to address these issues, the manual's authors hope to reduce the actual and environmental costs of unpaved roadway maintenance and erosion control incurred by counties and local municipalities. The manual is available for download at www.epa.gov/owow/nps/unpavedroads.html.

[For more information, contact Barbara Gibson, Executive Director, Choctawhatchee, Pea, and Yellow Rivers Watershed Management Authority, 400 Pell Avenue, Collegeview Building, Troy, AL 36082. Phone: (334) 670-3780.]

Notes on Watershed Management

Nonprofit Organization Teaches Outdoor Recreationists to Tread Lightly

Off-highway vehicles (OHVs) are enjoyed by many outdoor enthusiasts. They make the backcountry more accessible for fishing and hunting trips and other forms of recreation. Unfortunately, repeated, and often unintentional, misuse of OHVs can cause significant erosion problems and environmental damage to sensitive habitats.

Educating people that use OHVs about how they can travel off-road with minimal impacts on the landscape is the focus of a new campaign by Tread Lightly!, a Utah-based nonprofit organization. Dedicated to spreading a proactive, low-impact message, the organization was originally created in 1985 as a USDA Forest Service program. It was transferred to the private sector as a nonprofit organization in 1990. Although no longer funded by the federal government, Tread Lightly! maintains strong ties with many agencies, including the Forest Service, Bureau of Land Management, National Park Service, U.S. Army Corps of Engineers, and Fish and Wildlife Service. Tread Lightly! also works closely with many recreation-related organizations and corporations.

The "Tread" in Tread Lightly! represents the organization's main principles:

- ◆ Travel and recreate with minimum impact.
- ◆ Respect the environment and the rights of others.
- ◆ Educate yourself, plan and prepare before you go.
- ◆ Allow for future use of the outdoors, and leave it as you found it.
- ◆ Discover the rewards of responsible recreation.

Using public service announcements, the Internet, and other outlets, Tread Lightly! is encouraging OHV drivers to use common sense and caution when going off-road. Their tips include the following:

- Avoid mud if you can while remaining on the road or trail. If you can't avoid mud, use low gearing and just enough throttle to maintain forward movement.
- Cross streams slowly, at a 90-degree angle and only at designated fording points. This will help minimize streambed damage and will help keep water out of the engine's air intake.
- Avoid side slipping, which can start a rut, ultimately leading to erosion.
- Yield the right-of-way to drivers on the uphill grade or overtaking you.
- Straddle ruts, even if they are wider than your vehicle. This will keep the vehicle level.

The organization also focuses on other forms of recreation in addition to OHVs. A series of vehicle-specific guidebooks on low-impact recreation are available to the public:

- *The Tread Lightly! Guide to Trail Biking*
- *The Tread Lightly! Guide to ATV Riding*
- *The Tread Lightly! Guide to Mountain Biking*
- *The Tread Lightly! Guide to Snowmobiling*
- *The Tread Lightly! Guide to Personal Watercraft Use*
- *The Tread Lightly! Guide to Four Wheeling*

The guidebooks have enjoyed widespread distribution, especially through recreational and environmental fairs. “We usually print between 25,000 and 50,000 guidebooks at a time. Some of the books are now in their third or fourth printing,” says Emily Daniels, Education and Program Specialist with Tread Lightly! The organization also sells the guidebooks for \$1 each (plus shipping and handling) over the phone or on-line at www.treadlightly.org. Proceeds from the sales benefit the organization’s education fund.

Other educational resources available from Tread Lightly! include posters, videos, and an environmental junior high school curriculum. The curriculum is designed to help teachers educate students about the natural resource impacts of outdoor recreation, and it offers ideas for activities and field trips. To broaden its educational scope, Tread Lightly! is currently developing a hunter education curriculum that addresses land ethics across North America.

“More and more people are spending time outdoors. We have more and more technology available that allows us to go farther and do more,” explains Daniels. “Unfortunately, it seems like we’ve also gotten farther away from the ethics that go along with being outdoors.”

Applying Lessons to Real Life

Tread Lightly! does more than develop educational materials. Through its “Restoration for Recreation” program, the organization works to restore and protect natural areas adversely affected by recreational use. For example, Tread Lightly! recently raised funds to build a bridge across a Colorado stream to stop recreational vehicles from eroding streamside areas and degrading fish habitat. “The project has allowed recreation to continue while the fish habitat recovers,” notes Daniels.

The organization also works with corporations to protect the public from receiving incorrect or improper information about outdoor recreation. Before issuing an advertising campaign, many recreation-related corporations consult with Tread Lightly! to ensure that their message conforms to the environmental preservation initiatives promoted by Tread Lightly! “Many corporations send us copies of their proposed advertisements to proof. Sometimes we do have to tell them ‘no,’” explains Daniels. “They understand once we explain to them why their message promotes something harmful to the environment—such as speeding through a stream in a vehicle. Once again, it’s all about education.”

[For more information, contact Tread Lightly!, 298 24th Street, Suite 325, Ogden, UT 84401. Phone: (800) 966-9900; e-mail: tlinc@xmission.com; web site: www.treadlightly.org.]

Workshop Explores the “New” Watershed Approach

The watershed approach is not what it used to be, according to a report issued by researchers at the University of Wisconsin–Madison. As first conceived and implemented decades ago, the watershed approach relied mostly on centralized agency decision-making, river basin development goals, and resources management. During the 1990s multiple-stakeholder watershed partnerships became the norm, the emphasis shifted to a voluntary approach supported by regulation, and a new watershed approach was born. After years of change and growth, watershed planning and management approaches are now more decentralized and rely more on shared decisionmaking, collaboration, diverse stakeholder participation, and an understanding of the watershed’s ecosystem.

To understand the complexities of the “new” watershed approach, researchers at the University of Wisconsin–Madison convened a workshop in July 2000 for a dozen participants from across the country that had extensive experience in watershed management. The group discussed an array of topics, including the characteristics of watershed initiatives, how to evaluate the initiatives’ accomplishments, and the factors that influence success. The results of the workshop are highlighted in a January 2001 report, *Toward Understanding New Watershed Initiatives* (by Stephen Born and Kenneth Genskow), available for download at www.tu.org.

Watershed Initiative Components

The report identifies six characteristics that all new watershed initiatives share. Although not all are new to the watershed approach, the combination of the six represents a new approach for addressing complex water and other related resource management issues. The characteristics are

- Adopting watersheds and subwatersheds as the fundamental analytical and management units.
- Addressing a broad scope of issues and including goals pertaining to healthy ecosystems, economic returns, and resource management.
- Using assessments and decision processes that are led by a combination of local knowledge, biophysical science, and socioeconomic information.
- Including interactions among multiple agencies and multiple levels of government.
- Emphasizing influential and voluntary participation of multiple local and nongovernmental interests.
- Demonstrating a collaborative problem-solving, planning, and management orientation.

Evaluating New Watershed Initiatives

The group discussed methods for evaluating the success of new watershed initiatives. They agreed that evaluation requires measures of multiple dimensions sensitive to various types of accomplishments and the various maturity stages of watershed initiatives. The group developed a framework that allows watershed initiatives to track their progress across multiple dimensions over time. The framework includes measures for less tangible accomplishments—improved communication, educational efforts, trust building, and conflict resolution—as well as institutional changes, economic impacts, and environmental improvements. The report offers a more detailed explanation of the evaluation framework.

Keys to Success

The group also tried to identify the factors that contribute to the success of watershed initiatives. Because every partnership and watershed is unique, the group did not try to identify a specific set of factors that lead to success or failure. However, the group did identify two broad sets of factors that influence the degree of success. First, the group discussed exogenous factors, or those that are outside the partnership and present before the partnership begins. For example, watershed initiatives are influenced by the nature of the ecological setting and resource problems: ecological characteristics, specific resource issues, and competing demands dictate the necessary scope and geographical scale for action. Second, the group discussed endogenous factors, or those that are internal to the partnership and influenced directly by the partners. For example, watershed initiatives are greatly influenced by the composition of the partnerships (the absence or presence of important stakeholder groups).

Lessons Learned

Although workshop participants debated the validity of many ideas and issues, they did agree on a series of general messages that can help guide future watershed initiatives and policies. These include the following:

- Partners must agree on the key characteristics that in combination define the new watershed approach.
- Public and political entities have high expectations for watershed partnerships to achieve resource-level objectives; however, demonstrable environmental improvements might take decades or longer to fully realize. To assess its progress toward these objectives, a partnership must turn to a multidimensional evaluation framework.
- Good organizational and watershed planning processes lead to better recommendations for action. Organizational planning allows partners to develop joint goals and priorities, while watershed planning allows them to diagnose the problem and develop solutions.
- Partnerships generally do not exist apart from government entities. Governmental units often support watershed initiatives with staff, programs, and regulatory structure.
- The context in which the watershed initiative develops influences its scope, goals, characteristics, and accomplishments.
- The new watershed approach complements but does not replace regulation.
- Although causal relationships are not well known, a combination of many different factors can influence success. Partnerships must identify and address key factors that will likely be important in their watershed.

At the end of the workshop, participants agreed that their efforts had produced a good first step toward understanding the complexities of the components, evaluation, and success of new watershed initiatives. "We view this publication in part as a self-diagnosis tool for local groups," explains Dr. Stephen Born, University of Wisconsin–Madison professor and coauthor of the report. "By identifying topics for their consideration, we can help them better focus their efforts and evaluate their progress." The workshop participants agreed, however, that additional research is needed to analyze multiple watersheds and explore the context in which partnerships develop and grow. For more information about the components of watershed initiatives, see *Exploring the Watershed Approach: Critical Dimensions of State-Local Partnerships* (Born and Genskow, 1999), available from the River Network at www.rivernetwork.org.

[For more information, contact Stephen Born, 101 Old Music Hall, 925 Bascom Mall, University of Wisconsin–Madison, Madison, WI 53706. Phone: (608) 262-9985; e-mail: smborn@facstaff.wisc.edu.]

Beyond Water Chemistry: Utah Shows Good Watershed Chemistry

In the late 1980s the Nonpoint Source Task Force of Utah's Division of Water Quality embarked on a mission to improve water quality in the Little Bear River watershed, which lies along the Utah/Wyoming border at the southern end of the Cache Valley. Nonpoint source pollution was their primary concern—the watershed had the largest number of dairies and dairy animals in Utah. The Task Force had their work cut out for them when they set out to reduce the amount of sediment, nutrients, and bacteria that run off the watershed's 196,432 acres (including much rangeland) and more than 50 dairy farms. Less significant was the pollution from the two point sources in the watershed: a trout farm and the Wellsville City wastewater treatment plant, which contributed to loadings in the river system only if a storm-based overflow occurred.

The local Natural Resources Conservation Service (Blacksmith Fork) and the Bear River Resource Conservation and Development Council received funding in 1990 from USDA through the Hydrologic Unit Area (HUA) Water Quality Incentive Program and jointly created the "Little Bear River Project." Project organizers hoped to increase the implementation of conservation measures and improve manure and grazing land management in the watershed.

A Technical Advisory Committee consisting of local, state, and federal water quality professionals held public meetings to exchange ideas and opinions. While farmers were concerned about water shortages and erosion sloughing off their pastureland, water quality officials pointed out that stream bank erosion and animal-related fecal coliform were adversely affecting stream life and water quality. The officials also expressed concern about nutrient overenrichment in downstream reservoirs.

Because agricultural activities were so critical in the balance of water quality in this watershed, private landowner initiative and participation were critical. A Steering Committee composed of local landowners, irrigation company representatives, local town mayors, and municipal officials was formed to implement the technical recommendations stemming from the meetings held by the Technical Advisory Committee.

"We like the voluntary approach," says Jon Hardman of the USDA Natural Resources Conservation Service (NRCS) in Logan, Utah. "If landowners don't have ownership of the problem and its solution, there really is no way we can effect any change on a shared resource like water quality." So although the Technical Advisors gave direction and technological input and suggested broad goals such as modifying management practices on 7,500 acres of rangeland to reduce sediment loading, it was left up to the local Steering Committee to prioritize areas of effort and focus resources.

Economic and Engineering Elements

This voluntary atmosphere spurred landowners to pitch in. With technical assistance and funding from the USDA NRCS including USDA HUA money, many began work on stream bank and channel stabilization. In 1994 manure management took on increasing significance to the project. Sequestering manure in containment systems was a tried and tested method to reduce

manure-based nutrient loading into the water system. As Gordon Zilles, who operates a 150-cow dairy along a tributary of the Little Bear River, puts it, "I didn't know how much manure I was producing till I had to contain it all." Zilles built liquid storage ponds, which served as an example of good manure management for other landowners. Proper application (application over sufficient acreage for full absorption, or better distribution) was also emphasized. To manage excess manure, some producers worked with neighbors and other landowners in the watershed to gain permission to apply manure on their land.

Best Management Practices Implemented in the Little Bear River Watershed

Manure Storage Facilities	36 operations
Brush Management and Seeding	4,000 acres
Fencing	149,025 feet
Stream Bank Protection	12,766 feet
Riparian Vegetation	28 acres
Stream Channel Stabilization	10,572 feet
Prescribed Grazing	30,000 acres

Source: *Utah Watershed Review* Vol. 8, No. 5.

Some funding for structural improvements on properties came from Section 319 grants, where the cost-share requirement was supplemented by landowner contributions. Other types of management modifications garnered alternative sources of funding. For example, the USDA HUA Water Quality Incentive Program paid landowners when they changed farming practices that involved overhead, transportation, or mechanical investment costs.

Other issues such as headcutting, in which streams eat away at their channel, steep eroding banks, lack of stabilizing vegetation, snags, and improperly placed concrete rubble were addressed by riparian corridor management. Management measures included establishing vegetation on streambanks and installing fencing against animal trampling. Four landowners implemented forest riparian buffers and filter strips along a tributary to the Little Bear. They planted a zone of woody and herbaceous vegetation to protect waterways from excess nutrients and pesticides.

Grazing land management was another important facet of treatment in the watershed. Sediment runoff from rangeland could be reduced by using prescribed and rotational grazing. To minimize soil disturbance, landowners used alternative watering sources such as sprinkle irrigation instead of flood irrigation. Funding for irrigation improvements often came from the Utah Department of Agriculture through the Food-Agricultural Resource Development Loan Program.

Reaching the Masses

An important component of the project was information and education. The Technical Advisory Committee carried the water quality and watershed connection message to audiences at county fairs, local schools, and meetings of local volunteer organizations. The committee organized tours of properties where model best management practices had been implemented. Average attendance on the buses that took people on the tours was 50: other local landowners accounted for 40 percent; local citizens and conservation groups, 20 percent; and state and federal agencies, 40 percent. "A tasty barbeque at the end was an additional incentive," says Hardman, "and the tour gave people the opportunity to see innovative methods in action, demystifying them and giving an often necessary boost to landowners sitting 'on the fence'—too hesitant to try them out. The tours made for even more social coalescence around the watershed."

The Little Bear River Project took on momentum throughout the 1990s. So many landowners were coming forward to implement management practices on their property that the Steering Committee and NRCS developed a ranking system of critical problems in the watershed to help determine the properties that would be funded through cost-share dollars during a particular fiscal year.

The Fruits of Labor

Utah's Division of Water Quality has a cyclical five-year approach to watershed activities. Although ambient water quality monitoring efforts are ongoing, intensive water quality monitoring is done

every five years. The first period of intensive water quality monitoring significant to the Little Bear River was 1993-1994. The monitoring confirmed that the water quality was poor enough to qualify Little Bear River for the 303(d) list.

By the mid 1990s the Task Force's efforts began to pay off. Project implementation and efforts in the Little Bear watershed gained momentum among landowners. From 1991 to 1996 a total of \$1,507,000 in Section 319 funding was allocated to the watershed effort and 120 farmers had documented changes to their rangeland management approaches.

Thanks to the landowners' efforts, the Division of Water Quality detected measurable improvements in water quality during the next intensive water quality monitoring period, 1998-1999. A TMDL study submitted in April 2000, which included 1993-1994 and 1998-1999 monitoring data, found that even without a major time delay after best management practice (BMP) implementation throughout the watershed, water quality indicators for nutrients and sediment were improving. This was significant particularly below the Hyrum reservoir, where the only point source was the municipal treatment plant and the dominant influences on water quality were the diffuse, nonpoint source animal operations.

"Downward trends are expected to continue over time," says Mike Allred, Watershed Coordinator for the Bear River Basin from the Utah DEQ, "to the point where we expect that in the next round of intensive monitoring, 2003-2004, these segments will be taken off the state's 303(d) list of waters. Based on these BMP successes, further animal operations-based reductions are sought in the watershed. In addition, a study is currently under way to assess the feasibility of a regional composting operation to manage manure. Because of its continuing success, Utah's first USDA-assisted HUA Water Quality Project serves as a model for other Utah watershed managers who wish to develop positive chemistry in their communities while reducing nonpoint source pollution.

[For more information, contact Jon Hardman, 1860 North 100 East, North Logan, UT 84341. Phone: (435) 753-3871, ext. 25; e-mail: jhardman@utnorthlog.fsc.usda.gov. For more information on the Little Bear River TMDL, contact Mike Allred, Watershed Coordinator for the Bear River Basin, at mallred@deq.state.ut.us.]

What's New at Nippersink? Something Old

Nippersink Creek is back to its old self, thanks to a massive restoration project by the McHenry County Conservation District (MCCD). By restoring the original creek channel, MCCD has addressed flooding and erosion problems caused by past actions based on prior land-use beliefs. Nippersink Creek was once a wide, slow-moving creek in a rural landscape of the northern part of McHenry County in northeastern Illinois. It meandered through glacially deposited soil and heaps of till and gravel called kames. In the 1950s a landowner set out to move the creek channel because he believed the meandering creek was using valuable space and complicating maneuvers with farm machinery. His crews pulled rubble and till from kames to block the river's natural path and rerouted a 1.6-mile stretch into a straight 1-mile-long ditch that suited their farm management and property boundaries. They pulled up trees along the channel, filled it in with till from nearby kames, and then installed miles of drain tiles to make the fields tillable.

"Contemporary government flyers on agricultural technology encouraged this," points out Kate Halma of the MCCD. But now—a half-century later—the MCCD has addressed the flooding and erosion caused by the misinformed landowner's actions and restored the original creek channel.

The First Steps

The MCCD purchased the parcel in 1990 as part of its plan to knit parcels of land together into a nature/wetland reserve of open space, where the old prairie ecosystem could flourish. The Nippersink Creek restoration is the culmination of a 10-year project that included the restoration of 800 acres of prairie and wetlands adjacent to the Nippersink in an area called Glacial Park. The MCCD estimates that the completed project provides up to 94,511,000 gallons of flood storage capacity.

People who had a close relationship with the land and had repeatedly visited the Nippersink Creek in its floodplain planted the seeds for its restoration. "Annually in wet springs, remnants of the

skeleton of the old channel would be visible like a ghost imprint on the landscape,” says Brad Woodson, ecologist. “We began to think that the restoration project could only take flight with a more natural river, which would impede high-energy flooding events and sit better in the landscape . . . It seemed to prop up all our restoration goals.” As part of the restoration project the Natural Resource Division of the MCCD planned various elements, such as improving the index of biotic integrity for fish in the stream, increasing wetland habitats, and fostering a more organic and gentle relationship between the stream and the floodplain.

Nippersink Creek Facts:

- ◆ Age of Nippersink Creek: 12,000 years
- ◆ Total length of the Nippersink in miles: 24
- ◆ Miles added to length of the Nippersink by re-meandering: 1.1
- ◆ Miles of erosion matting placed along newly graded banks: 22
- ◆ Plants planted by MCCD staff, volunteers, and school groups: 220,000
- ◆ Acres of restored marsh and wetland: 290

The Big Dig

The restoration required historical and ecological research. The MCCD used aerial photos and old maps to establish the river's original path. An 1872 plat book and an 1837 government land survey book both illustrated a meandering river that appeared to fall in roughly the same location as the seasonal remnants of the old creek. Other historical jigsaw pieces included aerial photos from 1939 and 1954, which showed the comparison between the old and new channels. Interviews with farm workers helped interpret the visual evidence.

Hydrologists from the Army Corps of Engineers designed the width and depth of the restored creek sections to allow energy to dissipate. The restored creek section, tracing the old creek path, has low-angled slope banks instead of the modified channel's high walls with berms. The new low-angled banks allow water to rise and spill over into the 100-acre floodplain, dissipating energy and minimizing erosion.

The MCCD used heavy equipment to move tons of rock and soil. By removing debris from the original creek channel, they created a 1.6-mile stretch of sinuous waterway to replace the 1-mile “raceway.” Another 1½ miles of “spring runs” or smaller creeks were also added, for a total of 1.1 miles of length appended to Nippersink Creek. The MCCD moved some 1,100 total tons of rock to help with erosion control along the banks. They also excavated dirt and gravel from a section of the channel to rebuild a glacial kame that had been used to fill in the original channel.

The Finishing Touches

Over the summers of 1999 and 2000, a crew of 15 young people (college interns and seasonal workers) between ages 19 and 23 joined the five full-time MCCD staff in the restoration effort. Their job involved the difficult physical labor of digging up old drain tile from the surrounding fields and laying down and securing erosion control matting. The crew brought infectious enthusiasm to the project, burying time capsules with messages explaining how they had given birth to the new “old” river and how important the mission of ecological restoration was to them. Members of the community helped finish the project by volunteering to help the crew put in thousands of plants to restore the native aquatic ecosystem. On August 26, 2000, the symbolic final dig to complete the river flow connection and reroute the creek back to its original channel attracted supporters from the Chicago metropolitan area, 60 miles away, and made the cover of the *Chicago Sun-Times*.

Now that the restoration has been completed, the MCCD is collecting data to document flora and fauna regeneration, including population studies of fish, mussels, and vegetation. When the MCCD crew excavated the original channel, they found entire mussel beds still intact, containing 1,200 to 1,500 specimens of 16 different species. In contrast, the ditch river channel supported only five species of the most common types of mussels—those that tolerated pollution and silt. Only two of those five species were found in the shell deposits in the excavated bed of the original healthy stream. The MCCD is also monitoring the stream's relationship to the watershed, its flow velocities, and its carrying capacity to assess the difference between the straightened and restored channels.

In the summer of 2001, vistas over Nippersink Creek look peaceful as the creek flows in winding curves among restored wetlands and through riffles and pools that provide aeration and fish habitat. This new river is, well, oddly recognizable, explains Woodson. "Now, it looks pretty much just as it was in the old days."

[For more information, contact Kate Halma, McHenry County Conservation District, 18410 U.S. Route 14, Woodstock, IL 60098. Phone: (815) 338-6223.]

Landscaped Rain Gardens Offer Stormwater Control

The City of Maplewood, Minnesota, is taking a diplomatic approach to improving drainage in its older neighborhoods. Necessary road upgrades in many of these neighborhoods prompted the need to address existing drainage problems. Instead of choosing traditional curb and gutter drainage methods, the city decided to implement an innovative stormwater management program using rain gardens, which are shallow depressions in the landscape that capture and hold runoff from precipitation events. The city chose to use rain gardens because they see them as more environmentally friendly and aesthetically pleasing. The project isn't forced onto homeowners; instead, the city focuses on demonstration, education, and outreach to sell the idea.

The Origins

A successful pilot project implemented in 1995 was the starting point for the current citywide rain garden initiative. The rain gardens in the two blocks of the pilot project have done their job. In fact, "No runoff flows out of this area of the neighborhood. It is 100 percent contained," explains Chris Cavett, Assistant City Engineer with the City of Maplewood. The aesthetic and environmental benefits realized in this neighborhood have encouraged the city to expand its effort to do things a bit differently. Currently, rain gardens are offered to any homeowner in the older city neighborhoods where street and drainage projects are planned.

Education Is the Key

The city focuses on educating homeowners about the benefits of rain gardens for stormwater management. "The rain garden solution suits a lot of people in the older neighborhoods, who are often opposed to adding curbs and gutters to their street. However, there are also many people who don't want rain gardens. They are concerned about having a hole in their yard, or about breeding mosquitoes," says Cavett. "Implementing this project has required more public outreach and education than I was expecting—but the best solution isn't always the easiest, so I guess we'll keep trying."

Before the city begins a street improvement project in a particular neighborhood, it holds neighborhood meetings in addition to distributing a comprehensive educational mailing and questionnaire to the homeowners. The materials include an extensive "frequently asked questions" fact sheet that explains the purpose of rain gardens, how they are designed, how they work, how they benefit homeowners and their neighbors, and the types of plants that are best suited for various water conditions.

The city also includes a questionnaire that inquires about existing drainage problems and asks whether the homeowner would be willing to accept a rain garden. For homeowners that want to see a rain garden before they make a decision, the city lists completed and ongoing rain garden projects in the area. "Our response rate for the questionnaire is about 60 percent. Of the respondents, about half request rain gardens," notes Cavett.

OK, I Want a Rain Garden . . . Now What?

Homeowners wanting rain gardens have a lot of freedom in the type of rain garden installed in the boulevard adjacent to their property. Although garden placement is restricted by the presence of gas and water mains and other utilities, existing trees, and natural drainage, the city works with the homeowner to select the best garden size and location. The three standard garden sizes offered are 12 feet by 24 feet, 10 feet by 20 feet, and 8 feet by 16 feet. In addition to selecting the size, homeowners can select one of seven different garden themes:

- Easy shrub garden
- Easy daylily garden

- Sunny garden
- Sunny border garden
- Butterflies and friends garden
- Minnesota prairie garden
- Shady garden

The city provides the homeowner with all the plants necessary and a landscape plan at no additional cost. The city typically digs and prepares the rain gardens during the fall and orders the plants during the winter. All the homeowner has to do is plant! The following spring, the city works with the neighborhood to organize a block-wide planting day/block party at which neighbors can help each other and get better acquainted. According to Cavett, about one-half to three-quarters of the homeowners usually participate in the planting day—even some homeowners that chose not to have a rain garden come out and help their neighbors.

Rain Garden Design

The city's rain garden street improvement projects incorporate rain gardens, shallow swales, and small depressions in the rights-of-way that hold stormwater runoff collected from the streets and yards until it infiltrates. The rain gardens, swales, and depressions are designed to catch about ½ inch of rain. "About 85 percent of Minnesota's rains are ½ inch or less," explains Cavett. "If we had a rain garden in every yard we should be able to capture and infiltrate most, if not all, of the runoff. As it is, we do have overflows designed into our projects to accommodate additional runoff as needed." In areas where extra runoff is being directed from a bisecting street or flows from upland areas, the city includes limited storm drains and pipes that direct overflow into the city's storm sewers. These storm sewers eventually discharge into nearby wetlands or lakes.

To prepare a rain garden, the city's contractor excavates a gently sloping depression to collect the water. Rain garden depths vary depending on garden size and topography. At the deepest part of the garden, they dig a sump 42 inches wide and 3 feet deep to accommodate a geotextile filter fabric bag filled with clean crushed rock. The sump promotes rapid infiltration to reduce the amount of time water stands in the rain garden. Once the rock infiltration sump is in place, the city's contractor prepares the rain garden planting area by adding at least 8 inches of bedding material (typically a mixture of salvaged topsoil and clean organic compost) and then covers the area with 3 to 4 inches of shredded wood mulch.

Rain Gardens Save Money

The city's rain garden street improvement projects typically cost about 75 to 85 percent of the cost of a traditional curb and gutter project. "Our costs are kept fairly low because we recycle a lot of the existing street material to use as the base aggregate, we get landscape plants at a very reasonable price from the County Correctional Facility's greenhouse, and our residents do the planting. If we



Rain gardens can range from large to small, depending on the wishes of the homeowner.



had to use landscape contractors, our costs would be comparable with a curb and gutter project,” explains Cavett. Other long-term cost savings that are hard to quantify are the savings associated with the reduced demand on the city’s downstream storm sewer infrastructure, which is not characteristic of conventional storm systems. “This is a system that can actually reduce the volume of storm runoff from a neighborhood. The city may be able to reduce the need for storm sewer system upgrades and construction farther down the watershed, including detention and treatment facilities designed to prevent downstream pollution, erosion, and flooding problems,” Cavett adds. Because the City of Maplewood has been willing to go the extra mile to educate its citizens and promote an environmentally friendly construction technique, it has proven that environmental protection and economic savings can go hand in hand.

[For more information, contact Chris Cavett, Assistant City Engineer, City of Maplewood, 1830 Country Road, B East, Maplewood, MN 55109. Phone: (651) 770-4554; e-mail: chris.cavett@ci.maplewood.mn.us.

Urban Growth Leaves Its PAH Signature in Lake Sediments

Looking for an unbiased record of environmental contaminants in an urban environment? Perhaps you need look no further than the local urban lake. Lakes function as the endpoint of the watershed, collecting and storing contaminants and sediments that are carried by runoff into a stream network. Over the years new incoming sediment builds on top of old sediment, creating a vertical record of the contaminants contained in the runoff.

Scientists with the U.S. Geological Survey (USGS) National Water-Quality Assessment (NAWQA) Program mine the historical record of lake sediments using various paleolimnological techniques, including the harvesting of sediment cores. Depending on the particular study, sections of a sediment core may undergo radiochemical dating as well as an analysis of major, minor, and trace elements; chlorinated organic compounds; and polycyclic aromatic hydrocarbons (PAHs), a class of very stable organic molecules made up of only carbon and hydrogen. The results help define trends (or lack of trends) in water quality in the watershed over time.

To date, USGS’s Reconstructed Trends National Synthesis Study has successfully chronicled changes in contaminant levels in the sediments of more than 40 lakes and reservoirs. In some cases, scientists have been able to link these changes to changes in human activities in the watershed, such as the introduction of new contaminants or successful environmental pollution remediation.

The sediment record of Town Lake in Austin, Texas, provides a typical example of how events and trends in the urban environment can be related to nonpoint source pollution. Town Lake is actually a reservoir created in 1959 as a part of the Highland Lake chain on the Colorado River. In 1998, the USGS, in cooperation with the City of Austin, collected a core for the purpose of

measuring contaminants deposited in the reservoir sediments over the 40 years it had been in existence. The results of this sediment analysis include

- Evidence of high DDT concentrations in core sections from the early 1960s. This is most probably related to a DDT spill in the watershed in 1961 (made infamous in Rachel Carson’s famous book *Silent Spring*).
- A dramatic reduction of DDT, lead, and PCB concentrations in core sections after the 1970s. This reduction is most probably due to restrictions in DDT and PCB use and the mandate for lead-free gasoline in the 1970s.
- PAH concentrations that are 17 times greater at the top of the core than at the bottom.

This last finding is particularly troubling because PAHs are toxic to aquatic life and several are suspected

National Water-Quality Assessment (NAWQA) Program Offers Pollutant Reports

The information on PAHs in this article is part of a long-term, nationwide assessment on water-quality conditions in more than 50 major river basins and aquifers across the country by the U.S. Geological Survey National Water-Quality Assessment Program. The NAWQA Program has recently released summaries on nutrients, pesticides, metals, industry and petroleum-based compounds, and naturally occurring pollutants, such as radon, in 16 of these basins. (The first summary report in this USGS series was released in 1998 and described water-quality conditions in 20 basins.) The report presents significant findings on water quality in agricultural and urban areas and helps address issues regarding nonpoint source pollution, drinking-water standards, and aquatic ecosystems.

These reports are available online at <http://water.usgs.gov/nawqa>; from the USGS Branch of Information Services, P.O. Box 25286, Denver, CO 80225; by fax, (303) 202-4693; by e-mail, nawqa_info@usgs.gov; or by phone, (703) 648-5701.

carcinogens. Fortunately, PAHs do not usually pose a health risk for people who use or recreate in lake water because most PAHs stick to solid particles and settle to the bottom.

Why the dramatic increase in PAHs? Scientists think it might be due to the significant growth of Austin in the past two decades and the corresponding increase in vehicle traffic. PAHs are formed during the incomplete burning of coal, oil, and gas and other organic substances. Consequently, vehicle exhaust and used engine oil are usually important sources of PAHs in urban settings. This theory appears to be backed up by data that show that traffic in the greater Austin area increased about 2.5 times from 1982 to 1996, about the same rate of increase as that of the PAH concentrations in sediment cores from Town Lake during the same time period.

Reducing PAH inputs to Town Lake, as well as other urban lakes and reservoirs, is a challenge for watershed managers. The usual first step is to identify PAH hot spots in the watershed (places that produce significantly higher levels of PAHs than others). These places typically include gas stations, vehicle maintenance areas, and parking lots that experience high volumes of traffic. Pollution prevention techniques can then be implemented at these sources. These techniques might include education campaigns aimed at eliminating spills, leaks, and emissions and improving handling, storage, recycling, and disposal practices.

[For more information, contact Pixie Hamilton, staff hydrologist and communications specialist, (804) 261-2602, pahamilt@usgs.gov.]

Agricultural Notes

Got [Environmentally Friendly] Milk?

Many dairies in California are becoming more environmentally friendly because of a new statewide program. For years, as the optimal operational scale for the market has evolved, dairy farmers have been under pressure from environmental concerns and regulations. To steer them through the tricky course of product safety, animal health, herd management, pollution prevention, and regulatory compliance, a coalition called the California Dairy Quality Assurance Program (CDQAP) has pulled together a total-systems-management road map for dairies to follow. The road map guides the production process, using the best available technical modeling and calculations to ensure that producers can make meaningful operational decisions within a regulatory framework.

“It takes only one report of a manure lagoon spill into a waterway for people to turn on livestock or dairy production as if it was environmentally criminal,” notes Joe O’Donnell of the California Dairy Research Foundation. California, the nation’s top milk-producing state in 1999 (more than \$4 billion in annual sales of milk products), has 2,400 dairy farms. The large herds, which average 656 cows, generate copious volumes of waste. CDQAP helps farmers manage that waste and helps them protect their animals and the quality of their milk products.

CDQAP was launched in 1997 as a cooperative venture of state and federal agencies and a team from the University of California. Although three components—Animal Health and Welfare, Food Safety, and Environmental Stewardship—are involved, it is the last that has taken off with notable success. CDQAP created an Environmental Stewardship (ES) certification course to help dairy producers develop procedures and systems that allow them to operate while fully protecting environmental safety.

Management Components

The course comprises a voluntary threefold investment for dairy producers. First, they complete a 6-hour course offered by the University of California Cooperative Extension that addresses water regulations, stormwater pollution prevention plans, and facility evaluation manure management. Next, they develop an Environmental Stewardship Farm Management Plan by evaluating their specific farm conditions and designing a waste/nutrient balance plan tailored to their facility.

Finally, the producers are subject to on-site independent evaluations checking the facility for standards and capacity.

Top 10 Requirements of the CDQAP ES Program:

1. Producers must have sufficient lagoon capacity, which depends on facility design, management, herd size, average rainfall, and geographic location.
2. Producers must document their permits, including county use permits, waiver of waste discharge requirements, and National Pollutant Discharge Elimination System permits.
3. Lagoons must have at least a 10 percent clay content (state requirement).
4. Lagoons must have capacity to store runoff from a 25-year, 24-hour storm.
5. Producers must manage corrals to prevent water from infiltrating or standing.
6. Producers must prevent dairy nutrient discharges to surface water.
7. All long-range plans for facility improvements must be in concert with environmental standards.
8. Producers must collect runoff from solid manure.
9. Producers must collect runoff from feed (such as silage).
10. Producers must have an emergency manure management program.

The ES course was developed through collaboration among diverse partners including the U.S. EPA, California EPA, State Water Resources Control Board, California Department of Fish and Game, USDA Natural Resources Conservation Service, and several dairy industry leaders (California Manufacturing Milk Advisory Board, Milk Producers Council, Western United Dairymen, and California Farm Bureau Federation). Mike Stelzer, who has been involved in dairying since the 1950s, notes, “The ES program goals are not unreasonable, like a bar in high jump that has been set too high or moves around as you try to jump. The biggest frustration in the agricultural community with environmental regulation is that being in compliance seems like hitting a shifting target. This ES program is very satisfying to follow because so many authorities in the field sanction it.”

A Win-Win Program

In exchange for the producers’ voluntary investment, they receive a full understanding of relevant environmental regulations and the requirements that affect each component of the dairy operation. Producers learn how to use software that calculates optimal design and capacity for manure storage and flows of waste. They also receive assistance with developing a nutrient management plan—a requirement of the draft concentrated animal feedlot operations (CAFO) rule published in 2000—and individualized innovative manure sequestering/application projects.

Positive feedback has been running through the industry’s proverbial grapevine. “This has done more to pull together the dairy community than anything else in the history of the industry,” says Mike Stelzer. “It helps a farmer develop capacity in his operation so that now and 50 years from now it will be in compliance . . . It is a boon.”

The program has set a national precedent for formal, proactive, voluntary pro-environment action from the industry. By spring of 2001 at least 1400 dairy farmers and their employees had undergone the voluntary training. In the evaluation phase, seven dairy producers passed the rigorous on-farm evaluation by the California Department of Food and Agriculture, receiving full Environmental Stewardship certification.

To improve the quality of their dairy-based products, Land O’Lakes offers a \$300 cash incentive to their milk suppliers who have gone through the CDQAP certification, consumers are also taking note. “The Milk Marketing Board has the job of increasing the utilization of milk,” explains Joe O’Donnell. “As part of the promotion package, in addition to the billboards and advertisements, we want to address the quality of the product, especially the environmental quality. Consumers are watching for environmentally friendly production.” The CDQAP recognition tells consumers that they are purchasing wholesome, nutritious dairy products that are produced in concert with a healthy environment.

[For more information, contact Deanne Meyer, California Dairy Quality Assurance Program, 502 Mace Blvd., Suite 12, Davis, CA 95616. Phone: (530) 752-9391; e-mail: dmeyer@ucdavis.edu; web site: www.cdqa.org.]

Technical Notes

Unique Gel Is an Unconventional Way to Water

Many restoration projects in arid, remote, or erosion-prone sites now have a new lease on life because of a product that releases water over time. This unique product, called DRiWATER, is a gel consisting of 98 percent water and 2 percent food-grade ingredients. Tubes of the gel are opened at one end and inserted into the soil close to the roots of plants. Bacteria in the soil gradually break down the food-grade ingredients and convert the gel back into liquid water. The capillary activity of the soil carries and maintains moisture throughout the root zone. By applying moisture directly where it is needed over time, DRiWATER increases the opportunity for successful plant-based soil stabilization and restoration projects.

Making Arid Restoration Projects Work

DRiWATER enabled John Kretzmann, an environmental engineer with the New Mexico Mining and Minerals Division's Abandoned Mining Program, to reduce erosion on the 30-acre Carthage Coal Mine Area in central New Mexico. Kretzmann wanted to stabilize the soil by planting trees and shrubs. "The predicament is to get plants to establish in the arid environment, which is remote from supplies of water, and survive to a state where they can fulfill their function in the environment as natural erosion control, wind breaks, wildlife niches, and oases of ecological value," he says. In this case DRiWATER provided a source of water where one was lacking. Normally, water would have to be trucked and hand-applied using hoses. Transportation and labor costs are high and logistics tricky. Moreover, driving heavy trucks over loose soil can compact the soil, another negative for erosion control. Because his restoration area was remote, Kretzmann relied on DRiWATER's soil moisture delivery system and minimized costly irrigation methods.

DRiWATER is currently used for similar efforts in north-central Nevada. Joe Ratliff, a soil scientist with the Bureau of Land Management for the 11-million-acre Battle Mountain District ("an area larger than some states," he points out), has used it on two projects in very remote areas. "After disastrous fires in the late 1990s, we had to proactively restore native vegetation, primarily because there would be rampant erosion and sediment loading into waterways if we didn't. Also, the native species are not as resilient to fire and able to regenerate now as they used to be. We just need to give them a jump start." That's not an easy task in back country areas of Nevada, where little shade, minimal precipitation, and strong winds make for harsh, Mars-like conditions.

Ratliff was tasked with planting two native species—pinyon pines in the Shoshone Mountains and bitterbrush, a winter-forage plant for deer, in the Sulphur Spring Mountains. The ecosystem management approach stipulates that water be supplied to native plants for only the first few months after planting. From then on these plants, genetically and historically adapted to their environmental conditions, can take over, using their own moisture-capturing and management strategies.

Ratliff relied on DRiWATER to help the native plants get established. "No other watering method was an option," notes Ratliff. The distance to these sites and the volumes of water that would have been necessary to supply adequate moisture were too great. Ratliff estimates that with the help of DRiWATER, 60 to 75 percent of his 1,000 pinyon pines and 2,000 bitterbrush plants survived. Some of the saplings were actually lost to free-range cattle, rather than to environmental conditions. In fact, the cattle also ate some of the DRiWATER packs (which are biodegradable and edible). Despite the problems, Ratliff believes he had a success rate at least three to four times higher than he would have had without using DRiWATER.

Other Applications

DRiWATER is being used for diverse projects in many places. Landscape architects and developers have begun applying DRiWATER in water-scarce southern California for plantings in suburban developments. Internationally, the product has been used successfully under test conditions and for full-scale anti-desertification efforts. Locations include Egypt, Israel, and several provinces in interior northern China. DRiWATER-fed plant-based stabilization efforts also succeeded in

earthquake-disturbed sites in Taiwan. Slopes of up to 60 percent were planted with saplings and equipped with DRiWATER to help them survive because few other methods of irrigation could be used in the precarious situation.

Product Cost and Longevity

DRiWATER costs approximately \$1.50 per quart wholesale, depending on the number of units purchased. Homeowners typically pay \$3.50 per quart. The product is available in various quantities and watering life cycles. The duration of water release often depends on the moisture-seeking bacteria in the soil: in periods of rainfall, less liquefaction of the gel occurs because the bacteria are satiated with moisture from natural sources. DRiWATER, Inc., hesitates to describe the number of gallons of water that are equivalent to 1 quart of the gel. "Water equivalency is not the legitimate issue. The issue is getting enough moisture to the root mass during the critical establishment period," according to Debra Stokes-Haglund, Sales Manager at DRiWATER. The product is appropriate almost anywhere, as long as the soil type and temperature are hospitable for plant growth in the first place.

[For more information on DRiWATER, contact Debra Stokes-Haglund, DRiWATER, Inc., 600 East Todd Road, Santa Rosa, CA 95407. Phone: (707) 588-1444; e-mail: driwater@driwater.com; web site: www.driwater.com.]

Soybean Hulls Eyed for Wastewater Filtering

Do you have metals in your wastewater? Earlier this spring, scientists at the USDA Agricultural Research Service (ARS) reported that soybean hulls are showing promise as a new filter for removing toxic metals from industrial wastewater. Soybean hulls are an inexpensive, plentiful agricultural waste product typically sold to animal feed supplement producers. ARS scientists have discovered that the hulls can be modified to adsorb metals by changing the hulls' properties and surface charge using food-grade citric acid combined with a heating step. The scientists envision turning the hulls into adsorbent filters that can be used by electroplaters, jewelers, and other industries that generate wastewater containing metal contaminants.

Once used, several disposal options are available. First, the metal-laden hulls could be removed to a hazardous landfill at a cost to the user of the modified hulls. Second, the metal-laden, modified hulls could also be used to produce activated carbon, therefore using the same material to again produce adsorbent material, this time with a longer life expectancy. Finally, the metal-laden hulls could be stripped (metal removed from the hulls with dilute acid) of their metal and either composted in a non-hazardous landfill, used for cattle feed, or burned in a boiler to create steam for power generation.

Currently, metal adsorption in industrial wastewater is achieved with the use of commercial ion exchange resins. The resins cost between \$2 and \$20 a pound, depending on whether they're synthetic or cellulose-based. Soybean hulls should be much less expensive: the ARS scientists have calculated that making adsorbents from 22,000 pounds of soybean hulls per day costs about \$0.53 per pound. The lower cost does not mean less efficiency. In fact, scientists found that the modified hulls captured positively charged ion forms of cadmium, copper, lead, nickel, and zinc at rates slightly greater than comparable commercial resins.

What does this have to do with NPS runoff? That's the million dollar question. Will this technology also work for filtering metals from stormwater runoff? "Our modified hulls possess excellent ion exchange properties toward a diverse group of toxic metal ions, and the exact source of these metal ions should matter very little, originating from either point or nonpoint sources," explains Wayne Marshall, research chemist with the ARS Commodity Utilization Research Center. Although still in the experimental stage, this promising technology could eventually be a vital link between agricultural and industrial/urban areas. Instead of competing for land, these two sectors could become economically co-dependent, purchasing one waste product to control another.

[For more information, contact Wayne Marshall, USDA ARS Commodity Utilization Research Center, P.O. Box 19687, New Orleans, LA 70179. Phone: (504) 286-4356; e-mail: marshall@srcc.ars.usda.gov.]

San Diego's Innovative Approach to Improve Detection of Sewer Spills

San Diego has become the first city in the nation to use a state-of-the-art computer monitoring system for detecting sewage spills. In September 2000 the San Diego Metropolitan Wastewater Department (MWW) began operating its Flow Metering Alarm System (FMAS) to detect major sewage spills so that they can be contained quickly to reduce the amount of sewage that leaks from pipes and eventually contaminates local water bodies.

In the past MWW relied on residents or city workers to report sewage spills, which were identified by sight or smell. However, because San Diego has approximately 140 miles of trunk sewers running through secluded canyons and other remote areas of the city, breaks in these localities can go undetected for a considerable period of time before they are repaired. For instance, in February 2000 a ruptured sewer line leaked more than 34 million gallons of untreated sewage into the San Diego River before the problem was discovered 7 days later.

How Does It Operate?

The new early detection system, which cost the city \$510,548 to install, uses 96 flowmeters to monitor the operation of the city's 2,850 miles of sewer pipelines. The meters are installed on most major sewage pipes in the city and have electronic sensors that regularly measure changes in the depth and velocity of sewage flow. A drop of 25 percent or greater in flow volume transmits an alarm signal via telephone line to an FMAS computer in MWW's Central Operations and Management Center. The FMAS computer operator is notified of the location of the problem sewer line and receives diagnostic information. The operator then sends repair crews to the possible spill site.

Has It Been Effective?

According to MWW, 33 sewage spills reached public waters in 2000. This number represents a 21 percent reduction from the 42 spills that reached public waters in 1999. In addition, the number of beach closures associated with sewage spills declined from 16 in 1999 to 14 in 2000. However, even though the new detection system has satisfactorily passed testing for its designed function, its actual effectiveness in improving the detection of sewer spills requires further observation. More importantly, former Wastewater Director Dave Schlesinger believes that the new monitoring system will ensure that sewage spills like the one that occurred in February 2000 "will never happen again in a remote canyon area."

[For more information, contact Guann Hwang, Project Manager, San Diego Metropolitan Wastewater Department, 9192 Topaz Way, Mail Station #901, San Diego, CA 92123. Phone: (858) 292-6435; e-mail: gih@sdcity.sannet.gov.]

Notes on Education

Second National Information and Education Conference a Success

From the preconference workshop to "Where Do We Go from Here?" the 2nd National Conference on Nonpoint Source Pollution Information and Education Programs was a success. The conference was held May 14-17, 2001, at the Chicago Congress Hotel in Chicago, Illinois. The Illinois Environmental Protection Agency and the U.S. Environmental Protection Agency cosponsored the conference; the Chicago Botanic Garden was also a cosponsor and coordinator.

The conference itself began with welcomes and opening remarks by Barbara Whitney Carr, President and Chief Executive Officer of the Chicago Botanic Garden; William D. Seith, Deputy Director of the Illinois Environmental Protection Agency; and Charles H. Sutfin, Director of EPA's Assessment and Watershed Protection Division. All three speakers addressed the importance of outreach and education and reminded participants about the opportunity for creating partnerships while at the conference.

David Gershon, president of the nonprofit environmental education organization Global Action Plan (GAP), provided an inspiring keynote address. Gershon's organization has been working for the past 12 years to develop a program and delivery strategy to empower people to adopt

environmentally sustainable lifestyle practices in their own households. Gershon conducts research on social diffusion theory, which involves diffusing a new idea into the community from the inside out. His social diffusion research holds that when a new idea is adopted by 10 to 15 percent of a community's population, it has the critical mass needed to spread on its own momentum. The community members are divided into four categories:

- Early adopters—those persons who are willing to participate from the start
- Early majority—those persons who participate only after the early adopters get started
- Late majority—most of the population in a particular group
- Laggards—the skeptics that require the most convincing

GAP has found that neighbor-to-neighbor outreach is the best way to get homeowners to change their ways. When a neighbor knocks on doors in the community and says, “Hi, I’m your neighbor and I want to invite you to a neighborhood gathering in my home to hear about a program to improve our neighborhood environment and protect our neighborhood’s health and safety,” homeowners are much more likely to participate than when they merely receive a flyer in the mail.

The Conference Planning Committee, made up of employees from Illinois EPA, U.S. EPA, Chicago Botanic Garden, and many state and community affiliates, put together a unique program on NPS information and education programs. During the 3-day conference, attendees chose from a variety of sessions, including community awareness programs, community events, regional approaches, new partnerships, and municipal programs.

One of the highlights of the conference occurred on the second day when attendees were able to take a break from the conference setting and move to the Chicago Botanic Garden for the afternoon sessions. Not only did they enjoy the gardens, but they also learned about how the gardens are protecting their watershed and water quality. The day ended with an evening address by Dennis W. Dreher, a Chicago Wilderness Smith Family Fellow with the Northeastern Illinois Planning Commission, on building new partnerships for environmental stewardship.

The closing luncheon speaker, Mary E. Marsters, Vice President and Director of Outcome-Based Research, The Rensselaerville Institute, summarized the conference with a talk on “What have we learned...What does it all mean...Where do we go from here?” She analyzed the sessions held throughout the conference using a mix of the Rensselaerville Institute’s approaches and practices in outcome-based evaluation.

The conference provided an opportunity to learn about what others are doing to share information on NPS pollution, to network with other attendees, and to create new partnerships in the effort to inform and educate the public about NPS pollution. More than 240 attendees took home lessons in outreach and education that they can use in their own programs to spread the word and change people’s behavior.

[For more information, contact Barb Leiberhoff, Bureau of Water–Nonpoint Source Unit, Illinois Environmental Protection Agency, 1021 North Grand Avenue, P.O. Box 19276, Springfield, IL 62794-9276. Phone: (217) 782-3362; fax: (217) 785-1225; e-mail: barb.lieberhoff@epa.state.il.us.]

Research Station Teaches Watershed Stewardship

In 1999, several California organizations collaborated to open the American River Watershed Institute (ARWI) research station in the central Sierra Nevada mountains. ARWI is a nonprofit entity that was formed to create opportunities for citizens of all ages and cultures to actively engage in watershed stewardship, but the station’s focus is on educating teachers and students.

Sedimentation is the primary nonpoint source issue in the American River watershed, and ARWI targets its classes to address the sources of sedimentation in the watershed.

Two separate week-long courses—*Stream Research* and *Habitat Restoration*—were offered several times during the summer of 2001. The cost of a week-long course is \$250 per student and covers

the course instruction, meals, and tent facilities. Students camp in tents adjacent to the research station, which is a renovated dam tender's house at French Meadows Reservoir. The station was originally built in 1960 by Placer County but is now owned by the U.S. Forest Service, which leases the station to ARWI.



These “freshmen” scientists are collecting stream macroinvertebrates.

A typical course begins in the research station classroom with units on general ecology, watersheds, and orienteering. The class then moves outdoors to preselected sites to learn stream monitoring and habitat restoration techniques. Next, the students move to a new site in the watershed and implement their newly learned techniques as part of a research project. They take bank angle measurements, conduct pebble counts, and collect insects for macroinvertebrate identification in the research station laboratory. Data that the students collect are recorded on Forest Service data sheets. (The Forest Service uses the data in some of its own work.)

The activities conducted by ARWI are directly connected to California's state science standards. High school students earn 5 units of science credit toward graduation, and teachers receive 3 continuing education units (CEUs) per session from California State University, Chico. “Five separate school districts

have agreed to give high school students credit for attending the ARWI, which is unheard of anywhere else,” states Harry Hickman, Placer High School science teacher and lead instructor/scientist for ARWI research in the summer of 2001. Study at the ARWI research station enables participants to conduct research in small teams with scientists on topics such as forest characterization, stream condition analysis, and stream invertebrates. Owl and mammal surveys and habitat restoration coursework are also offered by ARWI.

One important distinction of ARWI is that research science is taught to the students in addition to typical environmental education and outreach. High school students and teachers learn and implement watershed evaluation and restoration skills side-by-side in the field. Another distinct feature is that guidance is provided by members of the American River Watershed Group (ARWG), a stakeholder group for the North and Middle Forks of the American River. ARWG works to integrate natural resource management to protect the special characteristics of the American River watershed and focuses on five areas—forest issues, water issues, safety, sustainable economics, and research-based education. In fact, ARWI was founded to advance the mission of ARWG, is composed of professionals from some 60 different groups, including local, state, and federal agencies; businesses; nonprofit organizations; and citizens and landowners. Hickman explains, “Biologists and hydrologists collaborate with the instructors and take the students out in the field to accomplish the work needed in the watershed.”

ARWI is supported by donated funds and research grants from state and federal agencies interested in understanding and restoring natural resources. Approximately \$80,000 in donated funds and supplies were received to upgrade the dam tender's house and turn it into a functioning research station. Research grants include a Site-Specific Objectives Grant from the State Water Board to study water quality and water quality assessment protocols. This grant is used to support the *Stream Research* course, in which students learn EPA's Rapid Bioassessment Protocols for macroinvertebrates and USFS's Stream Condition Inventory methodology. A specific project that was carried out during this summer's course is post-restoration monitoring at a creek degraded by mining in the 1850s. A survey of the site and restoration were completed last summer, and monitoring occurred this summer.

A second CALFED research grant provides money to support classes and workshops for meadow and stream evaluation and restoration. Under the grant, a meadow restoration project that includes fencing a meadow from nearby cattle was completed recently by different groups, including AWRI. "Projects like this build a sense of community by getting different groups involved," says Hickman.

ARWI just received a 3-year, \$200,000 Proposition 13 Grant from the state of California for sediment management projects. Using this money, AWRI will inventory sediment sources in the American River watershed and identify and prioritize restoration projects for all of the creeks in the watershed.

[For more information, contact Harry Hickman, AWRI, 251 Auburn Ravine Road, #107, Auburn, CA 95603. Phone: (530) 346-7967; e-mail: hhickman@placer.puhsd.k12.ca.us; web site: www.arwg.org.]

Reviews and Announcements

Secret Agent Worms Teach About Erosion in The Disappearing Earth

What is happening to the soil around Special Agent Worm's headquarters? Help Special Agents Napoleon Soil and Jane Blonde solve the mystery of the disappearing earth. While the secret agents search for answers, top secret information about the sources and dangers of soil erosion are exposed. *The Disappearing Earth: An Adventure in Erosion*, published by the University of Illinois with funding from the Illinois EPA through Section 319 of the Clean Water Act, "combines good science and a great story to produce an education tool of the highest quality," comments Jane Frankenberger, a soil and water engineering specialist from Purdue University. The comic book style and colorful illustrations make the story come alive as the worms encounter splash erosion, runoff, gullies, and rivers. The additional "top secret guides" to soil erosion and prevention also provide good scientific information for students as they solve the mystery of soil erosion. The following materials are available: the Complete Kit with Teacher's Guide (AK-11, \$175.00), the Consumable Items Replacement Pack (AK-11.1, \$24.00), and the Teacher's Guide Only (AK-11.2, \$41.80). For more information call (800) 345-6087.

Demonstrations in Soil Science Manual Available

A new 31-page manual developed by Purdue University Agronomy Department professors in 1998 features 17 experiments that demonstrate soil science principles. The experiments are targeted at students in grades K to 12 and are suitable for science fair exhibits or classroom demonstrations. The manual is available for download at www.agry.purdue.edu/courses/agry255/brochure/brochure.html. For more information, contact Dr. John Graveel or Sherry Fulk-Bringman, Agronomy Department, Purdue University, 1150 Lilly Hall, West Lafayette, IN 47907-1150. Phone: (765) 494-8060; e-mail: jgraveel@purdue.edu.

Greening School Grounds: Creating Habitat for Learning

Teachers of grades K to 12 now have a new tool to help them plan and implement schoolyard projects. This 144-page book provides guidance for completing numerous schoolyard projects like native plant gardens, tree nurseries, school composting, butterfly gardens, rooftop gardens, multicultural gardens, and habitat restoration. The book also contains practical tips on how to minimize vandalism, maximize participation, and raise funds. For more information contact Green Teacher at www.greenteacher.com.

Bird Conservation Plans Available

Partners in Flight (PIF), an international bird conservation coalition, has developed bird conservation plans for every physiographic region of the United States. PIF's goal is to ensure long-term maintenance of healthy populations of native, non-game birds. Although the plans are targeted at wildlife and land managers, they hold valuable information for anyone involved in programs or projects that focus on habitat conservation, water quality management, the use of chemicals, and other issues that might influence bird populations. Bird conservation plans are available at www.partnersinflight.org/pubs.

2001 Educator's Guide Helps Explore Nature in Your Neighborhood

Kids often think nature is something they have to drive to. The National Wildlife Federation's *2001 Educator's Guide* contains more than a dozen enjoyable hands-on activities for grades K to 8. The interdisciplinary activities are designed to introduce students to wildlife they can find in their backyard, schoolyard, local park, local coastal area, local pond, and other habitats. Activities encourage observation and action such as pollution prevention and habitat restoration and creation. Developed as part of the National Wildlife Federation's National Wildlife Week, the guide is available in English and Spanish on the Internet at www.nwf.org/nationalwildlifeweek.

New Nonpoint Source Posters Released

The Environmental Protection Agency's Long Island Sound Office recently released four new posters that stress the importance of reducing nonpoint source pollution at home. The posters use colorful and humorous photos to depict pollution problems from human activities such as vehicle oil leaks, car wash soaps, overuse of lawn fertilizer, and disposal of pet waste. The posters are available for viewing on the Web at www.epa.gov/region01/eco/lis/new.html.

New Video Demonstrates Streamside Planting Techniques

Washington State University Cooperative Extension has developed a video and fact sheet intended to improve the success of streamside planting projects. The 17-minute video, *Plant It Right: Restoring Our Streams*, provides students and volunteers essential information on proper planting techniques. The video shows youth volunteers demonstrating how to plant trees and shrubs correctly and contains other useful information. A separate two-page fact sheet covering the same information accompanies the video. To order, contact the WSU Cooperative Extension Bulletin Office at (800) 723-1763 and ask for *Plant it Right: Restoring Our Streams*, VT 0113. The cost per copy is \$30.90 (including shipping). Call for prices for quantity orders. The video is also available on-line through streaming video, and the fact sheet can be downloaded at <http://wawater.wsu.edu>. For more information, contact Robert Simmons, Water Resources Faculty, WSU Cooperative Extension-Thurston County, 720 Sleater-Kinney Rd., Suite Y, Lacey, WA 98503. Phone: (360) 786-5445, ext. 7915; fax: (360) 455-1575; e-mail: simmons@wsu.edu; web site: <http://thurston.wsu.edu>.

New Watershed Academy Web Module Available

EPA's Watershed Academy announces its 40th Web-based training module, "Wetland Functions and Values." This module reviews the extraordinary contributions that wetlands make to our water quality, economy, recreation, environmental health, and other areas. At the end are a self-test and a printable list of every wetland function and value discussed in the module. You can access this module at www.epa.gov/watertrain/wetlands.

EPA Watershed Training Opportunities Updated

EPA recently published an updated *EPA Watershed Training Opportunities* booklet that lists EPA's Office of Water and the Watershed Academy sponsored live training courses, Web-based training opportunities, materials such as documents and videos, and watershed-related web sites that are available to EPA staff and others. The *Inventory* is available on the Watershed Academy's web site at www.epa.gov/owow/watershed/wacademy/wtopps.html. Copies of the booklet are also available at no charge from the National Service Center for Environmental Publications at (800) 490-9198 (please reference document No. EPA 841-B-01-002).

Web Sites Worth a Bookmark

www.rivernetwork.org/library/resource/index.cfm

This web site offers a searchable on-line database of River Network's library of resources on fundraising, river monitoring, river restoration, and much more.

The Pennsylvania Organization for Watersheds and Rivers is dedicated to the protection, sound management, and enhancement of the Commonwealth's rivers and watersheds and to the empowerment of local organizations with the same commitment. This web site provides information on events, publications, and programs related to the protection of Pennsylvania's watersheds. It also includes a searchable directory of watershed organizations in the state.

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.

Meetings and Events

October 2001

- 10–12 *Mid-Atlantic Chapter of the International Erosion Control Association's Eighth Annual Conference, Workshop, and Trade Exposition*, Richmond, VA. Contact Jim Barrett at (804) 371-6826 or visit the web site at <http://ieca.8m.com>.
- 13–17 *WEFTEC 2001. Water Environment Federation's 74th Annual Conference and Exposition*, Atlanta, GA. Contact WEFTEC at (800) 666-0206 or e-mail: confinfo@wef.org; web site: www.wef.org.
- 23–25 *Demonstrating Nonpoint Source Solutions: Learning from On-the-Ground Projects*, Sacramento, CA. Contact Margie Lopez Read, California State Water Resources Control Board, 1001 I Street, 15th Floor, Sacramento, CA 95814. Phone: (916) 341-5533; e-mail: readm@swrcb.ca.gov; web site: www.swrcb.ca.gov/nps/conference.html.
- 23–26 *The Association of State Drinking Water Administrators 16th Annual Conference*, Baltimore, MD. Contact ASDWA, 1025 Connecticut Avenue, NW, Suite 903, Washington, DC 20036. Phone: (202) 293-7655; fax: (202) 293-7655; e-mail: asewa@erols.com; web site: www.asdwa.org.

November 2001

- 7–10 *North American Lake Management Society's 2001 Conference: A Lake Odyssey, Bridging the Gaps Between Science, Policy, and Practice*, Madison, WI. Contact Dr. Richard Lathrop, UW Center for Limnology, 680 North Park Street, Madison, WI 53706. Phone: (608) 261-7593; fax: (608) 265-2340; e-mail: rlathrop@facstaff.wisc.edu; web site: www.nalms.org/symposia/madison.
- 12–15 *American Water Resources Association's Annual Water Resources Conference, Albuquerque*, NM. Contact Michael E. Campana, Conference Chair, University of New Mexico, Water Resources Program, 1915 Roma, NE, Albuquerque, NM 87131-1217. Phone: (505) 277-5249; fax: (505) 277-5226; e-mail: aquadoc@unm.edu.
- 17–19 *The National Urban Watershed Conference*, Costa Mesa, CA. Contact: The National Water Research Institute, 10500 Ellis Avenue, PO Box 20865, Fountain Valley, CA 92728-0865. Phone: (714) 378-3278, fax: (714) 378-3375, e-mail: NWRI-2@worldnet.att.net.

January 2002

- 27–30 *Water Reuse, Conservation, and Resources Management*, Las Vegas, NV. Contact Debby Qualls, Water Environment Federation, 6666 West Quincy Avenue, Denver, CO 80235. Phone: (303)347-6240; e-mail: dqualls@awwa.org; web site: www.awwa.org/02sources.

February–March 2002

- Feb 27–
March 1 *2002 National Mitigation Banking Conference*, Washington, DC. Contact Terrene Institute at (703) 548-5473 or visit the web site at www.terrene.org.

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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 ground water. NPS pollution is associated with land management practices involving agriculture, silviculture, mining, and urban runoff. Hydrologic modification is a form of NPS pollution which 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 nor 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 (703) 548-5473 or FAX (202) 260-1977.

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