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The Ecological Management & Restoration of Watersheds

Special Focus: Wetlands

Draft Guidance for Constructed Treatment Wetlands Available for Public Comment

The CWAP logo denotes articles related to action items called for in the President's Clean Water Action Plan. See News-Notes #51 and #52 for more information on the plan.

After nearly three years of effort, an interagency federal workgroup has published and released for comment *Draft Guiding Principles for Constructed Treatment Wetlands: Providing Water Quality and Wildlife Habitat*, which offers advice on building and operating wetlands to treat an array of wastewater discharges. Produced by the Interagency Workgroup on Constructed Wetlands, the 39-page document offers guidance for locating, constructing, and operating constructed treatment wetlands designed to improve the water quality of discharges such as wastewater effluents and stormwater runoff while providing valuable wetland habitat. *Guiding Principles* also outlines current policies, permit programs, regulations, and resources, and answers frequently asked questions regarding constructed treatment wetlands.

Guiding Principles addresses many of the policy and permitting issues associated with constructed treatment wetlands. It summarizes technical and procedural information gathered by an interagency workgroup comprised of 42 members representing six agencies. Experts from state and local agencies and academic institutions, shared their knowledge and experience with the group, who displayed an extraordinary level of cooperation in pooling their professional expertise to communicate the most important lessons, specifications, and policy considerations concerning constructed treatment wetlands.

Robert Bastian, one of the EPA Project Coordinators, noted that "establishing guidelines for the development of constructed wetlands will help make it possible to get developers, environmental interests, policy makers, and regulators all singing off the same song sheet. Once involved parties

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clearly understand what the others are trying to do, they should be more amenable to supporting the creation of wetlands that not only polish wastewater effluents for downstream use, but also create high-value wetland habitat, including habitat for endangered species."

Designing and building wetlands to treat wastewater is hardly a new concept. As many as 5,000 constructed wetlands have been built in Europe, with about a thousand already in operation in the United States. Constructed treatment wetlands — in some cases involving the maintenance of valuable wetland habitat — have become particularly popular in the Southwest, where arid conditions make the wetland habitat supported by these projects an especially precious resource. The usefulness of constructed wetlands is not limited to treating municipal wastewater and stormwater runoff; constructed wetlands are also being used across the nation to enhance the water quality of landfill leachates, a variety of industrial effluents, acid mine drainage, agricultural runoff, and wastewater from confined animal production operations. In many cases, constructed wetlands have become an alternative to traditional advanced wastewater treatment systems. Because constructed wetlands offer the possibility of creating new wetland habitat and other advantages in addition to treating wastewater, properly designed projects are earning a reputation as "win-win" projects that provide environmental benefits while reducing operating costs.

While the environmental gains of constructed treatment wetlands can be significant, there are also risks in building wetlands for wastewater treatment. Potential adverse impacts include disrupting plant and animal communities, altering the hydrology of natural wetlands or other surface waters, introducing and spreading noxious species, and degrading downstream water quality and groundwater sources. An important objective of the guidance is to help practitioners avoid environmentally harmful impacts by proper planning, design, construction, and operation of projects.

One constructed treatment wetlands success story is the Tres Rios Demonstration Project in Phoenix, Arizona. In 1990, city managers in Phoenix needed to improve the municipal wastewater treatment plant to meet new water quality standards issued by the Arizona Department of Environmental Quality. After learning that upgrading their 91st Avenue Wastewater Treatment Plant might cost as much as $635 million, the managers began to look for a more cost-effective way to polish the treatment plant's wastewater discharge to the Salt River.

A U.S. Army Corps of Engineers' preliminary feasibility study suggested that the city consider a constructed wetland system that would polish effluent, support high-quality wetland habitat for migratory waterfowl and shorebirds, including endangered species, and downstream residents from floods at a lower cost of than retrofitting their existing treatment plant. As a result, the 12-acre Tres Rios Demonstration Project began in 1993 and now receives about two million gallons of effluent per day.

The city and the Bureau of Reclamation then asked EPA for help in dealing with the numerous policy and permitting issues associated with expanding the demonstration project to a full-scale, 800-acre project; this led to a 1995 project funded by EPA's Environmental Technology Initiative. This project has yielded promising results. During the past year, the Corps has begun investigating the feasibility of expanding the project to other parts of the greater Phoenix area.

As the number of constructed wetland projects grows, the Interagency Workgroup hopes that the guidance will become a reference source for an increasingly diverse range of professionals. Preliminary public feedback on the recently published draft, *Guiding Principles for Constructed Treatment Wetlands*, shows that the guidance is occupying an important and previously unfilled niche in the field of constructed treatment wetlands.

Interagency Workgroup on Constructed Wetlands Members

Department of Defense
- U.S. Army Corps of Engineers

Department of Commerce
- National Marine Fisheries Service

Department of Interior
- U.S. Fish and Wildlife Service
- Bureau of Reclamation

U.S. Department of Agriculture
- Natural Resources Conservation Service

Environmental Protection Agency
- Office of Wetlands, Oceans, and Watersheds
- Office of Wastewater Management
- Office of Science and Technology
- Office of General Counsel
- Regions I-X

Draft Guidance for Constructed Treatment Wetlands Available for Public Comment (continued)

The guidance is available for public comment through November 30, 1999. Once comments have been received and addressed by the Workgroup, the guidance will be revised and issued in final form.

[To review the document on the Internet, go to www.epa.gov/owow/wetlands/constructed/guide.html. To receive a paper copy, contact Peter Mali, Office of Water, Wetlands Division (4502F), U.S. Environmental Protection Agency, 401 M Street, SW, Washington, DC, 20460. fax: (202) 260-8000; e-mail: mali.peter@epa.gov. For more information, contact Bob Bastian, U.S. EPA, Office of Wastewater Management, 401 M Street, SW, Washington, DC, 20460. Phone: (202) 260-7378. Fax: (202) 260-0116; e-mail: bastian.robert@epa.gov.]

A Stormwater Solution That Works

A new stormwater treatment system is turning heads and drawing wildlife in Lansing, Michigan. Thought to be the first of its kind in the world, the Tollgate Drainage District Wetland Detention Basin is designed to mimic a natural wetland ecosystem, complete with wetland ponds, waterfalls, spillways, a peat/sand filter, and spreading ditches. The Tollgate system collects and treats runoff from 554 single-family homes in a 234-acre neighborhood and serves as a recreational and educational resource for community members.

Named after a tollgate on a road at the outlet of the drainage district during the late 1800s, the Tollgate Drainage District has served the residential portion of the Lansing Township with a combined sewer system since the 1940s. Until recently, the nearby city of Lansing received and treated the combined sewage. Because of frequent combined sewer overflows into the Red Cedar and Grand Rivers, the city was forced to mandate that the township separate its sewers. Once the sewers were separated, the city would continue to accept sanitary sewage, but the township had to manage its own stormwater.

Faced with the extremely costly traditional means of treating or conveying stormwater, Patrick Lindemann, Ingham County Drain Commissioner, turned to a less traditional option — a constructed wetland. "Often stormwater is piped directly to the river and discharged. We saved from $14 million to $17 million by not taking it to the river, and we are removing the nonpoint source pollutants from the stormwater." The commissioner, based on input from the community, chose a 3,000-gallon-per-minute recirculating wetland system to collect and treat stormwater and sump pump water from the neighborhood. It was built entirely on public land, part of which holds a municipal golf course. The 35.8 acre-feet of storage built into the system can hold stormwater from up to a 100-year, 24-hour storm event; additional stormwater will overflow into the golf course's holding ponds that double as water hazards. If necessary, 10 cubic feet per second of stored water can enter the city's treatment facility.

Community Involvement

As expected, the project initially generated community opposition, principally because the project would be paid for by a stormwater tax levied on the 554 homeowners. But, because stormwater management was mandated, they had to select a management system. To allay their concerns, the commissioner met with the public numerous times during the system selection stage, going door-to-door and meeting in groups. Once citizens realized that the wetland system would cost just over $6 million, whereas other conventional alternatives could cost more than $20 million, they chose the wetland option.

After the wetland system was selected, the commissioner combined the design and construction of the system with a continued rigorous public outreach and education effort. To simplify the education process, the neighborhood was divided into 11 districts that held numerous backyard barbeques, block parties, and living room meetings to inform homeowners about ways they could reduce their impact on stormwater and still maintain an attractive landscape. At the meetings, Lindemann explained how by reducing nonpoint source pollution, homeowners would save money by decreasing the cost of maintaining (grit chamber clean-outs, pond dredging, etc.) the wetland system.

The commissioner intends to continue the public outreach process for another 10 to 15 years. He has already planned multiple backyard barbeques for next summer, as well as neighborhood tours

A Stormwater Solution That Works (continued)

of the wetland system. "Education can't happen overnight," he said. "Eventually we hope to form a 'Friends of the Tollgate Wetland' group that will carry on the education process."

The commissioner's staff also conducted frequent surveys of every household to assess response and understanding. Not only did the surveys indicate when additional informational meetings were needed, they also helped identify community preferences. "We found from our surveys that one-third of the residents walk two miles a day. So, we built a ½-mile trail around the system," explained Lindemann. "The community loves it!"

The Wetland System

System Operation

Placed in an 11-acre park and on part of an adjoining golf course, the system is managed by the Ingham County Drain Commissioner using stormwater tax dollars. Water is collected from residential areas by catch basins and transported

(1) by gravity through grit chambers,

(2) over a limestone ledge to neutralize the water,

(3) into the upper pond (11,500 ft^2 and 5 ft deep), built to mimic a dead wood swamp,

(4) through a 60-foot stream (6 to 12 inches deep) containing meanders and eddies that encourage evaporation,

(5) into a second pond (10,120 ft^2 and 4 ft deep) containing neutralizing limestone ledges and built bell-shaped to dissipate energy and collect sediment,

(6) through a peat/sand filter (12,865 ft^2 and 0.5 to 2 ft deep) to remove nutrients and pollutants,

(7) into a spreading ditch (500 ft long by 2 ft wide) that removes sediment and encourages evaporation,

(8) through a live hardwood swamp that also has native species (living trees, left in the existing swamp when the system was constructed, will die and create a deadwood swamp),

(9) into three wetland ponds—here water enters a pipe and is forced back up to the top of the system, and,

(10) when water levels exceed wetland pond capacity, into holding ponds located on the adjacent golf course.

Maintenance Required

Little maintenance is anticipated for this seemingly complex system, with the exception of the following:

✔ Pond biomass (cattails, etc.) will be harvested and composted annually.

✔ Peat in the peat/sand filter will be replaced every few years.

✔ Ponds will be dredged every 10 years.

Other Benefits

In addition to offering recreational opportunities, the now-complete system is an outdoor classroom. "We see the system as a tool to teach pollution abatement. Nonpoint source pollution is purely a function of social behavior — you really have to educate," remarked Lindemann. The commissioner's staff provide site tours for schoolchildren, government officials, and citizens. The commissioner's office also partners with community groups to develop curricula for local schools, build birdhouses, and post educational signs describing the treatment process and identifying the growing populations of wildlife and native plants.

The wetland system has also benefitted the community golf course. One of the three ponds used for irrigation on the golf course is tied into the system. Pond water nutrient levels are tested before irrigation and are taken into account in the overall fertilizer application budget. This practice has reduced nutrient loading into the ponds and decreased golf course maintenance costs.

Although the system has been operating only since mid-1997, preliminary monitoring data indicate that, compared to untreated stormwater, the system has reduced suspended solids and pH and increased dissolved oxygen levels. The Michigan Department of Environmental Quality recently awarded commissioner Lindemann a grant to monitor the nutrient removal effectiveness of the peat/sand filter.

In addition to protecting water quality, the treatment system provides a beautiful park with walking trails and wildlife habitat for the community to enjoy. A forested island in the center of one of the ponds provides even more isolated wildlife habitat. Moreover, community members have remained involved and informed during the whole construction process, gaining knowledge about nonpoint source pollution prevention that they can pass on to future generations.

[For more information, contact Patrick Lindemann, Ingham County Drain Commissioner, P.O. Box 220, Mason, MI 48854-0220. Phone: (517) 676-8395.]

Wetlands Health Assessments in Massachusetts

Historically, the success of national and state wetland policies has been largely measured by the trend in wetland acreage. However, actions taken to stem losses and to recover wetlands may not be adequately protecting wetlands functions and values. The Massachusetts Coastal Zone Management (MCZM) Program, the University of Massachusetts Cooperative Extension (UMass), and the Massachusetts Bays Program (MBP), have been working to develop a transferable approach to assess wetland quality or ecological health.

Wetlands Health Assessments in Massachusetts (continued)

In a pilot project in Waquoit Bay watershed on Cape Cod, the trio designed a comprehensive evaluation, incorporating ecological indicators and rapid assessment procedures. In the past year, the methods were successfully tested on study sites north of Boston where the geology and hydrology differed significantly from the coastal plain of Cape Cod. This past summer, citizen volunteers monitored wetlands undergoing restoration as part of a longer term effort to encourage citizen stewardship and help develop a training module.

Measuring Ecological Indicators

Assessing a wetland includes measuring wetland vegetation, aquatic macroinvertebrates, avifauna, water chemistry, and hydroperiod. For each ecological indicator, an index (or scoring mechanism) is used to combine a number of metrics (measurements, variables, and attributes) into a single rank or score. Examples of the metrics include species diversity (or total number of species), community composition (such as the relative number of species representing certain families), and abundances of rare or pollution-tolerant species.

Fourteen test sites — seven freshwater and seven salt marsh wetlands in the Ipswich and North Coastal watersheds — were selected along a scale of human disturbance called the Land Use Index, which is a measure of perturbation at a specific site. It includes both a field-based survey and a remote-sensing component. The field survey takes into account readily identifiable impacts, such as storm drain discharges, eroding banks, runoff, or the presence of litter. Test sites are compared with a wetlands reference site selected because it shows minimal signs of human disturbance, is in permanent conservation ownership, and belongs to a similar hydrogeomorphic wetland type. Chemical and hydrological data are collected to help interpret the output scores. The final output is a cumulative Wetland Ecological Integrity Score that combines the scores of all the measured ecological indicators into one quantitative rank.

Rapid Assessment

The rapid assessment procedures include separate evaluations for habitat quality, nonpoint source inputs from surrounding land use (as a measure of human land disturbance), and a measure of functions and values. Distinct from field-based measurements, the rapid assessments rely on relatively simple observa-tions, existing information, simple calculations, and questions to evaluate habitat quality, nonpoint source contributions, and wetlands functions and values. These methods can be applied quickly, easily, and inexpensively and complement the field-based indicators by gathering basic information on wetland and landscape conditions. The field-based observations, along with the rapid assessments, can be combined into an overall measure of wetland ecological condition.

Results

Results from the North Shore projects corroborate the findings of the pilot project on Cape Cod that with increasing human disturbance, the integrity of the biological communities declines, along with water quality and hydrology. Shifts in plant and invertebrate community structure and indicator species richness and abundance were strongly associated with sources of nonpoint pollution, such as direct stormwater discharges and indirect septic system loads, and with direct physical habitat impacts, such as fill or hydrologic disturbance. High concentrations of nutrients, total and dissolved solids, and fecal coliform bacteria were found in the wetlands receiving direct discharges of stormwater and groundwater from

Wetland Program Development Grants Available

EPA's Wetland Program Development Grants are designed to assist state, tribal, and local government agencies in building their wetland management programs by helping them develop plans and management tools, advance the science and technical tools for protecting wetland health, facilitate the development of watershed stakeholder partnerships, and improve public access to wetland information.

Wetland Program Development Grants are applied for through EPA Regional Office staff who review the applications and select the most competitive projects for funding. FY 2000 target deadline dates for initial proposals or pre-applications are as follows:

- Region I — December 1, 1999
- Region II — December 3, 1999
- Region III — October 4, 1999
- Region IV — October 30, 1999
- Region V — December 15, 1999
- Region VI — October 1, 1999
- Region VII — contact regional office at (913) 551-7320
- Region VIII — December 3, 1999
- Region IX — September 1, 1999
- Region X — October 15, 1999

[For more information, call the Wetlands Hotline at 1-800-832-7828, e-mail: wetlands-hotline@epamail.epa.gov or visit the grants web site at www.epa.gov/owow/wetlands/2000grant/.]

Wetlands Health Assessments in Massachusetts (continued)

upland sources. Functional and habitat assessment scores decreased as the intensity of nearby land uses increased.

Citizen Monitoring

Citizen volunteers were trained to conduct wetland health assessments this past summer at several wetlands recently restored by improving tidal flow. Concurrent with citizen monitoring, program scientists collected data to validate the citizen effort and develop an easy-to-use-training manual for volunteers. The citizen volunteers may have been the most innovative, as well as the most challenging part of the project, given their varying levels of experience in environmental monitoring and wetlands biology. However, it was also one of the most rewarding aspects of the project; they were enthusiastic about learning the skill and many suggested how the assessments could be improved.

Measuring wetlands health is the next step in the evolution of regulatory protection for wetlands. If a health assessment can show how wetland functions and values respond to permitted wetlands mitigation, it will assist with regulatory decision making. Combining the rapid assessment with ecological indicators will improve understanding of the health of wetlands and how they are impacted. By engaging citizens to monitor wetlands, the project partners hope to foster stewardship of wetlands and educate communities on the complicated issues surrounding wetlands.

[For more information, contact Jan Smith, Executive Director, Massachusetts Bays Program, 100 Cambridge St., Massachusetts. Phone: (617) 727-9530 ext. 419; e-mail: Jan.Smith@state.ma.us.]

League of Women Voters Knee Deep in the Crusade to Protect Wetlands

You might find members of the League of Women Voters marching on Capitol Hill or running a local voting booth, but who would think they could be found planting trees in a swamp? Many League members have been doing that and more, working hard at restoring and protecting local wetlands and getting their communities to help them.

Through a cooperative agreement with EPA's Office of Wetlands, Oceans, and Watersheds, the League has completed 11 wetland-related restoration, protection, and education projects in 10 states. Before beginning their wetland projects, the League trained its members on the functions and values of wetlands; on national policy regarding wetlands; and on community education and public involvement strategies. The projects ranged from designing and conducting wetland workshops and tours to showing educational videos and putting together a traveling watershed model that included wetlands.

For example, a League chapter in Victoria, Texas, recognized a community need to include wetlands education in their schools' curricula. They used a constructed wetlands education facility and organized and facilitated a training workshop for 45 administrators and science teachers from the Victoria Independent School District. The Dupont-Victoria wetland education facility, a 50-acre wetland constructed as part of a $130 million environmental improvement program at DuPont Nylon's site in Victoria, provides a "polishing" component for a new wastewater treatment facility at the site and is used by the public as a wetland habitat and educational resource. In a full day of activities, participants learned the value of wetlands and gained an understanding about the need for public education on wetlands. Participants left with resource materials and other educational information to use in their classrooms. As a result of the project, the Dupont-Victoria site coordinator estimates that 2,000 to 2,500 students will visit the site each year. Many sessions have already been booked. The project is jointly funded by the Dupont-Victoria facility and EPA.

In another project in Rochester, New York, the Natural Resources Committee of the Rochester Metro Area League used EnviroScape®, a portable watershed model developed by JT&A, inc., to demonstrate the effect of NPS pollution on wetlands. They used the model in an outreach program that focuses on area youth. The model has hills, a stream, a pond, animals, trees, houses, vehicles, and more. They demonstrated the four basic functions of wetlands — water absorption, water filtering, habitat, and recharge — using sponges to simulate wetlands and cotton swabs to simulate cattails. League members "treated" the landscape with fertilizer (green drink mix) and

League of Women Voters Knee Deep in the Crusade to Protect Wetlands (continued)

pesticides (red drink mix) and let the students use water bottles to simulate rain. "The effect is very dramatic," says Natural Resources Committee Chairperson Jane Schmitt, "the sponges and cotton swabs change color as they absorb and remove some of the 'fertilizer' and 'pesticide' from the runoff." They also used a miniature tractor and cocoa to simulate soil erosion. The cocoa was sprinkled on the model's parking lots to demonstrate runoff from paved surfaces.

During the 1998 fall semester, League members presented the model to more than 1,100 children (grades 3-6) and adults, after school programs, Boy Scout Councils and Troops, environmental fairs, and at community events. The presentation also includes one of Terrene Institute's videos, called *Wake Up to Wetlands*, to help participants understand the functions and values of wetlands in their community.

"Although it has been a lot of work, the project has been fun and we have gained new members as a result. The children are very enthusiastic and really get involved in the presentation," remarked Schmitt. The presentations continue to be scheduled with Boy Scouts and Girl Scouts and at community events. The Rochester Museum of Science and Technology has even borrowed the model for use in their environmental education programs.

These and are other wetlands projects undertaken by the League are summarized in the League's Wetland Web Walk web site at www.lwv.org/webwalk/index.html. The League hopes that the summaries and lessons learned from these projects will help other watershed activity coordinators plan a successful wetland project in their community. The web site also addresses common problems associated with small community projects, such as recognizing community needs; finding leaders, partners, and funding; and keeping the momentum going for the activity or product.

The League is currently working on a project with EPA's Office of Water to create a national network of active citizen leaders and trainers in the watershed approach and to develop a core curriculum for the trainers to use when they train others. They also plan to distribute the curriculum to other organizations to increase the base of trained citizen leaders. Through this project, dubbed the ECH$_2$O Project, the League will encourage and facilitate the development of active watershed coalitions around the country.

[For more information, contact Bonnie Burgess, League of Women Voters, 1730 M Street, NW Washington, DC 20036-4508. Phone: (202) 429-1965; fax: (202) 429-0854; e-mail: BonnieB@lwv.org. For more information on the League in Rochester, contact Jane Schmitt, Chairperson Natural Resources Committee, League of Women Voters/Rochester Metro Area; e-mail: john_schmitt@bigfoot.com.]

BP Amoco Puts Extra Land to Good Use

BP Amoco Chemical Company is working for wildlife, water quality, and community education at its Decatur, Alabama facility. In the early 1990s, BP management decided to use a portion of its unused, undisturbed land for a community education and wildlife enhancement area. They partnered with the Wildlife Habitat Council to improve habitat and develop a 1.3-mile nature trail through 10 acres of a wooded natural depression wetland. The open-access nature trail gave BP Amoco employees and local citizens with the opportunity to observe bottomland and wetland flora and fauna up close.

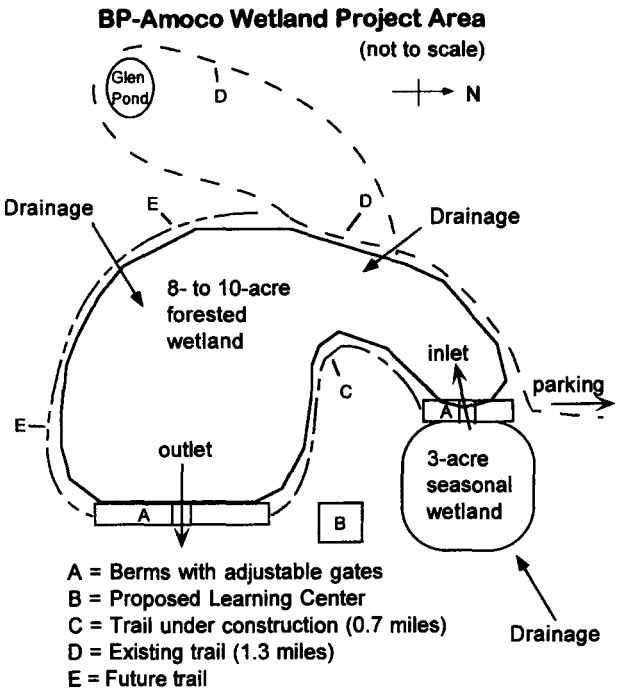
To recognize BP Amoco's education and protection efforts, the Wildlife Habitat Council awarded the Decatur facility the 1997 Corporate Habitat of the Year award. Enthused by the success of its first project, BP Amoco plans to expand its project area and scope. "Our management wants to show the community that BP Amoco continues to be very concerned about protecting the environment" remarked Chris James, BP Amoco project manager.

Ultimately, BP Amoco hopes to improve the wetland area and trail and construct a learning center adjacent to the wetland area for the community. Now, thanks to a $10,000 grant from EPA's Five Star Restoration Grant Program, BP Amoco is one step closer to its goals. The Five Star Restoration Program provides grants, facilitates technology/information transfer and partner collaboration, and supports peer-to-peer communication programs in an effort to promote community-based wetland and riparian restoration projects. The grant will allow BP Amoco and

BP Amoco Puts Extra Land to Good Use (continued)

its partners to expand the wetland area by 25 percent, add additional nature trails, and replace undesirable plant species with beneficial plants.

BP Amoco's partners will serve key project implementation roles. Wetland and habitat development will be led by experts from the Natural Resources Conservation Service, Flintcreek Watershed Project, Tennessee Valley Authority, the Morgan County Soil and Water Conservation District, and the Wildlife Habitat Council. Inmates at the Alabama Department of Corrections will provide manual labor. A local contractor will supply supervisory and heavy equipment expertise. Various student groups, including the City of Decatur Youth Services Corps, a local Boy Scout Troop, and a local elementary school, will conduct planting and other projects. To support these efforts, BP Amoco personnel will direct the project as well as supply the balance of project funds.



The first portion of the project, expansion of the wetland, has recently begun with the construction of two gated berms across the drainage area. The first, below the wooded natural depression wetland, will serve to raise the water level and expand the main wetland area. The second berm is located upgradient below a separate wetland area that was historically drained for agriculture. BP Amoco purchased the field in the early 1990s to restore it for wildlife. With the berm in place, the field will become a seasonally flooded basin wetland. The berm gate will remain open during the growing season to allow mixed grains, such as millet and buckwheat, to grow in the basin and to allow for waterfowl nesting. At the end of each growing season the basin will be slowly filled at six- to eight-inch increments, forming a shallow landing and feeding pond for migratory waterfowl. The basin will remained filled until the following growing season.

BP Amoco's expanded wetland project couldn't come at a better time. The site is located at the base of a small watershed empties directly into the Tennessee River. Recent construction in the large industrial park within the watershed is expected to decrease the quality and increase the quantity of stormwater runoff moving through BP Amoco's project site.

James sees BP Amoco's wetland project as a way to prevent nonpoint source pollution from reaching the river. "We expect the stormwater flows to change down the road as construction of buildings and parking lots continues. The expanded wetland will capture filter contaminated water." To date, the current drought in the area has prevented marked stormwater flow changes.

The environmental commitment of BP Amoco's Decatur facility is as a model for other business landowners. Through partnering efforts and voluntary improvements to previously unused land, BP Amoco is now educating the community about wetland areas, improving wildlife habitat, and increasing the filtering capacity of a wetland in a rapidly developing drainage area.

[For more information, please contact Chris James, BP Amoco Chemical Company, Finley Island Road, P.O. Box 2215, Decatur, Alabama 35601. Phone: (256) 340-5476; e-mail: jamesec@bp.com.]

Notes on the National Scene

Proposed Rule Strengthens TMDL Regulations

On August 14, President Clinton announced in his weekly radio address that EPA is proposing regulations establishing a new framework for identifying and cleaning up our nation's polluted rivers, lakes, and estuaries.

The Clean Water Action Plan (CWAP) launched last year by the President provides communities with new resources to reduce polluted runoff and other threats to water quality. The new proposal would complement the CWAP by strengthening EPA's Total Maximum Daily Load (TMDL)

Proposed Rule Strengthens TMDL Regulations (continued)

regulations (40 CFR Part 130) under the Clean Water Act's Section 303(d) to help restore 20,000 waterways nationwide. If adopted, these new rules would help restore approximately 300,000 river and shoreline miles and approximately 5 million acres of lakes that are now impaired by sediment, nutrients, harmful microorganisms, viruses and bacteria, metals, and other pollutants.

The primary mission of EPA's TMDL program is to protect public health and ensure healthy watersheds. The program identifies polluted waters (the section 303(d) listing process); determines how much pollutants must be reduced to meet water quality standards (establishing the TMDL); and ensures on-the-ground actions to reduce the pollutants (implementation). Listing impaired and threatened waters and establishing TMDLs are fundamental tools for identifying the remaining sources of water pollution and achieving water quality goals.

Don Brady, Watershed Branch Chief in EPA's Office of Wetlands, Oceans, and Watersheds, says that "The purpose of the proposed revisions is to identify water quality problems and develop clean-up plans, or TMDLs, for them." The proposed rule will help provide the public with more information about the health of their watersheds by comprehensively accounting for impaired or threatened waterbodies, ensuring public participation and enhanced clarity in the development of the lists and the selection of priorities, and giving clearer direction to and promoting consistency among states, territories, and authorized tribes in the development of schedules and priorities. Specifically, the proposed rule would revise the 303(d) list development process in the following ways:

- Identify all waterbodies impaired or threatened by pollutants.
- List waterbodies according to a methodology that explains to the public and EPA how existing and readily available data are used to identify impaired waterbodies.
- Require public participation in developing this methodology.
- EPA approval of the methodology would not be required, but EPA approval of the list would still be required.
- Require schedules for establishing TMDLs for each waterbody, phased over a 15-year period with high-priority waters first.

Developing TMDLs

Once the states, territories, and authorized tribes have identified their polluted waters, they begin to develop TMDLs. Before each TMDL is submitted to EPA, the public must have at least 30 days for public review and comment. The proposed regulatory changes would require that each TMDL have, at the very minimum, the following 10 elements:

- Name and location of the impaired or threatened waterbody.
- Identification of the pollutant and the amount that the waterbody can receive and still meet water quality standards.
- The excess amount of the pollutant that keeps the waterbody from meeting water quality standards.
- Identification of the source or sources of the pollutant.
- A determination of the amount of pollutants that may come from point sources.
- A determination of the amount of pollutants that may come from nonpoint sources.
- A margin of safety in case the modeling or monitoring techniques are not adequate.
- Consideration of seasonal variation to account for water levels, temperature, etc.
- An allowance for future growth and reasonable foreseeable increases in pollutants.
- An implementation plan with on-the-ground actions to ensure that the TMDL will result in a healthy watershed.

A TMDL specifies the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and allocates pollutant loadings among point and nonpoint sources while maintaining a margin of safety.

For more background on TMDLs, see *News-Notes* Issues #47, #49, and #51 or visit EPA's TMDL web site at www.epa.gov/owow/tmdl.

The proposed regulations call for each TMDL to have an implementation plan with a list of actions needed to reduce pollutants, a time line describing when these actions will occur, reasonable assurance that pollutants will be reduced, legal authorities that will be used to ensure reductions, an estimate of the time it will take to reach water quality standards, a monitoring or

Proposed Rule Strengthens TMDL Regulations (continued)

modeling plan to determine if the on-the-ground actions are working, milestones for measuring progress, and plans for revising the TMDL if necessary.

The proposed rule also revises the National Pollutant Discharge Elimination System (NPDES) and Water Quality Standards regulations to facilitate implementation of TMDLs. The revisions would require large, new, or significantly expanding dischargers to obtain an offset of one-and- a-half times their proposed discharge before beginning to discharge. If a waterbody is polluted, large, new, or expanding dischargers must work with other pollutant sources in the watershed to reduce or "offset" the total amount of the pollutant coming into the waterbody.

In the proposed revisions, EPA asks states, territories, and authorized tribes to include "reasonable assurances" in their implementation plans to make sure that these "on-the-ground" actions will occur. Reasonable assurance can be demonstrated in a variety of ways. For example, states, territories, and authorized tribes could use their nonpoint source management programs; federal, state, or local cost-sharing programs; or local ordinances and zoning requirements to demonstrate a commitment to reducing pollutants.

To enhance EPA and the state's ability to establish reasonable assurance, the proposed changes would allow them to decide that certain nonpoint sources are causing significant water quality problems. The proposed regulations would allow states and EPA to require these sources to have an NPDES permit. This authority would be limited to animal feeding operations, aquatic animal production facilities, and some discharges from forestry operations.

The proposed regulatory revisions were published in the *Federal Register* on August 23 and again on September 24 when the comment period was extended until December 22. Draft guidance is also available for comment.

[A copy of the proposals and the guidance are available on EPA's web site at www.epa.gov/owow/tmdl. Written comments on the proposed regulatory revisions to the TMDL program should be sent to Comment Clerk for the TMDL Rule, Water Docket (W-98-31), U.S. Environmental Protection Agency, 401 M Street, SW, Washington, D.C. 20460. Comments will also be accepted via e-mail through ow-docket@epa.gov.]

What "Nonpoint Sourcers" Need to Know About the 2000 Clean Water Needs Survey

Although nonpoint source pollution needs were included in the 1992 and 1996 Clean Water Needs Surveys (CWNS), EPA and state NPS coordinators have been working to improve their estimates of the needs to address nonpoint source pollution.

EPA is working with the states to develop the 2000 CWNS, as required by sections 205(a) and 516(b)(1) of the Clean Water Act (CWA). This will be the 13th such survey since the CWA was passed in 1972. The CWNS estimates the capital costs for water quality improvement projects and other activities eligible for Clean Water State Revolving Fund (SRF) support. The 1987 Amendments to the CWA authorized use of the SRF to address nonpoint source pollution.

For the purpose of the CWNS, a NPS need is a cost estimate for achieving an economically reasonable level of control on a particular NPS pollution problem. The needs assessment will include an identification of the problem, the location of the problem, the solution for the problem, the cost of the solution, and the basis for determining this cost.

In the 1996 CWNS, EPA modeled needs for agriculture and silviculture using USDA's National Resources Inventory database, which contains data on area of farm land, crop type, soil erosion rates, and other variables. EPA constructed a model to estimate needs to control nonpoint source pollution from cropland, pastureland, and rangeland. They then used Census of Agriculture data for each state to help calculate needs for animal feeding operations. The silviculture model used information on privately owned forestland from the U.S. Forest Service's Forestry Resources of the United States. Only privately owned forests were considered since federal lands are ineligible for SRF loans.

A best management system for each land type and source category was then identified and costed out, yielding an estimated needs figure. Using the model, the 1996 CWNS estimated needs

What "Nonpoint Sourcers" Need to Know About the 2000 Clean Water Needs Survey (continued)

totaling $9.4 billion to properly address pollution from silvicultural and agricultural sources, a figure criticized by many as being too low.

A few states actually documented needs, as opposed to modeling them for the previously mentioned nonpoint source categories, as well as for the following categories.:

- Urban
- Ground water
- Estuaries
- Wetlands

These documented needs were listed separately from the modeled needs for agriculture and silviculture in the 1996 CWNS; the methods used for documenting varied from state to state.

EPA is attempting to use only actual documented needs, as opposed to modeled needs, for the 2000 CWNS. Since the last CWNS, EPA has updated its CWNS database, which it has used in the past to help calculate needs for point sources. The database is specifically designed to

- easily report water quality needs data within watershed boundaries, as well as more traditional political boundaries;
- organize and report data from NPS needs in a standardized reporting format; and
- require geo-locational data (i.e., latitude and longitude) for all places with water quality or public health needs.

Preliminary Schedule for the 2000 CWNS

- ✔ 2000 CWNS Manual to States March 2000
- ✔ 2000 CWNS Database Finalized August 2001
- ✔ Data Collection Begins April 2000
- ✔ Report to Congress February 2002
- ✔ Data Collection Ends January 2001

The Agency is sponsoring a NPS subcommittee of state representatives from across the nation to help ensure consistency in the way states document nonpoint source needs. The subcommittee, chaired by the Illinois Bureau of Water, is exploring a variety of NPS issues and plans to provide guidance to other states.

NPS needs data from the states are essential to more fully document the extent and types of NPS pollution sources as well as the costs for implementing solutions to address them. If enough of these data are provided, EPA should be able to more accurately estimate what our nation's true NPS needs are.

[A complete copy of the 1996 Clean Water Needs Survey Report to Congress can be found www.epa.gov/OWM/uc.htm. For more information, contact Rick Mollahan, Illinois Environmental Protection Agency, P.O. Box 19276, Springfield, IL 62794-9276. Phone: (217) 782-3362; fax: (217) 785-1225; e-mail: epa1184@epa.state.il.us.]

EPA Releases Draft Guidance for Concentrated Animal Feeding Operations Permits

EPA has just released a draft guidance manual and example permit for state and EPA offices who issue Clean Water Act permits for concentrated animal feeding operations. On March 9, 1999, the USDA-EPA Unified National Strategy for Animal Feeding Operations (AFOs) set forth a range of flexible, common-sense actions to minimize water quality and public health impacts of AFOs, while ensuring long-term sustainability of livestock production in the United States. The strategy reflects extensive public comment, including 11 public meetings around the country. EPA is also taking comments on the draft guidance before it becomes final.

An estimated 15,000 to 20,000 concentrated animal feeding operations will be required to develop comprehensive nutrient management plans and comply with Clean Water Act requirements as part of their National Pollution Discharge and Elimination System (NPDES) permits (about 2,000 have been issued). These larger facilities can significantly impair water quality. Most of the more than 400,000 animal feeding operations will be encouraged to voluntarily develop their plans, and USDA is currently preparing a companion document to guide them.

The new guidance manual and example permit will improve implementation of the permitting program consistent with existing regulations and accelerate issuance of NPDES permits for large

New CAFO Fact Sheets Available

EPA's National Agriculture Compliance Assistance Center has released six new species-specific concentrated animal feeding operation (CAFO) fact sheets as companions to their earlier publica- tion titled, "CAFO Permit Requirements — General" (Ag Center document no. 11001). The fact sheets cover slaughter and feeder cattle, dairy cattle, horses, sheep, swine, and poultry.

You can order the fact sheets through the Center's "fax-back" system, and you will soon be able to view them on the web at http://es.epa.gov/oeca/ag/. For more information, call 1-888-663-2155 toll-free.

concentrated AFOs (e.g., operations with greater than 1,000 animal units) by January 2000. The guidance provides information on which facilities need to apply; the key elements of a NPDES permit for concentrated AFOs; the types of NPDES permits that may be issued and their relationship to comprehensive nutrient management plans; co-permitting of corporate entities; land application of manure; and public notice, monitoring, and reporting requirements. The example permit for state and EPA regional permitting authorities provides additional information about how the guidance should be implemented. It includes information on permit area and coverage, expiration, discharge monitoring and notification require- ments, standard permit conditions, reporting requirements, and much more.

After consolidating comments from a 60-day public comment period, which ended on October 6, EPA will revise the guidance and publish it as final. See *News-Notes* #52 and #54 for more articles on AFOs.

[For additional information, contact EPA's Water Resource Center at (202) 260-7786, or visit the web site at www.epa.gov/owm. You may submit written comments to Gregory Beatty, 401 M Street, SW, Mail Code 4203, Room 2304 NEM, Washington, D.C. 20460. Fax: (202) 260-1460; e-mail: beatty.gregory@epa.gov.]

News from the States, Tribes, and Localities

A Permanent Federal Investment in Conservation — What a Way to Start a Century

by Jack C. Caldwell, Secretary of the Louisiana Department of Natural Resources

Now pending in Congress is one of the most important pieces of conservation legislation this century, rolling into one act funds for coastal impact assistance in 30 states, funds for efforts to keep wildlife off the endangered species list, and full funding of the Land and Water Conservation Fund (LWCF) in all 50 states and territories. This monumental effort is called the Conservation and Reinvestment Act of 1999 (CARA), and is expected to come out of House and Senate committees this fall.

CARA is based on a classic American concept — reinvesting revenues from non-renewable resources (offshore oil and gas) into renewable resources (land, water, and wildlife). A portion of Outer Continental Shelf (OCS) oil and gas revenues (50 percent in Senate bill S. 25 and 60 percent in House bill HR 701) would be shared with the states through three titles to ensure permanent funding to coastal states and communities for impact assistance, beach erosion, and wetlands protection and restoration, and to all states for state parks, recreation, wildlife conservation programs, and federal land acquisition. Currently, all of the money received by the government from rents, bonus bids, and royalty payments from off-shore oil and gas production is used for the annual operating expenses of the federal government.

The impacts from OCS activities on the natural resources, communities, and public infrastructure are especially real in Louisiana, which, along with Texas, supports virtually all of the existing OCS activity in this country. Last year alone, Louisiana generated $2.5 billion in OCS revenue — more than 75 percent of the total revenue generated by OCS in the U.S. Louisiana contains the largest expanse of coastal wetlands in the lower 48 states, comprising more than 25 percent of the nation's coastal wetlands and 40 percent of its salt marshes. These wetlands are instrumental in filtering nutrients, sediment, and other pollutants from surface water runoff before it reaches open water. But Louisiana has already lost more than 1 million acres of coastal wetlands and barrier islands this century and they continue to disappear at the rate of nearly 30 square miles each year.

The very first successful OCS rig was erected 10 miles off the coast of Louisiana in 1947 and since then that number has increased to more than 30,000. Louisiana's coastal area is crossed by tens of thousands of miles of OCS pipelines that leave behind canals up to 70 feet wide and disrupt the natural sheet-flow that is essential to the survival of wetlands.

Hundreds of individuals and groups have endorsed the bills, specifically or in concept, including the National Governors Association, the National Association of Counties, and the International Association of Fish and Wildlife Agencies. The surprising strength of this legislation resides in its strong bipartisan support. At this printing, there were 106 co-sponsors in the House and 22 co-sponsors in the Senate, almost evenly split between Republicans and Democrats.

In Texas and along the Gulf Coast of Florida, the Offshore Continental Shelf (OCS) extends approximately 9 nautical miles seaward.

For all other states, the OCS extends approximately 3 nautical miles seaward.

There are still challenges to CARA, mainly concerning land rights. Some of the Act's proponents fear opposition to permanently funding these investments. However, most of its challenges, including those from environmentalists who say that the bills encourage more offshore drilling, have been resolved.

Facts About CARA

Title I

- The formula for distributing funds under Title I is based on proximity to wells and the number of miles of coastline and population. It was developed by the Coastal Impact Assistance Working Group of the OCS Policy Committee of the Minerals Management Service (MMS), U.S. Department of the Interior.
- All activities funded under CARA must comply with all federal, state, and local environmental regulations and standards.
- Nothing in either of the bills provides incentives for increased OCS drilling or anti-environmental activity of any kind.
- Louisiana, which hosts more than 90 percent of the federal OCS production and provides about $3 billion annually in federal revenues, would receive about 8 percent of these shared revenues.
- Title I provides more restrictions on the use of these funds than are provided in the Mineral Lands Leasing Act, which gives back 50 percent of all federal on-land oil production revenues to states.

Title II

- Title II dedicates 16 percent in S. 25 and 23 percent in HR 702 of federal OCS revenues to fund the Land and Water Conservation Fund, which provides for acquisition of lands for federal, state, and local parks; wildlife refuges; and national forests, as well as for the Urban Parks and Recreation Recovery Program.
- Title II restores state-side funds to the LWCF. For years, Congress has not appropriated the funds authorized for the LWCF.
- Federal land purchases would be those authorized by an Act of Congress from willing sellers. Two-thirds of the money would be spent east of the 100th meridian.

Title III

- Title III dedicates 7 percent in S. 25 and 10 percent in HR 701 of annual federal OCS revenues to a program of wildlife conservation initiatives sometimes referred to as the "Teaming with Wildlife" program. The funds would be allocated to states for wildlife conservation, including programs to prevent species from becoming endangered or threatened.
- The funds would be available to State Fish and Game Departments for game and non-game conservation programs and would be distributed through the Pittman-Robertson Fund.
- Title III will also support national conservation and wildlife education programs.

No user fees or taxes will be involved in Title III, and the bills are not regulatory in any way. Some of the ways the monies from Title III will be spent are: to conserve, restore, and manage fish and wildlife habitats, including wetlands; to invest in more than 2,000 fish and wildlife species that are

A Permanent Federal Investment in Conservation — What a Way to Start a Century (continued)

part of our outdoor experience, such as chipmunks, songbirds, and frogs; to establish canoe or raft corridors; to assist landowners in managing lands for wildlife; to provide trails, boardwalks, observation towers, and viewing blinds; and to restore declining bird species.

[If you would like more information on CARA, visit the Council for the Conservation and Reinvest- ment of Outer Continental Shelf Revenues web site at www.OCSrevenue.org. If you would like to receive an information packet or a 15-minute video on CARA titled "Sounds of Silence," call (225) 342-0556.]

New Survey Takes Maryland Streams into the Next Millennium

Maryland's new Stream Corridor Assessment (SCA) Survey is making life easier for restoration practitioners by helping identify stream restoration priorities in Maryland watersheds. Over the last five years, the Water Restoration Division (WRD) of the Maryland Department of Natural Resources (DNR) has been developing and refining the SCA Survey, a training and assessment tool that will provide assistance to local governments, watershed associations, and any other land management group interested in environmental restoration or management at the small watershed scale.

The SCA Survey provides a quick way of examining an entire drainage network so future monitoring and management efforts can be better targeted. This type of survey is needed in part because many existing stream surveys are very time-consuming and expensive, and they collect information for only a relatively small section of stream at any one time. The SCA Survey, on the other hand, is designed so that teams of two or three volunteers are able to survey two or more stream miles each day. Surveyors receive a full week of training in stream ecology (including morphology) and how to conduct the survey.

The main goals of the SCA Survey are to provide

- A list of environmental problems within a watershed's stream system and riparian corridor,
- Sufficient information on each problem so that a preliminary determination of both its severity and restoration potential can be made,
- Sufficient information so that restoration efforts can be prioritized, and
- A quick assessment of both in-stream and near-stream habitat conditions so that different stream segments can be compared.

In addition to identifying potential problems, the survey records information on the location of potential wetland creation/water quality retrofit sites and collects data on the general condition of both in-stream and riparian habitat. Wetland creation sites are identified as unforested open space near the stream channel or floodplain. A variety of agencies may be involved in wetlands creation, livestock fencing, riparian reforestation, bank stabilization, or other management actions. Funds from several sources can be combined to address the problems identified in the surveys, including federal, state, local, and private grants or mitigation funds. Maryland DNR's WRD or Shore Erosion Control Program, the local conservation district, the Natural Resources Conservation Service, or Ducks Unlimited may manage project implementation. In Maryland watersheds where the SCA Survey has been completed, both state foresters and NRCS personnel are using information on the location of inadequate buffers to help target their outreach programs to property owners where streamside buffers are needed most.

The SCA Survey is based on the idea that watershed restoration is a multilevel interagency and community effort that includes strong local sponsorship. The restoration process involves the following four steps:

1. Assessment of environmental problems using multiple survey techniques, including the SCA Survey.
2. Development of a consensus management plan with the landowner that might include long-term monitoring to clarify unanswered questions or to track restoration efforts.

3. Strategic and opportunistic implementation based on multiple funding sources, especially funding from state and local agencies that are responsible for their community and its environmental infrastructure. In many cases existing budgets can be adjusted to help accomplish restoration and protection goals, as well as a specific agency's management mandates.
4. Evaluation of results and the use of adaptive management strategies to refine restoration and management efforts.

As is the case with all the problem categories, if a site ranks high for potential management action, a restoration specialist revisits the site to confirm the initial assessment and begin to develop a restoration plan.

"The survey's success hinges on local watershed groups," said Ken Yetman, the survey's designer at WRD. "It is designed to work through local watershed groups that have targeted small watersheds through mechanisms like county stormwater management and NPDES programs, Chesapeake Bay Tributary Strategy Teams, or Maryland's Coastal Bays Program." For example, at the request of the Regional Environmental Coordination Division of the Department of Defense, WRD has begun to survey all the small watershed streams on military bases in Maryland for the purpose of environmental restoration.

The data are generally available to anyone who wants them, but SCA Survey data are probably too detailed to be of much use to umbrella organizations like the Bay Program and USDA. However, summary statistics and implementation project results are shared among all the management groups.

It is important to note that the SCA Survey is not intended to be a detailed scientific evaluation of a stream system, nor will it replace the more standard chemical and biological surveys. SCA is complementary to such surveys. SCA inventories primarily observe physical problems and restoration opportunities within a small watershed's stream corridor. Consequently, the survey provides a more comprehensive list of management opportunities than biological surveys, which characterize the general biological health of river basins. A significant difference is the scale and sampling coverage of the two types of surveys. Biological surveys use a statewide random sampling design, which gives broad-scale characterization of biological indicators. Within any small watershed, biological surveys may collect detailed biological information from a small number of 75-meter stream segments (typically one to four sites). In contrast, the SCA Survey collects data on 10 or more physical parameters for the entire length of all perennial stream miles within a targeted second or third order stream watershed. SCA surveys have covered all the stream miles in watersheds with stream networks as short as 10 miles and as long as 200 miles.

Each survey evaluates channel alterations, erosion sites, exposed pipes, pipe outfalls, fish barriers, inadequate buffers, in-stream and near-stream construction, trash dumping, unusual conditions, and representative sites for each stream corridor. Each category is rated from 1 to 5 for severity, correctability, and access for restoration practitioners. At least one photo is taken for each sample location. After the field survey is completed and the data are compiled, it is presented to a local watershed management team. The management team then makes final determinations on the priority rankings and management actions to be pursued. The final report contains maps, a summary narrative, and statistics for each category investigated and for each watershed subbasin. A SCA Survey manual should be published this winter.

Although almost any small group of dedicated volunteers can be trained to do an SCA Survey, the Maryland Conservation Corps (MCC) has completed most of the surveys to date. The MCC is part of the AmeriCorps Program, created to promote greater involvement of young volunteers (17 to 25 years old) in their communities and the environment. With proper training and supervision, these volunteers contribute significantly to the state's efforts to inventory and evaluate water quality and habitat problems from a watershed perspective.

New Survey Takes Maryland Streams into the Next Millennium (continued)

Over the past several years, the MCC has surveyed more than 650 miles of streams in Maryland and more than a million dollars of restoration work has been initiated based on the survey. Harford County, located along the northern tip of the Chesapeake Bay, has even included the survey as part of its overall strategy to manage municipal stormwater discharges under its NPDES permit. Based on the survey results, the county has implemented several watershed restoration projects, including stormwater management retrofits, streambank bioengineering, fish blockage removal, and riparian buffer plantings for three of its four major watersheds. Betsy Weisengoff, Water Resources Engineer with the Harford County Department of Public Works, praised the MCC and said, "The MCC did a great job for us. We could not have afforded to hire consultants do the survey, and it is too manpower-intensive to do with in-house personnel." Overall, the survey has proven to be a valuable management tool at both the state and local levels.

[For more information on the Maryland Stream Corridor Assessment Survey, contact Ken Yetman, Watershed Restoration Division, MD DNR, E-2, 580 Taylor Ave., Annapolis, MD 21401. Phone: (410) 260-8812. Persons wanting to volunteer for the Maryland Conservation Corps should contact the local watershed teams that sponsor the surveys.]

Puget Sound Action Team's Local Liaisons: Advocating for the Sound at the Local Government Level

by Joan Drinkwin and Timothy W. Ransom, Puget Sound Water Quality Action Team

By 2020, another 1.4 million people are expected to settle in the Puget Sound Basin, increasing the pressure on an already stressed ecosystem. Puget Sound is experiencing a decline in bottom fish populations, restrictions on shellfish harvesting, and rapid loss of freshwater, estuarine, and nearshore habitats. In addition, the Puget Sound Chinook salmon and Hood Canal Summer Chum salmon were recently listed as threatened under the federal Endangered Species Act. To address some of these problems at the local level, the Puget Sound Water Quality Action Team organized a local liaison team to work closely with localities to implement site-specific work plans.

The Puget Sound Water Quality Action Team and its stakeholder advisory group, the Puget Sound Council, biennially develop work plans to implement the longstanding *Puget Sound Water Quality Management Plan.* Actions in the work plans address issues ranging from municipal and industrial discharges to shellfish protection and public education. The Action Team is responsible for making sure the work plans are carried out.

Actions listed in the *1997-1999 Puget Sound Water Quality Work Plan* fall into two groups, those to be undertaken by state agencies and funded by the state legislative budget process, and those to be implemented by local governments and funded by local budgets. Local actions may be included in the work plan by local governments, or be recommended by the Action Team and Puget Sound Council. For example, the Action Team calls upon all local jurisdictions to develop stormwater management programs and to adopt regulatory protection for wetlands. Implementation of these local actions depends largely on the priorities and budget constraints of individual jurisdictions. The challenge is to ensure that these actions are implemented.

To expedite the implementation of local actions, the Action Team's local liaison work with city, county, and tribal governments, businesses and community groups. Liaisons are assigned specific counties to act as intermediaries between local jurisdictions and the state and possibly help locals interact with federal and tribal governments. They also act as liaisons between local jurisdictions when necessary. Each of six local liaisons is currently assigned from one to three counties following watershed boundaries. Some of the liaisons have been working in the same counties for several years, providing consistency for the local jurisdictions and developing expertise in local issues and politics.

Each liaison's focus depends on what issues need to be addressed in their assigned areas. For instance, in urban areas, liaisons work with cities on stormwater programs as well as ongoing, interjurisdictional watershed planning. In more rural areas, liaisons spend more time working with county health departments helping them develop adequate programs for on-site sewage system

Puget Sound Action Team's Local Liaisons (continued)

operation and maintenance. Each liaison develops his or her own strategy regarding how best to help implement the work plan in each county. The strategies are guided by priorities identified in the work plan, such as stormwater and shellfish protection. But each strategy is fine-tuned at the local level, depending on a number of factors, including the importance of each priority to that area and the likelihood of success.

The program, which has been up and running for nearly three years, accounts for 20 percent of the Puget Sound Water Quality Action Team's budget, most of which is funded by appropriations for the Puget Sound Management Plan; the rest is provided by EPA's National Estuary Program.

Working with City Government

The flexibility of each liaison's strategy allows them to focus their energy where they can make the difference between implementing or not implementing a work plan action. In Snohomish, a small city north of Seattle, the Washington Department of Ecology had paid a consultant to develop a stormwater management program, complete with capital facilities recommendations, funding structure, and regulatory language that would implement a key priority of the work plan — stormwater management. All that remained for the city to do was to adopt the plan using the local funding structure recommended in the plan. For more than a year, the city took no action. The Action Team local liaison consulted with the Department of Ecology and contacted the mayor. After the local liaison met with the city council and planning commission and had several conversations with the mayor, city council members, planning commissioners, and city staff, the city took the next step and included the adop- tion, implementation, and funding of the plan in its next budget.

Personal communication, coupled with the ability to spend enough time educating city officials about stormwater and encouraging them to proceed with their plan, helped move this item to the front of the city's agenda. This personal touch is the greatest strength of the local liaison program. On average, local liaisons spend about 50 percent of their time talking or meeting with people in their local areas. They regularly meet with newly elected officials to educate them about Puget Sound and the need to implement county work plans. They work closely with ongoing efforts to raise local issues, such as managing growth or protecting endangered species, at policy discussions. The local liaisons provide local jurisdictions with a consistent, trusted contact at the state government level.

Action Team Structure and Responsibilities

The Action Team's top priority is developing the work plan that will guide protection of Puget Sound over the next two years.

The Puget Sound Water Quality Action Team — a sub-agency of the Governor's Office — brings together the heads of 10 state agencies, a city and a county representative, a representative of federally recognized tribes, and ex-officio non-voting representatives of three federal agencies to lead and coordinate efforts to protect Puget Sound.

The nine-member Puget Sound Council advises the Action Team and recommends ways to make protection efforts viable for local governments and to improve the accessibility of state and federal services to cities, counties, and tribes.

A governor-appointed chair guides the work of the Action Team and Council, helps develop the work plan, and oversees how the work plan is carried out.

Working with Nongovernmental Organizations

Local liaisons often work with private citizens and nongovernmental organizations to get the work plan implemented as well. For example, in the Quilceda-Allen watershed, a small watershed draining into an estuary of Puget Sound, a local watershed committee had drafted a watershed plan recommending specific actions to manage nonpoint source pollution and protect habitat in the watershed. The plan was sent to Snohomish County for review and concurrence, but languished for more than a year as lawyers pondered the liability of adopting such a plan. The Action Team local liaison worked with the local chapter of the Audubon Society to host a meeting of citizens in the watershed to discuss the plan and hear from county officials about its progress. Responding to concerns raised at this meeting and to continuing pressure from constituents, county elected officials adopted the watershed plan shortly thereafter.

Working Together

As the population around Puget Sound increases, Puget Sound's condition worsens because of additional municipal and industrial discharges and nonpoint source pollution, as well as degradation of freshwater and marine habitats. Protecting and restoring Puget Sound is not the job of only state or federal government. Recognizing the essential role that local governments,

Puget Sound Action Team's Local Liaisons (continued)

businesses, and citizens play in protecting Puget Sound, the Puget Sound Action Team spends valuable resources working at the local level to advocate for specific actions and promote stewardship of Puget Sound. The local liaison program has proven to be an important component of the Puget Sound Action Team's strategy to implement the work plan through the Puget Sound Basin.

[For more information, contact Joan Drinkwin, Puget Sound Water Quality Action Team, P.O. Box 40900, Olympia, WA 98504-0900. Phone/fax: (360) 848-0924; e-mail: jdrinkwin@psat.wa.gov or Timothy Ransom, Puget Sound Water Quality Action Team, P.O. Box 40900, Olympia, WA 98504-0900. Phone/fax: (360) 407-7323; e-mail: transom@psat.wa.gov.]

Minnesota Residents Like Healthy Lakes and Support Measures to Keep Them That Way

Nearly one-third of Minnesota residents expect the quality of the water in Minnesota lakes to worsen over the next 10 years according to an April 1998 survey of 2,000 Minnesota residents conducted by the Minnesota Sea Grant and the Minnesota Department of Natural Resources. The goal of the survey was to find out what the people of Minnesota think about the condition of their more than 10,000 lakes and most importantly, if they would support actions to stem negative impacts on the lakes. (Although Minnesota is known as the "Land of 10,000 Lakes," according to the Minnesota Pollution Control Agency, there are actually 15,237 lake basins in the state. Of those, 3,395 are partially or completely dry.)

Survey staff divided the state into five main regions — northwest, northeast, central, south, and the metro area — and mailed the survey to 2,000 randomly selected Minnesota households across the regions (1,000 to the households in northeastern Minnesota and 1,000 to households in the rest of the state). The response rate for the mailed survey was 48.8 percent. They also conducted a telephone survey of 100 non-respondents from each of the two regions. They broke down the survey results by the respondent's region of origin, the lake region of the state that the respondent used most, and whether the respondent was a riparian property owner.

The survey's results, which were published in the report *Public Perceptions of the Impacts, Use, and Future of Minnesota Lakes*, indicate that more than 90 percent of respondents agreed that lakes are important whether Minnesotans use them or not, that lakes should be taken care of for the future, and that lakes are important because of their beauty, atmosphere, and fish and wildlife habitat. Although the recreational and economic values of lakes are still important to Minnesotans, fewer people felt that lakes are important for those reasons only.

Top 10 Activities Minnesota Residents Say Contribute to Lake Water Quality Degradation

1. Lawn Fertilizers and Chemicals
2. Agricultural Fertilizers and Chemicals
3. Septic Systems
4. Urban, Road, and Parking Lot Runoff
5. Soil Erosion from Farms and Fields
6. Exotic Species Invasions (e.g., Eurasian watermilfoil)
7. Livestock Manure
8. Exhaust and Fuel Leakage from Motorized Watercraft
9. Soil Erosion from Home Sites
10. Commercial and Industrial Waste Water Discharges

For comparison, the Minnesota Pollution Control Agency listed (in order of frequency) fecal coliform, turbidity, low oxygen, mercury, ammonia, and chloride as the state's most common water quality impairments in its 1998 Section 303(d) Report to EPA.

Most respondents (51 percent) felt that the quality of the water in Minnesota lakes has stayed about the same over the last 10 years. Only 40 percent, however, felt that water quality will stay the same over the next 10 years. Twenty-nine percent expect it to worsen.

Northeastern Minnesota residents seem to have a more positive feeling about lakes in their region than do residents of the rest of the state. Only 16 percent of those in the northeast felt that the quality of the water in the lakes they use the most would worsen over the next 10 years; whereas, nearly 30 percent of residents from other parts of the state expect lake water quality to worsen. This difference may be due to the fact that lakes in the northeast region tend to have less development and more public land surrounding them, giving residents the feeling that their lakes are more protected.

The survey also asked people whether they supported or opposed a list of possible solutions to problems on the lakes that they use most. Respondents were more supportive of voluntary and educational approaches than regulatory

Report on the Transparency of Minnesota Lakes

The Minnesota Pollution Control Agency's Citizen Lake Monitoring Program (CLMP), which first began in 1973, involves voluntary participation of citizens residing on or near lakes or those who are frequent lake users. Each year, participants are asked to take weekly transparency measurements on their lake during the summer using a Secchi disk. At least 8 to 10 readings per season are required to adequately define water quality each summer. During the 1998 sampling season, 816 volunteers sampled 693 lakes and took more than 13,000 Secchi disk readings.

Secchi transparency indirectly measures the amount of algae in the water and provides the basis for assessing water quality, estimating trophic status, and documenting trends in water quality over time. Data from the readings are entered into STORET, EPA's water quality database, along with other water quality data collected by the Minnesota Pollution Control Agency. For many lakes, CLMP data are the only water quality data available. Because tourism in Minnesota is largely water-based, information about the quality of Minnesota's lakes is vital for assessing their physical condition and recreational suitability.

The statewide seasonal transparency mean for the 1998 sampling season (June–September) was 9.6 feet, slightly lower than the 1997 mean of 10.5 feet. The report provides a detailed summary on the current quality of the water in Minnesota's lakes. It is available from Jennifer Klang, Environmental Out- comes Division of the Minnesota Pollution Control Agency, at (651) 282-2618 or (800) 657-3864.

solutions. Minnesotans were very supportive, however, of stricter septic system regulations to improve water quality (68 percent supported stricter regulations). Nearly 80 percent of respondents support increasing education on the impact shoreline property owners have lake water quality and nearly 60 percent support stricter zoning regulations for shoreline development to maintain natural shoreline character. Surprisingly, 66 percent of respondents said they would support motorboat size and speed limits to protect shoreline areas, even though 25 percent said they use the lakes for fishing by motor boat more than any other activity.

Information from the survey is being used to gauge support for educational programs, financial incentives for proper lakeshore management, modification of current lakeshore regulations, and other possible management options.

[For more information, contact Keith Anderson, Minnesota Sea Grant Water Resource Educator, 2305 East 5th Street, Duluth, MN 55812. Phone: (218) 726-7524; fax: (218) 726-6556; e-mail: kanderson1@extension.umn.edu or download the report from the Internet at www.d.umn.edu/seagr/areas/water/survey.html.]

Notes on Watershed Management

What are Nature's Boundaries? New Road Signs Explain

Drivers in New Jersey are learning exactly what watershed they are traveling through thanks to new watershed awareness signs unveiled by the New Jersey Department of Environmental Protection (DEP) and New Jersey Department of Transportation (DOT) this past June. The brown and white signs depict a heron in flight with a cityscape on one side of the river and a tree-lined suburb on the other. Underneath, another sign alerts drivers to the name of the watershed they are entering.

DEP plans to place these educational watershed signs at all the boundaries of New Jersey's 20 watershed management areas; more than 100 should be in place by the end of the year. Through the signs and other educational efforts, DEP is fostering a better understanding about the importance of protecting water through watershed management and providing a sense of stewardship and ownership among the public.

DOT Commissioner James Weinstein said that the signs are a "new symbol of cooperation" between the two departments. DEP Commissioner Robert C. Shinn, Jr. added that "it may appear DOT and DEP are on different roads, but you find the roads are in the same watershed." Ninety-six individual watersheds and 566 municipalities exist in New Jersey are criss-crossed by some 36,000 miles of paved roads. "Watersheds are nature's boundaries. It is our responsibility as the people of New Jersey to care for and protect our clean drinking water," said Shinn.

[For more information about New Jersey's Watershed Awareness Sign Program and Public Relations Campaign, contact Colleen Gould, New Jersey DEP, Division of Watershed Management, 31 Waldron Road, Allentown, NJ 08501. Phone: (609) 633-1179; e-mail: cgould@dep.state.nj.us.]

Landscape Professionals Develop First Environmental Landscape Certification

The Washington Association of Landscape Professionals (WALP) has joined with Seattle Public Utilities and King County's Hazardous Waste Division to develop the first environmental landscape certification program. Their goal is to provide landscapers with the knowledge they need to offer environmentally sound services to their clients, and to bring together city officials and landscape professionals in implementing landscaping best management practices.

As in many areas across the country, increasing development in the Puget Sound region has heightened the need to reduce stormwater pollution. Targeting landscaping as a significant contributor to nonpoint source pollution, the City of Seattle Public Utilities and King County's Hazardous Waste Division partnered to develop a Natural Lawn Care Program to educate the public on green landscaping techniques, such as conserving water, reducing fertilizer application, and keeping grass clippings out of storm drains. The program is targeted largely at homeowners, but both agencies felt that professional landscapers should be targeted as well, primarily because a survey conducted by the program revealed that a quarter of those who hire a landscaping firm said they would like to switch to a firm that practices natural lawn care.

The Associated Landscape Contractors of America (ALCA), a trade association of landscaping businesses that develops and maintains many active programs, already offers several certification programs, including Certified Landscape Professional (CLP), and Certified Landscape Technician: (CLT)-Interior and CLT-Exterior. To become CLT certified, the technician must pass both a written and a field demonstration exam. The rigorous exams cover such topics as first aid, plant identification, grading and sodding, tree planting, and using various tools and machines. Each candidate also selects a specialty in installation, maintenance, or irrigation.

Under WALP's new certification program, a landscaper who has completed CLT certification can choose to take an advanced environmental certification exam. Both written and field tests measure a candidate's knowledge of landscaping best management practices in seven sections: customer education (what professionals should tell customers about their services and the customers' options), site assessment, mowing, irrigation, fertilization, weed and pest control, and renovation and installation. Although the test is directed primarily toward lawn care, it will eventually be broadened to include other aspects of landscaping activities, such as soil management and erosion control.

The first pilot test, which covered three sections — irrigation, mowing, and fertilization — was offered (at no charge) to CLT certified landscapers on May 15, 1999, at Clover Park Technical College in Lakewood, Washington. The objective of this pilot testing was to assess the quality of the test, it's clarity, level of difficulty, etc. Although only one landscaper participated, WALP received good feedback on the test's design. Surprisingly, the pilot participant recommended that the test be made even more difficult, considering the fact that the test is for an advanced certification.

Over the next year, the three agencies will work together to fine tune the test, offer seminars for test preparation, and promote environmental certification to the landscaping industry through WALP's monthly publication, news releases, and other marketing. WALP hopes to have its first certified environmental landscapers by the spring of 2000.

If the Washington program is successful, the certification will be made available nationwide through ALCA which will oversee the test. The final environmental certification exam will have a general framework, with questions covering a standard selection of topics and techniques; however, because environmental conditions differ by areas of the country, the test will remain flexible so that regions can tailor questions to their area. ALCA's National Landscape Technician Council (NLTC), the governing board for the landscaping certification program, will approve regional questions.

Landscape Professionals Develop First Environmental Landscape Certification (continued)

Once certified, landscapers can use the CLT logo (and its new environmental endorsement) for marketing their business, by displaying the certification in their office and including the CLT logo on business cards, letterhead, and similar materials. The program has already generated public interest in environmental landscaping for both residential and commercial properties. Environmentally educated landscapers will be able to pass their knowledge on to customers and will offer them several landscaping alternatives. Environmental certification will also help landscaping agencies qualify for EnviroStars status, a recognition of King County businesses that use best management practices. King County and the City of Seattle have agreed to promote environmentally certified landscapers through the Green Business Directory (which lists businesses with EnviroStars status), advertising, and other means. To learn about more watershed protection efforts in the Puget Sound area, see the article titled "Puget Sound Action Team's Local Liaisons: Advocating for the Sound at the Local Government Level" on page 16.

[For more information, contact Peter Dervin, Executive Director, Washington Association of Landscape Professionals, 1723 100th Place, SE, Suite C, Everett, WA 98208-3800. Phone: (425) 385-3333; e-mail: pdervin@walp.org.]

Wild Things '99
Watersheds: Rivers Run Through Them!

On October 7 biologists with the U.S. Fish and Wildlife Service (FWS), teachers, and students in grades 4 through 8 took part in an electronic field trip to identify a watershed and how its health can affect aquatic life. This Internet watershed adventure was brought to schools live via satellite and cable from Boyer Chute National Wildlife Refuge in Nebraska, along the banks of the Missouri River. Students learned what watersheds are, why they should care about them, how to measure their health, what the FWS is doing to improve the quality of watersheds, and what they can do to help enhance watersheds. For more information or to get a videotaped copy of the presentation, contact the Prince William Network, Media Production Services, Box 389, Manassas, VA 20108. Phone: (800) 609-2680; web site: www.pwnet.org.

Technical Notes

New Fertilizer Reduces Nutrient Loss

Buried under all the reports of nutrient pollution from farms is a little bit of hope. Bethel Farms, a leading agricultural grower in central Florida, along with Helena Chemical Company in Memphis, Tennessee, has developed new temperature-release fertilizers that reduce nutrient leaching and runoff into waters along the coasts of Alabama, Florida, Georgia, Louisiana, Mississippi, South Carolina, and Texas. The new fertilizers, made of small resin-coated prills of nitrogen, phosphorus, and potassium, release nutrients only when the soil begins to warm — when plants are most likely to absorb it — unlike conventional water-soluble fertilizers that are released upon contact with moisture.

The new fertilizers are currently formulated only for soils in the southeastern United States. They are available to homeowners as well as some large-scale farmers, including vidalia onion farmers in Georgia, strawberry farmers and citrus growers in Florida, and sweet potato farmers in North Carolina.

Temperature-release fertilizers are made of small separate biodegradable granules called prills. The prills of nitrogen, phosphorus, and potassium and are individually coated with polyolefin. The amount of coating on each prill is exactly the same, but the duration of the nutrient release depends on the ratio of the resins used to coat the prills. As soil temperature increases, the prill begins to release nutrients; as the soil cools, the release of nutrients declines. This controlled release can last from two months to one year, with little to no leaching. Due to its elastic nature, it is less vulnerable to mechanical wear and tear, unlike conventional fertilizers. This also prevents nutrient leaching, thereby reducing nutrient runoff at the edge of the field.

New Fertilizer Reduces Nutrient Loss (continued)

In one study, Helena Chemical Company found that temperature-release fertilizer is four times more efficient than liquid fertilizer and that when applied at only 25 percent of the liquid fertilizer rate, they supply an equal amount of nitrogen to the plant with minimal nitrate runoff. In another study conducted by the University of Minnesota, nitrate mobility in soils began earlier with conventional liquid fertilizer than it did with temperature-release fertilizer.

But what's the catch? Temperature-release fertilizer is slightly more expensive than water-soluble fertilizer. Where conventional brands can cost from $2.97 to $3.97 for a 1.5-pound bag, Bethel Farms' temperature-release fertilizer costs between $4.95 and $5.95 for the same amount. Although this added expense may limit its use to high-value crops and certain non-agricultural sectors such as horticulture, golf courses, and gardens, Kenny Waters, a nutritional product specialist at Helena, contends that, "the temperature-release fertilizers use about 35 percent less total fertilizer by the end of the growing season than do conventional fertilizers, while increasing productivity and efficiency." In fact, Bethel Farms' Bloom Grow temperature-release fertilizer for annuals need only be reapplied every 6 months. Its conventional competitor must be reapplied every 7 days to achieve the same results.

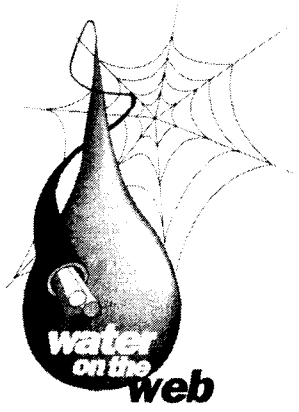
First developed in 1966 by the Chisso and Chisso-Asahi Corporations in Japan, the technology for the new fertilizer is based on a programmed-release fertilizer called Meister® that has been used in Japanese rice paddies for many years. The two corporations were looking for a fertilizer that was not significantly affected by factors such as pH, soil water content, and microbial activity. Since 1966, the Japanese have developed several types of temperature-release fertilizers that are used with rice, soybeans, vegetables, turf grass, and trees.

Currently, Bethel Farms offers six types of plant-specific fertilizers: Acid Grow for acid-loving plants such as ixoras, azaleas, camellias, and gardenias; Bloom Grow for all annuals; Citrus Grow for citrus and avocado trees; Palm Grow for palm trees; Plug Grow to establish grass plugs; and Rose Grow for roses and other perennials. Several other types will be available to homeowners and growers in 2000.

Although more expensive that traditional fertilizers, slow-release fertilizers like Bethel Farm's temperature-release fertilizers do reduce nitrate leaching. They also reduce the volatilization losses of ammonia — environmental benefits that Bethel Farms and Helena Chemical hope may increase the importance and use of temperature-release fertilizers in the future.

[For more information, contact Jennifer Kamberg, Advertising Coordinator, Bethel Farms, 8778 NW Bethel Farms Road, Arcadia, FL 34266. Phone: (800) 547-5847; fax: (941) 494-7052; e-mail: bethelf@desoto.net; web site: www.bethelfarms.com or Kenny Waters, Nutritional Product Specialist, Helena Chemical Company, P.O. Box 587, Brooklet, GA 30415. Phone: (912) 489-5150; fax: (912) 489-6403; e-mail: helena@helenachemical.com; web site: www.helenachemical.com.]

Water on the Web: Integrating Real-Time Data with Educational Curricula Through the Internet



"Surfing the net" has a new meaning for students involved in a state-of-the-art, Internet-based water quality monitoring project. Water on the Web (WOW) allows high school and college students to monitor several Minnesota lakes and a major tributary to Lake Superior over the Internet and integrate the results with geographic information systems (GIS), data visualization, and in-depth educational materials.

WOW is a cooperative effort involving the University of Minnesota-Duluth Education Department, the Natural Resources Research Institute (NRRI), Minnesota Sea Grant, and Apprise Technologies and is funded through the National Science Foundation. Since its inception in late 1997, more than 500 students have used the project's web site and its materials.

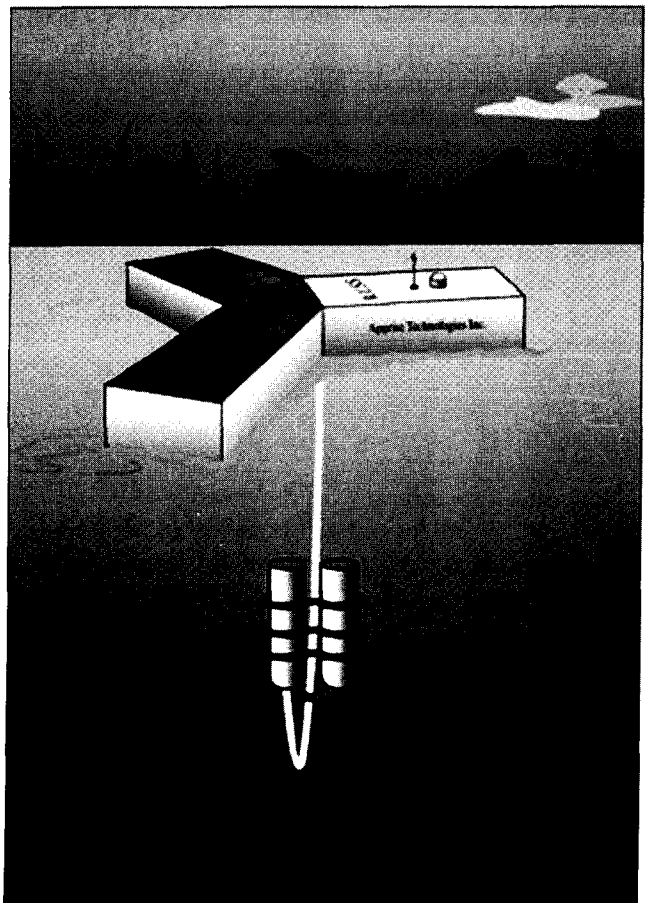
WOW teaches students the basic fundamentals of science based on real-time data; trains teachers in advanced technology, including GIS, remote sensing, instrumentation, and use of the Internet; and improves communication and cooperation among local industry, agencies, and educational institutions. Richard Axler, a research limnologist at NRRI and co-principal investigator for WOW, adds that "WOW helps equip students with real-world skills they can use in college and beyond."

The Technology Behind the Scenes

WOW is based on a new sampling device called RUSS (Remote Underwater Sampling Station), which was developed by Apprise Technologies in Duluth. RUSS is equipped with an on-board computer powered by solar-powered batteries that is operated by remote control through cellular phone transmission.

A leveling device attached to a multiprobe sensor moves up and down the water column, taking samples to measure pH, conductivity, turbidity, dissolved oxygen, and temperature at depths up to 100 meters. It was initially programmed to collect 1-meter-interval profiles at approximately 4-hour intervals seven days per week; but WOW coordinators plan to program additional event-specific sampling to collect information relevant to the time scale of nonpoint source pollution. This may involve continuous monitoring at a single depth before, during, and after a storm or the collection of intensive profiles at 1-hour frequencies. RUSS can detect short-term variations in water quality due to storm-associated wind mixing, erosion, and runoff. WOW is now integrating RUSS data with other data collected by NRRI and local agencies, such as chlorophyll *a*, Secchi depth, and nutrient concentrations, to evaluate the importance of runoff events in determining the lakes' trophic status and physical characteristics.

Using this new online technology, students can investigate a lake's water quality by designing their own experiments and sampling programs and conducting interactive inquiries of lakes and their watersheds. RUSS data will also be helpful to water resource managers because it provides continuous, year-round information on the conditions of Minnesota lakes, which until now has not been readily available. So far, RUSS units have been placed in Ice Lake, Lake Independence, and Grindstone Lake and at two sites in Lake Minnetonka in Minnesota.



RUSS is equipped with an on-board computer powered operated by remote control through cellular phone transmission. A device attached to a multiprobe sensor moves up and dopwn the water column, sampling pH, conductivity, turbidity, dissolved oxygen, and temperature at depths up to 100 meters.

RUSS Used for EMPACT Project

At the Lake Minnetonka site, NRRI and Sea Grant researchers are using RUSS in collaboration with the Hennepin Parks Department and the Minnehaha Creek Watershed District as part of a new study called LAKE ACCESS: Making Water Quality Data Real and Relevant for Minnesotans, funded by EPA's Environmental Monitoring for Public Access and Community Tracking (EMPACT) program. The EMPACT program works with communities to make timely, accurate, and understandable environmental information available so that people can make informed day-to-day decisions about their lives.

Lake Minnetonka is a large eutrophic urban lake in the western Minneapolis–St. Paul metropolitan area. It has chronic water quality problems associated with urban and agricultural runoff and severe infestation by Eurasian water milfoil, a fast-growing exotic aquatic plant that chokes out native plants, impairs fish habitat, and contributes to eutrophication.

This two-year project will provide near real-time and historic data, as well as interpretive information on lake water quality, to citizens in Hennepin Parks and the Minnehaha Creek Watershed District. In addition to being posted on the LAKE ACCESS and WOW web sites, data collected by two RUSS units in the lake will also be available through touch-screen computer kiosks located in local visitors' centers and the Minnesota Science Museum. The project will provide a mechanism for public feedback into the local government decisionmaking process by giving them information relevant to their quality of life and increasing their understanding of factors affecting water quality in Minnesota's lakes.

Future Plans

NRRI plans to deploy another RUSS unit on a bridge support in the St. Louis River, just upstream from Duluth. The St. Louis River is the second largest tributary to Lake Superior, the largest and cleanest of the Great Lakes. Remedial Action Plan reports have identified NPS pollution as a significant factor contributing to water quality degradation in the river. RUSS will provide hourly data on flow, turbidity , temperature, oxygen, electrical conductivity, and pH in the river, which will help evaluate water quality upstream of the major point and nonpoint sources in Duluth, as well as provide a real-time data set describing the river's response to runoff during spring snowmelt and during storms when intensive sampling is logistically difficult. In addition, the new Great Lakes Aquarium, now under construction, will use the data to develop NPS education programs.

Curricula for High School and College Students

The WOW web site provides both real-time and archived water quality data, and helps high school and college students learn about water chemistry, biology, aquatic ecology, math, and technology. Students can conduct interactive inquiries on lakes and watersheds, and basic science experiments, and learn data analysis techniques using these natural systems. A team of educators and scientists developed curricula that can be used for several areas, including biology, chemistry, physics, aquatic science, math and data analysis, technology, and environmental studies; each is available on the Internet and will soon be on CD-ROM. In one lesson titled "Relationships Between Watershed Characteristics, Land Use, and Lake Water Quality," students interpret temperature and oxygen profiles from Lake Independence (in an agricultural watershed) and Ice Lake (in an urban-forest watersheds). Using exercises that integrate RUSS data interpretation, GIS analyses, and modeling, students learn how differences in land use affect water quality, and in particular, nutrient concentrations.

Ilona Rouda, an advanced placement chemistry teacher at The Blake School in Minneapolis, whose students use WOW, praised the project: "This project makes students use the chemistry they know and even some they don't know. They really want to get data immediately, and with WOW, they can." She recently purchased a new computer and projector so that the entire class can view the WOW site and data together. Reported Rouda, "WOW has changed all of my chemistry classes!"

[For more information, contact Bruce Munson, Minnesota Sea Grant and Department of Education, University of Minnesota-Duluth, 2305 East 5th Street, Duluth, MN 55812. Phone: (218) 726-6324; e-mail: bmunson@d.umn.edu or George Host, Natural Resources Research Institute, University of Minnesota-Duluth, 5013 Miller Trunk Highway, Duluth, MN 55811. Phone: (218) 720-4279; e-mail: ghost@sage.nrri.umn.edu.]

Notes on Education

Illinois EPA's Music Video Entertains While Educating

"The problem is nonpoint source pollution. Now what's the solution?" is the message of "Environment Is Everything," Illinois EPA's video on the sources and consequences of nonpoint source pollution. The 4.5-minute music video was created as part of an exhibit at Chicago's John G. Shedd Aquarium. The world-famous aquarium, located on Lake Michigan, attracts nearly two million visitors a year.

During the summer of 1995, the Illinois EPA helped the aquarium launch two comprehensive exhibits on water quality and pollution, *Nonpoint Source Pollution and Stream Ecology*and *Water Wise*, that ran for three years. Funded in part under section 319 of the Clean Water Act, the exhibits illustrated the differences between healthy and polluted streams, and helped viewers understand the sources of contamination and some of the causes of and solutions for nonpoint source pollution. The exhibits covered significant sources of NPS pollution in Illinois, such as urban runoff, agriculture, and construction.

The "Environment Is Everything" video was shown as a part of the *Nonpoint Source Pollution and Stream Ecology* exhibit. The exhibit had two components: one showing a healthy and diverse stream environment and the other depicting a polluted and ailing stream. The quality and quantity of native fish and plants revealed the effects of pollution in each stream. Visitors were

Illinois EPA's Music Video Entertains While Educating (continued)

given microscopes to view native aquatic plants, insects, and amphibians, and Illinois EPA employees explained how they monitor and assess water quality; they also discussed techniques used to help identify NPS pollution in Illinois waterways.

In the video, which targets children, four kids explain the causes of nonpoint source pollution, and actions people can take to reduce the threat to water quality. Pollution generated from lawns, urban runoff, agriculture, and construction sites is traced to rivers, streams, and wetlands. The upbeat song "Environment Is Everything" stresses that all things are connected, demonstrating how our actions affect natural systems. In one segment excess fertilizer is linked to increased algal growth, bacteria, low dissolved oxygen levels, and fish kills. The video also suggests some actions citizens can take to reduce NPS pollution, such as sweeping litter away from storm drains, storm drain stenciling, recycling, and stream cleanups.

"Who Done it?"

A wetland is polluted. Who is to blame? The "Who Done it?" theatrical production was just one of a number of interactive activities sponsored by the Illinois EPA for the Shedd Aquarium. During the theatrical mystery performed inside the aquarium, detective Jonny Rivers questioned suspects to determine the source of pollution in a wetland. Possible culprits included Lawnmower Larry, who leaves his grass clippings vulnerable to runoff; Sally Slick, who changes her motor oil carelessly; and Busy Bob, who is too busy to pick up his trash. As Jonny Rivers questioned each suspect, the audience commented on their guilt or innocence. In the end, the case was brought before Judge Toad, whose verdict was that everyone is responsible for the problem of nonpoint source pollution and water quality degradation. Audience members received stickers recognizing their detective status in helping to solve the mystery. A hired theatrical troupe performed the play, which was taped by Shedd aquarium staff. Copies are available from Scott Ristau, Illinois EPA, Bureau of Water, 1021 North Grand Avenue East, Springfield, Illinois 62702. Phone: (217) 782-3362; e-mail: EPA1109@epa.state.il.us.

Although made for use at the aquarium, the music video is not a fixed component of the exhibit and is available as an independent educational tool, intended to be used in schools, at conferences, and in public service announcements. Already, many conferences and school groups have used it, and several copies have been distributed across the country.

To help gauge the effectiveness of the aquarium exhibits, Illinois EPA personnel manning the displays asked visitors for their opinions. Fifty-six visitors from 10 states and two foreign countries participated in the survey. Forty-five said they had previously been unaware of NPS pollution; 52 said they understood the problem after viewing the displays. The music video appeared to receive a favorable response and generated questions and discussions.

[A copy of the video for public education purposes can be obtained free of charge from the Illinois EPA. For more information, contact Scott Ristau, Illinois EPA, Bureau of Water, 1021 North Grand Avenue East, Springfield, Illinois 62702. Phone: (217) 782-3362; e-mail: EPA1109@epa.state.il.us.]

New Jersey Students Become Watershed Stewards

New Jersey high school students now have a new tool with which to learn leadership skills and the benefits of working to improve their watershed — the Watershed Stewards Program. Colleen Gould, the program's coordinator, developed this program to combine community service with environmental projects needed to enhance New Jersey's critical watersheds. This leadership training program empowers adolescents to develop and implement a watershed enhancement project by providing them with the necessary information, skills, and tools.

The program invites a team of five students and one adult from high schools across the state to attend a workshop at a selected nature center. The teams enjoy the opportunity to interact with students from other high schools with similar interests. They participate in a low ropes course to use their critical thinking and communication skills to solve problems in a group setting. The teams simulate an environmental issue that must be addressed on a local level and role play the development of a management plan that would solve the problem. They also learn about the importance of native species and environmental stewardship projects. Best of all, they learn life skills such as writing letters for donations, communicating with public officials, developing a project proposal, facilitating a meeting, and coordinating a project from beginning to end. Once the team members become acquainted in the team-building exercises, Gould and her staff focus their training on nonpoint source pollution and watershed planning activities taken from Project WET Water Education for Teachers, the 15-year-old international, interdisciplinary water science and education program for K-12 educators.

New Jersey Students Become Watershed Stewards (continued)

After the weekend course, the team must recruit 10 volunteers from their community and school, assist with a watershed enhancement project on a weekend, and hold one or two team-building meetings with students and staff from another environmental organization. Gould provides helpful information for creating the agenda for the meeting, such as clearly stating its purpose, beginning with a fun activity or ice-breaker, and involving participants in small breakout sessions.

"The most interesting part of the Stewards Program is understanding that students and schools are looking to do community service work and we can involve them in water quality improvement/enhancement projects (for NPS)," says Gould. "We have learned a lot since the inception of this program in 1997," Gould continues. In its first year, the teams were encouraged to create their own watershed improvement projects. This year, Gould thought that the program would be more effective by linking existing environmental projects and groups with the Stewards, enabling the teams to work with experts in the field on already established activities. Projects have included a streambank stabilization in Hopewell, a lake shore planting in the City of Rahway, and a wetlands planting in Harding Township.

With a grant of $21,000 from the Commissioner of the New Jersey Department of Environmental Protection two years ago, Gould has been able to teach more than 150 students the leadership skills needed to organize a project to enhance their watershed and reduce NPS pollution. The grant helped her fund two weekend workshops (complete with food, lodging, and facilitators) in March 1998 and 1999. Gould received another $5,000 to continue the project this year, specifically in the New York/New Jersey Harbor area, and has scheduled a workshop for December 3-5.

"A watershed, the catchment basin or drainage area of an entire river system, is an excellent medium for teaching students how to integrate and analyze information from a variety of sources and across the entire spectrum of school disciplines from science to language arts to history to art." says Gould. "Watershed education is more than just a trend — it is real-life education that works!"

Sponsored by the Youth Environment Society based in New Jersey, the Stewards Program is supported by the Adopt-A-Watershed Program, New Jersey Project WET, and the New Jersey Department of Environmental Protection's Division of Watershed Management. Gould works full-time as a consultant for the Division of Watershed Management through Rutgers University.

[For more information, contact Colleen Gould, NJ DEP Division of Watershed Management, 31 Waldron Road, Allentown, NJ 08501. Phone: (609) 633-3855; e-mail: cgould@dep.state.nj.us.]

Education Resources Column

New on the Web

■ ***National Pollution Prevention Center's Sustainable Agriculture College Curriculum.*** The National Pollution Prevention Center (NPPC) at the University of Michigan, created by EPA in 1991, promotes sustainable development by educating students, faculty, and professionals about pollution prevention; creating educational materials; providing tools and strategies for addressing environmental problems; and establishing a national network of pollution prevention educators. The NPPC recently added its Sustainable College Curriculum to the list of online educational materials at www.umich.edu/~nppcpub/. It includes reference sources and scientific information on environmental pollution, contamination, poisoning, soil erosion, degradation, and depletion of land, water, energy, and biological resources in U.S. agriculture.

■ ***Municipal Stormwater Programs Listing.*** The city of Fort Worth Department of Environmental Management has a new web page that alphabetical lists web sites of stormwater programs of other municipalities and counties in the United States. So far there are more than 40 links; add your site by contacting Kathryn Hansen, Environmental Coordinator for the Department, via e-mail at HanseKa@ci.fort-worth.tx.us. The site can be found at www.ci.fort-worth.tx.us/dem/stormcontacts.htm.

■ ***Get Creative with EPA's Watershed Graphics.*** The watershed graphics included in the guide *Getting In Step: A Guide to Effective Outreach in Your Watershed* are now available electronically on a

Educational Resources (continued)

new outreach web site at EPA's watershed homepage. The graphics are divided into different categories such as activities, cartoons, wildlife, silhouettes, and letterheads. Included are step-by-step instructions to download the graphics. Other outreach-related information is also included, and more will be added in the near future, including the *Getting in Step* guidebook itself. You can view and download the graphics at www.epa.gov/OWOW/watershed/outreach/outreachnonjs.html by clicking on "materials."

■ ***InterWet.*** With just a point and a click, visitors to a new Penn State web site called the Internet Watershed Educational Tool (InterWET) can calculate the consequences when one or more environmental policy factors are changed or disturbed in Pennsylvania's Spring Creek watershed. Constructed by a doctoral student at Penn State, InterWET is designed to enable beginners to take advantage of the results of complicated hydrological computer modeling — without having to do the math! The InterWET web site consists of multiple web pages to support 15 water resource components (surface runoff, ground water, sediment or erosion, in-stream nutrients, and fish populations) and three perspectives (researcher, conservationist, and local official). InterWET addresses each combination of a water resource component and a perspective. For example, the runoff web page shows a figure of the water cycle, describes the water cycle (including runoff), and explains what factors affect runoff. The local official perspective shows how current local planning policies will affect the future levels of each component. By varying policy choices, users can see how local decisions can prevent NPS pollution. The web site is available through the Penn State Agricul- tural and Biological Engineering homepage at http://server.age.psu.edu/dept/grads/parson/research/home.htm.

Videos

■ ***Farm*A*Syst and Home*A*Syst Videos.*** Tennessee's new Farm*A*Syst and Home*A*Syst videos put the responsibility of protecting water quality into the hands of the viewers. The Farm*A*Syst video shows a farmer reviewing Tennessee's *Pesticide Storage and Handling Fact Sheet.* The video emphasizes that the program is both voluntary and confidential. The Home*A*Syst video peeks in on one family assessing the environmental hazards in their home. For copies, contact the Farm*A*Syst/Home*A*Syst National Program, B142 Steenbock Library, 550 Babcock Drive, Madison, WI 53706-1293. Phone: (608) 265-4695. Fax: (608) 265-2775.

Reviews and Announcements

Pointless Pollution: Preventing Polluted Runoff and Protecting America's Coasts

Produced by the Coast Alliance, *Pointless Pollution: Preventing Polluted Runoff & Protecting America's Coasts* explains that the greatest threat to coastal waters is polluted runoff. It describes 24 runoff programs nationwide and provides suggestions on how the programs could be improved. the report details examples where polluted runoff has caused widespread economic and ecological damage. For instance, nearly three million acres of shellfish beds were closed in 1995 because of polluted runoff. In eight states, including California and New York, runoff was the only cause for closures. it also provides guidance on nps management measures and model development principles.

To order, send $20 to Coast Alliance, 215 Pennsylvania Avenue, S.E., Washington, DC 20003. Phone: (202) 546-9554; fax: (202) 546-9609; e-mail: coast@igc.org.

Sustainable Community Indicators

2nd Edition 1999. By Maureen Hart

What is a sustainability indicator? How do I know if my community is making progress towards becoming a sustainable community? What is the right indicator for my community? How do I know if an indicator is really measuring sustainability? And what is a sustainable community, anyway?

If you have been asking these questions, then you should read the second edition of the *Guide to Sustainable Community Indicators.* Like the first edition, published in 1995, the updated edition is

Educational Resources (continued)

for communities trying to build a better future. Its target audience includes grassroots organizations, municipal and state agencies, nonprofit organizations, local businesses, and people working on community economic development. The guide explains both sustainability and indicators, and encourages readers to use indicators or improve indicators already in use.

The new *Guide to Sustainable Community Indicators* is easily understood and used by individuals at the community level. It also contains information on:

- Community capital and pressure-state-response indicators,
- Carrying capacity, consumption, and population,
- Business, production, recreation, land use, and transportation indicators,
- Examples of good sustainability indicators,
- How to identify good sustainability indicators for your community, and
- An updated list of almost 700 indicators being used by communities of differing sizes.

[Copies are available for $19.95 (shipping not included). For more information, contact QLF/Atlantic Center for the Environment, 55 Main Street, Ipswich, MA 01938. Phone: (508) 356-0038; e-mail: atlantictr@igc.apc.org.]

Getting Started With TMDLs

Written for those doing hands-on field work, *Getting Started with TMDLs* is meant to serve as an introduction to the science, policy, and societal elements of the TMDL program. It was written by Dr. Wesley Jarrell of the University of Wisconsin, a pioneer in TMDL development. Dr. Jarrell worked on the Tualatin River watershed TMDL just west of Portland, Oregon. Because of the complex and all-encompassing nature of TMDLs, the publication is considered a starting point only. It provides a solid basis for a beginning and then leads to further information needed to manage watersheds.

Topics include stakeholder involvement, TMDL parameters, load and waste load allocations, sample sites, monitoring frequency, field equipment, sample data analysis, and models. Three appendices address frequently asked questions, Internet and stakeholder development resources, and air deposition models and web sites.

[For more information, contact Mary Therese (M.T.) Gookin, Marketing Coordinator, Environmental Products Group, or Rosalie Catalano, V.P. Corporate Communications, YSI Incorporated, PO Box 279, Yellow Springs, Ohio 45387. Phone: (800) 765-4974 or (937) 767-7241. The TMDL document is available in downloadable format from YSI's web site: www.ysi.com.]

[For a copy, contact Ecology's Publication Office at (360) 407-7472 or e-mail: ecypub@ecywagov and ask for publication #99-06.]

Well-Head Protection Report and Video

Planning for Well-Head Protection for Ground Water from the Whippany, Chatham, and Millburn Valleys of the Buried Valley Aquifer Systems extensively discusses the identification of water supply wells, delineation of well-head protection areas, and pollutant sources. It also focuses on the development of management approaches for pollutant sources, recommendations for well head protection, and public education projects.

[Both of these ground water materials are available from the Passaic River Coalition. The cost of the video is $19; the cost of the report is $56. For more information, contact Maria DuBois at (908) 766-7550.]

Agricultural Pest Management Handbook

The *1999 Illinois Agricultural Pest Management Handbook* provides an update on laws, regulations, pest management practices, and pest control products that can change significantly each year. The handbook covers insect pest control for field and forage crops and livestock, environmental hazards, pesticide equipment calibration, and weed control.

It is available on the Internet at www.ag.uiuc.edu/~vista/abstracts/alAPM.html. For a printed copy ($20 plus shipping and handling), contact ACES Information, T&C Services, 1917 South Wright Street, Champaign, IL 61820. Phone: (800) 345-6087; fax: (217) 333-3917; e-mail: acespubs@uiuc.edu.

Reflection

Where the Action Is

by Elaine Bloom, Environmental Analyst, New York State Department of Environmental Conservation, and a former staff member of *Nonpoint Source News-Notes*

I was asked to write a "reflection" to mark *News-Notes*' 10th anniversary. I can't do that without remembering my friend and mentor, *News-Notes* founder Hal Wise. Hal died in 1994, but when I worked with him, he would often sit me down for impromptu lessons, his half-century of planning and water resources experience imparting context to every topic we discussed.

The curriculum for our lessons was broad. We covered several decades of land-use planning in the United States. We talked a lot about politics and policy, which he loved and I hated. I liked science better, but Hal taught me to admire people who designed partnerships and policies as much as engineers who designed BMPs. His favorite *News-Notes* section was called "News from the States, Tribes, and Localities" — to which Hal always added "Where the Action Is." We delighted in the war stories readers submitted for this section — the closer to the grass roots, the better. One lesson Hal never failed to impress on me was that water and habitat quality depend largely on how communities value their land and water.

Hal's other pet section was "Notes on Education and Outreach." It's interesting that over the years it has become harder to decide if a particular article belongs in Hal's "Where the Action Is" section or in the Education section. This strikes me as a good thing. It means that education is overflowing into action.

In the early *News-Notes* years, we automatically popped anything related to schools into the Education section. Now the decision is not so easy. Many teachers are adopting water quality and habitat as the substrate for teaching science, social studies, math, even English. They've made it their business to become highly knowledgeable on the subject — not just about the science, but also about the surrounding social and political issues. Students catch their excitement and then, according to many teachers, the lessons take off, propelled by kids eager to get their feet wet, hands dirty, and minds cranking on real-world problems. Projects on their own turf — the schoolyard and surrounding community — are especially popular. We hear tales of stormwater BMPs installed for school parking lots and stream restorations and constructed wetlands on school property.

In the best cases, wise educators guide their students through projects that include research, real-life politics, partnership development, grant-writing, design, outreach, and construction/implementation. It pays off. Ordinances get adopted, streams restored, BMPs installed, minds opened. I'm betting Hal would say it's as much "Action" as "Education."

Articles about public participation have changed, too. Most used to be about "stewardship activities" that kept the citizenry off the streets and out of professionals' hair. In truth, they were stewardship-*building* activities that are now evolving into stewardship *action*. Some nonprofessionals now know the issues and the science just as well as (or better than) the professionals and official decision makers. They are often the driving force behind real change in their watersheds. It is definitely "Where the Action Is"!

Eight years of corresponding with *News-Notes* contributors and learning about all the nifty things you are doing kindled my desire to get closer to "Where the Action Is." So it's partly because of *you* that my hitch with *News-Notes* is over. I've moved to my home state of New York to be part of the "action." Thanks for inspiring me!

[For more information, contact Elaine Bloom, New York State Department of Environmental Conservation, Division of Water, 50 Wolf Rd., Albany, NY 12233. Phone: (518) 457-1623); e-mail: elbloom@gw.dec.state.ny.us]

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

November 1999

13 — *Excellence in Environmental Leadership Workshop*, Austin, TX. The Institute for conservation Leadership, in cooperation with local organizations, will offer day-long intensive workshops in six cities across the country this fall. The workshops are open to volunteers and staff of enviornmental and conservation groups that want to strengthen their organizations. Contact Peter Lane at peter@icl.org.

14-16 — *Animal Residuals Management Conference*, Crystal City, VA. Call 1-800-666-0206 or (703) 684-2452 or e-mail: confinfo@wef.org.

15-17 — *15th Annual Groundwater Foundation Fall Symposium*, Atlanta, GA. Contact The Groundwater Foundation, P.O. Box 22558, Lincoln, NE 68542. Fax: (402) 434-2742; e-mail: info@groundwater.org.

15-17 — *Understanding and Addressing Risks to Groundwater, The 15th Annual Groundwater Foundation Fall Symposium*, Atlanta, GA. Contact Cindy Kreifels or Zoe McManaman at (800) 858-4844.

16-17 — *Water Well Rehabilitation Technology*, Des Moines, IA. Contact: American Ground Water Trust, 16 Centre Street, Concord, NH 03301. Phone: (603) 228-5444, E-mail: agwthq@aol.com, web site: www.agwt.org.

16-17 — *Wetlands and Remediation: An International Conference*, Salt Lake City, UT. This conference will include both the treatment and remediation of contaminated wetlands and the use of wetlands for the treatment and remediation of contaminated water and wastewater. Contact Karl Nehring at (614) 424-6510; e-mail: nehringk@battelle.org.

17-19 — *The 3rd Partners for Smarth Growth Conference*, San Diego, CA. Contact the Urban Land Institute at (800) 321-5011 or (410) 626-7500; web site: www.uli.org.

18 — *Rivers, Dams, and the Future of the West*, Salt Lake City, UT. Topics will include assessing the impacts of dams, riparian restoration, planning and modeling mitigation, riverine ecosystems, and more. Contact the Jack Hamilton, Executive Director, Utah Wetlands and Riparian Center, University of Utah, 1515 Mineral Square, Rm. 138, Salt Lake City, UT 84112. Phone: (801) 581-6384; e-mail: jack.hamilton@m.cc.utah.edu.

December 1999

1-4 — *North American Lake Management Society Symposium 99*, Reno, NV. Contact Terry E. Thiessen, North American Lake Management Society, at (608) 233-2836; e-mail: thiessen@nalms.org; web site www.nalms.org.

4-9 — *AWRA Annual Water Resources Conference*, Seattle, WA. Contact Watershed Management to Protect Declining Species, American Water Resources Association, 950 Herndon Parkway, Suite 300, Herndon, VA 20170. Phone: (703) 904-1225; fax: (703) 904-1228; e-mail: awrahq@aol.com; web site: www.awra.org.

15-17 — *Conservation 2000: Conference to Highlight Local, State, and Federal Programs*, New Orleans, LA. Contact the Conservation Technology Information Center at (765) 494-9555 or e-mail: ctic@ctic.purdue.edu.

January 2000

16-20 — *4th International Conference on Diffuse Pollution*, Bangkok, Thailand. Contact Ms. Nitayaporn Tonmanee, Department of Land Development (DLD) Phaholyothin Road, Chatuchak, Bangkok 10900, Thailand, phone: (662) 579-0111, ext. 1386; fax: (662) 562-0732; e-mail: ldd@mozart.inet.co.th.

February 2000

7-10 — *Tools for Urban Water Resource Management and Protection: A National Conference*, Chicago, IL. Contact Bob Kirschner, Chicago Botanic Garden, 1000 Lake Cook Road, Glencoe, IL 60022. Phone: (847) 835-6837; fax: (847) 835-1635; e-mail: bkirschn@chicagobotanic.org.

Feb. 17-18 — *2000 Winter Meeting of the Oregon Society of Soil Scientists*, Newport, OR. Contact Crig Busskohl at (541) 278-3817; e-mail: Bussokohl_Craig_R/r6pnw_umatilla@fs.fed.us or Tom Clark at (541) 504-0520; e-mail: 3cats@coinet.com or John DePuy at (503) 315-5919; e-mail: jdepuy@or.blm.gov.

March 2000

7-8 — *No-Tillage Conference*, Muresk, Western Australia. Contact Bill Crabtree, Scientific Officer, 12 Fermoy Ave, Northam, 6401, Western Australia, Northam, WA 6401; e-mail: crabtree@muresk.curtin.edu.au.

13-16 — *Conference on Land Stewardship in the 21st Century: The Contributions of Watershed Management*, Tucson, AZ. Contact Peter F. Ffolliott, School of Renewable Natural Resources, Unviersity of Arizona, Tucson, AZ 85721. Phone: (52) 621-7276; fax: (520) 621-8801; e-mail: ffolpete@ag.arizona.edu; web site: www.srnr.arizona.edu/2000conf/landconf.html.

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

Editorial contributions from our readers sharing knowledge, experiences, and/or opinions are invited and welcomed. (Use the COUPON on page 27.) However, *News-Notes* cannot assume any responsibility for publication or nonpublication of unsolicited material or for statements and opinions expressed by contributors. All material in *NEWS-NOTES* has been prepared by the staff unless otherwise attributed. For inquiries on editorial matters, call (202) 260-3665 or (703) 548-5473 or FAX (202) 260-1977.

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

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