Nonpoint Source
News-Notes

September 2007, #82

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

Notes on the National Scene

EPA Promotes "Green Infrastructure" Solutions to Water Pollution

The U.S Environmental Protection Agency (EPA) Administrator Stephen Johnson celebrated Earth Day 2007 (April 19) by signing a statement of intent with four environmental organizations to promote the use of "green infrastructure" approaches, such as rain-catching roofs and gardens, to lessen sewer overflows and runoff after storms. The statement formalizes a collaborative effort among EPA, the National Association of Clean Water Agencies (NACWA), the Association of States and Interstate Water Pollution Control Administrators (ASIWPCA), the Natural Resources Defense Council (NRDC), and the Low Impact Development (LID) Center to help state, city, and local governments implement and evaluate innovative and effective green infrastructure approaches.

The statement of intent, available at www.epa.gov/npdes/pubs/gi_intentstatement.pdf, describes and facilitates cooperation, collaboration, coordination, and effective communication among the signatory organizations. These five organizations see the value of green infrastructure as "both a cost effective and an environmentally preferable approach to reduce stormwater and other excess flows entering combined or separate sewer systems in combination with, or in lieu of, centralized hard infrastructure solutions."

EPA's new Web-based NPS Toolbox helps communities conduct effective watershed education and outreach. See article on page 5.

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EPA Promotes "Green Infrastructure" Solutions to Water Pollution (continued)

The five signatory organizations plan to promote the benefits of using green infrastructure for protecting drinking water supplies and public health, mitigating overflows from combined and separate sewers and reducing stormwater pollution, and to encourage cities and wastewater treatment plants to begin using green infrastructure as a prominent component of their Combined and Separate Sewer Overflow (CSO & SSO) and municipal stormwater (MS4) programs.

Statement Objectives

The statement of intent explains how the five signatory organizations plan to work together to promote green infrastructure. They intend to:

- Develop models for all components of green infrastructure and make them available nationwide;
- Explore opportunities and incentives for the use of green infrastructure provisions in MS4 permits and CSO Long Term Control Plans (LTCPs);
- Develop guidance materials that would explain how regulatory and enforcement officials should evaluate and provide appropriate credit for the use of green infrastructure in meeting Clean Water Act requirements;
- Recognize the most effective and innovative uses of green infrastructure to meet Clean Water Act goals through EPA awards or recognition programs;
- Provide technical assistance, training, and outreach to potential users of green infrastructure, including states, cities, counties, utilities, environmental and public health agencies, engineers, architects, landscape architects, planners and nongovernmental organizations;
- Establish a web-based green infrastructure resource center at EPA; and
- Develop tools to assist local green infrastructure programs with outreach, training, model development and application, planning and design, monitoring, and plan review.

What is Green Infrastructure?

Communities are looking for ways to assure that the quality of their rivers, streams, lakes, and estuaries is protected from the impacts of development and urbanization. Traditional development practices cover large areas of the ground with impervious surfaces such as roads, driveways, and buildings. Once such development occurs, rainwater cannot infiltrate into the ground, but rather runs offsite at levels that are much higher than would naturally occur. The collective force of all such rainwater scours streams, erodes stream banks, and thereby causes large quantities of sediment and other entrained pollutants to enter the waterbody each time it rains.

In addition to the problems caused by stormwater and nonpoint source runoff, many older cities have combined sewage and stormwater pipes which periodically overflow due to precipitation events. In the late 20th century, most cities that attempted to reduce sewer overflows did so by separating combined sewers, expanding treatment capacity or storage within the sewer system, or by replacing broken or decaying pipes. However, these traditional practices can be enormously expensive.

To ameliorate these problems, a set of techniques, approaches, and practices can be used to reduce the amount of water that runs off-site. We refer to these collectively as "green infrastructure." "Green infrastructure" is a relatively new and flexible term, and it has been used differently in different contexts. Thus, to date, there is no universally established definition of the term. For example, some writers have defined it broadly as "an interconnected system of natural areas and other open spaces managed for the benefit of people and the environment." However, for the purposes of EPA's efforts to implement the Green Infrastructure Statement of Intent, EPA intends the term "green infrastructure" to generally refer to systems and practices that use or mimic natural processes to infiltrate, evapotranspirate (the return of water to the atmosphere either through evaporation or by plants), or reuse stormwater or runoff on the site where it is generated.
***Turn to page 9** to learn more about how the City of Seattle is incorporating green infrastructure into neighborhoods to control stormwater in priority watersheds*.

Portland, Oregon (www.portlandonline.com/bes) is a leader in the use of green infrastructure. These stormwater planters capture stormwater runoff and allow it to infiltrate. Any overflow backs up into the street and drains into existing storm drains.

EPA Promotes "Green Infrastructure" Solutions to Water Pollution (continued)

As an important first step, members of this collaborative effort have already joined together to launch the Web-based resource center for people interested in learning about various aspects of green infrastructure. Available at www.epa.gov/npdes/greeninfrastructure, this Web site will serve as a clearinghouse for information on green infrastructure, and will be continuously updated to provide visitors with the latest information available. The site currently offers general information on green infrastructure policy and environmental benefits of green infrastructure. It also provides case studies, links to relevant publications, and links to valuable resources, such as EPA's Low Impact Development Web page (www.epa.gov/nps/lid). The site also lists information about funding that is available for green infrastructure projects, as well as information for contacting EPA's green infrastructure partners.

When signing this statement, the signatory organizations encouraged "other organizations that support green infrastructure to join in this initiative." Many organizations have heeded this call—as of May 22, 2007, more than 30 groups across the nation had signed a "Stakeholder Statement of Support for Green Infrastructure" (available at www.epa.gov/npdes/pubs/gi_supportstatement.pdf). By signing the statement of support, these organizations have committed to work together to encourage cities and wastewater treatment plants to incorporate green infrastructure into their programs.

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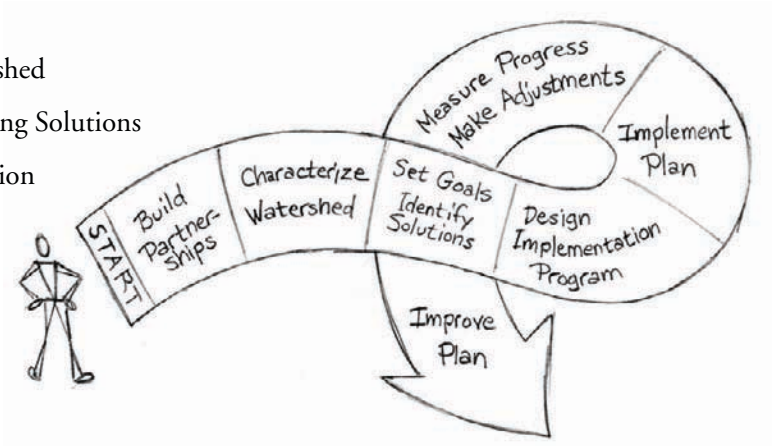
New Watershed Plan Builder Saves Time and Money

The U.S. Environmental Protection Agency (EPA) recently released Watershed Plan Builder, a Web-based, interactive tool designed to help organizations develop integrated watershed plans to meet state and EPA requirements and promote water quality improvement. This tool is designed to get users started, providing a framework for a watershed plan and tips on what should be included in the plan and how to obtain additional information.

Available at www.epa.gov/owow/watershedplanning, Watershed Plan Builder collects input from users and outputs a customized watershed plan outline in either PDF or Microsoft Word format. The tool also provides information resources from the EPA's Watershed Planning Handbook that follows the six steps of the watershed planning process:

1. Building Partnerships
2. Characterizing Your Watershed
3. Setting Goals and Identifying Solutions
4. Designing an Implementation Program
5. Implementing the Watershed Plan
6. Measuring Progress and Making Adjustments (adaptive management).



Much of the instructional text in the Plan Builder is taken from EPA's *Handbook for Developing Watershed Plans to Restore and Protect Our Waters* (available at www.epa.gov/nps/watershed_handbook). The Handbook was written to help watershed planners develop effective plans that would provide an analytical framework to restore water quality in impaired waters and to protect waters that may be threatened.

How do Watershed Plans Help?

Ever since 2002, EPA has promoted a watershed-based planning approach for nonpoint source projects. A watershed-based plan includes stakeholder involvement and management actions supported by sound science and appropriate technology. The watershed planning process works within

New Watershed Plan Builder Saves Time and Money (continued)

this framework to identify and quantify specific causes and sources of water quality problems. It also identifies water quality goals and specific actions required to solve those problems. States and watershed groups need tools to make their plan developmental process more effective and efficient. For this reason, EPA developed the Watershed Plan Builder online tool to attempt to speed up the process and remove uncertainties for those undertaking watershed planning. The simple truth is that local agencies and watershed groups are often spending hundreds of thousands to millions of dollars to restore and protect their watersheds—it does not make sense to begin without first identifying the magnitude of the problems, the goals, objectives, and restoration targets. Moreover, showing potential funders a more comprehensive watershed plan can often improve the odds that projects will be funded.

Watershed groups and local government agencies have made great strides in restoring the nation's waterbodies and continue to press for protection of our water resources through various legal, public outreach, and programmatic means. In the past, resources were spent on specific waterbody sections with problems or particular sources of pollutants, and time was spent implementing solutions where problems occurred, rather than at the cause of the problem.

Now, EPA is helping others to take a wider, watershed-view when doing watershed work, considering all major sources of pollution and habitat losses. For solutions, groups can now consider all possible legal and programmatic tools and administrative agencies with influence on activities that could affect waterbodies and the species that they support, and any options available through different partners and their constituents. Partnerships that cast a wide net over all the activities in a watershed provide the foundation for finding innovative solutions to water resource problems. The Watershed Plan Builder helps to identify key issues that may not be considered if just a few people are drafting a plan.

How Does Plan Builder Work?

To create an outline, a user may start with as little as the minimum contact information required, and geographically outline his or her watershed. As the user continues to gather data on a particular watershed, he or she can retrieve a customized plan from the online Plan Builder and add details of the watershed at any time, and at any step of the process.

The information supplied by the user helps build the customized aspect of the watershed plan outline. The Plan Builder connects a user's inputs on problems in the watershed with applicable agency and state programs that might offer program tools, legal tools, funding options, or other consultation considerations. These options are laid out in the plan outline. Users can easily jump to technical resources by clicking on links. If an option is 'not applicable,' a user can simply delete that section in the outline.

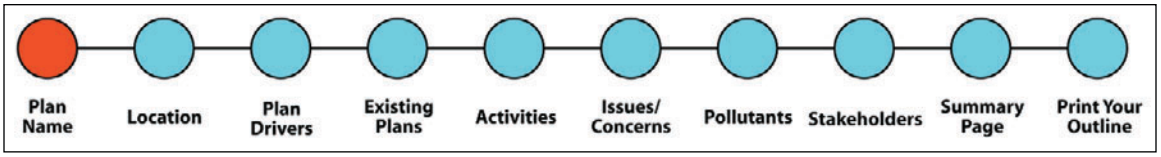
Watershed Plan Builder in Action

Kellie Johnson, facilitator for the Black Warrior Clean Water Partnership, used the Watershed Plan Builder to develop an updated management plan for an approximately 14-digit HUC watershed. Like many others, her organization had previously developed a watershed management plan, and had already compiled much of the data and information needed for Plan Builder. With this information already in hand, she "sailed through the Plan Builder in one and a half hours."

Johnson was new to Plan Builder, but still "found it easy to use, with commonsense, intuitive buttons." At the end of the process, she was somewhat taken aback to have produced a 57-page outline for her watershed plan. "It helped that each section of the outline had an example to follow and suggested data sources," she said.

In addition, the outline produced by the Plan Builder prompted Johnson for information she had not fully considered as important to include in her plan. For example, Plan Builder prompted her to include a section on planning for and controlling development. At first glance, the section on development may not have been directly applicable, in what she describes as a rural, agriculture-dominated landscape. However, Plan Builder made Johnson realize that it might be an important factor to consider down the road. Therefore, Johnson made a point to inform the local Soil and Water Conservation District—one of the watershed planning partners working with farmers— about how water quality might be impacted if farmland were to be developed or converted to urban uses. Ultimately, Johnson believes that using the Watershed Plan Builder bolstered and improved their existing management plan.

New Watershed Plan Builder Saves Time and Money (continued)



The Watershed Plan Builder guides users through these information-gathering steps.

To hear more about how the Watershed Plan Builder works, download the streaming audio version of the May 2007 webcast titled "The Watershed Plan Builder: EPA's New Interactive Web-based Tool Designed to Promote the Development of Comprehensive Watershed Plans," available at www.epa.gov/watershedwebcasts. This webcast provided background on the development of the tool, gave an overview of the Plan Builder contents, and then demonstrated how to navigate through the Plan Builder.

The outline serves to highlight a large variety of issues that have the potential to affect a restoration process and outcome. A comprehensive accounting, not only of sources of pollution, but of all potential sources of solutions, helps to build a better watershed plan and restoration strategy. Plan Builder offers a dissection of two existing comprehensive watershed plans to provide examples for plan writers. Other examples will be provided in future versions of the Tool.

EPA Wants Feedback!

EPA is making the Watershed Plan Builder Tool and Planning Web site available with the purpose of having it used and tested by a variety of watershed partnerships. EPA will use feedback from such organizations when it develops the final version. Please address all comments, suggestions, and corrections to OWOW-WPB@epa.gov with "Watershed Plan Builder Site" in the subject line. Submissions are due by September 30, 2007.

EPA's New Nonpoint Source Outreach Toolbox Strengthens Local Outreach

In May 2007, the U.S. Environmental Protection Agency (EPA) released the much-anticipated Nonpoint Source Outreach Toolbox, which has been met with wide enthusiasm. The Toolbox is a comprehensive, integrated set of Web-based resources designed to assist communities across the U.S. conduct locally effective watershed education and outreach activities. It is available online at www.epa.gov/nps/toolbox. The Toolbox is intended to walk local government staff, watershed organizations, and others through the steps needed to create effective campaigns to improve water quality and to place a vast array of resources into their hands.

"With this Toolbox, local practitioners will avoid the cost of reinventing the wheel to develop attractive and tested outreach messages, and increase their effectiveness by taking advantage of the how-to guide, evaluation surveys, and other features within it," said Don Waye, EPA's Nonpoint Source Outreach Coordinator, who also managed the Toolbox project. Nikos Singelis, a Senior Program Analyst with EPA's NPDES Stormwater Program, added, "the Toolbox should be a tremendous boon to the 5,000-plus communities regulated under Phase II, which requires them to conduct public education and outreach for local stormwater runoff issues."

Integrated in the Toolbox is a catalog of nearly 800 print, radio, and TV ads and outreach materials searchable by state, media type, or topic category. Categories include lawn and garden care, motor vehicle care, pet care, septic system care, household chemicals and waste, and general stormwater and storm drain awareness.

Each product in the catalog is fully viewable (or listen-able, in the case of radio ads), and users are encouraged to drill down into the underlying database to obtain contact and permission information, see all other ads associated with a particular campaign, and access any related campaign evaluations. This digital repository of contemporary materials (many of which have undergone audience-testing) is designed to meet the needs of stormwater professionals who might be strapped for ideas, money, time or staff to develop messages and products for their own communities. A "Featured Products" section developed by a panel of stormwater outreach experts from across the U.S. provides quick access to some of the most effective stormwater outreach products known to exist.

EPA's New Nonpoint Source Outreach Toolbox Strengthens Local Outreach (continued)

Resources for Improving Outreach Effectiveness

An important feature of the Toolbox is the inclusion of EPA's flagship publication on conducting watershed outreach, the 2003 *Getting in Step* guide. Alongside this guide in the Toolbox are related *Getting in Step* resources, such as a guide to reaching and working with stakeholders, a link to an online learning module within EPA's Watershed Academy Web that teaches the six-step watershed outreach approach, and a link for ordering EPA's companion video, and even information on hosting a *Getting in Step* workshop locally. *Getting in Step* provides the overall framework for developing and implementing an outreach campaign in concert with an overall water quality improvement effort. It presents the outreach process as discrete steps, with each step building on the previous ones. The steps are:

1. Define the driving forces, goals, and objectives
2. Identify and analyze the target audience
3. Create the message
4. Package the message
5. Distribute the message
6. Evaluate the outreach campaign

Because effective outreach is predicated on understanding and changing the human behaviors and activities that matter most in your watershed, and therefore on researching the groups of people you are trying to reach (your target audiences), the Toolbox includes a broad collection of surveys and campaign evaluations from around the country for handy perusal. Additionally, a section on logos, slogans, and mascots from various organizations is available to help unify a community's campaign. Lastly, the Toolbox includes a help/frequent questions section based on extensive beta testing and user feedback.

A CD version of the Toolbox is scheduled to be released by September 2007 so that it may be used without being connected to the Web. However, because the complete content of the Toolbox exceeds the capacity of a standard 700 MB CD, the CD version does not hold everything available in the Web version. EPA intends to regularly update and expand the Web version of the Toolbox.

For more information on EPA's Nonpoint Source Outreach Toolbox, please visit www.epa.gov/nps/toolbox. To order the Toolbox on CD, call EPA's National Service Center for Environmental Publications (NSCEP) at 1-800-490-9198, or e-mail nscep@bps-lmit.com and request Publication # EPA 841-C-05-003. To submit nonpoint source outreach materials for inclusion in future Toolbox updates, contact Don Waye, USEPA, 1200 Pennsylvania Avenue, N.W., Mail Code 4503T, Washington, DC 20460. Phone: 202-566-1170; E-mail: waye.don@epa.gov.

National Estuary Program Condition Report Released

Development pressures and pollution from point and nonpoint sources are just a few of the factors taking a toll on the nation's estuaries, according to a report by the U.S. Environmental Protection Agency (EPA). The EPA has released its first National Estuary Program (NEP) Coastal Condition Report (CCR), which ranks the condition of ecological resources in the 28 NEP estuaries. The NEP CCR is the third in a series of coastal environmental assessments. The first two reports addressed all U.S. coastal waters, while the NEP CCR focuses specifically on the NEP areas in the U.S. and Puerto Rico.

A marsh in Puget Sound, off the Washington coast.

The report, available at www.epa.gov/owow/oceans/nepccr, finds that the overall condition of the nation's NEP estuaries is generally rated as fair. The report also rated the estuaries by region—the Puerto Rico and Northeast Coast regions are rated poor, the Gulf Coast and West Coast regions are rated fair, and the Southeast Coast region is rated good to fair. Although population pressures in the NEPs were greater than those in non-NEP estuaries from 1990 to 2000, the NEP estuaries showed the same or better estuarine condition than U.S. coastal waters overall.

National Estuary Program Condition Report Released (continued)

Assessing Condition

The report presents two major types of monitoring data for each NEP estuary: (1) data collected as part of EPA's National Coastal Assessment (NCA)—— the most comprehensive and nationally consistent data set available on estuarine conditions, and (2) data collected by the individual NEPs or by the NEPs in partnership with interested stakeholders, including state environmental agencies, universities, or volunteer monitoring groups. Together, these data paint a picture of the overall condition of the coastal resources of the nation's NEP estuaries.

The NEP estuaries were rated individually, regionally, and nationally using four primary indicators of estuarine condition: water quality (e.g., dissolved inorganic nitrogen, dissolved inorganic phosphorus, chlorophyll a, water clarity, and dissolved oxygen); sediment quality (e.g., sediment toxicity, sediment contaminants, and sediment total organic carbon); benthic index; and a fish tissue contaminants index. For each of these four key indicators, the authors assigned a score of good, fair, or poor to each NEP. They then averaged these ratings to create overall regional and national scores. Based on these calculations, regions are rated as follows:

- *Northeast Coast region*: rated fair for the water quality index; poor for the sediment quality, benthic, and fish tissue contaminants indices; and poor for overall condition.
- *Southeast Coast region*: rated good for the water quality index; good to fair for the sediment quality index; fair for the benthic index; good to fair for the fish tissue contaminants index; and good to fair for overall condition.
- *Gulf Coast region*: rated fair for the water quality index; fair to poor for the sediment quality and benthic indices; good to fair for the fish tissue contaminants index; and fair for overall condition.
- *West Coast region*: rated fair for the water quality index; poor for the sediment quality index; good for the benthic index; poor for the fish tissue contaminants index; and fair for overall condition.
- *Puerto Rico*: the sole NEP estuary (San Juan Bay Estuary) is rated fair for the water quality index; poor for the sediment quality, benthic, and fish tissue contaminants indices; and poor for overall condition.

NEP Environmental Concerns

Why are some of the ratings so low? The report describes a number of major environmental concerns that plague some or all of the nation's 28 NEP estuaries. The top three include:

- **Habitat loss and alteration**—All 28 of the NEPs identify habitat loss or alteration of habitat as a primary environmental concern. Key causes include dredging and dredge-disposal activities; construction of groins, seawalls, and other hardened structures; and hydrologic modifications.
- **Declines in fish and wildlife populations**—25 NEPs cite environmental degradation associated with habitat loss, fragmentation or alteration, water pollution from toxic chemicals and nutrients, overexploitation of natural resources, and introduction of invasive species as reasons why native fish and wildlife populations have declined. Fourteen of these 25 NEPs note that declines have occurred in some recreationally or commercially valuable fish and shellfish species.
- **Excessive nutrients**—21 NEPs cite excessive nutrients such as nitrogen and phosphorus as a problem. Key sources include runoff of agriculturally and residentially applied fertilizers and animal wastes, discharges from wastewater treatment plants (WWTPs), leaching from malfunctioning septic systems, and discharges of sanitary wastes from recreational boats.

Additional areas of key concern cited by NEPs include toxic chemical contaminants (20 NEPs), pathogenic microorganisms (19 NEPs), alteration of freshwater flows (11 NEPs), and introduction

National Estuary Program Condition Report Released (continued)

of invasive species (11 NEPs). Each NEP develops its own management plan to address its specific areas of concern.

Report Structure

The 445-page report presents detailed national, regional, and individual NEP information. Chapter 2 presents available NCA data on a national scale for the 28 NEP estuaries in the conterminous 48 states and Puerto Rico. These data are then broken down and analyzed for the NEP estuaries of five geographic regions: Northeast Coast (Chapter 3), Southeast Coast (Chapter 4), Gulf Coast (Chapter 5), West Coast (Chapter 6), and Puerto Rico (Chapter 7). These chapters include a regional overview of NEP estuarine condition as well as profiles of the individual NEPs in that region. Each NEP profile presents information on the specific indicators used by an NEP to evaluate water and sediment quality, habitat quality, living resources, and other environmental stressors in their estuary, as well as an overview of the current projects, accomplishments, and future goals of the individual program.

These chapters also include a short "highlight" article for each NEP profile describing either a specific aspect of each estuary or an exemplary program developed to address site-specific environmental concerns. These articles are intended to illustrate the unique living resources of the estuary, as well as innovative monitoring methods, successful restoration/remediation efforts, or novel decision-making and management efforts undertaken at the local level. The diversity of the subjects described in the highlight articles speaks to the wide spectrum of programs and monitoring approaches that exist among the 28 NEP estuaries.

The NEP CCR is a useful resource for anyone concerned about estuaries—it not only presents a broad baseline picture of the condition of all 28 of the nation's NEP estuaries, but also offers information about the specific conditions and challenges of each NEP estuary. NEP staff and partners will use this NEP CCR as a continuing benchmark for analyzing the progress and changing conditions of the NEPs over time.

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The National Estuary Program

The mission of the EPA's National Estuary Program is to restore and protect America's nationally significant estuaries. Established as part of the 1987 amendments to Section 320 of the Clean Water Act, the NEP promotes comprehensive planning efforts to help protect nationally significant estuaries judged to be threatened by pollution, development, or overuse. The NEP is a unique voluntary program that operates through partnerships among EPA and other Federal, State, and local organizations; industry; academia; environmental and business groups; and community residents. Each NEP works using an inclusive collaborative decision-making process to deliver on-the-ground action—making the NEP an important model for protection and management of coastal and non-coastal watersheds. For more information, see the National Estuary Program Web site at www.epa.gov/owow/estuaries.

Hydromodification Management Measures Guidance Released

The U.S. Environmental Protection Agency (EPA) has released the final version of *National Management Measures to Control Nonpoint Source Pollution from Hydromodification*, a guidance document that provides background information about nonpoint (NPS) source pollution and offers a variety of solutions for reducing NPS pollution resulting from hydromodification activities including dams, channelization and channel modification, and streambank and shoreline erosion.

The guidance document is intended to provide technical assistance to states, territories, tribes, local governments, and the public for managing hydromodification and reducing associated NPS pollution. This guidance can also help state and local elected officials and agencies, landowners, developers, environmental and conservation groups, and other stakeholders as they work together to protect, maintain, and restore water resources that are impacted by hydromodification activities. These local efforts, in aggregate, form the basis for changing the status of hydromodification as a national problem.

The document provides:

- Background information, including a discussion of sources of NPS pollution associated with hydromodification and how the generated pollutants enter the nation's waters;

Hydromodification Management Measures Document Released (continued)

- Information about practices that can be used to implement the management measures;
- A discussion about how to assess and address water quality problems on a watershed level;
- Information about available models and assessment approaches that could be used to determine the effects of hydromodification activities; and
- Dam removal information, including permitting requirements, process, and techniques for dam removal.

What Types of Issues are Associated with Hydromodification?

Hydromodification is one of the leading sources of impairment in our nation's waters. According to the *National Water Quality Inventory: 2000 Report to Congress*, there are almost 3.7 million miles of rivers and streams in the United States. Approximately 280,000 miles of assessed rivers and streams in the United States are impaired for one or more designated uses, which include aquatic life support, fish consumption, primary and contact recreation, drinking water supply, and agriculture. Many of the pollutants causing impairment are delivered to surface and ground waters from diffuse sources, such as agricultural runoff, urban runoff, hydrologic modification, and atmospheric deposition of contaminants. The leading causes of beneficial use impairment (partially or not supporting one or more uses) are nutrients, sediment, pathogens (bacteria), metals, pesticides, oxygen-depleting materials, and habitat alterations.

The *National Water Quality Inventory: 2000 Report to Congress* identified hydrologic modifications (i.e., hydromodification) as a leading source of water quality impairment in assessed surface waters. Of the 11 pollution source categories listed in the report, hydromodification was ranked as the second leading source of impairment in assessed rivers, second in assessed lakes, and sixth in assessed estuaries. Three major types of hydromodification activities—channelization and channel modification, dams, and streambank and shoreline erosion—change a waterbody's physical structure as well as its natural functions.

Many of these hydromodification activities are necessary because of human activities. While hydromodification activities are intended to provide some form of benefit (e.g., levees for reducing flooding, electricity from hydroelectric dams, or bulkheads to reduce shoreline erosion and protect valuable property), there may be unintended consequences resulting from the activity. Solutions to problems associated with hydromodification are usually applied at the local level. This document will provide information that stakeholders can use to reduce or eliminate related sources of NPS pollution.

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Notes from the States, Tribes, and Localities

Seattle Projects Seek to Mimic Mother Nature

Seattle, Washington is gaining national recognition for its application of low impact development innovations. During the past eight years, Seattle Public Utilities' (SPU) natural drainage systems program has implemented a variety of methods to slow, hold, and treat stormwater runoff before it runs into local waterways. SPU has completed numerous projects—ranging in scale from the retrofit of a single residential block to the complete redevelopment of 129 acres of mixed-income housing in an urban setting.

A Natural Approach

Forests and grasslands once covered the Seattle region. Rainfall soaked quickly into the ground and moved through the soil until it reached the groundwater table or seeped into creeks. As Seattle grew, so did the number of parking lots, roads, and rooftops. Any rain that fell on these impervious surfaces drained off—carrying contaminants such as oil, pesticides, fertilizer, and heavy metals

directly into local waterways. The sheer volume of the stormwater runoff eroded stream channels, thereby degrading the habitat quality for wildlife.

In 1999, SPU launched its first of many projects to manage stormwater "naturally," and SPU's natural drainage systems (NDS) program was born. NDS project sites are selected based on the flow, habitat, and water quality benefits that the project will provide. All of the NDS projects help to manage stormwater in neighborhoods, while also improving the appearance and function of the street rights-of-way. Best of all, the NDS projects help the City of Seattle meet local, state, and national environmental regulations.

The Street Edge Alternatives—SEA Streets—project redesigned a typical residential block to include vegetated stormwater detention swales along a narrow, slightly curving street.

Funding for the NDS projects is derived from drainage and wastewater fees included in citizens' annual property tax bills. Drainage rates are based on a parcel's contribution to stormwater runoff—this is calculated using parcel size and the percentage of impervious surface covering a given lot. Wastewater rates are based on actual water usage during the winter period (extra water use in the summer is not included in the rate assessment because this water is assumed to be applied to lawns and gardens, rather than entering the sewer). NDS drainage rate-funded projects are typically located in watersheds and/or areas where stormwater and wastewater are completely separated. NDS wastewater rate-funded projects are located in combined sewer areas.

An aerial view of the SEA Streets project, immediately after construction.

Street Edge Alternatives

The first NDS program implemented was the Street Edge Alternatives, or "SEA Streets." Here, SPU implemented a stormwater retrofit of a residential block in northwest Seattle. The site, located in the Piper's Creek watershed, was picked in part because of existing flooding problems and in part to help protect and restore salmon habitat. SPU reduced the amount of impervious surface by 11 percent, provided surface detention in swales, and added more than 100 evergreen trees and 1,100 shrubs. This pilot project successfully showed that stormwater management could be aesthetically pleasing, while also improving drainage functions. In fact, monitoring showed that this retrofit project reduced runoff from this street by 98 percent during the wet season and by 100 percent during the dry season. For a virtual tour of the SEA Streets project, see www2.cityofseattle.net/util/tours/seastreet/slide1.htm.

110th Cascade

SPU's next project also took place in the Piper's Creek watershed. Here, SPU and Seattle Department of Transportation (DOT) replaced an existing ditch and culvert system along four blocks of Northwest 110th Street with a "cascade" model natural drainage system. Called the "110th Cascade" because the water appears to cascade down the hillside, the project is a series of stair-stepped natural pools on a moderately steep slope. A check dam at the end of each pool slows damaging stormwater flows and allows water to infiltrate. The 110th Cascade manages stormwater flow from approximately 21 acres. For a virtual tour of the 110th Cascade, see www2.seattle.gov/util/tours/110thCascade/slide1.htm.

Green Grid Projects

As SPU staff members and collaborators became more comfortable with various NDS elements, they began incorporating them on a larger scale. The Broadview Green Grid project, covering 15 residential blocks in northwest Seattle, included elements from both SEA Streets and the 110th Cascade. SPU collaborated with Seattle DOT to incorporate traffic calming, pedestrian safety, and aesthetic

improvements along with sustainable stormwater management. For a virtual tour of the Broadview Green Grid, see www2.seattle.gov/util/tours/Broadview/slide1.htm. Another, similar project—the Pinehurst Green Grid—was completed on a 12-block area in the fall of 2006.

The 110th Cascade project replaced an existing ditch with a stair-stepped drainage system that slows water as it flows down a moderately steep slope.

High Point Development

SPU used its experience from earlier projects to develop a comprehensive stormwater plan for the redevelopment of Seattle Public Housing's 129-acre High Point neighborhood in West Seattle. This project represents the first time that a natural drainage strategy of this scale has been used in a high-density urban setting in Seattle. The project includes replacing 716 worn-out public housing units built in the 1940s with 1,600 mixed-income housing units for renters and homeowners. The first phase of the High Point redevelopment project was completed in the fall of 2005—the entire project should be finished by 2010.

The NDS portion of the project is incorporating swales, pervious pavement, rain gardens, and narrowed streets, among other practices, to manage the runoff from 129 acres in one of Seattle's priority watersheds. The project includes the integration of public art, parks, trails, and open space into the stormwater facilities. This project achieves a balance of neighborhood green space, pedestrian safety, and water quality improvements. When completed, this ambitious project is intended to process water in a manner similar to a forest meadow. SPU began monitoring the first phase of the High Point NDS in January 2007—preliminary results will be available in 2010. For more information about High Point NDS, see www.seattle.gov/util/About_SPU/Drainage_&_Sewer_System/Natural_Drainage_Systems. For more about the overall High Point redevelopment project, see www.seattlehousing.org/development/highpoint/highpoint.html.

Next Steps

SPU has a number of additional projects in planning, preliminary engineering, or design phase, explains Gary Schimek, SPU Manager. SPU is also "working on a major effort to identify and prioritize the most critical flow control, flooding, and water quality problems within the City that may be, potentially, solved with NDS techniques," he notes. "The results of the effort will lead to the development of a long-term NDS implementation plan."

Program Serves as a Model for a Growing Audience

Seattle's success with the NDS program has gained national attention and recognition. In 2004, the program won the prestigious Innovations in American Government Award from the Ash Institute for Democratic Governance and Innovation at Harvard University and the Council for Excellence in Government. In 2007, the High Point Development was honored with an Urban Land Institute Award for Excellence for being one of the ten outstanding developments in North America.

Other municipalities are noticing Seattle's NDS success and often contact SPU staff looking for advice or ideas. Requests for help have increased dramatically over the past few years, notes Schimek. In response, SPU is establishing a new staff position to help with technical requests for guidance and to identify potential partners for NDS projects. Thanks to SPU's willingness to share information and support others, the NDS program will ultimately lead to water quality improvements far beyond the Seattle region.

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Indian Tribes Achieve Environmental Improvement

Tribes in the American southwest have made great strides in their efforts to monitor and control nonpoint source (NPS) pollution on reservation lands. Many of these tribes' projects were recently highlighted in *Tribal Water Quality Accomplishments*, a document released by U.S. Environmental Protection Agency (EPA) Region 9 (available online at www.epa.gov/region09/water/tribal/pdf/tribal-water-quality-accomplishments.pdf). This document describes how the Indian tribes have used Clean Water Act Section 106 funds for water quality monitoring, thus enabling them to

develop NPS pollution runoff control and management programs that ultimately improved environmental quality.

The Tribal Office of the EPA Region 9 Water Division administers Clean Water Act (CWA) Section 106 grants to federally recognized tribes throughout its service area (Arizona, California, Nevada, Hawaii, and Pacific Island territories). These grants are designed to help achieve environmental results by developing institutional capacity for administering water quality programs to protect, improve, and enhance natural resources. Tribes can use Section 106 grants to create programs that enable them to apply for and implement grants from other water programs, such as the CWA Section 319–NPS Program, CWA Section 104(b)(3)–Wetlands Development Grant Program and the Wetlands Implementation Program, and the Source Water Program, among others.

Section 106 Helping Many

Participation in the CWA Section 106 grant program continues to grow. As of 2007, almost 100 of the 146 tribes in Region 9 had been determined eligible to receive CWA Section 106 funding, up from just seven in 1990. Not all tribes apply for Section 106 funding. Some tribes do not have any water on their reservation under their jurisdiction, and have no reason to pursue funding. Others are not yet eligible to apply for the grants because they do not yet have an environmental department in place, and thus are not able to carry out any environmental programs.

Tiffany Eastman, Region 9 Tribal NPS Coordinator, explains "Tribes frequently rely on CWA Section 106 funds to help them gather water quality data and move forward in their efforts to protect and improve water quality on their reservations through NPS pollution control." For example, more than half of the tribes have used a Section 106 grant to support the development of NPS assessment reports and management programs (A&MP)—which make the tribes partially eligible to apply for CWA Section 319 NPS grants.

Monitoring can also be a key part of a Section 106-funded program; in fact, most 106-funded tribes now monitor the surface and groundwater on their reservations. Section 106 funds enable the tribes to assess their water when they first start the program and then monitor the water for trends over time. These funds also permit the tribes to monitor for pre- and post-project water quality to assess whether on-the-ground projects, such as those funded through the CWA Section 319 program, or passage of new ordinances, have yielded improved water quality. About half of the tribes have completed intensive monitoring and have submitted CWA Section 305(b) water quality assessment reports. Several of the tribes have developed their own Tribal- and EPA-approved water quality standards.

The *Tribal Water Quality Accomplishments* document describes the long-term results of water quality monitoring from the NPS management programs and other management efforts by 12 tribes in California, Nevada, and Arizona. A few of these—the Hualapai Nation, the Hoopa Valley Tribe, and the Pyramid Lake Paiute Tribe—are highlighted below. These three tribes are diverse in location, size, and sources of economic livelihood, and are representative of the region's wide variety of tribes and their accomplishments.

Hualapai Nation

The Hualapai Reservation, which encompasses approximately one million acres of land on the southern rim of the Grand Canyon in Arizona, is bordered on the north by a 108-mile section of the Colorado River. The tribe's main economic industries include tourism, cattle ranching, timber sales, and arts and crafts.

The tribe operates a river-rafting business on 60 miles of the Colorado River—serving approximately 14,000 visitors per summer month. Key water pollution sources in the area include sediment, bacteria, and nutrients. Sources include human waste from rafters and powerboat vacationers on the Colorado River, and drainage from numerous tributaries that are impacted by grazing animals.

The Hualapai Nation's Water Pollution Control Program began in 1991, when it received its first CWA Section 106 grant. Using those funds, the tribe developed its first EPA-approved Quality Assurance Program Plan (QAPP) and developed and implemented its water quality monitoring

program. Since then it has continued to successfully implement a wide variety of environmental programs.

To protect the water quality in the Colorado River and its tributaries, the tribe has focused much effort on monitoring and NPS control projects over the years. Many of the tribe's 319-funded NPS projects are targeted at numerous springs, streams, seeps, and wetland areas that once served as water sources for livestock and wildlife. The animals in these areas contributed sediment, nutrients, and bacteria to surface waters. The tribe restored or protected these impacted waterbodies by installing several management measures, such as: (1) feral animal removal; (2) construction of reservation boundary fencing to prevent feral animals from returning; (3) removal of invasive sagebrush; and (4) restoration of native grasses to reduce erosion.

A 2005 water quality assessment report indicated significant environmental improvement. Monitoring data show an increase in wetland vegetation, and a decrease in levels of fecal coliform, conductivity, total dissolved solids, turbidity, and soil erosion. Many previously impaired segments of waters are once again supporting certain kinds of recreation, wildlife, livestock, and municipal and domestic uses.

Hoopa Valley Tribe

The 89,572-acre Hoopa Valley Indian Reservation is the largest in California. It is located in Northern California, about 50 miles inland from the Pacific Ocean, and 300 miles north of San Francisco. The Trinity River, Klamath River, and many tributary streams flow through the reservation, providing habitat for migratory salmon and steelhead trout. Since 1990, the Hoopa Valley Tribe has monitored water quality on the reservation, based on its EPA-approved QAPP. Because logging is the main economic industry on the reservation, the tribe closely monitors logging-related erosion and sediment runoff that could negatively impact aquatic habitat. Other water quality accomplishments include the completion and approval of a NPS A&MP, which made the tribe eligible for CWA Section 319 NPS funding.

Members of the Hoopa Valley Tribe measure water flow as part of their tribal water monitoring program.

The tribe uses Section 319 NPS funding to address a wide variety of nonpoint source pollutants and water quality issues on the reservation. A recent NPS-funded project—the Abandoned Automobile Clean-up Project—included removing more than 180 abandoned autos from close proximity to streams, wells, and other water sources on the reservation. These vehicles had been visibly leaking brake fluid, antifreeze, and hydrocarbons into the streams. Thanks to the clean-up project, most abandoned vehicles are gone and auto fluids are no longer seen in the water.

Pyramid Lake Paiute Tribe

The 474,000-acre Pyramid Lake Paiute Indian Reservation is located in western Nevada, about 30 miles northeast of Reno. The Truckee River, which originates in Lake Tahoe, flows through the reservation for 31 miles and terminates in Pyramid Lake, a 114,000-acre slightly saline terminal desert lake that is located entirely within the reservation. The tribe's economy is largely supported by fishing and recreational activities in and around Pyramid Lake.

The Pyramid Lake Paiute Tribe received its first CWA Section 106 grant in 1989. Since then, the tribe has continuously monitored the surface water quality for physical, chemical, and biological parameters. In 1994, the tribe completed a NPS A&MP and became eligible for funding under the CWA Section 319 program. The tribe has been awarded multiple competitive Section 319 NPS grants to address problems identified through its water quality monitoring program. For example, the water quality program had identified uncontrolled cattle grazing to be the primary cause of high turbidity levels, elevated nutrient loads, loss of native vegetation, and destabilized streambanks. With Section 319 NPS funding, the tribe implemented management measures such as fencing and establishment of alternate water sources.

Indian Tribes Achieve Environmental Improvement (continued)

During 1999 to 2004, water quality monitoring and sampling on the Lower Truckee River has shown that riparian habitat has improved as a direct result of the implementation of Section 319 NPS projects. Nitrate and nitrite levels have declined from 0.17 mg/l in May 2000 to about 0.01 mg/l in July 2004. Monitoring results show a reduction in velocity and sedimentation and increased bank stability in the Truckee River.

The Future Looks Bright

Tribal member monitors the Truckee River.

As seen in the above examples, CWA Section 106 funds have jump-started many tribes' environmental improvement and NPS reduction programs over the years. EPA continuously encourages more tribes to adopt or expand their programs through frequent outreach and NPS-related workshops and trainings. At these events, tribes share their success stories and the lessons learned along the way, explains Eastman. "Sometimes tribes with little experience in water quality improvements are initially limited in their ability to address NPS pollution. When they come to a workshop and learn about what can be done, they get creative and come up with effective management measures to address their own NPS problems." Thanks to EPA and the other federal agencies that offer training and environmental program development and project support, increasing numbers of tribes are managing comprehensive water quality programs to protect, improve, and enhance natural resources for the benefit of all Tribal members.

[For more information, contact Tiffany Eastman, USEPA Region IX, Tribal NPS Coordinator, 75 Hawthorne Street, Mail Code WTR-10, San Francisco, CA 94105. Phone: 800-735-2922 (relay #415-972-3404); E-mail: eastman.tiffany@epa.gov. You may also contact Jenee Gavette, CWA 106 Program Coordinator at the same address. Phone: (415) 972-3439; E-mail: gavette.jenee@epa.gov]

Notes on Watershed Management

Cumberland River Compact is Building Outside the Box

The Cumberland River Compact launched a small outreach project in 2001 designed to educate builders, developers, local officials, and homebuyers about erosion and best management practices. Today, that same program has grown and blossomed into a comprehensive public-private partnership demonstrating an array of sustainable building and stormwater management practices. Known as "Building Outside the Box" (BOB), the program is gaining national attention for its ability to lead development and land management that benefits people, business, and water quality.

The Cumberland River Compact (Compact) is a nonprofit watershed organization formed in 1997. The Compact serves as an umbrella organization for fourteen sub-watershed organizations throughout Kentucky and Tennessee's 17,720-square mile Cumberland River watershed. The Compact emphasizes the use of education, partnerships, and networking to achieve environmental improvement. Beginning in 2001, the Compact worked with several partners to host three workshops for local officials and the development community. The workshops addressed conservation and development, how and why to implement best management practices, and the potential beneficial economics associated with green building. The relationships and partnerships developed at these workshops led the Compact to establish the BOB program, which emphasizes on-the-ground projects that could actively demonstrate and promote the use of sustainable building and stormwater control practices.

In 2003, the Compact received a three-year, $600,000 U.S. EPA-funded Watershed Initiative Grant to expand their local capacity building and education work. This grant helped to launch the BOB program. The goal of the BOB program was to show developers that they could make money by building in an environmentally friendly way, no matter the targeted income levels of the

Cumberland River Compact is Building Outside the Box (continued)

homebuyers. The program partners initially planned to implement best management practices at one agricultural site and develop three model homes, each adjacent to an impaired stream within the Cumberland River Basin. Since then, one of the planned model home sites has expanded to include 72 residential units. The sites, which vary in location and type, show a range of green building practices.

- **Morgan Park Place** is an urban infill site in the Germantown historic district of downtown Nashville, TN. Developers are building a 72 unit, mixed-use development. All the units will be EarthCraft House certified (see box on the next page for an overview of this certification program), the first multi-family development in the state to accomplish that designation. Some of the key water-friendly features of the site include: (1) state-of-the-art drip irrigation system that will save 50,000 gallons of water in each summer month; (2) use of rain gardens and pervious parking areas to treat stormwater runoff; and (3) high efficiency appliances that will save 1.7 million gallons of water per year. In recognition of this outstanding achievement, the state of Tennessee recently awarded BOB's Morgan Park Place project with the second Tennessee Governor's Environmental Stewardship Award for Excellence in Building Green. The Cumberland River Compact itself won this award in 2006 for the overall BOB project accomplishments at that time. A pictorial narrative of the Morgan Park Place site and its sustainable building features are available at http://swan.southeastwaterforum.org/bob/bobmid.asp.

Morgan Park Place—an urban infill development—incorporates rain gardens and pervious parking areas to treat stormwater runoff from the roof and parking lot.

- **Quiet Creek** is an 84 unit single-family home development being built along an impaired creek southeast of Nashville, TN. This site incorporates one certified EarthCraft House on a lot featuring an innovative bioretention zone and additional grassy swales and infiltration zones to treat stormwater runoff.

All downspouts from this BOB home at the Quiet Creek development lead into underground pipes that end with a pop-up valve into a rain garden.

- **Highlands at Ladd Park** is a 620-acre, suburban upscale single-family home development in Franklin, TN. The developers are committed to low impact development and high performance home construction, and hope to actually improve the water quality in the two streams on site that flow into the Harpeth River. The site features will include: (1) more than 40 percent open space with natural prairie restoration; (2) extensive stream restoration with native riparian zone plantings to correct decades of cattle impacts; (3) almost 10 miles of walking trails; and (4) incorporation of extensive low impact site design features such as bioretention zones, grassy swales, and pervious parking areas.
- **The Campbell Farm** is a 200-acre farm site in Logan County, KY along the banks of Pleasant Grove Creek, a tributary to the Red River. This rural site will incorporate agricultural best management practices and stream restoration. Practices included: (1) streamside fencing to prevent cattle access; (2) repair of erosion gullies from adjacent crop fields; (3) barn roof runoff collection and cistern system for use as cattle watering and crop spraying; and (4) stream bank restoration work.

The BOB program complements these existing projects with an ongoing low impact development and green building educational program for the region's development community. BOB has held four EarthCraft House training workshops so far, with more than 100 builders attending. BOB partners frequently present information about the program at conferences throughout the watershed and beyond.

Cumberland River Compact is Building Outside the Box (continued)

Planning Identified a Need for More Local Education

During the planning process for the BOB demonstration projects, developers noted that their efforts to implement water-friendly practices were often impeded by existing building codes and ordinances. To help, BOB hosted a site redesign collaborative session in the Nashville, TN area—this session brought together local officials, developers, and BOB staff to discuss and identify code- and ordinance-related obstacles to green building. The session was educational and helpful, explained Gwen Griffith, BOB Project Director. "As a group, we identified the better site design features that we could implement under the current system. We also identified those features that would require a code change." The process opened up a dialogue and led the way for future changes.

Want more information?

The Southeast Watershed Assistance Network maintains an interactive Web site for the BOB program at www.watershed-assistance.net. This site provides general information about watershed protection and the BOB program, including pictures and more information about each BOB site. In addition, a comprehensive slide show (10.5 MB Power Point) about the BOB project is available online at www.tnenvironment.org/Presentations/Griffith_017_East_TN_Env_Conf_3-9-06.pdf.

To better address green building impediments on a regional scale, the Compact, in a partnership with the Greater Nashville Regional Council and the Tennessee Department of Environment and Conservation (TDEC), surveyed public officials and their employees in the Middle Tennessee area to assess their water resource educational needs. The results were eye opening. The survey indicated that local elected and appointed officials and their government staff had a strong desire for water education. In response, the Compact created the Local Officials Community Water Curriculum (LOC).

Local Officials Community Water Curriculum

The LOC program focuses on issues faced by municipalities and counties. This program provides high quality educational opportunities to community leaders and is delivered by experts from cooperating organizations such as Tennessee Wildlife Resources Agency, TDEC, U.S. Army Corps of Engineers, Vanderbilt University, Tennessee Valley Authority, and Municipal Technical Advisory Service. Essentially, the Compact created a clearinghouse of established educational courses on various water quality and quantity topics to offer within the Cumberland River Basin. The curriculum is designed to target water resource needs at the local and regional level.

What is an EarthCraft House?

EarthCraft House is an award-winning program offered by leading homebuilders in the Southeast. The program standards were developed through a unique partnership with the housing industry, the environmental community, and government leaders. Southface, a nonprofit institute, provides technical assistance to all participating builders

To qualify for the EarthCraft House program, a builder must be a member of the local homebuilders association, join the EarthCraft House program, and complete a training course. Each new home is required to pass a pre-drywall and a final inspection before becoming an EarthCraft House. The inspections are based on a flexible point system that requires a minimum of 150 points to be certified in these areas:

- Site planning
- Energy efficient techniques and equipment
- Resource efficient design and materials
- Waste management
- Indoor air quality
- Water conservation
- Home buyer education and opportunities
- Builder operations

[For more information, see www.earthcrafthouse.org.]

Launched as a pilot in the greater Nashville region in 2005, the LOC is now spreading throughout the watershed. The program is unique, explains LOC Director Vena Jones, because it can be tailored to meet each community's needs. Jones first visits with interested communities and discusses their personal water resource education needs. Then she works to match their needs with suitable courses. Some communities want large seminar classes to educate the wider general public, while others request more intimate settings with the city council, planning commission, or other community board. Classes can be directed at a number of audiences, including the development community, policy makers, and general audiences. These classes can range from short, general information sessions to fully technical lectures with a diversity of topics such as federal stormwater regulations, low impact design, healthy aquatic wildlife, and habitat.

Overall, the LOC is relatively inexpensive to run—is costs less than $70,000 per year, estimates Jones. This includes a full-time salary, administration and management costs, plus other needs such as materials and reproduction, travel, and supplies. Most of the funds for the LOC have been obtained through grants and agency partnerships, although some participating communities

Cumberland River Compact is Building Outside the Box (continued)

have contributed funds for the LOC services. Eventually, Jones expects the Compact to move toward a fee-for-service structure.

Jones is pleased with the program's success to date, noting that nearly 1,400 local officials, government staff, development professionals, and community leaders have participated in training courses. "The LOC program provides local leaders with tools to make informed water resource, stormwater, and wastewater decisions," explains Jones. As a testament to LOC's effectiveness, Jones reports that many of the communities whose leaders participated in the LOC program have since adopted significant changes—developing new codes and ordinances, creating new models of on-the-ground water-friendly development, and encouraging greater cooperation between elected officials, government staff, and their development community.

BOB Next Steps

Once all of the planned BOB demonstration projects are complete, the Compact plans to conduct an economic analysis. The group is tracking all costs to see exactly where extra costs and savings occur. The Compact hopes to "fight the misperception that it costs more to build green," explains Griffith.

The Compact will use this and other information gleaned from its experiences with BOB to craft a Sustainable Building Resource Kit. This kit will be used to help educate people throughout the region and beyond. The Compact hopes to expand the BOB program to reach a broader audience, such as building professionals, realtors, bankers, subcontractors, community leaders, and the general public.

Eventually, the Compact and its partners hope to develop a Sustainable Building Resource Center that will serve as a regional source of green building information for water friendly, energy efficient homes. The group plans to launch the Center on the Web, but ultimately plans to house the Center in a physical building that would include a library and computers that visitors could use.

The BOB program, with its emphasis on strong public-private partnerships and education, is a recipe for success. "Many watershed groups have contacted us wanting to know how they can replicate the program," explained Griffith. As a result, a number of programs with similar elements are now being planned in watersheds around the country.

[For more information, contact Gwen Griffith, BOB Project Director, Cumberland River Compact, P.O. Box 41721, Nashville, TN 37204-1721. Phone: 615-837-1151; E-mail: info@cumberlandrivercompact.org. You may also contact Vena Jones, Director, Local Officials Water Quality Curriculum, at the above address. Phone: 615-522-7602; E-mail: venaj@cumberlandrivercompact.org; Web: www.cumberlandrivercompact.org.]

EPA Puts the "LID" on its Own Runoff

The U.S. Environmental Protection Agency (EPA) is hoping to inspire others to implement low impact development (LID) techniques into new and existing development projects. To help the public visualize and understand how various LID techniques work, the EPA, in collaboration with the U.S. General Services Administration and other partners, is demonstrating LID and sustainable stormwater management practices in a landscape and drainage renovation project in Washington, DC.

The first site is designed to showcase a wide variety of LID stormwater management techniques within a small area. This is primarily a utilitarian area that includes a loading dock and building services parking, but it is highly visible from a grand staircase used at a primary entrance used by EPA staff and visitors. The project reduces the volume and pollution levels of stormwater runoff through the use of bioretention cells, cisterns, and permeable pavement. It also demonstrates that sustainable design and LID can be used in high profile, urban sites with rigorous aesthetic design requirements.

Additionally, EPA placed four bioretention cells in a highly visible public area along Washington, DC's National Mall. This project has educational potential as both a self-guided and an instructor-led demonstration area. The area demonstrates how disconnection, storage, and evaporation can be used to modify runoff processes and how sustainable plantings combined with high-efficiency irrigation systems can be used on a large scale. The bioretention cells will receive irrigation water as needed from six 1000-gallon cisterns installed in an EPA parking garage. The cisterns will collect stormwater runoff from the building's roof and store it until needed. To see pictures of the LID components, see www.epa.gov/owow/nps/lid/stormwater_hq/pdf/fact_sheet.pdf. For more information, or to arrange for a tour of the site, please contact LIDHQ@epa.gov or see www.epa.gov/owow/nps/lid/stormwater_hq.

Software Spotlight

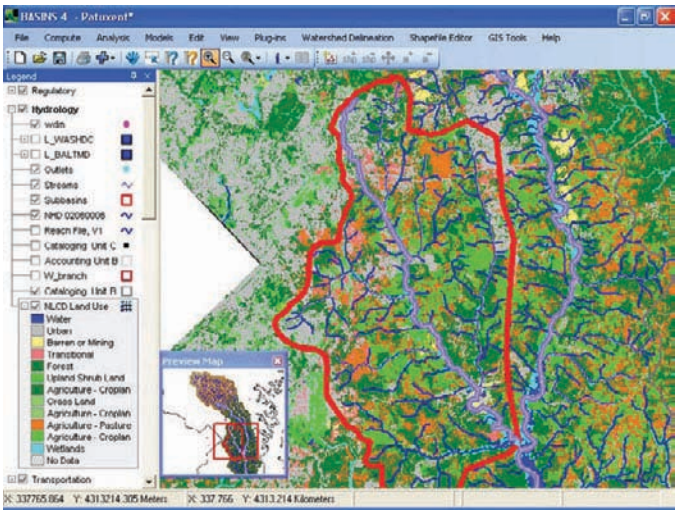
EPA Simplifies Access to BASINS Software

The U.S. Environmental Protection Agency (EPA) has released version 4.0 of the Better Assessment Science Integrating Point and Nonpoint Sources (BASINS) software system. Originally introduced in 1996, BASINS is a multipurpose environmental analysis system designed for regional, state, and local agencies that perform watershed and water quality-based studies. EPA's most recent release of BASINS offers something completely new—this is the first time BASINS can be used with non-proprietary, open source geographical information system (GIS) software architecture.

BASINS, which is installed on a personal computer via a free Web-based download, allows users to quickly evaluate large amounts of point and nonpoint source data in a format that is easy to use and understand. BASINS users can determine water quality trends at selected stream sites or throughout an entire watershed and can run "what if" modeling scenarios. This invaluable tool integrates environmental data, analytical tools, and modeling programs to support cost-effective approaches to watershed management and environmental protection, including the development of Total Maximum Daily Loads (TMDLs). The new product is available for download at www.epa.gov/waterscience/basins.

What is MapWindow?

In 1998, a team at Utah State University launched the development of a GIS programming tool that could be used for research projects—without requiring end users to purchase a complete GIS system or become GIS experts. The end result was MapWindow, a free, extensible (i.e., designed so that users or developers can expand or add to its capabilities) GIS that can be used as an alternative desktop GIS, to distribute data to others, and to develop and distribute custom spatial data analysis tools. This application allows users to freely distribute not only their data sets, but also the tool needed to view the data. The MapWindow Web site (www.mapwindow.com) offers detailed information about the product, as well as tutorials and discussion forums for user support.



The BASINS 4 user interface in MapWindow offers a view window, a legend, and a preview window.

What's New in BASINS 4.0?

Unlike previous releases, BASINS version 4.0 runs on a non-proprietary, open source GIS system architecture, providing a cost-saving alternative to expensive GIS software. "In the past, EPA had heard concerns from cash-strapped organizations about the difficulty of finding funds to buy expensive propriety software to run BASINS," explained EPA's Jim Carleton, the BASINS Team Leader. "This new, free program should alleviate those concerns." Additionally, by using open-source GIS tools and non-proprietary data formats, the core of BASINS becomes independent of any proprietary GIS platform, while still accommodating users of several different GIS software platforms.

For BASINS 4.0, EPA selected the open-source GIS tool MapWindow (www.mapwindow.com). MapWindow is able to perform most of the same operations that users have had access to under previous versions of BASINS using proprietary GIS software.

While not being dependent upon any proprietary GIS platform, the core of BASINS 4.0 is designed to complement and interoperate with existing GIS systems. For example, BASINS 4.0 will interoperate with ArcView and ArcGIS so that users of those packages will be able to transfer files to/from BASINS 4.0. A user may wish to transfer files into ArcView or ArcGIS to perform more advanced GIS operations, but a user will not be required to have either of these programs to run BASINS 4.0. EPA anticipates that the use of open source software will provide BASINS with greater stability and transparency because the source code for all components—including the foundation GIS software—is available to end users.

BASINS 4.0 is the first version to feature the Windows-based Climate Assessment Tool for analyzing potential impacts of changing climate on stream flows and pollutant loads. Like the previous version (version 3.1), BASINS 4.0 includes a Data Download tool, GIS project builder, and GIS edit tools. The program allows for automatic and manual watershed delineation, and can generate watershed characterization reports.

EPA Simplifies Access to BASINS Software (continued)

BASINS 4.0 currently uses only the surface water models HSPF and PLOAD. The previous version, BASINS 3.1, supported an additional model (SWAT) for other kinds of analyses. EPA plans to continue supporting BASINS 3.1 until SWAT can also be pulled into BASINS 4.0. "EPA believed it was better to release BASINS 4.0 with basic modeling capabilities, rather than make people wait longer," added Carleton. EPA will add other models to BASINS 4.0 as funding and software development allow.

Web-based Tool Keeps Data Current

Access to data in BASINS 3.1 and 4.0 is Web-based. The user specifies the geographic area of interest, and the software's Web Data Download tool downloads selected data from EPA, U.S. Geological Survey, and other Web sites. After the GIS data are downloaded, they are automatically extracted, projected to a user-specified map, and combined in a project file. The Data Download tool allows the user to add additional data to a BASINS project from a variety of data sources and to check for more recent data and updates. "The Data Download tool simplifies the process," emphasizes Carleton. "Users do not have to be GIS experts to generate the information they want."

The Data Download tool also has a built-in function for installing updates to any of the BASINS components. This feature automatically checks all components of the BASINS application since the last update. If any program components are out of date, this tool gives the user the option to download and install those updates. Through this feature, BASINS users can be assured that they are running the most up-to-date version of the software. This feature will come in handy as EPA adds additional models and other features to BASINS 4.0.

Learning More

The BASINS Web site offers a wealth of information to help both novice and experienced users (www.epa.gov/waterscience/basins). BASINS users may download comprehensive training materials directly from the Web, and may also register for one of many live training courses offered around the country. The Web site also offers a comprehensive case study that shows how BASINS was used to develop a total maximum daily load in Idaho's Upper Cottonwood Creek watershed. If a BASINS user needs input or suggestions from other BASINS users, he or she may turn to EPA's free BASINS listserver. The listserver allows registered users to e-mail a BASINS-related message or question to all other registered BASINS listserver members, who may then respond with an answer. An archive of all previous postings is always available for perusal by BASINS users and others.

With the release of BASINS 4.0, EPA is facilitating access to and sharing of data among a wider watershed audience. EPA hopes that more organizations, including schools, watershed organizations, and local and state governments, will now be more apt to use and share the powerful water quality information that can be generated by BASINS.

[For more information, contact Jim Carleton, BASINS Team Leader, USEPA, 1200 Pennsylvania Avenue, N.W., Mail Code 4305T, Washington, DC 20460. Phone: 202-566-0445; E-mail: carleton.jim@epa.gov]

Root Zone Water Quality Model Upgraded

Farmers know that smart management of root zones can have economic and ecological benefits. To help growers make well-informed decisions, scientists from the United States Department of Agriculture's Agricultural Research Service (ARS) have released an enhanced version of the ARS' Root Zone Water Quality Model (RZWQM). First released in 1992, RZWQM is a computer model that simulates plant growth and the movement of water, nutrients, and chemicals within and around the root zones of agricultural crops. It helps growers evaluate how management practices influence runoff, groundwater quality, water conservation, and crop yields.

Modelers use RZWQM primarily as a tool for assessing the environmental impact of alternative agricultural management strategies on the subsurface environment. These alternatives may include: conservation plans on field-by-field basis; tillage and residue practices; crop rotations; planting date and density; and the scheduling of irrigation and fertilizer and pesticide application (method of application, amounts and timing). The model predicts how the management practices will affect

Root Zone Water Quality Model Upgraded (continued)

the movement of nitrate and pesticides in the root zone—including whether the compounds will likely run off or percolate below the root zone. The model predicts the potential for pollutant loadings to the groundwater, thus allowing an assessment of nonpoint source pollutant impacts on surface and groundwater quality.

Enhancements

The new version has a Windows XP interface, making it more user friendly than the earlier model, which used Windows 98. The new interface has been modified to allow input on more components. Responding to requests from field scientists, ARS linked the model to existing crop-growth models—CERES, CROPGRO, and SHAW—to improve water and plant-growth simulations. This increased the number of crops to which the simulations could be applied. The team also extended RZWQM's application to about 30 meters beyond the root zone and improved the way it models the flow of shallow groundwater to tile drains.

Other federal agencies are seeing the benefits of RZWQM. EPA regulators have proposed using RZWQM to estimate pesticide concentrations in areas prone to contamination. The model allows users to include in their calculations preferential flow, water tables, depth to groundwater, and agricultural management practices, which earlier methods had not taken into account. The U.S. Geological Survey (USGS) recommends RZWQM for use in its National Water Quality Assessment Projects.

[For more information, see www.ars.usda.gov/Business/docs.htm?docid=6341. To download the software, see http://arsagsoftware.ars.usda.gov/agsoftware/ (registration required). To read more about RZWQM, see the article published in the March 2007 issue of ARS' Agricultural Research magazine—www.ars.usda.gov/is/AR/archive/mar07/zone0307.htm.]

Reviews and Announcements

Better Site Design Handbook Available

The Center for Watershed Protection's Better Site Design Handbook is now available for free download (www.cwp.org/PublicationStore/bsd.htm). This offering completes the Center's comprehensive suite of guidance documents on Better Site Design. The Handbook outlines 22 guidelines for more environment-friendly development: changes to subdivision and land development and zoning regulations that will better manage stormwater, preserve and enhance existing natural areas, and reduce pollution in local streams. It provides detailed rationale for each principle, everything from basic engineering principles to actual vs. perceived barriers to implementing Better Site Design; examines practices in local communities; details the economic and environmental benefits of Better Site Design; and presents case studies from across the country.

Book Highlights the Role of Mushrooms in Environmental Restoration

Mushroom guru Paul Stamets recently released the book *Mycelium Running: How Mushrooms Can Help Save the World*. This book explores how mushrooms can be cultivated to break down toxic materials into harmless compounds and restore damaged ecosystems. The author discusses a number of ways that mushrooms can be applied to ecosystem restoration: mycorestoration (restoring stripped land), mycofiltration (creating filters or buffers), mycoremediation (healing chemically damaged land), and mycoforestry (restoring forests). The book's list price is $35 and is available from online booksellers.

Draft Report on the Environment Released

The U.S. Environmental Protection Agency's (EPA) Science Advisory Board (SAB) recently released the draft 2007 Report on the Environment: Science Report (ROE) for public comment and external review (see www.epa.gov/ncea/sciencereport). The draft report consists of two documents: (1) the ROE Science Report (for the science community); and (2) Highlights of National Trends 2007 (for all citizens). ROE compiles the latest and most reliable indicators to help understand critical trends

in the environment and human health. Additionally, the report identifies key limitations of these indicators and gaps where reliable indicators do not yet exist. These gaps and limitations: (1) highlight the disparity between the current state of knowledge and the goal of full, reliable, and insightful representation of environmental conditions and trends, and (2) provide direction for future research and monitoring efforts.

DVD Copies of After the Storm Program Available

DVD copies of *After the Storm* are now available at no charge. This popular half-hour television special about watersheds was co-produced by The Weather Channel (TWC) and EPA. *After the Storm* premiered on TWC in 2004, and continues to serve as a popular vehicle to educate citizens about stormwater management. The program highlights three case studies – Santa Monica Bay, the Mississippi River Basin/Gulf of Mexico, and New York City—where polluted runoff threatens watershed health. For more information, including tips about what you can do to prevent pollution, or to view (or preview) the entire video directly from the Web, visit www.epa.gov/weatherchannel. To order a free copy of *After the Storm*, contact NSCEP at 800-490-9198 or send an email to nscep@bps-lmit.com and refer to either the DVD version of *After the Storm*, publication # EPA 841-C-06-001, or the VHS version, publication # EPA 840-V-04-001.

Enhanced Water Quality Standards Information Online

EPA has upgraded the Web site that provides Agency guidance for administering state and tribal water quality standards. EPA originally developed the Web site (www.epa.gov/waterscience/standards/handbook) to feature EPA's 1994 Water Quality Standards Handbook, which provides comprehensive guidance for implementing EPA's water quality standards regulations. EPA has recently upgraded and expanded the site; it now provides more than 100 new links to EPA documents and Web pages with supporting information.

EPA Releases Options for the Expression of Daily Loads in TMDLs

In June 2007, EPA issued a 62-page draft technical document for the development of total maximum daily loads (TMDLs) called *Options for the Expression of Daily Loads in TMDLs* (available online at www.epa.gov/owow/tmdl/draft_daily_loads_tech.pdf). This document provides technically sound options for developing "daily load expressions" as a routine process in TMDLs calculated using allocation timeframes greater than daily (e.g., annual, monthly, seasonally). The document is written for TMDL practitioners who are familiar with the relevant technical approaches and regulatory requirements pertaining to TMDLs. This technical document was developed in response to a November 2006 EPA memorandum that indicated that EPA would issue additional technical guidance providing specific information regarding the establishment of daily loads for specific pollutants that will take into consideration the averaging period of the pollutant, the type of water body, and the type of sources the TMDL needs to address. This memorandum, available at www.epa.gov/owow/tmdl/dailyloadsguidance.html, clarified EPA's expectations concerning the appropriate time increment used to express TMDLs in light of a recent decision by the U.S. Court of Appeals for the D.C. Circuit in Friends of the Earth, Inc. v. EPA, et al. In Friends of the Earth, the D.C. Circuit held that two TMDLs for the Anacostia River (one established by EPA and one approved by EPA) did not comply with the Clean Water Act because they were not expressed as "daily" loads.

Fireworks Displays Linked to Perchlorate Contamination in Lakes

A study featured in the June 1, 2007 issue of the American Chemical Society's bi-monthly journal *Environmental Science & Technology*, indicates that fireworks, often held over lakes and other bodies of water to minimize the risk of fire, can deposit significant amounts of perchlorate into the water. Researchers from the EPA conducted the study because of growing concern about the potential harmful effects of environmental perchlorate on human health and wildlife. Sources of perchlorate range from lightning and certain fertilizers to the perchlorate compounds in rocket fuel

and explosives. The researchers definitively established fireworks displays as a source of perchlorate contamination by analyzing water in an Oklahoma lake before and after fireworks displays in 2004, 2005, and 2006. Within 14 hours after the fireworks, perchlorate levels rose 24 to 1,028 times above background levels. Levels peaked about 24 hours after the display, and then decreased to the pre-fireworks background within 20 to 80 days. For the complete article, see "Perchlorate Behavior in a Municipal Lake Following Fireworks Displays," at http://pubs.acs.org/cgi-bin/sample.cgi/esthag/asap/pdf/es0700698.pdf.

The Inside Scoop: How to Conduct a Pet Waste Outreach Campaign Manual Available

The New Hampshire Department of Environmental Services recently released this how-to manual providing a step-by-step guide to designing and implementing a well researched and sound pet waste outreach campaign (www.des.state.nh.us/Coastal/scoopthepoop.htm). It will show you how to work with local partners to motivate dog owners/walkers to pick up after their dogs and dispose of the waste in an environmentally sound and safe way. It gives readers background information to help decide if they want to start a pet waste outreach campaign, shows how to implement and promote a successful campaign, and provides suggested outreach activities, resources, and examples to make the campaigns easier. A successful campaign in Dover, New Hampshire, is also presented to give readers ideas and encouragement.

Invasive Plant Curriculum Now Online

The Bureau of Land Management recently developed "Alien Invasions - Plants on the Move," a weed curriculum for grades K-12. This curriculum is designed for teachers who want to integrate the topic of invasive weeds in the classroom, develop weed awareness, and provide students with an understanding of the wide-ranging potential impacts of invasive weeds. More information is available at www.weedinvasion.org/weeds/weed_home.php.

Peak Wet Weather Management Guide Released

The Water Environment Federation (WEF) recently released a new publication, *Guide to Managing Peak Wet Weather Flows in Municipal Wastewater Collection and Treatment Systems*. The guide is intended for owners, planners, designers, and operators of wastewater collection and treatment systems and provides information for making decisions on how to improve sewerage performance during wet weather. In December 2005, EPA proposed a new policy for addressing peak wet weather discharges at wastewater treatment plants. The WEF guide includes information on effective technology alternatives and practices for managing peak wet weather flows and will support implementation of the proposed EPA policy. This guide outlines an approach for the analysis of collection and treatment of wastewater flows during wet weather conditions, leading to development of sound and effective practices for municipal facility planning, design, and operation for optimum management of wet weather flows. It helps publicly owned treatment works better plan for wet weather flows and describes a process that can be used to build support for real-world solutions that effectively use resources to improve water quality. The document may be downloaded for $25 ($10 for members) at www.wef.org/marketplace.

Report Highlights Streamflow and Nutrient Delivery from the Mississippi River

U.S. Geological Survey (USGS) scientists have published a new analysis of streamflow and nutrient (nitrogen, phosphorus, and silica) delivery from the Mississippi River Basin to the northern Gulf of Mexico. Scientists have linked the delivery of nutrients and streamflow from the Basin to the formation and extent of a hypoxic zone—a zone of water with low dissolved oxygen that forms each summer in the northern Gulf along the Louisiana-Texas coast. The resulting lack of oxygen can cause stress or death in bottom-dwelling organisms that cannot escape to more oxygen-rich areas of the Gulf. The report also provides information on streamflow and nutrient delivery for 30 subbasins. The subbasins vary in size from 16,200 square kilometers to 1,847,000 square kilometers and

have varied nutrient yields based on differing hydrology, land use, and climate. The information is presented for the available period of record for each subbasin, which for some dates back to the early 1960s. See http://toxics.usgs.gov/highlights/of-2007-1080.html for more information.

Sediment Assessment Methodology Tools Available

EPA recently finalized the WARSSS Sediment Assessment Method Web site (www.epa.gov/warsss), designed to help watershed managers assess and restore waters with suspended or bedded sediment problems. The centerpiece of the WARSSS Web site (Watershed Assessment of River Stability and Sediment Supply) is a step-by-step, three-phase assessment methodology developed by Dr. David L. Rosgen for detecting sediment problems and source areas, estimating excessive sediment loads, and planning (including development of TMDLs) to restore normal sediment dynamics in streams and rivers. Besides the WARSSS methodology, the site also contains the entire sediment model WRENSS, a stream classification tutorial, and a large collection of links to clean sediment information and tools. This Web-based assessment tool was designed for scientists who need to assess sediment-impaired waters in planning for their restoration. Dr. Rosgen recently released a book on the same topic, titled *Watershed Assessment of River Stability and Sediment Supply (WARSSS)*, now available from online booksellers and at www.wildlandhydrology.com/html/warsss.htm.

USGS Reports on Aircraft De-Icer Toxicity

The USGS has been examining the relative toxicity to aquatic life from a variety of formulations used to remove or prevent dangerous ice buildup on aircraft. A recent study has confirmed that proprietary additives are responsible for the observed toxicity. The additives are used in de-icers (products that remove snow and ice buildup) and anti-icers (products that prevent ice and snow buildup) to facilitate product application, ensure that the product will adhere to aircraft wings and fuselage, and enhance its overall effectiveness. Additives that are proprietary have compositions known only to the manufacturer. Although research conducted in the mid-1990s revealed the toxicity of proprietary additives, this study compared numerous de-icers and anti-icers and confirmed that most still have toxic additives that have not been publicly identified. Study results also indicated that anti-icers have a larger percent of additives and are therefore more toxic than de-icers. Many airports have implemented measures to reduce runoff of chemicals into the environment, so the fate of these substances varies depending on the individual airport and weather conditions during their use. For more information, see a longer summary at www.usgs.gov/newsroom/article.asp?ID=1603 or refer to the full USGS report *Aquatic Toxicity of Nine Aircraft De-Icer and Anti-Icer Formulations and Relative Toxicity of Additive Package Ingredients Alkylphenol Ethoxylates and 4,5-Methyl-1H-benzotriazoles* at http://pubs.acs.org/cgi-bin/abstract.cgi/esthag/2006/40/i23/abs/es0603608.html.

Voluntary Listing Encouraged for Waters Polluted by Atmospheric Mercury

In March 2007, the EPA released a memo to states, territories, and tribes about a recommended voluntary approach for listing waters impaired by mercury mainly from atmospheric sources. This atmospheric mercury settles onto the ground and is washed into waterways as nonpoint source pollution. The approach uses Clean Water Act tools to encourage comprehensive state and regional mercury control programs. EPA is recommending the voluntary approach for states that have in place a comprehensive mercury reduction program with elements recommended by EPA. These states may separate their waters impaired by mercury primarily from atmospheric sources in a specific subcategory ("5m") of their Clean Water Act section 303(d) lists. States using this approach may also defer development of Total Maximum Daily Loads (TMDLs) for mercury-impaired waters as a result of having implemented mercury reduction programs. Rather than deferring action, the 5m approach recognizes states that are already taking action in advance of TMDLs to address their mercury sources and achieve environmental results earlier. For more information, see www.epa.gov/owow/tmdl/mercury5m.

Web Module Offers Watershed Outreach Training

The EPA's Watershed Academy recently updated its free online training module on "Getting In Step: A Guide to Conducting Watershed Outreach Campaigns." This module offers a tested six-step system to help local governments, watershed organizations, and others maximize the effectiveness of public outreach campaigns to help solve nonpoint source pollution problems and protect local waterways. The module is based on EPA's 100-page guidebook of the same name. Links to all of EPA's "Getting in Step" resources are available in the new Nonpoint Source Toolbox at www.epa.gov/nps/toolbox/guide.htm. Approximately 50 additional free online Watershed Academy training modules are available at www.epa.gov/watertrain.

Recent and Relevant Periodical Articles

Getting Paid to No-till, Getting Paid to Learn

By Kyle Nickel (www.conservationinformation.org/partners/040107/success.asp). This article, printed in the April 2007 issue of *Partners*, the newsletter of the Conservation Technology Information Center, explains the very successful Lower Elkhorn Natural Resources District (LENRD) no-till incentive program. In northeastern Nebraska, the 15-county LENRD has developed a unique way to increase no-till acres and educate more area farmers about the benefits of a no-till system. The LENRD no-till incentive program, which currently has nearly 20,000 acres enrolled, not only encourages no-till adoption, it also keeps producers up to date on the latest issues and technologies associated with no-till systems. While incentive programs are not uncommon, the LENRD program stands apart because of the educational component of the compliance agreement. In order for participants to receive the $10 an acre payment to keep land in continuous no-till on up to 160 acres, they must attend two no-till education classes a year for the five-year length of the program contract.

Herbal Herbicides

By Janet Raloff (www.sciencenews.org/articles/20070317/bob8.asp). This article, printed in the March 17 edition of *Science News Online*, discusses allelopathy—the ability of some plants to release chemicals that kill or weaken other plants. Researchers in this field hope to identify grasses and other plants that naturally inhibit weed growth, thereby reducing the need for herbicide application to fields and lawns.

Mating Disruption of the Oriental Beetle

By Koppenhoeffer et. al, 2007 (www.usga.org/turf/green_section_record/2007/jan_feb/mating.html). This article, featured in the Jan/Feb 2007 issue of the United States Golf Association's magazine *The Green Section Record*, describes research by Rutgers University showing that the use of sex pheromones can interfere with reproduction of oriental beetles in turfgrass. The larval stage of the beetles—white grubs—can damage large areas of turfgrass and are typically treated with insecticides. The use of non-toxic sex pheromones to disrupt insects' normal reproductive patterns is a growing field of interest. In this study, researchers applied a microencapsulated formulation of the oriental beetle sex pheromone on golf course turfgrass. The pheromone confused the beetles, luring them into traps and preventing them from reproducing. The results indicate a reduction in oriental beetle grubs during the three-year study.

Precision Agriculture Systems: Maximizing Benefits with Better Management

By USDA Agricultural Research Scientists (www.ars.usda.gov/is/AR/archive/mar07/agric0307.htm). This article, printed in the March 2007 issue of *Agricultural Research* magazine, explores the combinations of precision-agriculture methods that work best. The authors explains how collection of certain types of data—such as soil electrical conductivity to map soil variability and develop productivity zones—can help farmers economically while also protecting the environment.

Pointing a Finger At The Source Of Fecal Bacteria

By the American Society of Agronomy (www.eurekalert.org/pub_releases/2007-05/asoa-paf052307.php). The American Society of Agronomy issued this news release on May 23, 2007, detailing a recent study that identified sources of fecal bacteria found in contaminated streams. Nebraska researchers used two "source-tracking" methods to determine the origin of fecal pollution in streams: (1) comparing the genetic material with that of known fecal bacteria sources; and (2) looking for a "marker" within the genetic material that is associated with a specific fecal source. The researchers report that they were better able to identify the source of fecal bacteria with greater certainty than if they had tested with a single method only.

Web Sites Worth a Bookmark

American Water Hydro School (www.amwaterhydroschool.org)

This new interactive Web site is designed to make it easy for children to gain knowledge while playing online games, conducting activities in the field, and telling others what they are doing to become stewards of the natural world. The site also includes a section for educators to find water-related activities for both the classroom and outside. The activities are arranged by key topic, curriculum area, and grade range.

Center for Absentee Landowners (www.absenteelandowners.org)

This Web site is the gateway to the new Center for Absentee Landowners, which is funded by a three-year USDA Conservation Innovation Grant. This nationwide Center hopes to provide specialized tools and services and act as an advocate for more than 40 percent of U.S. landowners—those who do not operate the agricultural land they own. The Center works to inform and assist absentee landowners with understanding and implementing conservation programs on their land. The Center is designed to help absentee landowners understand the different programs available, which agencies to contact, and the tools needed to implement conservation.

Earth Portal (www.EarthPortal.org)

The National Council for Science and the Environment recently launched Earth Portal, a comprehensive, free, and dynamic resource for timely, objective, science-based information about the environment. Earth Portal includes (1) Encyclopedia of Earth (www.eoearth.org), which offers an initial 2,300 articles from over 700 experts from 46 countries; (2) Earth News (www.earthportal.org/news), which includes breaking news updates from many sources, with links from key words to encyclopedia articles, enabling readers to learn about the science behind the headlines; (3) Earth Forum (www.earthportal.org/forum), which allows the public to engage in discussions with experts, ask questions and get answers, and to participate in community debates about issues that matter to them; and (4) Environment in Focus (www.earthportal.org/?page_id=70), which provides an exploration of a major issue each week—energy, climate change, environmental economics and other topics—led by a prominent expert in the subject and involving articles, news, places, discussions, Q&A, interesting facts, and more.

Environmental Stewardship (www.epa.gov/stewardship)

This EPA Web site serves as a hub to help businesses, government, and private citizens make intelligent choices on sustainable environmental benefits. Simple everyday decisions by organizations and individuals on such issues as recycling, reuse or choice of fuel support pollution prevention and environmental stewardship. The site provides information links individuals can use to protect the environment in different settings, such as home, work, school and shopping. For example, one link goes to a Web site showing citizens how they can use pesticides safely. The Web site also enables users to find the EPA partnership programs that best align with their needs and interests.

A Farmer's Guide to Agriculture and Water Quality Issues (www.cals.ncsu.edu/wq/wqp)

This Web site is designed to help agricultural producers better appreciate how their actions affect water quality, what environmental requirements apply to them, what actions they can take to meet those requirements, and what incentive programs they can access. Information providers, such as Cooperative Extension Agents and Natural Resources Conservation Service District personnel, will find the site useful for conducting outreach to the agricultural community across the country. The site was developed by North Carolina State University, in partnership with numerous public and private partners.

National Livestock and Poultry Environmental (LPE) Learning Center (http://lpe.unl.edu)

The LPE Center, funded through the USDA Cooperative State Research Education and Extension Service, utilizes a national advisory team of stakeholders to identify critical environmental issues specific to animal agriculture. The LPE Web site provides access to resources such as National Webcast Workshops, a Web-based Learning Center, and Outreach Models (e.g., virtual on-farm tours of emerging technologies), and concise "Research Updates for Non-Researchers." The LPE Center target audience is the advisor, whether they are agriculture organizations, public and private sector advisors, or those involved in public policy.

Private Landowner Network (www.privatelandownernetwork.org)

The Resources First Foundation's Private Landowner Network (PLN) is an online source of tools, information, and conservation resources designed for private landowners and conservation professionals. PLN provides a means for landowners to easily connect with qualified, often local, professionals to navigate the complexities of real estate transactions, tax and estate planning, and regional land conservation activities. The PLN resource database contains local land trusts, nonprofit conservation organizations, and others who can help landowners fulfill their conservation objectives. The site includes information about federal and state funding and technical assistance programs.

South Florida and the Everglades: A Virtual Field Trip (www.nicholas.duke.edu/wetland/ftintro.htm)

The Duke University Wetland Center offers a photo and computer image tour of the Everglades—past, present, and future. The trip begins with a review of the Everglade's natural processes, including the hydrology, geology and biology that shaped the Everglade ecosystem before it was altered. The trip next examines the anthropogenic changes that have occurred in the Everglades ecosystem over the past century. Finally, the trip discusses ongoing and future projects intended to restore the Everglades.

Calendar

September 2007

15-19	*International Symposium on Air Quality and Waste Management for Agriculture*, Broomfield, CO. For more information, see www.asabe.org/meetings/airwaste2007.
19-21	*Mid Atlantic Composting and Compost Use Conference & Expo, Beltsville*, MD. For more information, see www.midatlanticcompost.org.
24-26	*2007 National Ground Water Association/USEPA Fractured Rock Conference: State of the Science and Measuring Success in Remediation*, Portland, ME. For more information, see http://info.ngwa.org/servicecenter/Meetings/Index.cfm#MT1.
30-Oct 5	*International Conference on Irrigation and Drainage: The Role of Irrigation and Drainage in a Sustainable Future*, Sacramento, CA. For more information, see www.icid2007.org.

October 2007

3-6	*Rally 2007: The National Land Conservation Conference–New Frontiers of Conservation*, Denver, CO. For more information, see www.lta.org/training/rally.htm.
13-17	*WEFTEC.07: Water Environment Federation's 80th Annual Technical Exhibition and Conference*, San Diego, CA. For more information, see www.weftec.org.
15-19	*2007 Southern Region Water Quality Conference*, Fayetteville, AR. For more information, see www.arnatural.org/water.
20-24	*11th National Symposium on Individual and Small Community Sewage Systems*, Warwick, RI. For more information, see www.asabe.org/meetings/sewage2007.
22-25	*10th Annual Wetlands and Watersheds Workshop: Science for Environmental Decision-Making*, Ocean City, MD. For more information, see www.wetlandsworkgroup.org/wetreg10/10thWorkshop.htm.
28-Nov 2	*ISMAR 6: International Symposium on Managed Aquifer Recharge*, Phoenix, AZ. For more information, see www.ismar2007.org.
29-Nov 3	*North American Lake Management Society Symposium 2007: Understanding the Science of Lake Management*, Orlando, FL. For more information, see www.nalms.org/Conferences/Orlando.

November 2007

1-2	*Annual Conference on Ecosystems Restoration and Creation*, Plant City, FL. For more information, see www.hccfl.edu/depts/detp/ecoconf.html.
4-8	*Estuarine Research Foundation 2007—Science and Management: Observations, Syntheses and Solutions*, Providence, RI. For more information, see http://erf.org/erf2007.
4-8	*A Century of Integrating Crops, Soils and Environment*, New Orleans, LA. For more information, see www.acsmeetings.org.
7-9	*2007 National Conference on Agriculture and the Environment*, Monterey, CA. For more information, see www.agwaterquality.org/2007conference.
12-15	*43rd Annual American Water Resources Association (AWRA) Conference*, Albuquerque, NM. For more information, see www.awra.org/meetings/New_Mexico2007.
14-17	*2007 North American Association for Environmental Education Annual Conference: Explore New Horizons for Environmental Education*, Virginia Beach, VA. For more information, see www.naaee.org/conference.

December 2007

4-7	*2007 National Ground Water Association (NGWA) Ground Water Expo and Annual Meeting*, Orlando, FL. For more information, see www.ngwa.org/2007expo.
9-11	*Irrigation Association 2007 Technical Conference*, San Diego, CA. For more information, see http://irr.confex.com/irr/2007am.

February 2008

3-7	*USDA-CSREES National Water Conference 2008*, Sparks, NV. For more information, see www.soil.ncsu.edu/swetc/waterconf/2008/home08.htm.
10-13	*2008 Sustainable Water Sources: Conservation and Resources Planning*, Reno, NV. For more information, see www.awwa.org/conferences.

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