



Nonpoint Source News-Notes

November 2008, #85

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

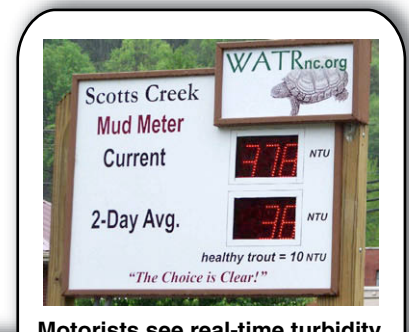


Notes on the National Scene

NEMO Nation Grows: Network Helps Link Land Use and Water Quality

Long before Disney released its version of Nemo, there was NEMO—Nonpoint Education for Municipal Officials. What is NEMO? NEMO is an educational program built on the simple premise that most land use decisions—many of which are so central toward preventing polluted runoff—are made at the local level, often by volunteers who serve on local planning boards and have little or no specific training in land use planning or natural resource protection. NEMO programs focus on educating and empowering these officials to make informed choices that reflect the connection between land use and environmental protection.

Is NEMO in your neighborhood? Probably. With a presence in 31 states and more on the way, NEMO programs are benefitting more and more communities. The various NEMO programs are modeled after the extremely successful Connecticut NEMO program, which was founded in 1991 at the University of Connecticut by the Cooperative Extension System, the University's Natural Resources Management and Engineering Department, and the Connecticut Sea Grant College Program.



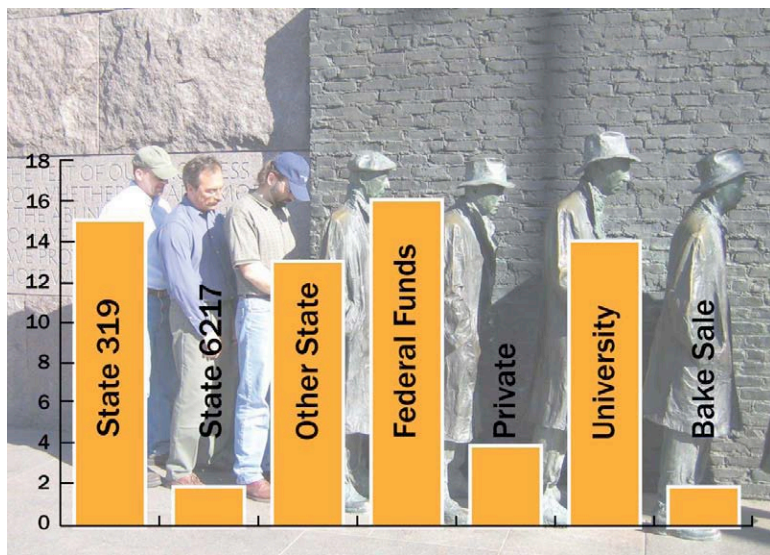
Motorists see real-time turbidity data on this North Carolina billboard. See article on page 13.

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Who leads NEMO programs? The typical NEMO program is university based—27 of the 31 existing NEMO programs are led by either Sea Grant and/or Land Grant/Cooperative Extension. State natural resource/environmental agencies are also involved in leading NEMO programs in six states (four of those are in collaboration with universities).



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Figure 2. Humorous look at sample funding sources available to NEMO programs (photo courtesy of Julie Westerlund, Northland NEMO).

Of the programs that do not involve universities, two are led by nonprofit organizations and one is led by a federal agency. Regardless of who leads, every NEMO program is built upon a diverse array of partners, from state agencies to National Estuarine Research Reserves to planning organizations, and others. These partners often provide guidance, technical support, outreach assistance and more.

NEMO programs rely on both paid and volunteer efforts. On average, NEMO programs are coordinated by 1.5 full-time paid employees. This ranges from no full time staff for some of the newer programs to up to seven staff members. The average number of actual educators within a NEMO program is nearly six, since many NEMO programs rely on partners or trained volunteers to help deliver workshops.

NEMO Programs in Action

NEMO programs rely first and foremost on face-to-face presentations and workshops to reach their target audience. On average, the typical NEMO program gives a workshop or presentation about once every three weeks, and estimates that it works with 13 communities and reaches approximately 450 people per year. NEMO programs supplement their workshops with a wide variety of outreach and education tools, such as fact sheets, interactive Web sites and guidance publications. For links to a variety of NEMO tools, see <http://nemo.uconn.edu/tools.htm>. Additional resources can be found at http://nemonet.uconn.edu/about_network/publications.htm (National NEMO Network resources) or <http://nemo.uconn.edu/tools/publications.htm> (Connecticut NEMO resources).

The typical NEMO program is also offering more technical information to land use officials. About two thirds of NEMO programs offer to review a community's plans, regulations and/or ordinances, make suggestions for incorporating natural resource protection into the plans and provide examples of model regulations. A smaller subset, about one-third, are providing geospatial support to communities in the form of new tools, analysis and modeling (see box for examples of some of the more technical resources released recently by NEMO programs across the country). The Network Hub continues to seek to make this more typical through trainings and other opportunities for Network members.

NEMO Programs Make a Difference

NEMO is successful because the programs and their partners are not content to merely raise local decision makers' levels of understanding of natural resources and water quality issues; rather, they aim to see that the new-found understanding translates into real changes in land use policies and practices. NEMO programs are seeing these changes nationwide. A long list of examples of local actions that have been catalyzed, at least in part, by NEMO educational and technical assistance can be found at http://nemonet.uconn.edu/about_network/impacts.htm. A few highlights include:

- *Northland NEMO* worked with the City of Osceola, Wisconsin, to complete a stormwater study focused on protecting a designated trout stream in the area. As a result of the NEMO study, the city installed a rain garden demonstration project in a new development that had been designed with traditional "curb and gutter" drainage.

- *New Hampshire NEMO* provided educational and technical support to the Town of Nottingham over a one-year period. The town has since collaborated with the neighboring Town of Deerfield and a local land trust to complete a conservation easement on an 89-acre parcel of prime wildlife habitat that the towns share.
- Northport, Maine incorporated watershed planning for nonpoint source pollution management into their comprehensive plan after working with *Maine NEMO*.
- Mississippi's Hancock County worked with *Mississippi NEMO* (coordinated by the Mississippi Department of Environmental Quality) to pass a stream buffer ordinance prohibiting any construction or clearing 25 feet from the top of the bank of any stream. Prior to the ordinance's adoption, new developments cleared the land all the way to the stream.
- California Coastal Commission, which coordinates the *California NEMO*, required a large residential/commercial subdivision in the City of Oxnard to minimize impervious surfaces, direct all rooftop runoff to vegetated areas and install best practices to treat polluted runoff before discharging to the adjacent harbor. Also, a recent golf course project in the City of Malibu implemented a water reuse/recycle system and the use of biofiltration swales onsite to eliminate dry weather runoff from the site and reduce the pollutants in stormwater runoff.

NEMO's success has not gone unrecognized; various NEMO programs have received numerous awards over the years (see http://nemonet.uconn.edu/about_network/awards.htm). For example, in February 2008 the National NEMO Program earned the 2008 Water Resources Team Award from

New NEMO Resources Recently Released

- **Connecticut NEMO's Stormwater Web Sites.** In March 2008 Connecticut NEMO unveiled a low impact development (LID) regulation Web site (nemo.uconn.edu/tools.htm) that allows users to search for and explore the entire text of LID-friendly planning and zoning regulations adopted by their neighboring towns. This site is another of Connecticut's integrated stormwater Web sites, collectively aimed at helping communities "get over the hump" in adopting LID and other innovative stormwater techniques. The LID regulation Web site helps communities ensure that their regulations allow or even encourage the use of LID practices. This builds on the Connecticut LID Inventory Web site (clear.uconn.edu/tools/lid) which is a portal to explore on-the-ground LID projects in other towns (Figure 3). The National NEMO Network is working to expand the Connecticut LID Inventory Web site model in the near future to include LID examples from around the country.
- **New England LID/BMP Database.** New England NEMO programs and the University of New Hampshire's Stormwater Center developed an online database of LID/BMP installations in the New England region (see www.erg.unh.edu/stormwater/index.asp). The site provides details and contact information on pervious pavers, green roofs, rain gardens, vegetated swales and other stormwater treatment practices that have been installed throughout the region. Users of the site can search by practice or by state and can submit sites to be included in the database. It is modeled after Connecticut NEMO's online LID Inventory (clear.uconn.edu/tools/lid).
- **Indiana NEMO's Local Community Decision Maker.** The Indiana NEMO program (a.k.a Planning with POWER) has launched a new online tool called *Local Community Decision Maker* (see www.planningwithpower.org/dm). This massive Web site is filled with maps and research on environmentally sensitive areas, land use change, economic development, potential sources of contamination and more. The tool seeks to provide local planning officials in Indiana with all the resources necessary to adequately balance growth and natural resource protection.
- **Online Community Resource Inventory.** Effective planning for a community's future requires that local officials understand the community's natural, cultural and economic resources. Connecticut NEMO's online CRI tool walks officials through creating a basic inventory of community resources that can help inform land use planning decisions. Data is provided for all of CT's 169 towns. NEMO programs in Rhode Island, Minnesota, South Carolina and North Carolina are now adapting this tool for use in their states (see <http://clear.uconn.edu/projects/cri>).

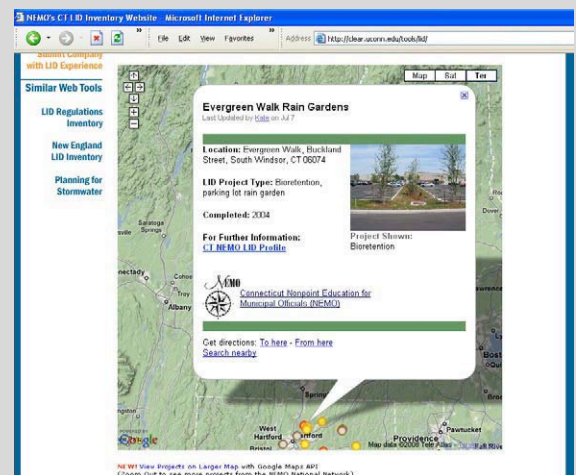


Figure 3. The Connecticut LID inventory site combines information about LID practices in Connecticut with cartographic data from Google Maps to present a single integrated tool. When a user clicks on a dot denoting the location of a practice, a pop up box appears with a picture of the site and a link to find more detailed information.

the U.S. Department of Agriculture for *Outstanding Integrated Program*. The award recognized the NEMO team and the NEMO Network for establishing an “outstanding program that has had a significant impact on the protection of water resources in urbanizing areas across the country.”

The Future Looks Bright

NEMO’s local education messages have come at the right time to the right people. Many of the U.S. Environmental Protection Agency’s (EPA’s) regulatory water quality programs, such as total maximum daily loads and the Stormwater Phase II Program, rely heavily on better local land use plans and regulations to meet goals. Interest in environmentally-friendly growth and sustainable communities continues to grow. Land use topics such as sprawl, open space protection, farmland preservation and stormwater runoff are frequently mentioned in local news media. Despite the relative lack of funding and support typically available for these types of local issues, NEMO is having an impact. Why? NEMO has demonstrated that focused, innovative and research-based education can change the way that communities plan, regulate and build their landscape.

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Natural Resource Agencies Turn to the Web to Share Messages

Government agencies around the country are increasingly turning to digital media to share their messages over the Web. As the public grows more Web-savvy, many agencies are going beyond straight-text Web pages into the realm of podcasts, electronic mailing lists, webcasts, online videos and games to better reach their audiences. A variety of fun and useful resources are now available for organizations and individuals involved in watershed management.

Podcasts

Podcasting is a way of publishing MP3 audio files on the Web so they can be downloaded onto computers or portable listening devices, such as iPods or other MP3 players. Podcasting allows users to subscribe to a feed of new audio files using “podcatching” software (a type of aggregator), which periodically checks for and downloads new audio files automatically. A podcast feed is an RSS feed that contains an audio file. (For more information on RSS feeds, see www.usa.gov/webcontent/technology/rss.shtml.)

Any digital audio player or computer with audio-playing software can play podcasts. Users can also download podcasts to their desktop computer. The benefit of podcasts is that users can listen to them whenever they want and choose to listen to only that news that interests them.

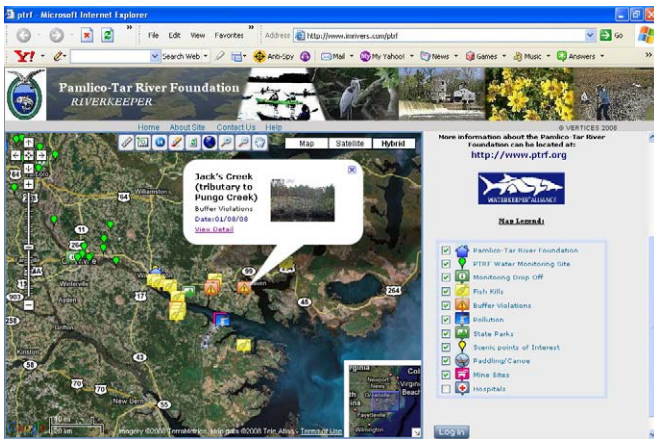
A Web page offering a comprehensive list of U.S. government-sponsored podcasts is available at www.usa.gov/Topics/Reference_Shelf/Libraries/Podcasts.shtml. Specific examples of nonpoint source- or watershed-related podcasts currently available include:

- **EPA’s Greentips Podcasts** (www.epa.gov/earthday/podcasts). Recent podcast topics in this EPA series include enforcing water laws, using pesticides safely, and protecting natural beach environments.
- **EPA’s Office of Wetlands Oceans and Watersheds (OWOW) Podcasts** (www.epa.gov/owow/podcasts). EPA OWOW recently posted its first podcast—*From Gray Funnels to Green Sponges*—in a planned series about smart growth and green development. This site also provides a link to archived audio versions of *Watershed Academy Webcasts*.
- **EPA’s Risk Management Research Audio News** (www.epa.gov/nrmrl/podcast/RMRpodcast.xml). This podcast series recently included episodes about porous pavement, using swales to manage stormwater, and managing urban stormwater effects through grass-roots participation.
- **U.S. Geological Survey (USGS) Podcasts**. USGS offers a number of podcasts, including *Selected Podcasts about Water* (<http://water.usgs.gov/dispatch/2008/podcast>); *CoreCast* (www.usgs.gov/corecast), which recently featured Midwest flooding, pharmaceuticals in

waterways, and nutrient sources and Gulf of Mexico hypoxia; and *CoreFacts* (www.usgs.gov/podcasts/corefacts), which are brief weekly audio podcasts that ask and answer natural science questions about such topics as acid mine drainage and the leading causes of frog declines and deformities.

Mash-ups

Mash-ups are Web sites or Web applications that combine content from more than one Web-based source into an integrated tool. Commonly, maps are used to add visual location information to existing databases that can include text, photos and even video content. The term mash-up originated on the music scene, referring to when people mixed different songs together to make a new song. Typically the Web mash-up site offers a new service using data from other distinct sources that the mash-up site does not own. For example, Connecticut NEMO (Nonpoint Education for Municipal Officials) offers a mash-up Web site that displays the location of low impact development (LID) practices on interactive maps with pop-up boxes that offer more details (for more information, see related box on page 4). NEMO expects to expand its mash-up Web site to address LID practices nationwide.



Eastern North Carolina's Pamlico-Tar River Foundation's (PTRF) site on *IMRivers* is a good example of a mash-up. *IMRivers* allows PTRF to input watershed management-related information such as monitoring sites, and also to include information about locations and dates of water quality violations that have occurred in the watershed. By clicking on an icon, pop-up boxes allow Web users to drill down into the map for more information, including pictures or videos, Web site links, and contact information.

IMRivers (www.imrivers.com) is another good example of a water-related mash-up. The nonprofit organization River Network offers this interactive mapping service that pulls data from Google Maps and federal and state Web-based geographical information system (GIS) services. For a small fee, River Network member organizations can plug into this mash-up service—creating organization-specific interactive maps that display multiple layers of information including data, photos, video and text (Figure 1). Groups can use *IMRivers* to communicate whatever information is important for their watershed, from land use, pollution sources, clean up and restoration activities to water quality, flows, natural history or recreational access.

Electronic Mailing Lists/List Serves

Electronic mailing lists, also known as list serves, are e-mail based notification services or discussion groups where members can ask questions or share information. After joining an electronic mailing list, a member can send an e-mail to a specified address, which will then automatically forward the message to everyone who has joined that electronic mailing list. The members who receive the message can then respond to the sender, respond to the entire list or choose not to respond. Electronic lists allow members to share advice, ask questions or publicize events to a wide audience of experts in their field.

EPA offers multiple electronic mailing lists on a national and regional level. To view and subscribe to lists on a variety of subjects, see https://lists.epa.gov/read/all_forums. Two specific nonpoint source pollution-related electronic mailing lists available are NPSInfo and the NPS News-Notes Distribution (more information is available at www.epa.gov/nps/npsinfo and www.epa.gov/NewsNotes/notifi.htm, respectively). Other watershed-related lists include waternews, waterheadlines, and watershed-news. The public may also subscribe to receive e-mails about press releases from the national and regional EPA offices. More information is available at www.epa.gov/newsroom/email_signups.htm.

Widgets Anyone?

EPA is reaching out to Web users with widgets, which are snippets of programming codes that can be embedded in a blog or Web page to add interest. For example, EPA's new *Find Your Watershed* widget connects any non-EPA Web page directly to EPA's *Surf Your Watershed*. By displaying this

widget, partners can help drive traffic to EPA's *Surf Your Watershed* database, which helps people find their watershed, learn about its health, and connects them with organizations at work in their watershed. EPA's first widget, the *Environmental Tip of the Day*, released last spring, was seen 363,000 times in June after it was posted, which is more than any single page on EPA's Web site other than the home page. EPA's widgets can be accessed at www.epa.gov/widgets.

Other Media Resources—Training, Discussing, Playing

Web-based training and seminars are growing more popular—even more so now that transportation costs have jumped while the training and travel budgets of many organizations have shrunk. EPA's *Watershed Academy Webcast Seminars*, for example, which can be watched live or downloaded at a later time, are ideal for people wanting to learn more about a watershed topic but are unwilling or unable to travel to a live training course (see www.epa.gov/watershedwebcasts).

In addition, agencies have not overlooked the value of online discussions about issues. Some agency Web sites include blogs, which are Web sites where regular entries are made (such as in a journal or diary) and presented in reverse chronological order. Most blogs are primarily textual although many focus on photographs, videos or audio. Two government blogs that have touched on watershed-related issues include U.S. Department of Agriculture National Agricultural Library's (NAL's) *InfoFarm: The NAL Blog* (<http://weblogs.nal.usda.gov/infotfarm>) and EPA's *Greenversations*

(<http://blog.epa.gov/blog>). EPA's *Greenversations* blog recently added "Science Wednesday" (<http://blog.epa.gov/blog/category/sciencewednesday/>) to cultivate public interest in environmental science and engineering. A lengthy list of U.S. government-sponsored blogs is available at www.usa.gov/Topics/Reference_Shelf/News/blog.shtml.

EPA also occasionally offers a real-time online interactive forum where you can discuss a wide range of environmental and human health issues with EPA's senior officials. Known as *Ask EPA* (www.epa.gov/askepa), this resource and many of the others mentioned above are available through EPA's communication portal (www.epa.gov/multimedia). EPA Region 3, which serves the mid-Atlantic region, offers a similar portal to access audio, photo and video media at www.epa.gov/region3/multimedia.

Agencies are increasingly branching out into the arena of online games and quizzes to attract interest and make science learning fun. EPA's *Nonpoint Source Kids Page* (www.epa.gov/nps/kids) and EPA's Office of Groundwater and Drinking Water *Kids' Games and Activities* page (www.epa.gov/safewater/kids/game-sandactivities.html) offers numerous, eye-catching educational games for young and old alike. EPA's *Test Your WaterSense Quiz* (www.epa.gov/watersense/quiz) features a Pac Man©-like game board that requires players to answer water questions and help the hero, Flow, dodge the villainous Water Wasters such as Sogosaurus, who doesn't care that she waters her lawn every day of the week. To view links to additional game sites offered by government agencies, see http://kids.gov/6_8/6_8_fun_activities.shtml.

Options for Web-based learning and discussion grow daily. Most federal agencies now offer prominent links from their home pages to interactive media resources throughout their Web sites and beyond. Keep your eyes open for new opportunities and enjoy the ride!

Other Available Blogs about Water

A number of nongovernment organizations also host blogs about protecting and restoring waters.

You might want to check out:

- American Water Resources Association's Blog (<http://awramedia.org/mainblog>)
- Water Words That Work Blog (www.waterwordsthatwork.com).
- Oregon State University's Institute for Water and Watersheds—Water Wired Blog (<http://aquadoc.typepad.com/waterwired>).

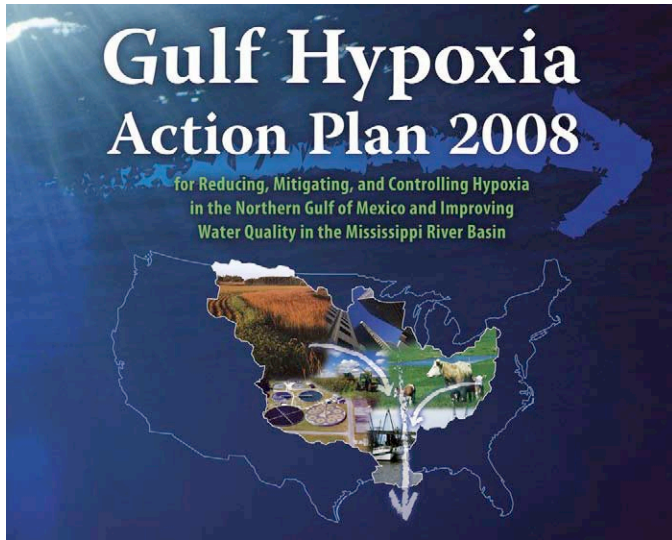
Many of these blogs offer additional links to other water-related blogs available across the country.



EPA's *Test Your WaterSense* game asks water-related questions at each "power" button. Winning answers make your water drop impervious to the monsters for a short time to allow you to complete the maze.

Revised Gulf Hypoxia Plan Emphasizes Adaptive Management Approach

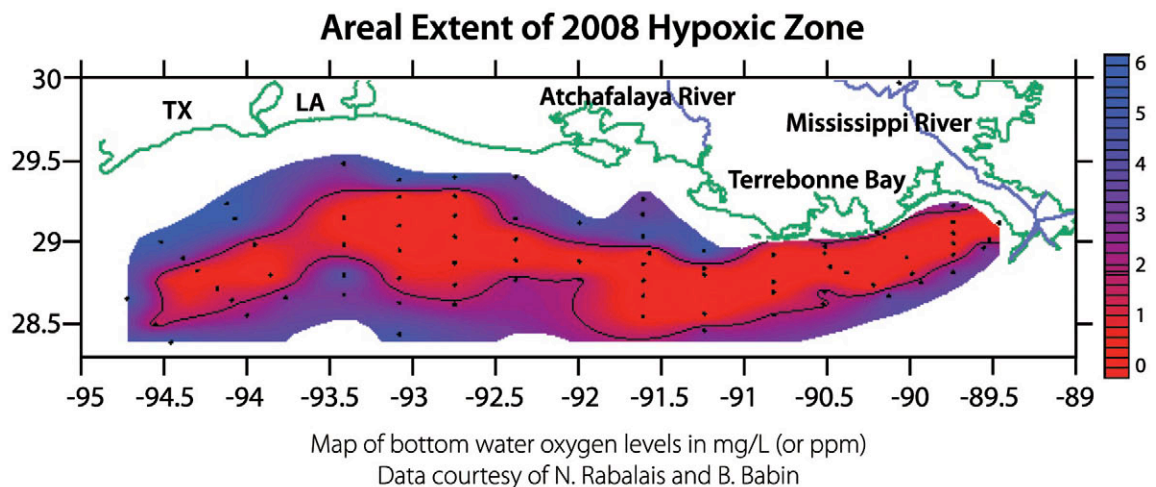
More than 30 years after the passage of the Clean Water Act, a large area of low oxygen or hypoxia, absent of most marine life, continues to form in the Gulf of Mexico during the summer off the coasts of Louisiana and Texas. The hypoxia is primarily caused by excess nutrients that originate in Middle American cities, farms, and industries. These nutrients are carried by stormwater and wastewater discharges into rivers and ultimately into the Gulf of Mexico. Once there, these nutrients support extensive growths of algae that deplete the oxygen in the water when they die, sink to the bottom, and decompose. The condition is exacerbated by the stratification of the water column—the result of warmer, low salinity surface waters that isolate the organic-rich, high salinity bottom waters from the surface, and prevent oxygen exchange with the atmosphere—which occurs where the Mississippi River meets the Gulf of Mexico.



The cover of the 2008 Action Plan shows an outline of the Mississippi River watershed, which drains 41 percent of the contiguous United States and includes waters from several major river systems, including the upper and lower Mississippi River, the Missouri/Platte River Basin, the Ohio/Tennessee River Basin, and the Arkansas/Red/White River Basin.

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Coordinated efforts to address the hypoxia problem have been going strong for a decade, thanks to the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force (Task Force) and its partners throughout the Mississippi/Atchafalaya River Basin (MARB). The Task Force recently released its 2008 Action Plan—which outlines an updated national strategy to reduce the size of the hypoxic zone (also known as the dead zone). Unfortunately, much work needs to be done. Scientists from the Louisiana Universities Marine Consortium found the size of the 2008 Gulf of Mexico dead zone to be 20,720 square kilometers (about 8,000 square miles) (see figure below). The 2008 dead zone is the second largest on record since measurements began in 1985 and is larger than the land area of the state of Massachusetts. The size of the hypoxic zone varies considerably each year, depending on natural and man-made factors.



Addressing the Dead Zone

Formal efforts to address hypoxia in the Gulf of Mexico began in the fall of 1997 when a federal interagency working group convened to investigate the causes and consequences of Gulf hypoxia. The working group then expanded to include states and tribes affected by Gulf hypoxia and established the Task Force. (For more information about the Task Force, see www.epa.gov/msbasin/taskforce.htm.) In 2001 the Task Force released an Action Plan which described a national strategy to reduce, mitigate and control hypoxia in the northern Gulf of Mexico and improve water quality

in the MARB. The 2001 Action Plan established a goal of reducing the 5-year running average size of the hypoxic zone to less than 5,000 square kilometers (about 1,900 square miles) by 2015. Task Force members also agreed to develop strategies to reduce nutrients entering the Gulf of Mexico, particularly the amount of nitrogen, by 30 percent.

In the 2001 Action Plan, the Task Force pledged to implement 11 management actions and to assess progress every five years. This reassessment would address the nutrient load reductions achieved, the responses of the hypoxic zone and associated water quality and habitat conditions, and economic and social effects. The Task Force began its required reassessment in 2005, which culminated in the release of an updated Action Plan in June 2008.

2008 Action Plan

The 2008 Action Plan updates and expands the Task Force's existing national strategy. The updated Action Plan includes emerging science and reflects the Task Force's efforts to better track progress, update the science and adapt actions based on current data and conditions. The updated plan lays out specific actions that need to be undertaken to reach the goals. Throughout the process of the reassessment, the Task Force has reaffirmed six overarching principles that will guide the process:

- Encourage actions that are voluntary, incentive-based, practical and cost-effective;
- Utilize existing programs, including existing state and federal regulatory mechanisms;
- Follow adaptive management;
- Identify additional funding needs and sources during the annual agency budget processes;
- Identify opportunities for, and potential barriers to, innovative and market-based solutions; and
- Provide measurable outcomes as outlined below in the three goals and eleven actions.

The Task Force has revised and reaffirmed three Action Plan goals that conform to these principles and will provide the overall measure of the results of the plan: (1) a *Coastal Goal* to reduce the size of the Gulf of Mexico hypoxia zone; (2) a *Within Basin Goal* to restore and protect the waters of the 31 states and tribal lands within the MARB; and (3) a *Quality of Life Goal* to improve the communities and economic conditions across the MARB.

Actions to Achieve Results

In the 2008 Action Plan the Task Force identified 11 key actions (listed below) to help meet its goals. These actions encourage and advance the continued implementation of cost-effective, voluntary, incentive-based best management practices and conservation practices at the local and regional level—actions to both reduce the export of nutrients into the water and to reduce those nutrient loads once they enter public waterways. The first three actions are intended to accelerate the reduction of nitrogen and phosphorus, while the next eight actions are meant to advance the science, track progress and raise awareness of the problem.

- *Action 1.* Complete and implement comprehensive nitrogen and phosphorus reduction strategies for states within the MARB encompassing watersheds with significant contributions of nitrogen and phosphorus to the surface waters of the MARB, and ultimately to the Gulf of Mexico.
- *Action 2.* Complete and implement comprehensive nitrogen and phosphorus reduction strategies for appropriate basin-wide programs and projects. Target first those programs and projects with significant federal lead or co-implementation responsibilities.
- *Action 3.* While developing comprehensive state and federal nitrogen and phosphorus reduction strategies and continuing current reduction efforts, examine and, where possible, implement opportunities to enhance protection of the Gulf and local water quality through existing federal and state water quality, water management and conservation programs.
- *Action 4.* Develop and promote more efficient and cost-effective conservation practices and management practices for conserving nutrients within the MARB watershed and evaluate

their effectiveness at all scales beginning with local watersheds and aggregating them up to the scale of the MARB.

- *Action 5.* Identify and, where possible, quantify the effects of the hypoxic zone on the economic, human and natural resources in the MARB Basin and Northern Gulf of Mexico, including the benefits of actions to reduce nitrogen and phosphorus and the costs of alternative management strategies.
- *Action 6.* Coordinate, consolidate and improve access to data collected by state and federal agencies on Gulf Hypoxia and MARB program activities and results.
- *Action 7.* Track interim progress on the actions to reduce nitrogen and phosphorus by producing an annual report on federal and state program nutrient reduction activities and results.
- *Action 8.* Continue to reduce existing scientific uncertainties identified in the Science Advisory Board and workgroup reports regarding source, fate, and transport of nitrogen and phosphorus in the surface waters of the MARB to continually improve the accuracy of management tools and efficacy of management strategies for nutrient reduction.
- *Action 9.* Continue to reduce uncertainty about the relationship between nitrogen and phosphorus loads and the formation, extent, duration and severity of the hypoxic zone, to best monitor progress toward, and inform adaptive management of, the Coastal Goal.
- *Action 10.* Promote effective communications to increase awareness of hypoxia and support the activities of the Task Force.
- *Action 11.* In five years (2013) reassess nitrogen and phosphorus load reductions, the response of the hypoxic zone, changes in water quality throughout the MARB, and the economic and social effects, including changes in land use and management, of the reductions in terms of the goals of this Action Plan. Evaluate how current policies and programs affect the management decisions made by industrial and agricultural producers, evaluate lessons learned, and determine appropriate actions to continue to implement or, if necessary, revise this strategy.

Each action listed above is described in greater detail in the 2008 Action Plan (www.epa.gov/msbasin/actionplan.htm). For example, following each action are the reasons for the action, the key players and the process for implementing the action. Because many of these actions are beyond the scope of existing state and federal water quality and conservation efforts, they will achieve only limited progress without additional financial (and in some cases legislative) support. Therefore, the plan also includes a description of the “critical needs”—additional funding and analyses that are essential to achieve significant reductions in the size of the hypoxic zone. The Task Force is committed to meeting these critical needs, wherever possible, and is publishing a separate, more detailed Annual Operating Plan to guide the implementation of these actions.

What is the Outlook for Success?

The work of the Task Force will continue to provide a basin-wide context for the pursuit of both voluntary, incentive-based efforts for nonpoint sources and existing regulatory controls for point sources. Improved coordination and, in most cases, continued expansion of private and government supported efforts to reduce losses of nutrients are central to the success of the Action Plan’s strategy. Stakeholders throughout the MARB are constantly working to improve the efficiency of farming practices, reduce point and nonpoint sources of pollution, and restore wetlands and riparian buffers.

These efforts combine to make progress toward the 2008 Action Plan’s goal of reducing the five-year running average size of the hypoxic zone to less than 5,000 square kilometers (about 1,900 square miles) by 2015. The current five-year average (2004–2008)

University Study Shows Spread of Global Dead Zones

A global study led by Professor Robert Diaz from the College of William and Mary’s Virginia Institute of Marine Science shows that the number of zones of hypoxia (“dead zones”) has increased by a third between 1995 and 2007. Diaz and collaborator Rutger Rosenberg of the University of Gothenburg in Sweden say that dead zones are now “the key stressor on marine ecosystems” and “rank with over-fishing, habitat loss, and harmful algal blooms as global environmental problems.” The study, which appears in the August 15 issue of the journal *Science*, tallies 405 dead zones in coastal waters worldwide, affecting an area of 95,000 square miles, about the size of New Zealand. For more information, see www.vims.edu/deadzone.

is 17,076 square kilometers (6,600 square miles)—more than twice the size of the goal. The Task Force recognizes that it is facing an uphill battle. Even though current activities of landowners and managers will help reduce the size of the hypoxic zone and improve water quality, the Task Force admits that these activities might not be sufficient to fully meet the 2015 goal. More funding is needed to support necessary projects. In addition, emerging issues might significantly affect the Action Plan's design and implementation—issues such as climate change, new technologies for monitoring and modeling, changes in agricultural practices, and increases in biofuels production and associated increases in applied fertilizer. In the end, the adaptive nature of the 2008 Action Plan will be its greatest strength.

For more information, including links to other sites about hypoxia, see www.epa.gov/msbasin.

[For more information, contact USEPA, Office of Wetlands, Oceans, and Watersheds, 1200 Pennsylvania Avenue, N.W., Mail Code 4501T, Washington, DC 20460; E-mail: ow-hypoxia@epa.gov]

Notes from the States, Tribes, and Localities

Uncovering a Creek in Indiana

A daylighting project near Lake Michigan is helping to raise public awareness and combat nonpoint source pollution. In 2005 the Indiana Department of Natural Resources liberated 1,100 feet of Dunes Creek from a pipe and restored the creek's natural channel and riparian zone. The daylighted portion of the creek is now home to a very diverse assemblage of fish and wildlife, and serves as a popular education site for park visitors, school groups and others.

Background

Dunes Creek flows into Lake Michigan at Indiana Dunes State Park located in Chesterton, Indiana. During construction of the park in the 1920s, the Civilian Conservation Corps diverted roughly

1,300 feet of Dunes Creek into an 84-inch concrete and steel pipe just upstream from the beach and paved the area to use as an encampment. This area was subsequently used for overflow parking from the main parking area, located nearby. Eighty years later, this overflow parking lot was in disrepair and rarely used. Also, as beach water quality monitoring frequency increased, data showed that Dunes Creek had high levels of *Escherichia coli* (*E. coli*) bacteria from upstream sources. These levels had increased even further after flowing through the piped section of the creek because the warm dark

What is Daylighting?

Daylighting refers to the process of deliberately exposing some or all of a waterbody after it has been confined to a culvert or pipe. The goal of these projects is to allow streams to return to a more natural state so they can filter pollutants, slow floodwaters and provide habitat for fish and wildlife. For more information, see the Rocky Mountain Institute's document *Daylighting: New Life for Buried Streams*, at www.rmi.org/images/other/Water/W00-32_Daylighting.pdf.



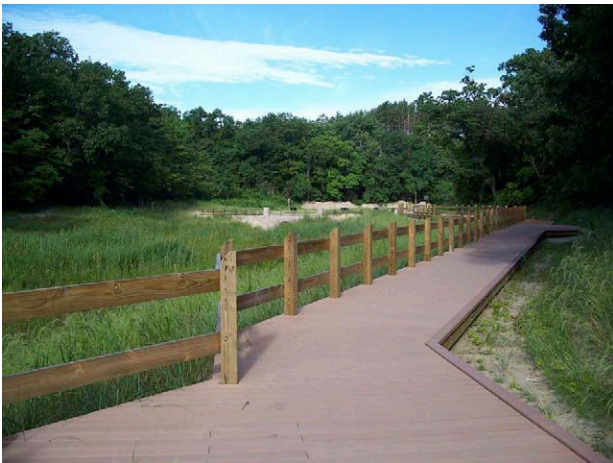
Dunes Creek, once confined to a pipe under a parking lot (left), now flows freely through its restored stream channel (right).

environment “seems to have acted as an incubator,” according to Joe Exl, DNR’s Coastal Nonpoint Coordinator. These high bacteria levels sometimes required the park to close swimming beaches adjacent to the Dunes Creek outlet to Lake Michigan. As part of a larger plan to reduce *E. coli* levels in Dunes Creek and improve important coastal habitat, the Indiana Department of Natural Resources (DNR) decided to remove the parking lot and restore the stream. Ultraviolet light, such as from sunlight, can destroy bacteria.

Using grant money from state and federal sources, the Indiana DNR Lake Michigan Coastal Program launched the restoration project in 2005. Contractors removed almost three acres of concrete from the old parking lot, temporarily rerouted the stream, removed the pipe, constructed a new stream channel and floodplain, and revegetated the area with native plants and seeds. The project cost \$627,900, of which \$425,000 was provided by the National Oceanic and Atmospheric Administration and the DNR Lake Michigan Coastal Program. “As far as we know,” says Mike Molnar, program manager for the DNR Lake Michigan Coastal Program, “this is the first time a creek has been daylighted in a freshwater sand dune environment.”

Results

The project quickly yielded benefits, noted Exl. “Within days of project completion, I saw fish migrating into the daylighted area from upstream.” By the summer of 2008, post-construction monitoring showed a greater diversity of fish and macroinvertebrates in the daylighted portion of Dunes Creek as compared to a natural, wooded section upstream. The stream is now home to small reproducing populations of steelhead and coho salmon, which require good stream habitat and water chemistry. Because of park facility design, Dunes Creek remains confined to a pipe for the last 200 feet before it discharges to Lake Michigan. Normally, a pipe of this length presents an insurmountable obstacle to salmon trying to get upstream. “In this case, these guys have had no problem making their way up to the daylighted portion,” explains Exl.



A new boardwalk provides park visitors with an up-close view of the restored stream channel.

The project’s impact on *E. coli* levels is a little less clear. Preliminary data showed mixed results—although *E. coli* levels sometimes decreased after flowing through the sunlit daylighted portion of the creek, they increased again as the creek flowed through the 200 feet of pipe just before discharging to Lake Michigan. “The creek has a number of upstream bacteria sources that need to be addressed—particularly failing septic systems,” notes Exl. A survey of the watershed estimated that nearly 40 percent of the upstream septic systems are not operating properly. The local health department and a local nonprofit organization (Save the Dunes) have been working to educate these upstream homeowners about necessary septic system maintenance and repair.

Additional help is on the way. The DNR Lake Michigan Coastal Program is partnering with Indiana’s state department of health and three coastal county health departments to develop a septic system tracking program by modifying EPA’s TWIST—The Wastewater Information System Tool—model (http://cfpub.epa.gov/owm/septic/septic.cfm?page_id=220). This program will identify the types of systems in the coastal watersheds and their locations. The partners will then be able to develop a maintenance program tailored to each watershed. Exl sees Dunes Creek benefiting from the tracking program. “The soil underlying the watershed is not very suitable for septic tanks—it varies between sand and clay. Long-term maintenance of existing systems is very important.” So, although very successful, the Dunes Creek daylighting project is just one of a number of projects needed to comprehensively address the *E. coli* problem in the Dunes Creek watershed.

The Future Look Bright

Fortunately, the Dunes Creek daylighting project is serving to raise awareness of water quality issues in the watershed. “The project site has been a great asset for a variety of public outreach programs,”

explains Exl. "Quite often I use the site for volunteer water quality monitoring workshops and school groups." Exl recently partnered with Save the Dunes to hold a workshop about natural channel design using Dunes Creek as an example.

Day-to-day visitors also benefit from the project. The state park recently completed construction of a new boardwalk connecting the campground with the beach—this allows visitors to stroll past the daylighting project site. Project partners installed educational signs along the way that describe the project and its water quality benefits, including how the restored channel serves as an excellent filter for nonpoint source pollutants such as sediment and nutrients.

The success of this unique project has been noticed. In 2006, it received the Award of Excellence by the Association of Conservation Engineers and was nominated for the 2007 Governor's Awards for Environmental Excellence in Indiana. This exposure has helped to raise the visibility of the project and has bolstered the ongoing education efforts at the site.

[For more information, contact Joe Exl, Coastal Nonpoint Coordinator, Indiana Department of Natural Resources Lake Michigan Coastal Program, 1600 North 25 East, Chesterton, IN 46304. Phone: 219-921-0863; E-mail: jexl@dnr.in.gov]

North Carolina Mud Meter Informs Local Citizens

We've all seen those electronic billboards that show us the current time and temperature. Realizing the educational potential of this type of communication, a western North Carolina watershed group recently installed a roadside billboard that shows real-time turbidity levels in a stream passing under the road. Known as the "Mud Meter," the unique project has received media attention and has served as a great way to get nonpoint source conversations started.

Dr. Roger Clapp, Executive Director of the Watershed Association of the Tuckasegee River (WATR), spearheaded the Mud Meter project to bring attention to the sediment entering Scotts Creek, a tributary of the Tuckasegee River. The Tuckasegee River flows northward from the Blue Ridge Plateau near the South Carolina border and drains the reservation of the Eastern Band of Cherokee Indians, a large portion of Smoky Mountains National Park and private lands. Erosion, sediment and turbidity are the biggest water quality problems in this once heavily forested, mountainous terrain. Sources of excessive erosion are abandoned logging roads, neglected farm fields, destructive all-terrain vehicle use, poor pasture management practices, and construction, notably for a recent wave of second-homes.

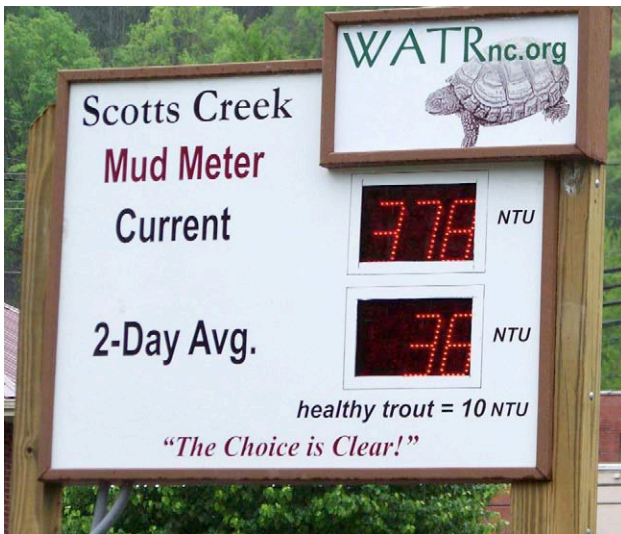
Dr. Clapp saw the Mud Meter project as an entertaining and innovative way to attract interest and educate people about the potential negative impacts of sediment in waterways. "Mud Meter is a fun name for a serious project," explains Clapp. "This is an antidegradation water quality project for WATR. We believe that this mountain community deserves clean, cool streams to preserve the region's heritage and to support the prized trout fishing and the tourist economy." The group hopes that community members will learn more about sediment in streams and begin taking steps to better protect their water resources.

Dr. Clapp received his inspiration to create the Mud Meter while at a Friday night high school football game. "There were roughly two thousand people in the stands enjoying the game and I realized that this was my outreach target audience. How was our group going to reach all of these people with our water quality message?" says Clapp. "It occurred to me that a public display, like a football scoreboard, would create a word-of-mouth buzz and chatter in the community about water quality."

The Nuts and Bolts of a Mud Meter

Dr. Clapp partnered with Dr. Brian Howell from nearby Western Carolina University to develop and launch the Mud Meter. Dr. Howell, Director of the university's Electrical Computer Engineering Technology Program, recognized the project as a way to get his senior design students involved in an innovative, hands-on project.

The Mud Meter consists of a probe which reads turbidity from 0 to 400 Nephelometric Turbidity Units (NTUs), a vented pressure transducer for water depth, a specific conductivity sensor and a temperature sensor. Dr. Howell's students designed the data logger, circuits, circuit boards and the weather-proof box. The unit requires 110 volts—provided by a connection to a nearby street light—to drive the two display units and the meter. The meter takes data readings every 15 minutes. Student-written programs enable the sensors to interface with the data center, and transmit the data to the billboard. Stored data can be downloaded with a wireless receiver.



WATR's Mud Meter monitors and broadcasts Scotts Creek's real-time turbidity data on a roadside billboard. The billboard explains that 10 NTU is a benchmark turbidity level to ensure healthy trout. On this day, a rainstorm upstream sent a plume of turbidity that eventually registered 400 NTU on the Mud Meter.

Several sources helped fund the Mud Meter project, including a U.S. Environmental Protection Agency Clean Water Act section 319 grant, WATR member dues, and Jackson Paper (a unique upstream paper plant that operates a zero discharge facility). The City of Sylva provided the location for the meter's placement and the electricity to run the meter. In rough numbers, costs included about \$4,000 for the sensors, \$500 for the display panels and the sign, \$700 for electronic parts for the data logger customized to drive the electronic display and \$500 for a licensed electrician. Dr. Howell, his students and WATR volunteers and staff provided countless hours of labor.

The project partners officially unveiled the Mud Meter in April 2008 at the city's annual *Greening Up of the Mountains* festival. U.S. Representative Heath Shuler and North Carolina Senator Bill Snow assisted at the unveiling and helped to bring an audience of more than 100 people. The three local weekly newspapers all printed enthusiastic stories. The billboard is mounted on the right hand side of Sylva's main bridge over Scotts Creek and is easily visible to passing motorists.

The Future of the Mud Meter

WATR has big plans for the Mud Meter. Data collected by the Mud Meter will be posted on WATR's Web site (<http://watrnc.org>) and it will be submitted to North Carolina's Division of Water Quality. The data will offer a series of daily snapshots showing how the watershed is performing and what conditions accompany sediment fluctuations. Eventually, the group hopes to post the Mud Meter's water data in near real-time on the Web.

Clapp and Howell would like to build a network of turbidity, complementary sensors and rainfall recorders which they collectively call a "watershed observatory." This unique network would depend on a series of solar-powered, low-power transmitters that would relay information strategically through the surrounding mountains. The other option, a satellite uplink, is too costly to be realistic for WATR. Eventually, the group hopes to improve the overall design of the Mud Meter to include a more adaptive monitoring system that can vary the intensity of monitoring as climatic conditions change.

Measuring Success

Dr. Clapp hopes to achieve erosion-related water quality improvements in the next four years. "The immediate objective now is to introduce the word turbidity into everyday conversation...though some people seem content with 'mud.' Scotts Creek is designated a trout-habitat stream so the state limit should be 10 NTU—which is practically clear." During the first week of operation, the turbidity in Scotts Creek exceeded the limit for trout habitat 54 percent of the time. In fact, a heavy rainstorm occurred the day after the Mud Meter was installed, sending a sediment plume downstream that caused the meter to top out at 400 NTU for 4.5 hours. Since then, WATR has monitored two other nearby streams with wide-range turbidity sensors and found values ranging to 1800 NTU. Consequently, WATR plans to install a new wide-range sensor on the Mud Meter soon.

Other challenges have been the ongoing regional drought in western North Carolina which has resulted in record low discharge and uncharacteristically clear streams since spring. The Mud Meter records turbidity spikes with no relation to storm flow, suggesting that workers, vehicles, children and/or fishermen occasionally disturb the water upstream. Additionally, a bout of vandalism has led to down time and required construction of a more secure housing for the Mud Meter's electronics.

Looking to the future, Clapp thinks that he can keep the Mud Meter in its current configuration for two years. After that, the sign will become almost background noise, and passersby will not notice it much. At that point, WATR will have the data necessary to modify the billboard to show the loading rate, or tons of soil moving beneath the bridge per day. "We can keep the sign in that mode for two more years; by that time we should be making some headway on erosion reduction. A cleaner creek should be the news then," said Clapp.

Personal Communication is the Key

"The most successful way to spread the word in the rural mountains of North Carolina is through small, personal living room gatherings, not at a public meeting. Internet, e-mail, newspaper, and radio can reinforce a message, but one-on-one messaging is the way to get results," notes Clapp. "We hope that the buzz around the Mud Meter will help us identify friends within the community that can assist in the development of a watershed plan."

[For more information, contact Dr. Roger Clapp, Executive Director, Watershed Association of the Tuckasee River, P.O. Box 2593, Bryson City, NC 28713. Phone: 828-488-8418; E-mail: info@watrnc.org]

Agricultural Notes

BMP CHALLENGE Program Expands

"What if I lose money?" This is a common concern voiced by corn farmers when they are asked to implement new best management practices. Thanks to a project called the BMP CHALLENGESM, many of these farmers no longer have to worry—they can use a side-by-side approach in their own fields to test how crop yields are affected when they apply new BMPs compared to their usual farming methods. The BMP CHALLENGE provides a net income guarantee which acts as an economic safety net, removing the risk of economic loss as the farmer experiments and becomes familiar with the BMP. Since its inception 12 years ago, this innovative, cost effective, market-based approach has produced satisfied farmers and has reduced nutrients and sediment entering the nation's waterways.

What is it?

BMP CHALLENGE is a collaborative project of the American Farmland Trust (AFT); Agflex, an Iowa corporation; and the IPM (Integrated Pest Management) Institute of North America. AFT's Agricultural Conservation Innovation Center began the BMP risk management project in 1996 by surveying BMPs, cropping systems and analyzing economic risk as a barrier to adoption of BMPs such as nutrient management and IPM. The partners initiated a pilot program in 2000, and then launched the official BMP CHALLENGE program in 2006. Since then, the program has helped 102 corn producers experiment with conservation practices on their farms, without risk to income.

The numbers of participating farmers has grown, but is still limited by a series of factors, explains Maggie Westaby, BMP CHALLENGE Project Assistant.



Corn grown for grain or silage is eligible for the BMP CHALLENGE program.

“The farmers we target for this program are those who have not responded to other approaches.” This limits the program’s overall target audience to those farmers who need this kind of market-based approach to make a transition from their long-held practices. Westaby points to funding as another limiting factor. “There are many more producers who could benefit from this approach than we can accommodate with current funding levels. We have received several new grants this year that will also help the program to continue and expand, particularly in the Chesapeake Bay region.”

The project is supported in part by grants from the U.S. Department of Agriculture’s Natural Resources Conservation Service (NRCS), Bush Foundation, Iowa Department of Economic Development, Pennsylvania Department of Environmental Protection, Pennsylvania Department of Agriculture Conservation Commission, and the Chesapeake Bay Commission. The program is backed by a commercial service agreement provided by Agflex. Although the BMP CHALLENGE is designed to eliminate risk, it does not operate as a typical insurance policy, since there are no fees associated with participating and it pays only for losses related to nutrient insufficiency and reduced tillage.

The successful program is spreading—currently, the program is open to farmers in 15 states including Iowa, Illinois, Indiana, Minnesota, Michigan, Ohio, Pennsylvania, Missouri, Idaho, North Carolina, Nebraska, Florida, Maryland, Delaware and Wisconsin. To participate, farmers must be eligible for EQIP and grow corn for grain or silage. Fields of sweet corn, popcorn or corn planted for wildlife or ethanol are not eligible.

How Does the Program Work?

The BMP CHALLENGE programs work to give farmers an opportunity to test reduced nutrient and tillage rates on their fields, without worrying about income loss. BMP CHALLENGE staff work directly with farmers, through watershed/conservation districts, and with other organizations, to reduce nutrient and sediment outputs to local waterways and educate farmers on BMPs.

“What is Tillage?”

Tillage is manipulation of the soil with tools, methods and implements for getting optimum environmental conditions for seed germination, seeding establishment and growth of plants (crops). Tillage methods designed to minimize erosion are often referred to as conservation tillage. Some well-known conservation tillage methods include no-till, in which the farmer plants a crop directly into the residue of the previous year’s crop; strip till, which preserves all of the crop residue left from the previous year’s harvest except for a narrow strip that is removed in which the seed is planted; and ridge-till, which involves pushing crop residue out of the way, scraping off the top of a permanent ridge of soil, and planting seeds in the newly exposed soil on top.

In 2006 the program split into two distinct options—the Nutrient BMP CHALLENGE and the Reduced Tillage BMP CHALLENGE. The two programs operate in a similar manner, but the Nutrient BMP CHALLENGE focuses on reducing nutrients applied to the fields and saving the farmer money by reducing the amount of fertilizer purchased, while Reduced Tillage BMP CHALLENGE focuses on reducing sediment loss from fields and saving the farmer money by reducing tillage costs.

To join the Nutrient BMP CHALLENGE program, a farmer enrolls one or more fields (before applying commercial fertilizer) by simply contacting the project staff. The farmer applies his or her usual fertilizer rates to a check strip in each field enrolled. On the balance of the enrolled field, the farmer applies university-recommended BMP fertilizer rates nitrogen (N), phosphorus (P), and/or potassium (K) with the help of a crop advisor. At harvest, the farmer and the crop advisor assess yield differences between the check strip and the rest of the field. If the check strip produces a higher yield, the project pays the farmer based on yield loss for the balance of the field (minus fertilizer savings). The farmer’s income is guaranteed (see Tables 1-3). When the yield on the balance of the field exceeds that of the check strip, the farmer keeps most of the extra money; the program partners only ask the farmer to contribute 33 percent of the fertilizer savings (up to a maximum of \$6 per acre) back into the program. This contribution helps the program to remain viable and accessible to other farmers who would like to participate.

The enrollment process for farmers participating in the Reduced Tillage BMP CHALLENGE is similar to that described above. Instead of reducing nutrients, however, the farmer uses no till, strip

till, ridge till or other techniques aiming to preserve at least a 30 percent residue cover after planting. The change in tillage creates a significant learning hurdle as farmers and their advisors adjust tillage and planting equipment, weed management strategies and other key system components. This learning curve is an ideal target for the BMP CHALLENGE, protecting farmers' net income as they learn a new approach that reduces soil erosion and nutrient runoff.

Table 1. Fertilizer cost savings on a Nutrient BMP CHALLENGE field

Results	Check Strip Rate (Typical)	Nutrient BMP Rate
Amount of N applied	180 lbs/acre x \$0.48/lb = \$86.40/acre	140 lbs/acre x \$0.48/lb = \$67.20/acre
Amount of P applied	75 lbs/acre x \$0.30 = \$22.50/acre	35 lbs/acre x \$0.30 = \$10.50/acre
Total fertilizer cost	\$108.90/acre	\$77.70/acre
Total fertilizer cost savings: \$108.90 - \$77.70 = \$31.20/acre using Nutrient BMP Challenge rate		

Table 2. Example results showing a crop yield loss on a field enrolled in the Nutrient BMP CHALLENGE program

Yield with Check Strip Rate	Yield with Nutrient BMP Rate
80 bushels (bu)/acre x \$4.75/bu = \$855.00/acre	165 bu/acre x \$4.75/bu = \$783.75/acre
<ul style="list-style-type: none"> • Net yield loss: \$855.00 - \$783.75 = \$71.25/acre yield loss • Net economic return: \$71.25 loss - \$31.20 fertilizer savings = \$40.05/acre net loss • Results for yield loss example: \$40.05/acre paid to grower by BMP CHALLENGE 	

Table 3. Example results showing a crop yield gain on a field enrolled in the Nutrient BMP CHALLENGE program

Yield with Check Strip Rate	Yield with Nutrient BMP Rate
180 bushels (bu)/acre x \$4.75/bu = \$855.00/acre	190 bu/acre x \$4.75/bu = \$902.50/acre
<ul style="list-style-type: none"> • Net yield gain: \$855.00 - \$902.50 = \$47.50/acre yield gain • Net economic return: \$47.50 gain + \$31.20 fertilizer savings = \$78.70/acre net gain • Results for yield gain example: \$78.70/acre gain - \$6/acre farmer contribution to BMP CHALLENGE = Grower keeps \$72.70/acre net gain 	

Program Results

The Nutrient BMP CHALLENGE program has reduced nitrogen use by an average of 40 pounds (lbs) per acre, for a total of almost 77.8 tons. These reductions also contribute to reduced emissions of nitrous oxide, a greenhouse gas, by nearly 5122 lbs. On average the program has had to compensate more farmers for yield losses than not (see Table 4), but in return the program has considerably benefitted the environment by removing tons of potential pollutants from many of the nation's watersheds.

Table 4. BMP CHALLENGE Summary of Program Results, 2000–2007

2000–2007 Results Management	Nutrient BMP	Reduce Tillage	Enhanced Nutrient Management
Total acres, 2000-2007	3885 acres	1139 acres	3554 acres
BMP yield average and range [bushels (bu)/acre]	Avg: 158.9 Range: 15.4 – 220	Avg: 159.9 Range: 72 – 192	Avg: 121.6 Range: 9 – 217
Check-strip yield average and range (bu/acre)	Avg: 165.4 Range: 16.7 – 230	Avg: 172.2 Range: 110 – 210	Avg: 129.6 Range: 10 – 238
Farmer net returns after fertilizer or tillage savings, average and range per acre	Avg: (\$3.90) Range: (\$53.03) – \$81.25	Avg: (\$18.98) Range: (\$157) – \$130	Avg: (\$19.95) Range: (\$111) – \$105
Total N use reduction (lbs)	155,712		96,237
Estimated sediment reduction (tons)		1709	
Estimated P load reduction (lbs)		2278	
Estimated N ₂ O reduction (lbs)	5122		3166
Estimated CO ₂ reduction (tons)		570	

Beginning in 2005, Pennsylvania corn farmers in watersheds impaired by excessive nitrogen levels experimented with the Enhanced Nutrient Management BMP CHALLENGE program. This project has reduced nitrogen by more than 48.1 tons since 2000. Brian Brandt, farmer and agronomist who oversees AFT's work on nutrient management, is pleased with the program's results. "Over the past two years, corn producers in Pennsylvania used the BMP CHALLENGE to achieve deep reductions in nitrogen applications—at a rate 15 percent below university recommendations—but with consistent and cost effective results on 4000 acres," said Brandt. The Pennsylvania program also reduced nitrous oxide emissions by approximately 3166 lbs. Since 2000, the two programs have collectively reduced N by nearly 126 tons and nitrous oxide emissions by nearly 4.15 tons.

To date, farmers participating in the Reduced Tillage BMP CHALLENGE have been compensated for a nearly \$20 per acre reduction in net returns while reducing sediment by more than 1700 tons and associated soil phosphorus loss by nearly 2300 lbs. Reducing tillage also reduced associated carbon dioxide emissions from equipment by 570 tons. In 2008, the program is working to provide additional support to farmers and advisors new to conservation tillage, including connecting them with experienced farmers, to smooth out the learning curve and reduce program costs.

Future Plans

Encouraged by the program's success in Pennsylvania, AFT advocated implementing a multi-state, field-scale demonstration of the program throughout the Chesapeake Bay watershed—a region also suffering from high inputs of agriculture-related nitrogen into its waterways. AFT will get its chance. In June 2008, the NRCS awarded AFT a competitive \$650,000 Conservation Innovation Grant to undertake the "BMP CHALLENGE for Enhanced Nutrient Management" in Maryland, Pennsylvania and Virginia. By expanding the Nutrient BMP CHALLENGE to 8500 acres in the three Bay states, AFT believes farmers will be able to reduce between 200,000 and 270,000 pounds of nitrogen from the Bay watershed, benefiting the Bay as a whole.

Using these farmers' experience as a platform, AFT will work to generate credits for nutrient trading programs in the Chesapeake Bay watershed. "This type of integrated approach is ideal—a program that works for production agriculture with environmental benefits, that will help states achieve their environmental commitments, and provide a different income stream for producers in the form of nutrient trading credits," says Jim Baird, Mid-Atlantic States Director for AFT.

What is Water Quality Trading?

Water quality trading is an innovative approach to achieve water quality goals more efficiently. Trading is based on the fact that sources in a watershed can face very different costs to control the same pollutant. Trading programs allow facilities facing higher pollution control costs to meet their regulatory obligations by purchasing environmentally equivalent (or superior) pollution reductions from another source—from either point or nonpoint sources—at lower cost, thus achieving the same water quality improvement at lower overall cost. For more information, plus links to trading programs across the nation, see EPA's water quality trading site at www.epa.gov/owow/watershed/trading.htm.

Likewise, BMP CHALLENGE is currently collaborating on a project in Minnesota to explore agriculture's role in water quality trading (see box) and how programs such as BMP CHALLENGE can participate. The state of Minnesota has been designing and developing a water quality trading program that incorporates both point and nonpoint sources of nutrient pollution. Thanks to a grant from the USDA NRCS Conservation Innovation Grant Program, BMP CHALLENGE partners are holding a series of educational workshops to inform wastewater treatment plant operators and agricultural professionals across the state about water quality trading and the involvement of nonpoint source pollution credits. For more information about how the BMP CHALLENGE can be incorporated in to trading programs, see www.bmpchallenge.org/downloads.htm.

BMP CHALLENGE partners are currently exploring additional funding options to allow its successful model for agricultural pollutant reduction to continue to grow. The group hopes to expand the program into new states such as California and broaden the scope to include other crops, such as soybeans and additional types of corn. More details about the program are available at www.bmpchallenge.org.

[For more information, contact Maggie Westaby, BMP CHALLENGE, 4510 Regent St., Madison, WI 53726. Phone: 608-232-1425; E-mail: maggie.westaby@bmpchallenge.org]

Rolling Machines Can Reduce Agricultural Nonpoint Source Pollution

Farmers could soon be on a roll when it comes to preparing their fields for planting. That's thanks to rolling machines—developed by U.S. Department of Agriculture's Agricultural Research Service (ARS) scientists in Auburn, Alabama—that can quickly flatten mature, high-biomass cover crops such as rye. The ARS research shows that the new machines save money, reduce soil erosion and runoff, help control weeds, conserve water in the soil, and decrease—or eliminate—the need for herbicides.

Each roller tested consists of a long cylinder adorned with a series of evenly spaced, blunt, steel crimping bars, each about one-quarter-inch thick. As a standard tractor pulls the roller over the field, pressure from the bars flattens and damages the cover crop without cutting or uprooting it. Within 3 weeks, the rolled cover crop dries out, forming a mat of dead biomass into which farmers can plant cash crops such as cotton.

The rollers' design is based on similar machines that have been used in South America for decades. Since 2001, ARS has been doing research to find the best crimping roller design for southeastern conditions, and benefits from this research are now becoming more widely recognized.

“The rollers have the potential to help some producers save a lot of money,” says Randy Raper, an agricultural engineer at the ARS National Soil Dynamics Laboratory (NSDL) in Auburn. “Insufficient water results in lower yields, particularly here in the southern states, so any practice that stores water in the soil will result in greater crop productivity.” The rolling technology can extend drought resistance by as much as two weeks, help producers manage high-biomass cover crops and facilitate planting in no-till fields, Raper says.

Machines Offer Benefits for No-Till and Organic Farmers

Tall cover crops like rye have many benefits for no-till farming. They prevent erosion, reduce moisture evaporation, limit runoff and increase infiltration and soil water-storage capability. But planting a cash crop in a sea of unruly cereal grains can be daunting for producers who are new to the task. The roller simply reduces cover crops to a flat layer of mulch. A planter, running parallel to the roller's path, can plant seeds directly into the ground without significantly disturbing the biomass mat.

Because using a cover-crop roller can eliminate the herbicide required to kill a cover crop, it's an ideal tool for organic farmers or other managers who want to reduce or eliminate herbicide use, according to Chris Lawrence, an agronomist with the USDA Natural Resources Conservation Service. Lawrence has helped farmers in Virginia experiment with the ARS rollers for herbicide-free, no-till management. Lawrence worked with Raper and NSDL agricultural engineer Ted Kornecki to design rollers with specifications to address the needs of the local community.

Lawrence worked with one farmer who rolled his fields before planting no-till certified-organic soybeans, with promising results. By using the rollers, the farmer was able to eliminate multiple tillage trips and dramatically reduce both tillage costs and erosion risk, compared to his normal clean-till planting practice.

The no-till beans weren't as tall as a heavily tilled control group, Lawrence says, and had lower yields as a result. But the reduction in labor and fuel costs led to overall savings. “After harvest, we estimated that the rollers had saved the farmer an average of \$50 per acre,” he says.

Roller Designs Vary

Auburn scientists have made several improvements to the original design, making rollers that are more effective and easier to use. Kornecki and his colleagues compared the impact of three different roller designs. The first roller has a traditional design, with long, straight, horizontal bars. The second has diagonal bars that curve around the roller. The third has a smooth drum attached to a crimping bar that mashes the rye down as the machine moves forward.

The scientists used each roller to flatten a rye cover crop and measured what percentage of the crimped plants died within three weeks. The scientists found that all three models killed enough rye—90 percent or more—to enable farmers to begin planting cash crops in the field. The third roller, which used the crimping bar, yielded the best results.

How does it work? The crimper uses a simple drum roller. As the machine rolls over the rye, a crimping bar attached to the drum rapidly pounds the flattened grain, damaging the stalks. The scientists also found that by spraying herbicide on every fourth crimp, they could kill 98 percent of the rye within a week, using 87 percent less of the herbicide Roundup (glyphosate) than would be required to kill non-rolled rye.

Kornecki is also developing new models to address different farming configurations—including one that could be used for crops grown in elevated beds and a lightweight model with two drums. “We’re still fine-tuning the technology,” Raper says. “But these machines could have a major impact on sustainable farming.”



Roller designs may include straight horizontal crimping bars (left photo), curved crimping bars (middle photo), or a smooth drum attached to a single crimping bar (right photo). (Photos by Ted Kornecki)

[This article was excerpted and reprinted from the September 2008 issue of *Agricultural Research* magazine (www.ars.usda.gov/is/AR/archivesep08). For more information, contact Laura McGinnis, Public Affairs Specialist, Room 1-2224-A, 5601 Sunnyside Ave., Beltsville, MD 20705-5129. Phone: 301-504-1654; E-mail: laura.mcginis@ars.usda.gov.]

Reviews and Announcements

Balancing Tires and the Environment

Tire companies, big box stores and the government are putting the brakes on the use of lead wheel weights. Through EPA’s *National Lead-Free Wheel Weight Initiative*, partners have agreed to phase-in the use of lead-free alternative wheel weights and reduce the amount of lead released into the environment by 2011. Eliminating lead wheel weights—one of the largest remaining sources of unregulated lead—is a significant step toward reducing the overall amount of lead released into the environment. EPA estimates that 50 million pounds of lead per year are used for wheel weights in cars and light trucks. Wheel weights often come off when a vehicle hits a pothole in the road or stops suddenly, which allows lead to become part of the nonpoint source pollution stream. Once in the environment, lead is persistent and bioaccumulates in the food chain. For more information, see www.epa.gov/osw/hazard/wastemin/nlffwi.htm.

Clean Water State Revolving Fund—20 Years of Progress

EPA released its 2007 Annual Report on the Clean Water State Revolving Fund (CWSRF) Programs, *Yesterday, Today & Tomorrow: 20 Years of Progress*. The report marks the 20th anniversary of the largest federal funding program for wastewater infrastructure projects. Since its inception, the CWSRF has funded \$63 billion in projects to meet water quality needs ranging from wastewater treatment plant rehabilitation and nonpoint source pollution control to estuary and watershed management. For more information on how the fund has been used in the past and how it may help your future efforts, see www.epa.gov/owmitnet/cwfinance/cwsrf.

Climate Change Strategy Will Help Manage Water Resources

Preparing for the potential effects of climate change, EPA released a new strategy focusing on 40 specific actions for the national water program to take to respond to climate change. EPA's *National Water Program Strategy: Response to Climate Change* describes steps for managers to adapt their clean water, drinking water and ocean protection programs. The strategy reviews potential impacts of climate change on water resources, which include increases in certain water pollution problems, changes in availability of drinking water supplies and collective impacts on coastal areas. For more information, see www.epa.gov/water/climatechange.

Compliance Monitoring Strategy Released

EPA's Office of Enforcement and Compliance Assurance has issued its *Clean Water Act National Pollutant Discharge Elimination System Compliance Monitoring Strategy for the Core Program and Wet Weather Sources*. This new strategy, which takes effect in 2009, outlines inspection and compliance goals for the entire National Pollutant Discharge Elimination System (NPDES) program, including major and minor NPDES facilities, pretreatment programs, biosolids, combined sewer overflows (CSOs), sanitary sewer overflows (SSOs), stormwater and confined animal feeding operations (CAFOs). It places increased emphasis on wet weather issues—particularly stormwater sources—and sets ambitious targets for audits and inspections of Phase I and II municipal separate storm sewer systems (MS4s), construction sites and industrial facilities. For more information, see www.epa.gov/compliance/monitoring/programs/cwa/npdes.html.

Document Explores Economic Measures of Soil Conservation Benefits

The U.S. Department of Agriculture's Economic Research Service (ERS) released a report describing data and methodologies used to apply monetary values to changes in soil erosion. The document—*Economic Measures of Soil Conservation Benefits: Regional Values for Policy Assessment*—clearly describes values and methodology so that analysts can apply the data to specific soil conservation projects. ERS has used the values to estimate soil conservation benefits of changes in farm programs and practices. The benefit values are regional dollar-per-ton measures of 14 different categories of soil conservation benefits. The data are intended to be detailed enough for national and regional estimates, but lack the precision required for smaller scale estimates. For more information, see www.ers.usda.gov/Publications/TB1922.

Educational Resources Available from WaterSense

The WaterSense program recently released a set of free water educational materials for kids and teachers. *A Day in the Life of a Drop* teaches students about the connections between the sources of the water they use and how that use affects human health and the environment. These resources help students understand about watersheds and where their water comes from, and allows them to track their homes' water use. Teachers can easily expand this lesson to include a more comprehensive discussion of nonpoint source pollution, or use this lesson as a part of other subjects including math, science, social studies, geography and language arts. These fun learning materials, which include a teachers' guide, two student worksheets and a spreadsheet, are available at www.epa.gov/watersense/water/drop.htm.

Florida Governor Unveils Strategy to Save America's Everglades

Florida is pursuing a new partnership to revive Florida's Everglades—the "River of Grass." In June 2008, Florida Governor Charlie Crist called on the South Florida Water Management District to begin negotiating an agreement to acquire as much as 187,000 acres of agricultural land owned by the United States Sugar Corporation. The vast tracts of land would then be used to reestablish a part of the historic connection between Lake Okeechobee and the fabled River of Grass through a managed system of storage and treatment and, at the same time, safeguard the St. Lucie and Caloosahatchee rivers and estuaries. Acquiring the enormous expanse of real estate offers water managers

the opportunity and flexibility to store and clean water on a scale never before contemplated. Water managers expect that dedicating significantly more land in the Everglades Agricultural Area to restoration will build upon and enhance the 30-year state/federal Comprehensive Everglades Restoration Plan and the State of Florida's Northern Everglades Program to restore and protect Lake Okeechobee, the St. Lucie and Caloosahatchee rivers and their respective estuaries (for more information, see <https://my.sfwmd.gov>). Also available is the National Research Council's Committee on Independent Scientific Review of Everglades Restoration Progress' new document, "Progress toward Restoring the Everglades: The Second Biennial Review, 2008," which is online at www.nap.edu/catalog.php?record_id=12469.

Girl Scout Water Drop Patch Project Updated

The Girl Scouts of the USA and the Environmental Protection Agency have updated the manual for their popular Water Drop Patch Project. The project manual is designed for adults to use with Girl Scout Brownies through Ambassadors (grades 2-12) and divided into grade-level, age-appropriate watershed activities. Two exciting new activities added to the revised manual include constructing a rain garden to help control stormwater runoff and creating a watershed outreach video. Girl Scouts who complete the requisite number of activities receive a beautiful patch emblazoned with a white egret. The Water Drop Patch Project is nationally recognized as part of the Girl Scouts of the USA's *Linking Girls to the Land* program. For more information, see www.epa.gov/adopt/patch.

Interactive Watershed Mapping Available for Kids

IMRivers (www.IMRivers.com), a new Web site developed for nonprofit River Network, allows network partner groups to develop interactive watershed maps and make them available to the public. Now, *IMRivers* is offering *IMRivers Junior* (www.imriversjr.com), which offers the same mapping application capabilities as *IMRivers*. *IMRiverJR* is available free of charge to any organization working with K-12th grade students to educate them about the importance of ecological conservation. Government organizations, nonprofit organizations and classrooms can access and manage their own *IMRiversJR* account as a novel and innovative teaching tool. The maps can display multiple layers of information including data, photos, videos and text. The information can be about land use, pollution sources, clean up and restoration activities, water quality, flows, natural history, recreational access and other topics.

National List of Beaches Available

EPA recently posted the *2008 National List of Beaches*, which provides a picture of the extent of beach monitoring in U.S. coastal and Great Lake waters. The list provides information to the public about beaches in their state and identifies whether these beaches are monitored for pollutants such as *E. coli* bacteria. For more information, see www.epa.gov/waterscience/beaches. Information about beach closings and advisories for the 2007 swimming season is available at www.epa.gov/waterscience/beaches/seasons/2007. Data for 2008 will be posted when available.

New Energy Act Boosts Low Impact Development Practices

The recently signed Energy Independence and Security Act of 2007 will boost the use of low impact development practices in federal projects. The bill requires that the "sponsor of any development or redevelopment project involving a federal facility with a footprint that exceeds 5,000 square feet shall use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow." See Section 438 entitled "Storm Water Runoff Requirements for Federal Development Projects." EPA staff will work with an interagency committee led by the Federal Environmental Executive to help develop appropriate implementation procedures to comply with the new law. More information will be available as the law is implemented. To view the text of the law, see www.govtrack.us/congress/bill.xpd?bill=h110-6.

New Stormwater Management Tools Released

The Center for Watershed Protection (CWP) recently released *Managing Stormwater in Your Community: A Guide for Building an Effective Post-Construction Program*, a resource that provides practical tips and features a series of tools that can be downloaded and modified by local programs to help implement stormwater management programs. The guide covers topics ranging from program planning, integrating stormwater with land use planning, developing locally-appropriate stormwater criteria, stormwater inspection and maintenance programs, and program evaluation and tracking. The tools include a program self-assessment; a model post-construction stormwater ordinance; plan review, inspection, and maintenance checklists; and more. The guide and tools can be downloaded at www.cwp.org/postconstruction.

The CWP also developed three other new documents that will inform stormwater managers and staff around the country (available at www.cwp.org):

- *Municipal Pollution Prevention/Good Housekeeping Practices (Manual 9)* presents practical, how-to guidance for developing and implementing pollution prevention practices at municipal facilities and operations such as public works yards, parks, road maintenance and repair, and many others.
- *Monitoring to Demonstrate Environmental Results: Guidance to Develop Local Stormwater Monitoring Studies Using Six Example Study Designs* presents the broad concepts and methods behind setting up special monitoring studies in support of the NPDES stormwater permitting program. The monitoring study presents a range of options for municipalities to consider depending on their goals, objectives and budgets.
- *Deriving Reliable Pollutant Removal Rates for Municipal Street Sweeping and Storm Drain Cleanout Programs in the Chesapeake Bay Basin* quantifies how street sweeping and storm drain cleanouts can reduce water pollution. The Center collaborated with a number of agencies to conduct a three-phase research study consisting of a literature review, a survey and a monitoring program. Although the study focused on Chesapeake Bay communities, the report offers valuable information for communities nationwide.

Rain Garden Design Templates Available

The Low Impact Development Center offers a series of rain garden, or bioretention, design templates that can be used by landscape architects, landscape contractors, and garden clubs across the nation. These designs promote the use of rain gardens by providing a set of easily accessible, high quality sustainable and maintainable designs for the landscape industry and citizens. For more information, see www.lowimpactdevelopment.org/raingarden_design.

Resource Highlights National Environmental Trends

EPA recently released the *2008 Report on the Environment: Highlights of National Trends*, which explains trends in our nation's health and environment. The report is intended for a general audience and summarizes highlights of the more comprehensive *EPA's 2008 Report on the Environment*, which was released in May, and provided the scientific and technical information. EPA also launched a new Web site that allows the user to search the full technical report for specific trends in air, water, and land. For more information, see www.epa.gov/roe.

TMDL Document Highlights Mercury from Air Deposition

EPA recently released a document called *TMDLs Where Mercury Loadings are Predominantly from Air Deposition* to help states, EPA regional staff, and other stakeholders identify approaches to develop mercury total maximum daily loads (TMDLs) under Clean Water Act section 303(d). Compiled in a "checklist" format, the document focuses on the elements of mercury TMDLs where mercury loadings are predominantly from air deposition; however, the tools and approaches described here may be useful in other situations where other pollutant loadings are primarily from air deposition.

The checklist identifies the elements of TMDLs and other considerations for developing mercury TMDLs at different geographic scales: waterbody-specific, regional or statewide, and multiple states. This effort is part of EPA's multi-pronged approach to listing mercury-impaired waters and developing mercury TMDLs. Recent efforts include revising strategic plan reporting provisions to more specifically account for mercury-impaired waters in tracking waterbody restoration. EPA also issued a 2007 memo on the "5m" subcategory for listing waters impaired by mercury from air deposition (see www.epa.gov/owow/tmdl/mercury5m). For such waters, states may defer the development of mercury TMDLs where a comprehensive state mercury reduction program has been put in place. The checklist is available at www.epa.gov/owow/tmdl/pdf/document_mercury_tmdl_elements.pdf.

Water Quality Exchange Expands

EPA Office of Water released the Water Quality Exchange (WQX) version 2.0, a data transfer system which now allows states, tribes and other organizations to share their biological and habitat monitoring results. WQX version 2.0 builds on WQX version 1.0, which was released in February 2007 and provided a way for states, tribes and other organizations to share physical, chemical and fish tissue water monitoring data. Because many monitoring programs use biological and habitat data as the basis for assessing water quality, WQX version 2.0 enhances the richness of information available for data sharing, analysis and improved decision making by watershed managers. All data shared using the WQX framework can be accessed online in the STORET Data Warehouse, EPA's repository for water quality data. See www.epa.gov/storet/wqx.html for more information.

Watershed Webcast Resources Grow

EPA's Watershed Academy periodically offers free Webcast seminars. Streaming audio versions of archived seminars are available for viewing at www.epa.gov/watershedwebcasts. Webcasts from January 2008 through October 2008 include the following:

- The Wastewater Information System Tools (TWIST) for Managing Decentralized Systems, January 16, 2008
 - Wastewater Utilities Using Sustainable Watershed Approaches, February 20, 2008
 - Managing Nutrients in Your Backyard and Your Community, March 19, 2008
 - Monitoring Watershed Program Effectiveness, April 10, 2008
 - Wetlands and Climate Change, May 13, 2008
 - ATTAINS – A Gateway to State-Reported Water Quality Information, June 18, 2008
 - Clean Water State Revolving Fund: What's in it for Watersheds, July 16, 2008
 - Green Streets: From Gray Funnels to Green Sponges, July 23, 2008
 - Moving Forward on Gulf Hypoxia, October 7, 2008
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Recent and Relevant Periodical Articles

Can You Own the Rain?

By Daniel Fitzgerald (www.denverpost.com/headlines/ci_9712027)

This article, printed in the June 27, 2008 issue of the *Denver Post*, explores how the complexities of Colorado's water law prevented Mrs. Kris Holstrom from installing a rain barrel to capture the rain water that fell on her roof for the purpose of using it to irrigate her organic plants. The state denied her application for a water right to the rain on her roof, arguing that others had already claimed her rain. The article further explores the implications of Colorado water law and describes how rainwater harvesting could greatly benefit the state's water resources.

Get a Whiff of This: Sewage-sniffing Dog Hunts for E. Coli Sources along Kawkawlin River

By Jeff Kart (http://blog.mlive.com/bctimes/2008/09/get_a_whiff_of_this_sewagesnif.html)

This article, printed in the Bay City Times on September 16, 2008, introduces Sable, a sewage-sniffing dog. Sable is trained to sniff out the scent of human sewage and surfactants used in household detergents to detect illicit and failing septic connections that flow from homes into rivers and streams. Sable spent last summer training and working in the Flint and Lansing, Michigan areas, sniffing out sewage and finding several illicit connections. This article discusses Sable's efforts to find *E. coli* sources along the Kawkawlin River in Michigan's Bay County in fall 2008.

Green Building Alternatives to Rainwater Harvesting in Colorado

By Jane Clary, Chuck Haines and Jonathan Jones (<http://ourwater.org/econnection/connection30/rainwater.html>)

This article, printed in the Summer 2008 issue of the *Colorado NPS Connection*, explains the conflict between Colorado water law and the use of low impact development techniques such as rain barrels and cisterns. These "rainwater harvesting" techniques allow someone to capture the rain and use it onsite—which is prohibited by law in Colorado. The authors then discuss other low impact development tools that can be used to manage rainfall runoff to help protect water quality.

Iowa Flooding Could Be an Act of Man, Experts Say

By Joel Achenbach (www.washingtonpost.com/wp-dyn/content/article/2008/06/18/AR2008061803371.html)

This article, printed in the June 19, 2008 issue of the *Washington Post*, explores some researchers' concerns that the June 2008 Midwest flooding was exacerbated by changes people have made to the landscape. Land use decisions that can cause water to move more quickly off the land into creeks and rivers—thereby increasing the magnitude of floods—include building in the floodplain, installing drain tiles in farm fields, and increasing the amount of land in cultivation, among other things.

Rain Gardens Reign

By Margaret Buranen (www.stormh2o.com/may-2008/rain-gardens-management.aspx)

This article, which appeared in the May 2008 issue of *Stormwater* magazine, describes efforts to encourage homeowners to install rain gardens across the nation. The article opens by introducing Kansas City, Missouri's 10,000 Rain Gardens project, and proceeds to discuss other projects that encourage installing rain barrels and rain gardens, either alone or as part of larger low impact development projects, to help reduce stormwater runoff. Other projects mentioned include ones in Mt. Airy, Ohio; Muncie, Indiana; several towns in Massachusetts; Port Angeles, Washington; Lexington, Kentucky; a watershed in Wisconsin; and Portland, Oregon.

Surface Water Flow Measurements for Water Quality Monitoring Projects

By Don Meals and Steve Dressing (www.ncsu.edu/waterquality/issues/notes128.pdf)

This article, featured in the June 2008 issue of the North Carolina State University Water Quality Group's *NWQEP NOTES*, provides basic guidance on estimating or measuring surface water flow for nonpoint source watershed projects. The discussion focuses on flow measurement in open channels (natural streams and ditches) or field runoff, but does not address flow in pipes or other structures. The article includes an overview of surface flow fundamentals, common purposes for flow measurement, basic measurements that go into determining flow and practical methods for obtaining these measurements.

Web Sites Worth a Bookmark

Climate Ready Estuaries (www.epa.gov/cre)

EPA's new Climate Ready Estuaries (CRE) Web site provides users with information and tools to learn about and adapt to coastal changes (including increases in nonpoint source pollution) resulting from climate change. For example, the online toolkit features resources related to coastal vulnerability, adaptation planning, smart growth, sustainable financing and monitoring.

Long Island Sound Riparian Toolbox (www.hydroqual.com/projects/riparian)

This site allows users to view, read, copy or download documents, such as public education brochures, model regulations, scientific articles regarding riparian buffers, a glossary of terms, GIS data and other resources. Although designed for Long Island Sound, the site offers riparian buffer resource information that is applicable nationwide.

National Environmental Services Center (NESC) (www.nesc.wvu.edu)

This newly redesigned Web site provides access to training resources for managing water, wastewater and other environmental issues. The site is a hub for a variety of NESC programs including the National Drinking Water Clearinghouse, the National Small Flows Clearinghouse, and the National Environmental Training Center for Small Communities. The new NESC site features access to publications, free and low-cost products, databases, and information about different water and wastewater topics.

Volunteers and Invasive Plants—Learning and Lending a Hand (www.fws.gov/invasives/volunteersTrainingModule)

The Center for Invasive Plant Management and the U.S. Fish and Wildlife Service developed this online learning module targeted at volunteers working to reduce invasive plant species in the National Wildlife Refuge System. The Web site provides a wealth of useful information and resources on invasive plant management and includes interactive elements such as case studies, video clips and quizzes.

Water Quality Information Center (www.nal.usda.gov/wqic)

The Water Quality Information Center, part of the U.S. Department of Agriculture's National Agricultural Library, collects, organizes, and communicates the scientific findings, educational methodologies and public policy issues related to water quality and agriculture. This Web site offers electronic access to the information collected by the Center and provides links to other resources.

Calendar

For an updated events calendar,
see www.epa.gov/newsnotes/calendar.htm.

November 2008

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| 11/12–13 | <i>Water Education Foundation's San Joaquin River Restoration Tour</i> , Fresno, CA. For more information, see www.watereducation.org/toursdetail.asp?id=845 . |
| 11/16–19 | <i>2008 International Low Impact Development Conference</i> , Seattle, WA. For more information, see www.asce.org/conferences/lid08 . |
| 11/17–19 | <i>2008 Mid-Atlantic Regional Water Resources Research Conference—The Water-Energy Nexus: A Necessary Synergy for the 21st Century</i> , Shepherdstown, WV. For more information, see http://www.wri.nrcce.wvu.edu/conferences/2008/WRRI . |
| 11/17–19 | <i>The West's Water Future: Water Information Needs and Strategies</i> , Salt Lake City, UT. For more information, see www.westgov.org/wswc/wat%20mngmt.html . |
| 11/17–20 | <i>AWRA 44th Annual Water Resources Conference</i> , New Orleans, LA. For more information, see www.awra.org/meetings/NewOrleans2008 . |
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11/17–20 *Coastal Cities Summit: Values and Vulnerabilities*, St. Petersburg, FL. For more information, see www.coastalcities.org.

December 2008

- 12/2–5 *2008 National Ground Water Association Ground Water Expo and Annual Meeting*, Las Vegas, NV. For more information, see www.ngwa.org/2008expo.
- 12/8–9 *20th Annual Northwest Environmental Conference and Tradeshow*, Portland, OR. For more information, see www.nwec.org.
- 12/8–10 *Biodiversity in a Rapidly Changing World*, Washington, DC. For more information, see <http://ncseonline.org/conference/biodiversity>.
- 12/8–11 *Conference on Ecosystem Services 2008: Using Science for Decision Making in Dynamic Systems*, Naples, FL. For more information, see <http://conference.ifas.ufl.edu/ACES>.
- 12/8–11 *2008 Florida Bay and Adjacent Marine Systems Science Conference*, Naples, FL. For more information, see www.conference.ifas.ufl.edu/FloridaBay2008.
- 12/8–12 *Water Quality Standards Academy*, Arlington, VA. For more information, see www.glec-online.com/Announ-Session17.htm.
- 12/19 *Webinar: Preparing and Implementing Construction Site Storm Water Pollution Prevention Plans*, offered by the American Society of Civil Engineers. For more information, see www.asce.org/webinar/product/1325.

January 2009

- 1/12 *Decentralized Wastewater Treatment Workshop 2009*, East Lansing, MI. For more information, see www.conservationinformation.org.

February 2009

- 2/7 *EcoLandscape 2009 Conference*, Sacramento, CA. For more information, see www.ecolandscapes.org/eventsConference.html.
- 2/8–12 *2009 USDA-CSREES National Water Conference*, St. Louis, MO. For more information, see www.usawaterquality.org/events.
- 2/9–12 *International Erosion Control Association's Annual Conference*, Reno, NV. For more information, see www.ieca.org/conference/annual/ec.asp.
- 2/17–20 *Stormwater and Urban Water Systems Modeling*, Toronto, Canada. For more information, see www.computationalhydraulics.com/Training/Conferences/confsem.html.
- 2/18–20 *Soil and Water Conservation Service Technical Conference*, Rapid City, SD. For more information, see www.ndswcs.org/News.htm.
- 2/19–20 *International Conference on Stormwater and Urban Water Systems Modeling*, Toronto, Ontario. For more information, see www.computationalhydraulics.com/Training/Conferences/conferencetoronto.html.
- 2/26–27 *International Water Conservation and Xeriscape Conference*, Albuquerque, NM. For more information, see www.xeriscapenm.com/xeriscape_conferences/2009.

March 2009

- 3/18 *Designing for Water Conservation—Audio/Web Conference*, hosted by the American Institute of Certified Planners. For more information, see www.planning.org/audioconference.
- 3/22–26 *2009 International Master Gardener Conference*, Las Vegas, NV. For more information, see www.unce.unr.edu/imgc.

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Do you have an article or idea to share? Want to ask a question or need more information? Please contact NPS News-Notes, c/o Don Waye, by mail at U.S. EPA, Mail Code 4503-T, 1200 Pennsylvania Ave., NW, Washington, DC 20460, by phone at 202-566-1170, or by e-mail at waye.don@epa.gov.

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