



# Nonpoint Source News-Notes

June 2009, #87

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



## Notes on the National Scene

### EPA Unveils Watershed Central

Looking for the latest tools for watershed planning and protection? Stop by “Watershed Central,” the U.S. Environmental Protection Agency’s (EPA’s) new Web site designed to help the public exchange information and locate the resources needed to restore their local watersheds. Watershed Central ([www.epa.gov/watershedcentral](http://www.epa.gov/watershedcentral)) helps users find environmental data, watershed models, guidance documents, nearby local organizations and other information. It contains links to a variety of watershed technical resources, funding resources and mapping applications offered by EPA and other organizations. The site also includes a “Watershed Central wiki,” where watershed practitioners can collaborate and share information online.

#### What is Watershed Central?

EPA developed Watershed Central to serve as a single site where people could access the tools, data and information resources needed to support federal, state, tribal and local watershed management decisions (Figure 1). EPA has invested significant resources to develop tools and guidance to help people effectively manage their water resources. These resources are housed on different Web pages within the EPA site because EPA’s Web pages are



**EPA Launches Healthy Watershed Initiative**

Protecting healthy watersheds saves money and the environment. See article on [page 3](#).

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*EPA Unveils  
Watershed  
Central  
(continued)*

organized around individual programs rather than around a watershed assessment and management process. In the past, users looking for watershed management resources sometimes found navigating EPA's Web site to be cumbersome, time-consuming and confusing. Watershed Central helps to overcome these problems by presenting existing tools and resources from individual watershed-related EPA program pages in a coordinated and integrated framework that follows the watershed management process (see Figure 2).

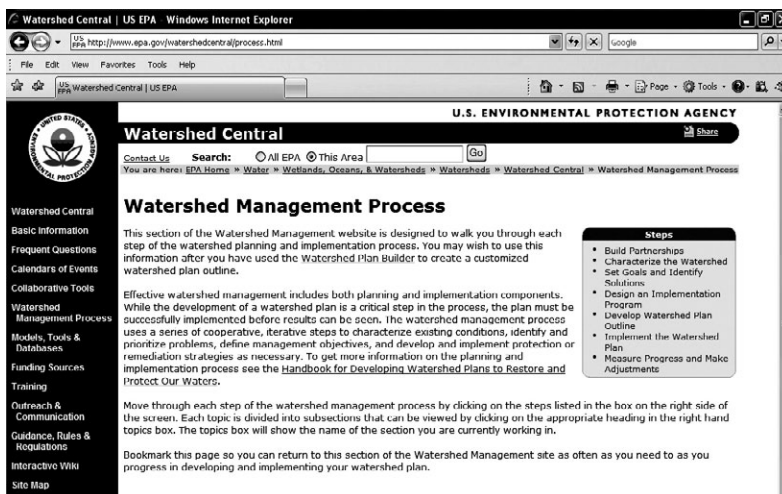
For example, EPA recently developed several products to help build watershed management capacity at the state and local level. These include:

- *Handbook for Developing Watershed Plans to Restore and Protect Our Waters* to help state and local watershed planners answer watershed management questions critical to developing, implementing and evaluating watershed management plans ([www.epa.gov/nps/watershed\\_handbook](http://www.epa.gov/nps/watershed_handbook)). *Plan Builder*, a Web-based watershed plan development tool to help localities prepare comprehensive watershed plans, contains much of the same content and is also accessible from the Handbook's Web site.
- CADDIS ([www.epa.gov/caddis](http://www.epa.gov/caddis)), which helps users determine and document causes of watershed impairment.
- Recently Redesigned *EnviroMapper for Water* ([www.epa.gov/waters/enviromapper](http://www.epa.gov/waters/enviromapper)), a Web-based Geographic Information System (GIS) application that dynamically displays water quality and other environmental information about the nation's waterbodies.

"In the past, EPA's various watershed management tools and resources were tucked into various EPA program Web pages. Unless you knew what program housed the resource, you didn't know where to look," explained Stuart Lehman, Project Manager. "We created Watershed Central so people could access all the tools they'd need at the appropriate step within their watershed management process." These resources are also quickly available by following the links provided to specific categories such as "Models, Tools and Databases" provided on the navigation bar on the left (see Figures 1 and 2).



**Figure 1. The Watershed Central homepage offers links to the key areas of the site, plus direct links to resource areas.**



**Figure 2. The "Watershed Management Process" button accessible from Watershed Central's main page (see Figure 1) brings users here. This area of the Web site walks a user through the entire watershed management process, using the links provided in the box on the right. For each step of the watershed management process, the user is taken to a page with text that explains the step and provides links directly to resources available from EPA and other organizations that are relevant to that step.**

*Watershed Central Offers a Wiki*

Watershed Central includes a dynamic feature called a wiki, which is a Web site that allows users to submit and edit content. Information is constantly reviewed and updated by the watershed community (just like Wikipedia). The Watershed Central wiki includes case studies, success stories, information about watershed organizations and their experiences, details on various watershed management tools, and commentary from watershed practitioners about local approaches to watershed management.

EPA encourages watershed practitioners to register for free wiki access and submit new or revised content through the wiki site. “The great thing about the wiki is that everybody can modify and improve content based on their knowledge and experience,” noted Lehman. “We have a team of EPA staff that will review the wiki submissions and help tag the text with appropriate categories to improve accessibility.” EPA will review submissions bi-weekly. All non-EPA users who wish to register for wiki will create a name and password, fill out a short form and click on “submit.” Non-EPA users should list Stuart Lehman (E-mail: [lehman.stuart@epa.gov](mailto:lehman.stuart@epa.gov); Phone: 202-566-1205) as their EPA contact.

### Watershed Central Webcast Available

On April 15, 2009, EPA's Watershed Academy presented a Webcast entitled “Watershed Central: A New Gateway to Watershed Information.” Now available in archived form at [www.epa.gov/watershedwebcasts](http://www.epa.gov/watershedwebcasts), this Webcast introduces viewers to the information and tools available on Watershed Central, including the new Watershed Central wiki.

Watershed Central and the associated wiki are designed to be a central location on the Web for sharing watershed information and management tools. EPA recognizes that it takes informed citizens and corporations and active involvement of universities, states, tribes, local and federal agencies to find comprehensive solutions to water resources problems. EPA invites all to share their projects and experiences using various tools. Please e-mail [watershedcentral@epa.gov](mailto:watershedcentral@epa.gov) with comments or questions about the Watershed Central site. If you have ideas for Watershed Central or Watershed Central wiki content, EPA asks that you please contribute to the wiki online.

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## EPA Launches Healthy Watersheds Initiative

We've all heard the saying “An ounce of prevention is worth a pound of cure.” Local, state and federal governments currently invest billions of dollars annually to treat polluted water and restore degraded waterways. Now, the U.S. Environmental Protection Agency (EPA) is launching a new Healthy Watersheds initiative to encourage local and state agencies to be proactive and place a stronger emphasis on protecting their remaining healthy watersheds as a way to save money and the environment.

### Why Emphasize Healthy Watersheds?

Healthy watersheds provide numerous environmental benefits and services, including reduced vulnerability to severe impacts by invasive species, climate change and future land use changes. Healthy watersheds can store carbon in vegetation and soils, offsetting greenhouse gas emissions. Healthy watersheds and associated streamside areas provide habitat for fish, amphibians, birds and insects, and offer green corridors that connect animal and bird populations to food and water sources.



A child plays along a small river in Virginia.

Maintaining healthy watersheds also makes economic sense. Healthy watersheds serve as refuges where people spend money to fish, boat, hike and pursue other recreation opportunities. Water treatment costs are lower. “The cost of protecting watersheds is much less than the cost of restoring impaired waters,” explains EPA’s Laura Gabanski, who is spearheading the new initiative. “Choosing to protect ecologically valuable systems will save money in the long run.” For example, a survey of 27 different water treatment utilities showed that protecting aquifer recharge zones and surface water sources reduces drinking water treatment costs. In fact, the survey showed that for every 10 percent increase in forest cover of the source area, the chemical and treatment costs decreased by 20 percent (see [www.ci.slc.ut.us/Utilities/NewsEvents/pdf/Op0504\\_1.pdf](http://www.ci.slc.ut.us/Utilities/NewsEvents/pdf/Op0504_1.pdf)). Healthy watersheds also tend to suffer less damage from floods, fires, and other natural disasters, thereby reducing costs to communities.

## *Expanding the Watershed Approach*

The Healthy Watersheds initiative focuses on using a holistic approach to protect and conserve healthy aquatic ecosystems. To maintain ecological integrity of aquatic resources, watershed managers need to understand not only the biological, chemical and physical condition of waterbodies, but also the critical watershed functional attributes, such as hydrology, geomorphology and natural disturbance patterns. Programs that protect and restore aquatic ecosystems are most effective when they recognize and integrate these dynamics and manage watersheds as systems. “To maintain healthy aquatic ecosystems, we need to make sure that the processes that drive their condition remain intact,” explains Gabanski. “In addition to being concerned about specific pollutants in a watershed, we should be focusing on the condition of key dynamics of the watershed system.”

EPA launched a new Web site to support the initiative, available at [www.epa.gov/healthywatersheds](http://www.epa.gov/healthywatersheds). The site provides the tools and information that states, local governments and others need to identify and protect healthy watersheds. “We have the tools available to implement this watershed systems approach,” notes Gabanski. “Now we just have to let people know about it.”

## *Identifying and Protecting Healthy Watersheds*

Through the Healthy Watersheds initiative, EPA recommends using an integrated framework to identify and assess healthy watersheds and intact healthy components of other watersheds. The Healthy Waters Framework is largely consistent with the ecological attribute approach found in the “Framework for Assessing and Reporting on Ecological Condition,” a tool developed by EPA’s Science Advisory Board in 2002 (see [www.epa.gov/healthywatersheds/publications.html#integrated](http://www.epa.gov/healthywatersheds/publications.html#integrated)). The framework provides a construct for addressing the dynamic complexities of watershed ecosystems through an integrated assessment of the landscape condition, biotic condition, chemical/physical parameters, and critical watershed functional attributes such as the natural disturbance regime and hydrology/geomorphology. (See box for more detail.)

Integrated assessments can range from a screening level geographic information system-based assessment to sophisticated ecological modeling and statistical analyses of ecological attributes. The Healthy Watersheds Web site offers detailed information about many different types of ecological assessment and analysis tools available.

After identifying healthy watersheds or healthy components of watersheds, a watershed manager should incorporate a variety of strategies to ensure that the watersheds remain healthy. The Healthy Watersheds Web site describes a series of conservation and protection approaches and provides links to case studies, reports and useful tools. Often, a mix of tools needs to be tailored

### **Healthy Watersheds Framework’s Essential Ecological Attributes**

The Healthy Watersheds concept views watersheds as integrated systems that can be understood through the dynamics of essential ecological attributes, including:

- **Landscape Condition.** Natural vegetative habitat patches and corridors provide the green infrastructure, or interconnected natural areas, necessary to maintain landscape condition in healthy watersheds.
- **Biotic Condition.** Healthy aquatic ecosystems reflect healthy watershed conditions. An examination of habitat and the presence, numbers and condition of aquatic organisms and communities in a waterbody indicates the biotic condition.
- **Chemical/Physical Parameters.** Data on parameters such as nutrients, temperature, dissolved oxygen, organic matter and pH can indicate ecosystem health.
- **Natural Disturbance Regimes.** Understanding the natural disturbance regime (fire and flood frequency, etc.) of a watershed allows managers to develop management and protection measures that will maintain the watershed in as natural a condition as possible.
- **Hydrology/Geomorphology.** In a healthy stream, erosion and sediment deposition rates achieve a balance, or dynamic equilibrium, based on water flow, soil type and other factors. The dynamic equilibrium of the physical system establishes the dynamic equilibrium of the biological system, thus maintaining the ecological integrity of the system as a whole.
- **Ecological Processes.** Ecological processes include energy flow, elemental cycling, and the production, consumption and decomposition of organic matter.

for a particular location to most effectively maintain watershed health and integrity. The Healthy Watersheds Web site provides examples of tools for:

- Habitat and biodiversity conservation
- Green infrastructure and landscape conservation
- River corridor protection
- Land protection programs and local land use ordinances
- Water policy and instream flow protection

Increasing awareness and changing behavior through education and developing responsible attitudes among watershed citizens and communities is also an essential component of the Healthy Watersheds concept. Efforts to protect and conserve healthy watersheds will fail without stakeholder participation and cooperation. The Healthy Watersheds Web site offers links to a series of resources to help managers educate the public, including EPA's 2003 "Getting in Step: A Guide for Conducting Watershed Outreach Campaigns" ([www.epa.gov/watershed/outreach/documents/getnstep.pdf](http://www.epa.gov/watershed/outreach/documents/getnstep.pdf)), which presents key principles, techniques and information for effective watershed outreach.

Gabanski notes that the Healthy Watersheds approach is already being adopted by federal, state and local agencies and is optimistic that the Healthy Watersheds approach will become part of future EPA strategic plans to protect the nation's waters. "I see this as complementary to our water quality programs which emphasize restoring impaired waters. You cannot have one (restoration) without the other (protection)—they work hand-in-hand," she explains. "By identifying the healthy watersheds that still remain and taking steps to protect them, we can ensure that they'll be healthy in the future and that the natural infrastructure will remain to support our restoration efforts."

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## Forty Years Later—and Still Saving Our Streams

The summer of 1969 proved to be a pivotal season for water. Environmental awareness had been on the rise, fueled by decades of visible pollution problems and books such as Rachel Carson's *Silent Spring*, which chronicled the ongoing indiscriminate use of pesticides. On June 22, Ohio's Cuyahoga River attracted national media attention when oil slicks and debris on the river caught fire. Although not the first fire seen on this or other U.S. rivers, the Cuyahoga River fire sparked national disgust and outrage. The public clamored for action. Within a few years, the federal government created the Environmental Protection Agency and passed groundbreaking laws such as the Clean Water Act. That summer also marked the start of another significant, far-reaching national water quality protection program—the Izaak Walton League's (League's) Save Our Streams program, which gave people a way to personally take action and make a difference. Save Our Streams pioneered citizen-based stream monitoring and provided individuals with a simple, reliable tool to assess, restore and protect their local streams. Forty years later, Save Our Streams remains one of the League's most successful conservation programs.

### *What is Save Our Streams?*

The original Save Our Streams effort began in Maryland as a stream adoption program modeled after the state's adopt-a-highway program. League members and others checked streams regularly for siltation and barriers to fish passage. They reported water pollution problems to the appropriate local and state authorities, removed trash and debris and educated the public about how to prevent water pollution. The League expanded the program nationwide in 1974. In the 1980s Save Our Streams became one of the first programs to successfully train volunteers to assess water quality using a simple, accurate method based on the presence and diversity of stream insects and crustaceans (often referred to as "aquatic bugs"). By examining the number and variety of aquatic bugs, volunteers can determine if a waterway is in trouble (see box, next page).

## Save Our Streams Biological Stream Monitoring

Although Save Our Streams programs might differ slightly from state to state, the overall biological monitoring approach and structure is essentially the same. The League relies on the presence of benthic macroinvertebrates to assess water quality. Macroinvertebrates are large enough to see with the naked eye (macro) and have no backbone (invertebrate). Benthic macroinvertebrates live in the benthos, or stream bottom, and include insect larvae, adult insects and crustaceans.

Stream-bottom macroinvertebrates are good indicators of water quality because they differ in their sensitivity to stress in the waterway. Some benthic macroinvertebrates are very sensitive to pollutants in the water. Others are less sensitive to pollution and can be found in almost any stream. Benthic macroinvertebrates usually live in the same area of a stream for most of their lives. Sampling these macroinvertebrates in a stream is a good indication of what the water quality has been for the past few months. If the water quality is generally poor, or if a polluting event occurred within the past several months, it will be reflected in the macroinvertebrate population.

The Save Our Streams program identifies three groups of macroinvertebrate taxa based on their sensitivity to pollution: pollution sensitive, somewhat pollution tolerant and pollution tolerant. The Save Our Streams method involves collecting a sample of macroinvertebrates from the stream, identifying the organisms and rating the water quality. Water quality ratings of excellent, good, fair and poor are based on the tolerance levels of the organisms found and the diversity of organisms in the sample. A stream with excellent water quality should support organisms from all three pollution tolerance groups.

[This information was excerpted with permission from the League's Save Our Streams Web site at [www.iwla.org/sos](http://www.iwla.org/sos).]



**Flat-headed mayflies are pollution sensitive and are usually found only in high quality waters.**

In 1990, the Save Our Streams stream biological monitoring method became one of the first to be approved by the U.S. Environmental Protection Agency as a method to collect useful and scientifically valid information about water quality. Approximately 300 League chapters are active across the country, many with Save Our Streams programs. Thousands of volunteers across the country now use the Save Our Streams method and other League resources to determine water quality and protect streams in trouble. Dozens of states have adopted volunteer monitoring programs based on the Save Our Streams method.

### *Kids (and Adults) Love Bugs!*

Over the years the Save Our Streams program has grown into a national watershed education and outreach program. League members across the country engage children and adults in monitoring and restoration efforts, raising interest and awareness in water quality issues. “The Save Our Streams monitoring method is real-world science,” explains Leah Miller, the League’s Director of Clean Water Programs. “Kids and adults both love capturing and identifying aquatic bugs. Plus, you get your water quality rating results on the spot—no waiting for data from the laboratory.” This low-tech, hands-on approach to water quality monitoring makes it ideal for schools and watershed groups with limited budgets.



**Volunteers sample a small stream using the Save Our Streams method.**

Successful programs continue to grow and expand. For example, the League’s Project Watershed in central New York uses Save Our Streams to engage students in hands-on science (<http://projectwatershed.org>). Project Watershed partners, including the League’s Central New York Chapter and other organizations, schools and agencies have worked with approximately 30 area high schools in recent years to monitor streams. Next year the consortium will bring an additional 30 high schools and middle schools into the program. “The students are inspired to apply

what they've learned in the real world," notes Miller. "One group recently went to the local government and advocated protecting a high quality stream." The students used their monitoring data to convince local zoning officials not to permit new development that could degrade water quality.

### *Monitors Watch for Changes*

Once introduced to the Save Our Streams method, volunteers across the country are able to keep a close eye on local waters. "Volunteer monitors can monitor streams frequently and often identify problems that might otherwise go unnoticed for a while," explains Miller. For example, Save Our Stream monitors have found and helped to correct problems caused by sewer leaks, chemical spills, polluted runoff from parking lots and roads, sediment pollution from developments, and runoff of airport de-icing chemicals, among other sources. "In fact, we identified a problem near our headquarters office during a workshop," adds Miller. "We found almost no aquatic bugs when assessing a local stream that was usually healthy. We walked up the stream and discovered oil seeping from the streambank—apparently someone's home heating oil tank had sprung a leak. Our monitoring efforts allowed the problem to be identified and corrected quickly."

Many Save Our Streams volunteer programs across the country work closely with state and local environmental agencies to share data. New York's Onondaga County, for example, uses data collected by the Central New York Project Watershed to inform many of its watershed decisions. Many localities rely on volunteer data to help target restoration efforts or identify areas that need additional monitoring by state or local agencies. Virginia's Save Our Streams program ([www.vasos.org](http://www.vasos.org)) trains and certifies volunteer water monitors throughout the state to ensure they comply with the state's quality assurance and quality control requirements. Once certified, monitors can submit their data to the state agencies for use in statewide water quality assessments.

### *Program Evolution*

Over the years, the League's Save Our Streams program has expanded. League staff can help local groups assess watersheds, restore streams, forge partnerships, advocate for clean water and educate the public. "Our members and volunteer monitors became frustrated because the state or local agencies did not always have the resources to help address water quality problems in a timely manner," explained Miller. "Volunteer monitors, on the other hand, can often take immediate action to solve the problems they identify through monitoring. We can help get them started in their restoration efforts."

Want to learn more? The League offers several workshops, books, and videos focused on monitoring and restoring streams. For example, the League's "Watershed Stewardship Action Kit" offers a series of fact sheets about watershed surveys, water conservation, wetland and stream ecology, and the instructions and data forms for water quality monitoring. The League's "Field Guide to Aquatic Macroinvertebrates" is a laminated guide that includes line drawings and identifying characteristics of the insects and crustaceans that live in stream bottoms. The League's "Guide to Aquatic Insects and Crustaceans" is a more detailed key to aquatic bug identification. The "Save Our Streams for America's Streams – A Guide to Water Quality Monitoring" video demonstrates monitoring techniques. The League also offers workshops on monitoring and assessment, stream restoration, wetland ecology and watershed conservation policies upon request. More information about these resources is available on the League's Web site at [www.iwla.org](http://www.iwla.org) (click on "Stream and Wetland Publications"). For information about Save Our Streams programs in your state, see [www.iwla.org/chapters/Division\\_021509.pdf](http://www.iwla.org/chapters/Division_021509.pdf).

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## *Federal Environmental Protection Funding Levels Increase*

Projects to protect and restore the environment will soon be on the rise, thanks to newly enacted and proposed funding increases for the U.S. Environmental Protection Agency (EPA). On February 17th, President Barack Obama signed the American Recovery and Reinvestment Act of

2009 (Recovery Act). The Recovery Act, designed to jumpstart the nation's economy, includes measures to modernize our nation's infrastructure, enhance energy independence, protect the environment, expand educational opportunities, preserve and improve affordable health care, provide tax relief and protect those in greatest need. The Recovery Act specifically includes \$7.22 billion for projects and programs administered by the EPA (see [www.recovery.gov](http://www.recovery.gov)). In addition, on February 26th President Obama proposed a 2010 federal budget that would increase EPA funding. The proposed budget increases for 2010 are in addition to the funding provided by the 2009 Recovery Act.

### *Recovery Act*

The Recovery Act makes \$6 billion available for water projects and protection efforts. Recovery Act funding is being channeled primarily through the Clean Water State Revolving Fund ([www.epa.gov/owm/cwfinance/cwsrf](http://www.epa.gov/owm/cwfinance/cwsrf)) and Drinking Water State Revolving Fund ([www.epa.gov/safewater/dwsrf](http://www.epa.gov/safewater/dwsrf)) and includes \$4 billion for assistance to help communities with water quality and wastewater infrastructure needs and \$2 billion for drinking water infrastructure needs. Twenty percent of the funds from both the CWSRF and DWSRF (a total of \$1.2 billion) will be targeted toward "green infrastructure, water and energy efficiency, and environmentally innovative projects." Additionally, section 604b of the Clean Water Act authorizes EPA to award funds to states to support local and regional water quality assessment and management planning grants. Since section 604b funds are one percent of the CWSRF's annual allocation, the Recovery Act boosts spending for watershed planning activities by \$40 million.

The Recovery Act provides another \$1.2 billion to support the following EPA programs that help prevent or remove pollution from the air, surface water, groundwater and soils:

- Brownfields: \$100 million for competitive grants to evaluate and clean up former industrial and commercial sites.
- Superfund Hazardous Waste Cleanup: \$600 million for the cleanup of hazardous sites.
- Leaking Underground Storage Tanks: \$200 million for cleanup of petroleum leaks from underground storage tanks.
- Diesel Emissions Reduction: \$300 million for grants and loans to help regional, state and local governments, tribal agencies and nonprofit organizations with projects that reduce diesel emissions.

EPA plans to award both the designated funds to states and the competitive grants as quickly as possible. For details on program status, see [www.epa.gov/recovery](http://www.epa.gov/recovery).

### *2010 Proposed Budget*

On February 26th, President Obama proposed a 2010 federal budget that significantly increases the amount of funding directed to the EPA. The President's proposed 2010 budget includes:

- \$10.5 billion in total for the EPA (compared to \$7.64 billion provided in 2009).
- \$3.9 billion for the CWSRF and DWSRF.
- \$475 million for a new EPA-led, interagency Great Lakes restoration initiative, which will target the most significant problems in the region, including invasive aquatic species, non-point source pollution and contaminated sediment.
- \$3.9 billion for the EPA's operating budget, which comprises its core regulatory, research and enforcement activities.
- \$1.1 billion in EPA grants for states and tribes to administer environmental programs.

Of course, the President's proposed 2010 budget will be reviewed and modified by Congress on the way to its final passage. With many competing priorities and economic realities, EPA's future budget remains uncertain. For more information about EPA's proposed 2010 budget, follow the link to the Environmental Protection Agency at [www.whitehouse.gov/omb/budget](http://www.whitehouse.gov/omb/budget).



# Notes from the States, Tribes, and Localities

## *Teaming Up to Address Stormwater along Lake Superior*

In 1999, new federal regulations required that small municipalities and others across the nation develop stormwater management and education programs. In the Lake Superior area, as in many other parts of the country, numerous organizations decided to join forces and take a regional approach to comply with these regulations. Representatives from 26 local and regional governments, agencies, nonprofits, colleges and universities around the Lake Superior shoreline came forward to form the Regional Stormwater Protection Team (RSPT). The team's collaborative efforts have proven to be cost effective and have improved and standardized the stormwater messages reaching the public.

### *Regulations Required Stormwater Management Programs*

The U.S. Environmental Protection Agency (EPA) enacted the National Pollutant Discharge Elimination System (NPDES) Phase II stormwater rule in 1999. The Phase II rule requires that regulated small municipal separate storm sewer systems (MS4s) in urbanized areas (see box for more details) develop a stormwater management program. Phase II stormwater management programs must include six elements that, when implemented together, are expected to result in significant reductions of pollutants discharged into receiving waterbodies. These six elements include:

- Public education and outreach
- Public participation and involvement
- Illicit discharge detection and elimination
- Construction site runoff control
- Post-construction runoff control
- Pollution prevention/good housekeeping

Phase II requirements can sometimes seem overwhelming to a local government on a limited budget with limited staff. Realizing this, EPA structured the rule to help ease the burden. In fact, the Phase II rule specifically identifies a number of implementation options for regulated small MS4 operators. These include sharing responsibility for program development with a nearby regulated small MS4, taking advantage of existing local or state programs, or participating in the implementation of an existing Phase I (large municipalities) MS4's stormwater program as a co-permittee. EPA intended for these options to promote a regional approach to stormwater management that is coordinated on a watershed basis.

### *RSPT Opted to Take Regional Approach*

The RSPT opted to create a regional entity that could help all of the area's small MS4 operators comply with the Phase II rule. The participating agencies and organizations signed a memorandum

#### **What is a Municipal Separate Storm Sewer System (MS4)?**

A MS4 is defined as a conveyance or system of conveyances that is (1) owned by a state, city, town, village or other public entity that discharges to waters of the U.S.; (2) designed or used to collect or convey stormwater (including storm drains, pipes, gutters, ditches, etc.); (3) not a combined sewer; and (4) not part of a publicly owned treatment works (sewage treatment plant). The drainage network of a MS4 transports polluted stormwater runoff from the watershed and discharges it, usually untreated, directly into local waterbodies. EPA stormwater rules require that MS4 operators obtain a NPDES permit and develop a stormwater management program to control this pollution.

The NPDES Phase II rule applies to any MS4 in Census Bureau-designated "urbanized areas" not already permitted under the Phase I rule. Phase I of the NPDES stormwater regulations went into effect in 1990, and applies to medium and large MS4s (e.g., cities and counties) serving populations over 100,000. Note then, for example, the City of Chicago, as an operator of a combined sewer system, is not a Phase I permittee since it does not own or operate a separate storm sewer system that serves more than 100,000 people. For more information, including maps showing MS4s across the country, see <http://cfpub.epa.gov/npdes/stormwater/munic.cfm>.

of understanding agreeing to share resources to protect and enhance the region's water resources by coordinating educational programs and technical assistance. "Consolidating resources doesn't just save time and money—it allows us to work faster and share ideas more effectively," says Chris Kleist, the City of Duluth's stormwater coordinator. "Instead of doing our own programs and offering separate workshops and trainings, we all agreed to put our heads together and share our knowledge and money."

The team has developed a media campaign that includes everything from brochures to three 30-second "Watershed Moment" television public service announcements. The group also hosts family-oriented Lake Superior Watershed Festivals, offers training workshops for construction and maintenance crews, and has created a live mascot, Rex, who hands out doggy bags to pet owners at various events.

RSPT members also contribute information to [www.lakesuperiorstreams.org](http://www.lakesuperiorstreams.org). This interactive Web site provides real-time water quality data from regional streams and incorporates the data into community information, classroom curricula, case studies, and tools for contractors, developers and decision makers. Team members pay dues that vary based on population to help support the projects. Plus, more than \$225,000 in project funding has come from the National Oceanic and Atmospheric Administration's coastal program during the past four years. All of RSPT's activities

### Groups across the Nation Partner to Manage Stormwater

The Lake Superior Regional Stormwater Protection Team isn't the only wide-scale, diverse partnership designed to maximize available resources to protect regional water resources. Numerous similar groups have formed around the country since the Phase II stormwater rule went into effect. Participating groups typically contribute money or staff to support the team's projects or program management. Fees usually either are a specific dollar amount or vary depending on the MS4's population. Partnership structures might vary, but the end result is the same—the partners share resources to efficiently and effectively accomplish stormwater management and public outreach. The following list includes some examples of regional stormwater management coalitions:

- **Northeast Wisconsin Stormwater Consortium (NEWSC)** ([www.newsc.org](http://www.newsc.org)). Formed in 2002, the organization has 34 municipal members that cooperate to implement Phase II stormwater programs locally and regionally. NEWSC focuses its work through four committees, each focusing on a particular aspect of the NPDES permit. For more information on this and other stormwater partnerships in Wisconsin, see a summary in *Wisconsin's Municipal Stormwater Collaboratives*, by Kendra Axness, available at <http://runoffinfo.uwex.edu/pdf/swgroups9-07.pdf>.
- **Mid-America Regional Council (MARC)** ([www.marc.org](http://www.marc.org)). MARC brings together a committee of representatives from local governments and environmental organizations to develop a regional watershed public education program designed to raise public awareness about watershed issues and water quality in the Kansas City region.
- **Iowa Stormwater Partnership (ISP)** ([www.iowastormwater.org](http://www.iowastormwater.org)). ISP is a partnership of 38 municipalities, agencies and organizations. ISP works to improve water quality in Iowa by promoting methods, design guidelines, standard specifications, educational activities, and research and demonstration projects for the purpose of reducing storm water pollutants in Iowa streams.
- **Northern Virginia Clean Water Partners** ([www.onlyrain.org/index.htm](http://www.onlyrain.org/index.htm)). Comprised of nine Northern Virginia local governments, two independent water and sanitary sewer authorities, and one regional commission, the Clean Water Partners work collaboratively to reduce the amount of pollution reaching local waterways. The group uses radio, print and television advertisements to maximize the reach of its pollution-control messages to more than a million residents in the Northern Virginia region.
- **Central Minnesota Water Education Alliance (CMWEA)** ([www.mnwaterconnection.com](http://www.mnwaterconnection.com)). CMWEA is a coalition of central Minnesota cities, counties and other organizations that provides educational outreach to promote water quality stewardship. By working together, the members of CMWEA provide a consistent water quality educational message in a cost-effective manner.
- **Metro WaterShed Partners: Minneapolis and St. Paul** ([www.cleanwatermn.org](http://www.cleanwatermn.org)). Metro WaterShed Partners is a coalition of more than 60 public, private and nonprofit organizations in the Twin Cities metro area committed to protecting water quality through collaborative educational outreach, networking and resource sharing.
- **Chittenden County Vermont Regional Stormwater Education Program** ([www.smartwaterways.org](http://www.smartwaterways.org)). This program unites nine municipalities and three publicly owned separate storm sewer systems (University of Vermont, Burlington International Airport and the Vermont Agency of Transportation). Each entity contributes about \$5,000 per year to help pay for stormwater education and outreach.

focus on strategies to protect existing resources and prevent the high costs of trying to restore water quality later, notes Kate Kubiak, conservation specialist with the South St. Louis Soil and Water Conservation District. To view an online slide show about the RSPT, see [www.lakesuperiorstreams.org/stormwater/media/RSPT-MeetingTheChallenge.pdf](http://www.lakesuperiorstreams.org/stormwater/media/RSPT-MeetingTheChallenge.pdf).

“One of the things that has been really valuable about the group,” says Pat Collins, program manager for Minnesota’s Lake Superior Coastal Program, “is that they take advantage of the synergy that you get when you bring together different agencies and organizations that share the same goals relative to stormwater management and protection.” For more information on the RSPT, see [www.duluthstreams.org/stormwater/rspt.html](http://www.duluthstreams.org/stormwater/rspt.html).

[For more NPDES Phase II information, see [www.epa.gov/npdes](http://www.epa.gov/npdes). For more information about RSPT, contact either Chris Kleist at 218-730-4130, [ckleist@duluthmn.gov](mailto:ckleist@duluthmn.gov) or Kate Kubiak at 218-723-4867, [kate.kubiak@southstlouisswcd.org](mailto:kate.kubiak@southstlouisswcd.org). This article includes information printed in the April/May 2009 National Oceanic and Atmospheric Administration’s Coastal Services Center’s quarterly magazine Coastal Services. For the original article, see [www.csc.noaa.gov/magazine/2009/02](http://www.csc.noaa.gov/magazine/2009/02).]

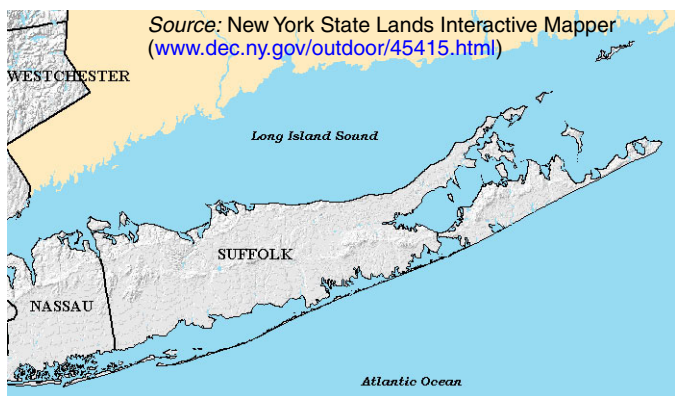
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## County on Long Island Enacts Nitrogen Fertilizer Law

Applying nitrogen fertilizer during winter months is now illegal in Suffolk County, New York. This 912-square mile county at the end of Long Island is home to 1.5 million people, most of whom are dependent upon local groundwater supplies for their drinking water. Mounting evidence of nitrogen pollution in groundwater water supplies as well as problems with nitrogen-fueled eutrophication in nearby estuaries prompted county legislators to pass a law in December 2007. Effective beginning January 2009, the law prohibits application of both organic and inorganic fertilizer

between November 1 and April 1 throughout the county and prohibits application of nitrogen on county owned properties year-round. It also includes an educational component for consumers and businesses, helping to ensure compliance with the legislation. Violations are punishable by a fine of up to \$1,000.

“This legislation is absolutely necessary to protect our water supply,” said Suffolk County legislator Lou D’Amaro, vice-chairman of the environment, planning and agriculture committee. “Scientific studies show that excessive fertilizer applications do not create greener lawns and have led to nitrogen leaching into our groundwater, causing the degradation of our water. As a result, this bill strikes a good balance between lawn maintenance and the protection of our groundwater.”



New York’s Suffolk County is home to 1.5 million people.

### Law Limits Nitrogen

The law provides a critical component to a multi-pronged Suffolk County Fertilizer Nitrogen Pollution Reduction Plan, which seeks to reduce nitrogen pollution in this portion of Long Island. Nitrogen pollution or nitrate leaching occurs when water carries nitrates (common in fertilizers) into nearby surface waters or through the soil below root levels and into the groundwater. Long Island relies heavily on groundwater for its drinking water. In fact, when creating the new law the Legislature cited findings in 2006 that showed 15 community public water supply wells and nearly 10 percent of private wells in Suffolk County violated the 10 milligrams per liter (mg/L) drinking water standard for nitrate.

The law will also help protect the Peconic Estuary system. The estuary is on the east end of Long Island and includes several small bays such as Flanders Bay, Great Peconic Bay, Little Peconic Bay, Shelter Island Sound and Gardiners Bay. The major sources of fresh water to the estuary are the Peconic River and groundwater seepage. Elevated levels of nitrogen in estuarine waters encourage the algae growth, which can harm plants, wildlife and recreational use. The nitrogen loads entering nearby Peconic Estuary via groundwater alone have increased by more than 200 percent since the 1950s because of inputs from fertilizers, onsite septic systems and wastewater treatment plants.

“Fertilizers account for 56 percent of nitrogen pollution emanating from residential properties,” said County Executive Steve Levy. “It is a more cost-effective approach to prevent nitrogen pollution at the source, rather than spending millions to remediate our waterways after the fact.” The county’s new fertilizer reduction plan could reduce the amount of nitrogen leached into groundwater and surface waters from residential fertilizer applications by at least 25 percent, or 60 tons every year.

### *Elements of Nitrogen Pollution Reduction Plan*

The county’s comprehensive nitrogen fertilizer reduction plan outlines a variety of restrictions and projects, including:

- A countywide ban on application of all fertilizers between November 1 and April 1, a period when nitrates would be most likely to move through cold or frozen soil into groundwater and surface waters.
- A ban on use of fertilizer on all county owned properties, with the exception of golf courses, athletic fields, the Suffolk County Farm in Yaphank, and when establishing new turf on public works project sites. On athletic fields, the plan requires the county to use the minimum amounts of slow-released fertilizers needed. Fertilizer application rates are limited to three pounds of nitrogen per 1,000 square feet over a golf course. The county will follow legislature-approved nutrient management practices at the Suffolk County Farm.
- Expanding existing educational campaigns for consumers and retailers to promote the use of low-maintenance lawn care and landscaping techniques, modify people’s fertilizer application behaviors and encourage greater use of slow-release formulas. The county and its partners will develop an interactive Web site for homeowners that will help them to identify the correct amounts of fertilizer needed on their lawns and when to apply it.
- Requiring that all licensed landscapers take an approved turf management course which teaches the proper use and application of fertilizers and methods to minimize nitrogen leaching. The Cornell Cooperative Extension of Suffolk County offered free certification courses for landscapers in early 2009 to help them comply with this requirement.
- Requiring all retail establishments that sell fertilizer to post signs advising consumers about the risks of nitrogen-based fertilizers and helping them to choose fertilizers that pose the least harm to the environment. These retailers must also offer brochures that explain how to properly use and apply fertilizer products.

“Because this important legislation is designed to decrease the overall use of fertilizer, the time in which it is applied, and educate consumers and businesses, we believe it will truly have a significant impact on the health of both our citizens and our environment, providing protection for future generations,” D’Amaro said. For more information see [www.suffolkcountyny.gov/departments/EnvironmentandEnergy/fri.aspx](http://www.suffolkcountyny.gov/departments/EnvironmentandEnergy/fri.aspx). To view the law, see [www.co.suffolk.ny.us/legis/Resos2007/i2117-07.htm](http://www.co.suffolk.ny.us/legis/Resos2007/i2117-07.htm).

*[For more information contact Jennifer McGivern, Suffolk County, 100 Veterans Highway, Hauppauge, NY 11788. Phone: 631-853-4412; E-mail: [jmcgivern@suffolkcountyny.gov](mailto:jmcgivern@suffolkcountyny.gov)]*

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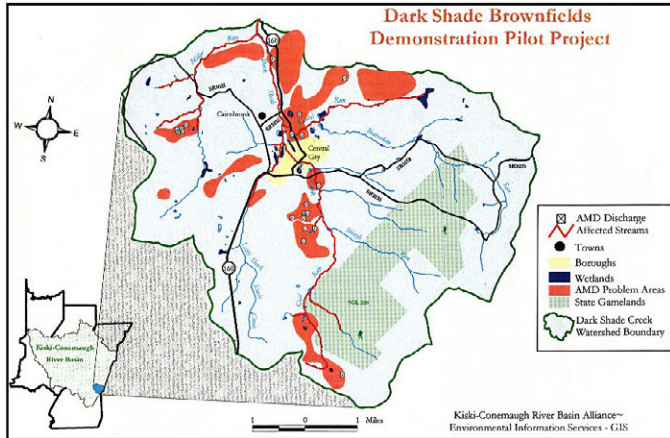
## ***Notes on Watershed Management***

### *Reclaiming Appalachian Mining Lands—One Watershed at a Time*

Sometimes you need to think big. A partnership in Pennsylvania’s Dark Shade Creek Watershed did just that—in 1998 they boldly designated an entire 34-square mile, abandoned mine-scarred watershed as one big contaminated property. The U.S. Environmental Protection Agency (EPA) agreed with their designation and in 1999 awarded the coalition a Brownfields Assessment Pilot grant. The coalition used the pilot grant to launch a number of clean up and ecotourism initiatives. Now, only ten years later, the Dark Shade Creek watershed is beginning to recover.

## Mining Left its Mark

The Borough of Central City and Shade Township (combined population of less than 5,000) are located within the Dark Shade Creek watershed, a nine-mile tributary of Shade Creek that empties into Stoneycreek River. Dark Shade valley is located within Pennsylvania's Appalachian coal mining region. The mining industry thrived here in the late 1800s and early 1900s, but declined soon after World War II. In 1950, the Dark Shade region supported more than 20,000 mining jobs, compared to only 1,500 by 1995. The loss of jobs was compounded by the negative environmental impacts the mining industry left in its wake. Piles of coal waste covered acres of land throughout the watershed. Waterways ran orange with acid mine drainage (AMD) and did not support fish or other aquatic life. Potentially contaminated land remained vacant. The area's economy was in crisis.



This map of the Dark Shade Creek watershed shows the areas impacted by acid mine drainage.

As the 20th century drew to a close, the communities of Central City and Shade Township struggled to fix the overwhelming mining-related problems that continued to cripple its economy and environment. In the late 1990s, a nonprofit group called "AMD & ART" partnered with these communities to explore innovative ways to restore Dark Shade Creek and promote it as a recreational tourist draw for fishing, white water rafting and ecotourism. Noting how many abandoned mines and mining waste piles were scattered throughout the watershed, the partners decided to designate the entire 34-square mile watershed as a single large contaminated property (see map). The partners applied for and received a \$200,000 Brownfields Assessment Pilot grant in 1999 to address mine-scarred lands.

## Grants Help to Transform the Watershed

The group's pilot project objective was to further the Dark Shade area's economic growth and provide areas for recreational activities. The group wanted to install AMD treatment systems on land that could double as community parks, and transform the Dark Shade valley brownfields into usable land for commercial businesses and recreational trails. The EPA brownfields grant enabled the communities of Central City and Shade Township to work with the U.S. Department of Interior's Office of Surface Mining (OSM), the U.S. Department of Agriculture, Pennsylvania Department of Community Economic Development, AMD & ART, and coal companies to clean up and redevelop numerous sites in the project area. The pilot grant also helped launch the Shade Creek Watershed Association, an organization of local community residents that leads community education and coordinates continuous stream sampling.

Since 1999, the project partners have received more than \$1 million in grant funds from the EPA, Pennsylvania's Growing Greener Program, OSM, the Pennsylvania Department of Environmental Protection and others to support a variety of restoration projects in the watershed. For example, the Shade Creek Watershed Association frequently doses small tributaries within the watershed with limestone rock and dust as a temporary measure to help raise the waters' pH levels. On a larger scale, the partners removed a number of coal waste piles and restored the land underneath. At one site, the exposed land became a game feeding plot. At another, the partners transformed the land into a park, complete with a walking trail and volleyball court. The partners have installed numerous passive treatment systems for acid mine drainages, including an anoxic limestone dosing system and a bioreactor treatment system that uses biological matter such as mushroom compost and decomposing vegetation to treat the water as it moves through a series of ponds. The Shade Creek Watershed Association plans to install an interpretive trail at the bioreactor site.

A series of additional treatment system and coal waste pile removal projects are currently underway or in the planning stages. For example, at one site, coal waste covers 3.4 acres and is spilling over directly into Dark Shade Creek (see photos, next page). The partners will remove two acres of that waste (18,183 tons) and sell it to a cogeneration plant (which produces both electricity and heat)

for approximately \$65,000. The remaining coal waste will be capped. The revenue from the coal sale will help pay for the project.

In the near future, the partners hope to address “the big four” acid mine discharge sites, explains Sharon Harkcom, project manager for the Borough of Central City. These four sites are all within one-half to three-quarters of a mile of each other and include two of the worst discharges in the watershed. “It makes sense to try to address them all at once,” notes Harkcom. “Fixing these discharges would significantly improve water quality.” However, the project is currently limited by a lack of available land to support a passive treatment system (e.g., limestone-lined trenches, etc.), and a lack of funding to treat it with a costly active treatment system (e.g., a system requiring periodic chemical injections to precipitate metals out of solution).

### *Making Progress*

Water quality in some areas of the Dark Shade Creek Watershed is improving. Monitoring data collected by the Shade Creek Watershed Association have shown that the pH of waterways below several new treatment systems is at acceptable levels. Native trout are appearing again in streams that once ran orange with acid mine drainage. “We are seeing fish in Shingle Run again for the first time in more than 100 years,” notes Harkcom. Feed plots for local fauna and community parks now stand where abandoned coal refuse piles once towered. The projects have brought jobs to the watershed, and residents of Central City and Shade Townships are realizing aesthetic and recreational benefits. “However, much work remains to be done,” adds Harkcom. “The problems are so extensive—we are working steadily to address as many as we can.” Fortunately, the Dark Shade Creek watershed is home to many determined individuals who are seeking to reclaim their mine-scarred lands.

*[For more information, contact Sharon Harkcom, Borough of Central City, 314 Central Avenue, Central City, PA 15926. Phone: 814-754-8290; E-mail: [skharkcom@yahoo.com](mailto:skharkcom@yahoo.com)]*



**Portions of this 3.4-acre coal waste pile are spilling directly into Dark Shade Creek.**

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## *Christina River Basin Project Exceeds Restoration Goals*

Patience and determination are paying off in the Christina River. Five years after receiving a \$1 million targeted watershed grant from the U.S. Environmental Protection Agency (EPA), the Christina River Basin Clean Water Partnership in Pennsylvania and Delaware has implemented

numerous projects to remove pollution from stormwater runoff. The group wisely used the grant money to leverage additional funds for its efforts—for every federal dollar they received, the Partnership leveraged more than two dollars, allowing them to exceed their original project goals. Although the targeted watershed grant period ended in 2007, the momentum provided by the project has continued.

### *Partnership History and Goals*

In the mid-1990s, a diverse group of federal, state and local government, nonprofit groups and academic institutions came together to form what would eventually be known as the Christina Basin Clean Water Partnership. The group coordinates efforts to protect the water quality in the 565-square mile Christina River basin, which provides drinking water to 500,000 people in Delaware, Pennsylvania and Maryland. The basin includes rapidly developing rural and suburban areas, and also serves as home for many major manufacturing, chemical, cable, steel, paperboard and pharmaceutical industries.

### **Targeted Watersheds Grant Program**

Established in 2003, EPA's targeted watersheds grant (TWG) program was designed to encourage successful community-based approaches and management techniques to protect and restore the nation's watersheds. EPA awarded targeted watersheds grants to 61 organizations between 2003 and 2007. Funding for new TWG projects ceased in 2008. Winning projects typically included a variety of methods for addressing watershed concerns, such as water quality trading, agricultural best management practices, wetland and riparian restoration, nutrient management, fish habitat restoration and public outreach and education. Each watershed organization involved diverse stakeholders including those from academia, local and state governments, tribes and nonprofit organizations. For more information, see [www.epa.gov/twg](http://www.epa.gov/twg).

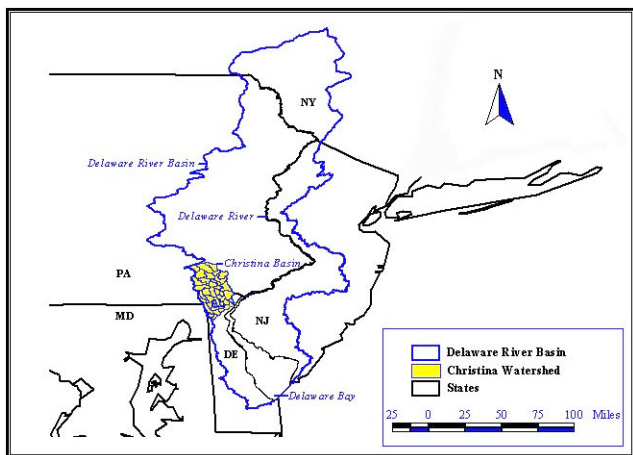
In 1994, the Partnership developed a watershed-wide, multiphase clean water strategy to achieve a long-term goal of restoring the water quality of all waterways in the Christina River basin to their protected designated uses by 2015. This strategy addresses water quality problems through voluntary watershed and water quality planning, management activities, and point and nonpoint source total maximum daily load implementation. The Partnership ultimately submitted this plan as part of its successful application for one of EPA's first targeted watershed grants in 2003.

### *Grant Provided Momentum for Success*

The \$1 million targeted watershed grant provided the Partnership with the foundation it needed to seek additional funding. In fact, for every single federal dollar it received, the group raised an additional two dollars worth of local match and funding from local and private sources. This allowed Christina Basin partners to exceed their original project goals, some by more than 50 percent.

For example, the Partnership planned to restore 5,000 feet of stream in Delaware—but ended up restoring almost 9,000 feet in that state. Some of the group's on-the-ground projects in Delaware, Pennsylvania and Maryland include:

- Installed 10 stormwater retrofits
- Installed approximately 8,000 feet of stream fencing
- Planted 50 "Smartyards," which use native plant species to reduce runoff (see [www.delawarenatureociety.org/smartyards.html](http://www.delawarenatureociety.org/smartyards.html))
- Implemented 10 nutrient management control plans on more than 1,000 acres of farmland
- Restored more than 10,000 feet of stream
- Added seven nutrient management control systems on farmland
- Built eight water control structures on six farms
- Installed approximately 730 acres of soil conservation practices on eight farms
- Installed 2,250 feet of waterway diversions on three farms



**The Christina River watershed drains a 565-square mile area within the greater Delaware River watershed and provides more than 100 million gallons of water per day for more than half a million people in three states.**

The targeted watershed grant also helped to support an annual conference, numerous watershed meetings, public outreach events, publications, storm drain stenciling efforts, annual bus tours and best management practice site monitoring. The Partnership's "December 2008 Christina Basin Targeted Watershed Grant Final Report" ([www.wra.udel.edu/files/TWG\\_Report\\_1\\_6\\_09\\_Final\\_ALL.pdf](http://www.wra.udel.edu/files/TWG_Report_1_6_09_Final_ALL.pdf)), describes all of the projects supported by the targeted watershed grant, and includes chapters about lessons learned and next steps.

The partners consider the project to be successful on many fronts. "Our interstate partnership created jobs and worked with farmers, homeowners and schools from Wilmington to the West Brandywine and exceeded our watershed restoration goals, a pleasing development given the Christina Basin is the source of over 60 percent of Delaware's drinking water and the home of the First State's only six trout streams," said Gerald Kauffman, director of University of Delaware's water resources agency. The Partnership will continue to monitor water quality over time. Data show some improvements already, although most of the restoration projects were implemented too recently to judge what the cumulative long-term water quality results might be.

### *The Future Looks Bright*

The targeted watershed grant expired in 2007; however, the Partnership continues to promote state, county and local water quality initiatives in Pennsylvania and Delaware, including the Christina Basin Pollution Control Strategy and the Chester County Watersheds Plan. "The targeted watershed grant was especially valuable because it allowed us to prove that we could exceed our restoration goals if we have the resources," explained Kauffman. "Now, we want to continue the momentum."

To that end, the Partnership is applying for grants to support its efforts for the next few years. The partnership hopes to fund 125 green jobs using stimulus funds from the American Recovery and Reinvestment Act of 2009 from sources such as EPA, U.S. Department of Agriculture and the National Oceanic and Atmospheric Administration. The group is also developing ideas for potential sustainable funding sources that could support its basin restoration efforts indefinitely. The final proposal will likely be a combination of sources that might include water allocation fees, bi-state stormwater utility fees, permit fees and pollutant taxes. The Partnership is also working with several basin municipalities to assess the possibility of joining forces to pool funding and collectively implement stormwater management programs and public education efforts. Once a stable funding source is in place, the Partnership will forge ahead with its efforts to implement projects in six key areas, including stormwater management, open space protection, wastewater improvements, agricultural management, environmental education and land use planning.

“We have made considerable progress over the past few years—but we still have a long way to go,” notes Kauffman. The partners will continue to work toward the original 1994 goal to restore all impaired waters in the Christina River basin by 2015; however, the partners recognize that fully meeting this goal is unlikely. Instead, the partners are currently developing some incremental targets over the next 10 years, explains Kauffman. “If we can establish sustainable funding to support our ongoing restoration efforts, I think we can feasibly restore at least 50 percent of the basin’s impaired streams by 2020.”

*[For more information, contact Gerald Kauffman, University of Delaware, Institute for Public Administration, Water Resources Agency, 180 Graham Hall, Newark, DE 19716. Phone: 302-831-4925; E-mail: [jerryk@udel.edu](mailto:jerryk@udel.edu)]*

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## Notes on Education

### *Curriculum Introduces Students to Integrated Pest Management*

Schools around Connecticut are expanding their environmental education programs to include a concept often reserved for farmers and employees of pest control and landscaping companies—integrated pest management (IPM). The University of Connecticut’s Department of Plant Science has completed an IPM curriculum for elementary and middle school grades. Students learn what pests are, how to control them and how to protect the environment. The comprehensive IPM curriculum is especially relevant to science programs but also links to language arts, social studies, math and art.

#### *A Decade in the Making*

In 2000, the University of Connecticut received funding from the Bingham Trust to develop an IPM environmental education curriculum based on information developed by the University’s IPM Program. In 2006, the Northeast IPM Center awarded the University a grant to expand this curriculum to reach students in multiple grade levels across Connecticut and beyond. “Communicating IPM information and techniques can help students and their families learn how they can keep the environment safe and healthy in and around their homes, buildings, farmland and natural areas,” explains senior extension educator Donna Ellis.

#### **What is IPM?**

Integrated Pest Management (IPM) is an effective and environmentally sensitive approach to managing pests that relies on a combination of practices. IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property and the environment. The IPM approach can be applied to both agricultural and nonagricultural settings, such as the home, garden and workplace. IPM takes advantage of all appropriate pest management options, including the careful use of pesticides.

The curriculum teaches students to identify pests (insects, weeds and pathogens), understand how to control them (using mechanical, biological, chemical and cultural controls), and find ways to protect the environment by keeping food and water safe and preserving biological diversity. Each grade-level curriculum introduces age-appropriate topics, such as recognizing and safely controlling invasive weeds, or reducing infestations of Colorado potato beetles in the family garden.



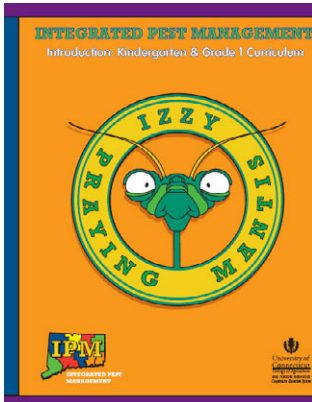
Although not the only IPM curriculum available, the University of Connecticut's curriculum is thought to be one of the most comprehensive in the nation.

### Curriculum Contents

The University has completed IPM curriculum materials for all of elementary and middle school grades except 5th and 6th (currently under development). The University plans to create a unit for high school in the future. Each curriculum unit includes a box with introductory material, lesson plans, background materials, picture cards, activity books, reading books, videos/DVDs, assessment sheets and an Izzy hand puppet (grades K-3). "The curriculum materials were designed by a team of experienced teachers who were also curriculum specialists," explained Ellis. "The teachers worked with our IPM staff to develop engaging and entertaining lesson plans that effectively teach the methods and implementation of IPM to students."

Each area in the curriculum is aligned with the Connecticut Frameworks (Connecticut's curricular goals and standards) and the National Science Standards, notes Ellis. "In Connecticut, the teachers essentially can't use any curriculum unless it aligns with one or more of the Connecticut standards, so our production team developed the IPM curriculum to be as widely applicable as possible."

The curriculum provides all of the background information that a teacher needs, plus offers detailed outlines for multiple lessons. Teachers can use each lesson individually as a stand alone activity or can combine lessons to develop a particular concept in some depth. Each section identifies which lessons present the core concepts of IPM. Every lesson within the curriculum includes resources, references and support materials. "The teachers report that they are very pleased with the organization and structure of the curriculum," adds Ellis. "Plus, the students enjoy it!"



The cover of the IPM Grades K & 1 curriculum features Izzy the praying mantis, the program's prominently featured mascot.

### Acquiring Curriculum Materials

Each boxed curriculum kit is valued at approximately \$300. Teachers in Connecticut who attend a training workshop (\$25 registration fee) receive a free copy of the grade-appropriate curriculum to take back to their school. The IPM curriculum team has offered a few workshops in neighboring states upon request. To date, the University has distributed more than 260 kits to teachers in Connecticut, Massachusetts and other states. A limited number of boxed curriculum materials might be available for teachers or organizations outside of the northeast—please contact the University of Connecticut's Department of Plant Science for more information. Fortunately, the IPM curriculum team has posted the information for each grade level curriculum online at [www.hort.uconn.edu/IPM/curriculum/currintro.html](http://www.hort.uconn.edu/IPM/curriculum/currintro.html). Interested individuals and schools may download this information for free. Ellis expects that the curriculum could be adapted fairly easily to other states.

### Similar Programs Expected to Expand throughout the Northeast

Pleased by the success of Connecticut's program, the Northeastern IPM Center has convened a School IPM Implementation Working Group. The group is using the Connecticut curriculum as a foundation and is working to spread similar programs and curricula through all northeastern schools. Additionally, the Northeastern IPM Center's School IPM Implementation Working Group is striving to help northeastern states meet the national goal of implementing IPM practices in all U.S. schools by 2015. This is a new effort to reduce the use of pesticides in and around schools (see box for more details). For more information on the regional IPM centers, see [www.ipmcenters.org](http://www.ipmcenters.org).

[For more information, contact Donna Ellis, University of Connecticut, Department of Plant Science Unit 4163, Storrs, CT 06269. Phone: 860-486-6448; E-mail: [donna.ellis@uconn.edu](mailto:donna.ellis@uconn.edu).]

### School IPM 2015: Improving Pest Control in Schools

The Environmental Protection Agency, the U.S. Department of Agriculture, the Regional IPM Centers, and the IPM Institute of North America recently released a new plan, called "School IPM 2015: a Strategic Plan for Integrated Pest Management in Schools in the United States." The partners expect the plan to reduce both pest complaints and pesticide use in the nation's schools by 70 percent by 2015. Through a better understanding of pest biology, inspection, monitoring, and prevention, the plan will help reduce schools' pesticide residues, pest problems, and pest-related allergens, while also improving student health and attendance. For more information, see [www.ipminstitute.org/school\\_ipm\\_2015.htm](http://www.ipminstitute.org/school_ipm_2015.htm).

## ***Reviews and Announcements***

### *Coastal Wetlands Lost in Eastern U.S.*

While the nation as a whole gained freshwater wetlands from 1998 to 2004, a new report by the National Oceanic and Atmospheric Administration and the U.S. Fish and Wildlife Service documents a continuing loss of coastal wetlands in the eastern United States. The new report, “Status and Trends of Wetlands in the Coastal Watersheds of the Eastern United States,” shows a loss of 59,000 acres each year in the coastal watersheds of the Great Lakes, Atlantic Ocean and Gulf of Mexico from 1998 to 2004. The report cites the high populations in the coastal areas as a key reason for this wetland loss. More than half of the nation’s population lives in coastal counties in densities five times greater than inland counties—building roads, homes and businesses to support these populations destroys wetlands. The report notes that restoring wetlands is also more difficult in coastal areas where land values are high and factors such as storms hamper restoration efforts. The report is available at [www.nmfs.noaa.gov/habitat](http://www.nmfs.noaa.gov/habitat).

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### *EPA Offers New Climate Change and Water E-Newsletter*

The EPA National Water Program has created a new electronic newsletter or “listserve” covering news and information related to water programs and climate change. The e-newsletter will provide short articles and links to other related Web sites weekly. The e-newsletter is part of a larger effort to inform clean water and drinking water program managers about climate change topics, issues and opportunities called for in the recent “National Water Program Strategy: Response to Climate Change.” To subscribe to the climate change and water e-newsletter, see [www.epa.gov/ow/climatechange](http://www.epa.gov/ow/climatechange).

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### *Helping Horse Owners Manage Manure*

The Livestock and Poultry Environmental Learning Center now offers a series of Web-based resources on how to manage horse manure (see [www.extension.org/pages/Managing\\_Horse\\_Manure](http://www.extension.org/pages/Managing_Horse_Manure)). Topics include stall waste, barnyards, storing manure, spreading manure, off-farm disposal options and pasture management. The articles include an overview of each topic and provide links to additional information and resources.

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### *Low Impact Development Fact Sheet Updated*

EPA recently updated the fact sheet titled “Incorporating Environmentally Sensitive Development into Municipal Stormwater Programs.” Although developed for EPA Region 3, the fact sheet includes concepts applicable nationwide. It explains how municipalities can encourage or require low impact development practices to meet stormwater goals. The fact sheet is available on EPA’s municipal stormwater Web site ([www.epa.gov/npdes/stormwater/municipal](http://www.epa.gov/npdes/stormwater/municipal)) or directly at [www.epa.gov/npdes/pubs/region3\\_factsheet\\_lid\\_esd.pdf](http://www.epa.gov/npdes/pubs/region3_factsheet_lid_esd.pdf).

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### *National Ocean Service Offers Online Estuary Game*

The National Oceanic and Atmospheric Administration’s National Ocean Service recently released a new educational online game called “WaterLife: Where Rivers Meet the Sea” (see <http://games.noaa.gov/oscar>). Designed for 4th through 7th graders, the Web-based game introduces science-based educational concepts; raises awareness and interest in topics dealing with estuaries, water quality, tides, and marine debris; and explains what individuals can do to help. The game occurs inside the ecosystem of an estuary on the west coast of the United States. Following a young girl named Valerie, players interact with Oscar the sea otter and the Claminator, a large saltwater clam species known as a geoduck clam. To succeed, players must learn about food webs, understand why estuaries are essential to both ocean life and to humans, and recognize the factors that produce healthy estuaries.

## National Water Program Releases New Online Video

The National Water Program, a partnership of land grant colleges and universities and the U.S. Department of Agriculture's Cooperative State Research, Education, and Extension Service, just released its latest issue of "The Fluid Planet," an online video series. Available at [www.csrees.usda.gov/newsroom/partners/fluid\\_planet.html](http://www.csrees.usda.gov/newsroom/partners/fluid_planet.html), the videos highlight efforts to improve water quality and quantity. Featured programs include:

- The Rio Grande Basin Initiative is funding conservation projects at Texas A&M University and New Mexico State University to balance increasing demands on the Rio Grande River.
- The University of Idaho snow-pack study is helping forestland managers understand the impact of timber harvests on snowmelt and water supplies in the West.
- A team from three universities—Rutgers, Cornell and Virginia Tech—is touting the benefits of rain gardens for businesses and backyards to filter pollutants from storm water runoff.
- Researchers in New Mexico are studying new and old systems that use the Rio Grande River for irrigation. They're testing state-of-the-art drip lines and ancient community waterway canals.

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## Online Game Features Vermicomposting

The California Integrated Management Waste Board offers "The Adventures of Vermi the Worm," an animated, interactive online game that teaches the basics of vermicomposting and its benefits, plus other waste management strategies such as the "3Rs"—reduce, reuse and recycle. In vermicomposting, red worms consume food scraps and other organic matter and excrete it as worm manure, an organic material rich in nutrients that looks like fine-textured soil. Kids can go on an adventure with Vermi as he visits a school garden and hooks up with his buddies, Bubba the Worm, Hugh Hammer, Sunny Flower, and Trashcan. At each stop, kids will learn something about vermicomposting or the 3Rs. At the worm bin, kids will help regulate a worm's habitat; at the garden they'll do an experiment using vermicompost; with Trashcan they'll make choices on how to reduce, reuse, recycle and vermicompost items that sometimes end up in the garbage; and more. For more information, see [www.ciwmb.ca.gov/Vermi](http://www.ciwmb.ca.gov/Vermi).

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## Researchers Compare Mercury Levels in Watersheds

The U.S. Geological Survey (USGS) recently published three articles on mercury transport, biogeochemical processes and bioaccumulation in stream ecosystems in *Environmental Science & Technology*. The USGS studied eight streams in Oregon, Wisconsin and Florida from 2002 to 2006. Although all eight streams receive mercury predominantly via atmospheric deposition, watershed characteristics primarily determine mercury transport and bioaccumulation in these streams. Key factors include (1) the abundance of wetlands, which influence how much of the atmospherically deposited mercury is converted to methylmercury (the most toxic, bioaccumulative form of mercury); and (2) runoff of dissolved organic carbon and suspended sediment, which control how much mercury and methylmercury is delivered to the streams. Findings show that the relative amount of methylmercury in streams is strongly correlated with streamflow and the production of methylmercury in the watersheds (particularly in wetland areas), which is subsequently transported in runoff to streams. An unexpected finding was that methylmercury production in channel sediments appears to be relatively unimportant for governing within-stream methylmercury levels. Methylmercury concentrations increase with each trophic level in the food chain. For more information, see <http://water.usgs.gov/nawqa/mercury/pubs>.

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## Report Investigates Influences on Shallow Aquifer Water Quality

The U.S. Geological Survey collected and analyzed data from more than 400 wells in the shallow regional unconfined aquifer in the Northern Atlantic Coastal Plain (New York through North Carolina) to assess what natural and human factors influenced water quality. They studied concentrations of nitrate and selected pesticide compounds and volatile organic compounds found in

groundwater to see if these are related to likely influences, such as observed geochemical patterns, surface land use, soil types and hydrogeology. The study results demonstrate that understanding geochemical information and distribution of potential pollution sources will help predict the regional occurrence of selected compounds in unconfined aquifers. For more information, see the report “Natural and Human Influences on Water Quality in a Shallow Regional Unconsolidated Aquifer, Northern Atlantic Coastal Plain,” at <http://md.water.usgs.gov/publications/sir-2008-5190>.

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### *Report Shows Some Cities Shifting to Redevelopment*

EPA recently released “Residential Construction Trends in America’s Metropolitan Regions,” a report that examines building trends in the 50 largest metropolitan areas from 1990 to 2007 (see [www.epa.gov/smartgrowth/construction\\_trends.htm](http://www.epa.gov/smartgrowth/construction_trends.htm)). The report shows that while a large share of new residential construction took place on previously undeveloped land at the urban fringe, more than half of the county’s larger metro regions saw a sharp increase in residential building in urban core areas. The clear trend toward more redevelopment has key implications for smart growth. First, regions often cited as leaders in promoting growth management and redevelopment (Portland, Denver, Sacramento and Atlanta) are among the medium-sized cities where the shift inward has been most dramatic. Second, in metropolitan regions with large and diverse central cities with strong ties to the global economy (New York, Chicago, Boston, Miami, Los Angeles), the market fundamentals have shifted toward redevelopment even in the absence of formal policies and programs at the regional level. EPA believes this trend reflects growing appreciation in many communities for smart growth development that reuses already-developed property and infrastructure, protects air and water quality, and preserves natural lands and critical environmental areas.

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### *Soil Education Materials Available*

The National Association of Conservation Districts (NACD) is offering “DIG IT! The Secrets of Soil” education materials through its online store ([www.nacdstore.org/soileducation.html](http://www.nacdstore.org/soileducation.html)). The materials correspond with NACD’s 2009 Stewardship Week theme and the Smithsonian’s National Museum of Natural History’s ongoing soil exhibit. Materials include books, workbooks, posters, bookmarks and activity placemats. Prices range from \$8 to \$20.

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### *Video Highlights Green Methods to Control Stormwater Runoff*

EPA and the U.S. Botanic Garden have produced an online video, “Reduce Runoff: Slow It Down, Spread It Out, Soak It In,” highlighting the use of rain gardens, green roofs, rain barrels and cisterns to manage stormwater runoff. Green stormwater management practices not only reduce the volume of runoff at its source by capturing harmful pollutants but also improve air quality by planting trees to absorb erosion, reduce the urban heat islands effect and a community’s carbon footprint. The video highlights the green techniques displayed at the U.S. Botanic Garden’s 2008 Exhibit and at EPA headquarters in Washington, D.C. To watch the video, go to [www.epa.gov/nps/lid](http://www.epa.gov/nps/lid). For more information on stormwater management, go to [www.epa.gov/greeninfrastructure](http://www.epa.gov/greeninfrastructure).

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### *Watch “Poisoned Waters” Online*

PBS’ FRONTLINE aired “Poisoned Waters,” a program about Puget Sound and the Chesapeake Bay, on April 21, 2009. This program is now available online at [www.pbs.org/wgbh/pages/frontline/view](http://www.pbs.org/wgbh/pages/frontline/view). With polluted runoff still flowing in from industry, agriculture and massive suburban development, scientists fear contamination to the food chain and drinking water for millions of people. A growing list of endangered species is also threatened in both estuaries. As President Barack Obama, Congress and states set new agendas and spending priorities, FRONTLINE correspondent Hedrick Smith examines the rising hazards to human health and the ecosystem, and explains why it’s so difficult to keep our waters clean.

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## Web-based Tool Interprets Water Quality Data

Colorado State University's Water Quality Interpretation Tool (<http://wsprod.colostate.edu/cwis435/index.cfm>) helps people evaluate the quality of water for drinking, irrigation or livestock use by comparing water quality data provided by a certified laboratory with Colorado-specific and federal water quality standards. Although designed for use in Colorado, the tool presents valuable information about the suitability of water quality for particular uses and has wider applicability.

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## Recent & Relevant Periodical Articles

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### *Aquatic Invasive Species*

The spring 2009 issue of the national newsletter *Volunteer Monitor* ([www.epa.gov/owow/monitoring/volunteer/issues.htm](http://www.epa.gov/owow/monitoring/volunteer/issues.htm)) focuses on aquatic invasive species. Articles include examples of case studies and techniques that volunteer monitors are using to assess the presence of aquatic invasive species, and precautions that monitors are taking to prevent cross-contamination of waterbodies.

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### *From Golf to Gulf, Drainage Industry Greens*

This article, published in the January 2009 issue of the U.S. Department of Agriculture's *Agricultural Research* magazine ([www.ars.usda.gov/is/AR/archive/jan09/drainage0109.htm](http://www.ars.usda.gov/is/AR/archive/jan09/drainage0109.htm)), discusses the efforts by scientists at six Agricultural Research Service laboratories in five states to bring three industries together with agribusiness to clean drainage water before it contributes to water quality problems in the Gulf of Mexico and elsewhere. The article discusses scientists' efforts to use filter cartridges on golf course drainage pipe outlets to remove nutrients and pesticides before they reach streams. The article also discusses using industrial products/byproducts as filtering materials for water draining off farm fields, where filter cartridges aren't practical.

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### *Stormwater Management in Arid and Drought-Prone Regions*

This article, featured in the January-February 2009 issue of *Stormwater* magazine ([www.stormh2o.com/january-february-2009/rainwater-harvesting-reuse.aspx](http://www.stormh2o.com/january-february-2009/rainwater-harvesting-reuse.aspx)), discusses how cities in arid regions are changing their stormwater management practices in response to the declining availability of water.

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### *Watershed Management in the Southwest U.S.*

The March/April 2009 issue of *Southwest Hydrology* ([www.swhydro.arizona.edu/archive/V8\\_N2/SWHVol8Issue2.pdf](http://www.swhydro.arizona.edu/archive/V8_N2/SWHVol8Issue2.pdf)) focuses on various topics related to watershed management in the southwestern United States. This issue includes articles that discuss groundwater, landscape changes, hydrology and land management, native trout management, watershed effects of fire, and restoration in New Mexico uplands and floodplains.

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## Web Sites Worth a Bookmark

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### *California's Nonpoint Source Encyclopedia* ([www.waterboards.ca.gov/water\\_issues/programs/nps/encyclopedia.shtml](http://www.waterboards.ca.gov/water_issues/programs/nps/encyclopedia.shtml))

This encyclopedia is a free online reference guide designed to convey information about basic nonpoint source (NPS) pollution control and to provide quick access to essential resources. The NPS Encyclopedia homepage describes how to use the guide and offers an index of each land use category. It also lists applicable laws, policies and ordinances. Each land use category Web page contains an index of relevant management measures, general technical and financial resources, programs and references. Although designed for California, this online resource offers valuable information for anyone looking to be educated about NPS pollution.

## Low Impact Development Urban Design Tools ([www.lid-stormwater.net](http://www.lid-stormwater.net))

Designed by the nonprofit Low Impact Development (LID) Center, this Web site provides guidance to local governments, planners, and engineers for developing, administering, and incorporating LID into their aquatic resource protection programs. Visitors can select icons to view sketches of a number of LID techniques dispersed throughout general land use settings to help them choose LID techniques for their site.

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## Midwest Organic and Sustainable Education Service ([www.mosesorganic.org/resources.html](http://www.mosesorganic.org/resources.html))

Midwest Organic and Sustainable Education Service (MOSES) is a nonprofit education and outreach organization working to promote sustainable and organic agriculture. MOSES offers a diverse menu of free and affordable resources for farmers interested in learning more about organic farming. Farmers just starting the process can access fact sheets and guidebooks on organic certification, how to transition to organic crop production, how to choose a certification agency and available grant opportunities.

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## Picturing Smart Growth ([www.nrdc.org/smartgrowth/visions](http://www.nrdc.org/smartgrowth/visions))

The Natural Resources Defense Council (NRDC) and Urban Advantage partnered to develop an eye-opening Web site about smart growth potential. Using photo-editing software, Urban Advantage transformed pictures of communities from all over the country to show how they could become more aesthetically pleasing, walkable neighborhoods. Visitors to the NRDC Web site are presented with photo slideshows that progressively show possible changes, such as adding sidewalks, streets trees, bike lanes and mixed use buildings to an existing site. The Web site offers five featured scenarios, which provide detailed explanations and photos of how a particular site might be improved through smart growth principles. Visitors can also see a snapshot of what smart growth changes could look like at an additional 70 sites across the country via a Web mashup. Links provide visitors with more smart growth information and resources.

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## StormUlator ([www.stormulator.com](http://www.stormulator.com))

This free online runoff calculator estimates what practices might be needed to keep pre- and post-runoff volume the same on a particular site. The StormUlator is a public awareness tool developed by the California State Water Resources Control Board, University of California—Davis and the California Sea Grant Program.

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## Watershed Forestry Resource Guide ([www.forestsforwatersheds.org](http://www.forestsforwatersheds.org))

This Center for Watershed Protection-sponsored site serves as a central source for resources related to forests and watersheds, and offers fact sheets, slideshows, training exercises and other tools, as well as links to research papers, reports and relevant Web sites. The site was developed in cooperation with the U.S. Department of Agriculture's Forest Service - Northeastern Area, with supplemental funding from The Home Depot Foundation.

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## Calendar

For an updated events calendar,  
see [www.epa.gov/newsnotes/calendar.htm](http://www.epa.gov/newsnotes/calendar.htm).

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### June 2009

5/29–6/1

*2009 National River Rally*, Baltimore, MD. For more information, see [www.rivernetwork.org/rn/rally](http://www.rivernetwork.org/rn/rally).

6/2–4

*Professional Development Workshop: Natural Channel Design Principles*, Asheville, NC. For more information, see [www.ncsu.edu/srp/rc\\_200.html](http://www.ncsu.edu/srp/rc_200.html).

6/7–12

*Association of State Floodplain Managers' 33rd Annual National Conference: Green Works to Reduce Flood Losses*, Orlando, FL. For more information, see [www.floods.org/conferences,%20Calendar/Orlando.asp](http://www.floods.org/conferences,%20Calendar/Orlando.asp).

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- 6/14–17 *National Association of Resource Conservation and Development (RC&D) National Conference*, Albuquerque, NM. For more information, see <http://rcdnet.org/nationalconference.php>.
- 6/14–18 *AWWA Annual Conference & Exposition*, San Diego, CA. For more information, see [www.awwa.org/ace09](http://www.awwa.org/ace09).
- 6/16–17 *Professional Development Workshop: Riparian Planning and Design*, Raleigh, NC. For more information, see [www.ncsu.edu/srp/rc\\_200.html](http://www.ncsu.edu/srp/rc_200.html).
- 6/22–25 *11th Annual Region 6 MS4 Operator's Conference*, Houston, TX. For more information, see [www.houstonbeautiful.org](http://www.houstonbeautiful.org).
- 6/23 *EPA Webcast: Managing Wet Weather with Green Infrastructure—(1) Funding & Incentives and (2) Brownfield Redevelopment*. For more information, see [www.epa.gov/npdes/training](http://www.epa.gov/npdes/training).
- 6/23–26 *GIS Tools for Strategic Conservation Planning*, Charleston, SC. For more information, see [www.conservationfund.org/training\\_education/upcoming\\_training\\_courses](http://www.conservationfund.org/training_education/upcoming_training_courses).
- 6/29–7/1 *Adaptive Management of Water Resources II*, Snowbird, UT. For more information, see [www.awra.org](http://www.awra.org).

## July 2009

- 7/7–10 *Interdisciplinary Environmental Conference*, Daytona Beach, FL. For more information, see [www.ieaonline.org](http://www.ieaonline.org).
- 7/9–11 *Urban Water Management: Issues and Opportunities*, Chicago, IL. For more information, see [www.isws.illinois.edu/hilites/confinfo/ucowr](http://www.isws.illinois.edu/hilites/confinfo/ucowr).
- 7/11–15 *Soil and Water Conservation Society's 2009 Annual Conference*, Dearborn, MI. For more information, see [www.swcs.org/en/conferences/2009\\_annual\\_conference](http://www.swcs.org/en/conferences/2009_annual_conference).
- 7/13–16 *Looking Beyond the Transportation Footprint—New Partners / New Scales*, Shepherdstown, WV. For more information, see [www.conservationfund.org/course/looking\\_beyond\\_transportation\\_footprint\\_new\\_partners\\_new\\_scales](http://www.conservationfund.org/course/looking_beyond_transportation_footprint_new_partners_new_scales).
- 7/19–23 *Coastal Zone 2009, Revolutionary Times: Catching the Wave of Change*, Boston, MA. For more information, see [www.csc.noaa.gov/cz](http://www.csc.noaa.gov/cz).
- 7/20–24 *3rd National Conference on Ecosystem Restoration*, Los Angeles, CA. For more information, see [www.conference.ifas.ufl.edu/NCER2009](http://www.conference.ifas.ufl.edu/NCER2009).
- 7/28 *EPA Webcast: Managing Wet Weather with Green Infrastructure—(1) Retrofits: Green Streets and (2) Operation & Maintenance*. For more information, see [www.epa.gov/npdes/training](http://www.epa.gov/npdes/training).
- 7/28–30 *Professional Development Workshop: Introduction to Taxonomy and Pollution Ecology of Aquatic Insects*, Asheville, NC. For more information, see [www.ncsu.edu/srp/ept\\_workshop.html](http://www.ncsu.edu/srp/ept_workshop.html).

## August 2009

- 8/3–7 *Fifth International Soil and Water Assessment Tool (SWAT) Conference*, Boulder, CO. For more information, see [www.brc.tamus.edu/swat/conf\\_5th.html](http://www.brc.tamus.edu/swat/conf_5th.html).
- 8/9–12 *TMDL 2009: Combining Science and Management to Restore Impaired Waters*, Minneapolis, MN. For more information, see [www.wef.org/ConferencesTraining/ConferencesEvents/TMDL](http://www.wef.org/ConferencesTraining/ConferencesEvents/TMDL).
- 8/10–13 *Visions of a Sustainable Mississippi River: Merging Ecological, Economic, and Cultural Values*, Collinsville, IL. For more information, see [www.conferences.uiuc.edu/mississippiriver](http://www.conferences.uiuc.edu/mississippiriver).
- 8/13 *Professional Development Workshop: Management of Invasive and Exotic Vegetation in Riparian Areas*, Raleigh, NC. For more information, see [www.ncsu.edu/srp/rc\\_400.html](http://www.ncsu.edu/srp/rc_400.html).
- 8/16–20 *StormCon 2009*, Anaheim, CA. For more information, see [www.stormcon.com/sc.html](http://www.stormcon.com/sc.html).
- 8/23–27 *Farming Systems Design 2009*, Monterey, CA. For more information, see [www.iemss.org/farmsys09](http://www.iemss.org/farmsys09).

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