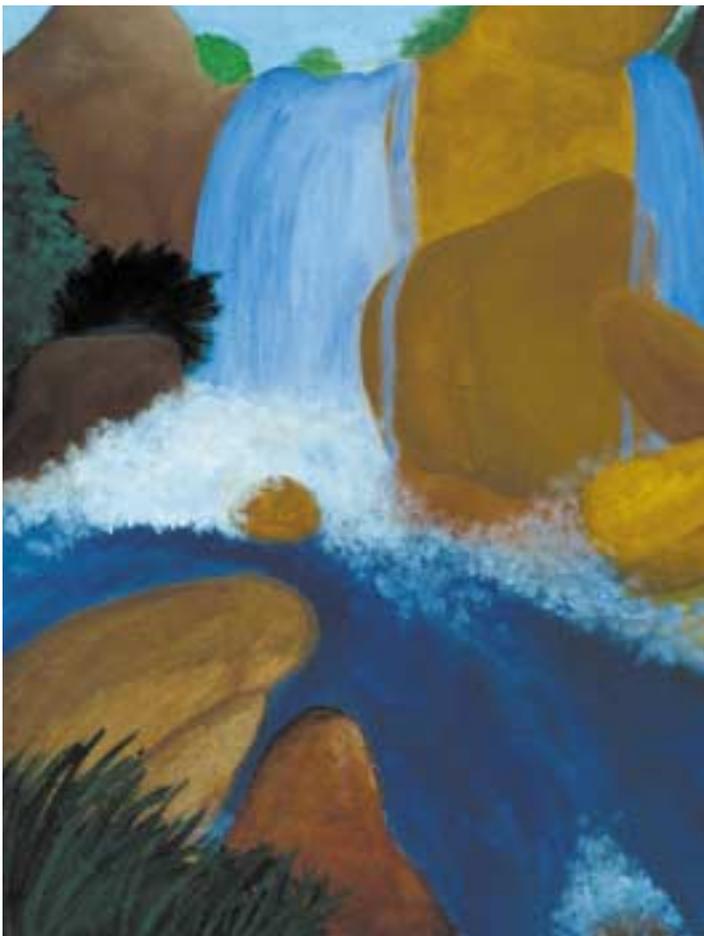


# How is the Watershed Approach Working?



*Waterfall*  
Jennie Fong  
Grade 11  
Archbishop Mitty High School  
San Jose, California

This section examines local, state, tribal, and federal use of the watershed approach to address the threats presented in the previous section. How well is the watershed approach working? This section reports the successes and shortcomings of selected local watershed efforts and governmental programs to date.

Many perspectives inform this report. The information and opinions in this chapter and the next reflect comments from local watershed stakeholders and studies from university scholars and state, tribal, and federal governments. Two groups deserve special recognition for contributing ideas to this report. A series of Regional Watershed Roundtable discussions has provided invaluable insights from diverse groups of watershed stakeholders. These roundtable discussions, building blocks to a National Watershed Forum in the summer of 2001, provide opportunities for dialogue about issues, an exchange of information, and collaboration on watershed protection and restoration projects. As of December 31, 2000, more than 1,000 people had participated in Regional Watershed Roundtable discussions at more than 20 locations.

The second group, a Watershed Reinvention workgroup, identified opportunities to orient federal programs and processes on a watershed basis and make these programs



more flexible, collaborative, and innovative. Federal watershed practitioners from all agencies and departments that impact water quality participated in the workgroup. The workgroup’s recommendations highlight opportunities for flexibility, collaboration, and innovation in watershed management efforts. The federal watershed practitioners developed their recommendations after considering the experiences of the workgroup participants, analyzing agency programs, and evaluating recent studies from private organizations and academic institutions.

Although local watershed stakeholders, government agencies, and academia consider the watershed approach from different perspectives, they make similar recommendations for national watershed protection and restoration efforts.

## Seven Themes of Watershed Management

Seven themes of watershed management are commonly found in local watershed efforts and can frame a discussion of watershed approaches (see Figure 6). The seven themes are the following:

- Increasing public education and awareness
- Developing new partnerships and coordinating efforts
- Collecting necessary information through monitoring and research
- Establishing appropriate plans and priorities
- Obtaining funding and technical assistance
- Implementing solutions
- Evaluating the results

Assessing the results of watershed management efforts in the United States remains more subjective than quantitative. Therefore, this report highlights examples of successes and shortcomings for each of the seven themes of watershed management using input from multiple sources.

FIGURE 6. Seven Themes of Watershed Management



## Education and Awareness

Education and awareness efforts inform citizens, corporations, and governments about watershed health and also about management activities that address watershed threats. Education programs inform the public about the impacts of individual, daily decisions on watershed health. They help citizens understand connections between watershed health and their quality of life.

Many watershed education programs have been very successful. For example, the Blackfoot Challenge education program and Project NEMO (Nonpoint Education for Municipal Officials), highlighted in this section, are excellent examples of watershed education efforts that influence behavior.

Watershed practitioners believe that peer education programs are the most effective way to change local land management practices. Many programs, including the Department of Agriculture’s Natural Resource Conservation Service extension program (the nation’s largest conservation technical assistance program), rely on

“The way we perceive the nation as individual resource users, researchers and decision-makers has a direct and major impact on how we perceive problems and solutions.”

*New Strategies for America's Watersheds*

**DESIGNING EDUCATION EFFORTS WITH MULTIPLE COMPONENTS**  
**THREATS: SEDIMENTS, NUTRIENTS, THERMAL MODIFICATION**

Private land use practices in the Blackfoot River watershed (Montana) have increased sedimentation, nutrient loads, and temperatures in the river. In response, stakeholders in the Blackfoot watershed designed a comprehensive collection of education and awareness programs.

The Blackfoot Challenge, a grassroots organization, sponsors teacher education programs that demonstrate how teachers can blend watershed resource education activities into their existing curricula. The organization also hosts workshops on weed management and alternative ranch income (e.g., ecotourism and guest ranching) for private landowners in the watershed. Wildlife management experts hold meetings about threatened and endangered species in the watershed such as grizzly bears, wolves, bull trout, and west slope cutthroat trout. These education programs have helped to change land use habits in the watershed, improving watershed health.

person-to-person interaction to educate landowners and implement projects that improve watershed health.

The federal government increasingly uses advanced technologies to distribute information and services for watershed management. For example, the Watershed Information Network ([www.epa.gov/win](http://www.epa.gov/win)) organizes infor-



*Education programs inform landowners about the impacts of individual, daily decisions on watershed health.*

mation and services for watershed practitioners. The network provides information about major laws governing water resources and links to watershed partners, including federal and state agencies and local watershed groups. It provides descriptions, application procedures, and deadlines for funding and technical assistance programs. In addition, the network provides information about on-line and in-person training. For example, the network contains links to the Environmental Protection Agency's Watershed Academy ([www.epa.gov/owow/watershed/wacademy](http://www.epa.gov/owow/watershed/wacademy)), an educational resource that offers many on-line training modules. Individuals can use the modules at their own pace to learn about topics including ecology, watershed planning, and best management practices.



These efforts notwithstanding, watershed roundtable discussions consistently note that watershed education programs are still needed for citizens, watershed groups, corporations, local governments, and government officials. In a 1998 poll sponsored by the Roper Center for Public Opinion Research, nearly half of the people surveyed thought that factories were still the leading cause of water pollution and did not know how to do more to protect the environment. Only 22 percent of Americans knew that nonpoint source pollution is now the nation's leading water quality challenge and that changes in their everyday actions could have a positive effect. While watershed education programs have had many successes in recent years, this poll suggests that Americans still do not know the causes of watershed health impairments and therefore watershed education programs need still greater emphasis.

## Partnerships and Coordination

Watershed practitioners consistently say that effective partnerships provide the foundation for watershed protection or restoration activities. Local partnerships drive most watershed activities. In addition, since governments own land, regulate activity, and provide assistance, coordination within and among government agencies also benefits watershed health. Coordinating the actions of local watershed groups with government agencies increases efficiency.

### Local Watershed Partnerships

Watershed partnerships can include any person or group interested in watershed health. Typical partnerships include many watershed stakeholders:

- Landowners
- Elected officials
- Representatives of federal, tribal, state, and local government agencies
- Agricultural organizations
- Business organizations

*How is the Watershed Approach Working?*

## EDUCATING MUNICIPAL OFFICIALS ABOUT NONPOINT SOURCE POLLUTION

**THREATS: NUTRIENTS, SEDIMENTS, CHEMICAL POLLUTANTS**

Project NEMO (Nonpoint Education for Municipal Officials) educates local government decision-makers in Connecticut about land uses that cause nonpoint source pollution. The program makes technical presentations to town engineers, planners, and commissioners and recommends a three-tiered planning strategy based on natural resources, site design, and stormwater best management practices. The University of Connecticut Cooperative Extension System developed the NEMO project in partnership with two other units of the university: the Department of Natural Resources Management and Engineering and the Connecticut Sea Grant Program. The University of Connecticut Cooperative Extension System manages the NEMO program with the assistance of the Environmental Protection Agency, the Connecticut Department of Environmental Protection, the Connecticut chapter of the Nature Conservancy, and EnviroGraphics, Inc.

## BANKING GRASSLANDS TO ENHANCE RANCHING IN NEW MEXICO

**THREAT: HABITAT MODIFICATION**

The Valle Grande Grass Bank is a partnership of ranchers, environmentalists, and Forest Service personnel that rehabilitates hard-used rangelands in northern New Mexico. Ranchers that overuse rangelands can increase erosion and displace native species. The grass bank provides alternative grazing lands so that ranchers can rest and restore their home pastures. The Conservation Fund, a nonprofit organization, manages the grass bank. Ranchers deliver their cows to the grass bank and plant their overused lands with desired vegetation. Ranchers usually participate in the grass bank for several growing seasons to allow the new vegetation to become established and resilient.

- Environmental organizations
- Student groups and senior citizen organizations

By including many interest groups, local watershed partnerships tap the varied skills of different partners, increase credibility, reduce duplication of effort, and maximize results from limited funds.



## PROTECTING LAKE KEOWEE IN SOUTH CAROLINA THREATS: NUTRIENTS, CHEMICAL POLLUTION, SEDIMENTS, PATHOGENS

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The Friends of Lake Keowee Society (FOLKS) is a 3,000-member organization dedicated to protecting regional lakes in South Carolina. The all-volunteer group has a diverse membership that includes retirees, scientists, farmers, realtors, and boat dealers. Every realtor and boat dealer in the region provides new homeowners and boat owners with free memberships to FOLKS. The organization believes that homeowners and boat owners that use the lake have a vested interest in a healthy lake.

Since the early 1970's, population growth rates in this region of South Carolina have increased four-fold. Increased urban runoff and septic system failure have accompanied this rapid growth. These changes threaten the lake's ability to provide drinking water for local municipalities and attract tourism and recreation. FOLKS volunteers have worked with state agencies, Clemson University, and the Appalachian Council of Governments to secure aerial surveys and maps of lakes, coordinate sediment and siltation monitoring, and assist with volunteer water monitoring. This broad coalition is working vigorously to maintain watershed health in the Lake Keowee region.

In recent years, local watershed partnerships have grown in number. The Environmental Protection Agency's Adopt Your Watershed program ([www.epa.gov/adopt](http://www.epa.gov/adopt)) and River Network ([www.rivernet.org](http://www.rivernet.org)), a national nonprofit organization, both recognize over 3,000 local watershed groups. Citizens increasingly participate in these efforts because they are increasingly aware of watershed health, and state and federal governments increasingly support watershed groups. States such as Washington, Oregon, and New Jersey encourage watershed planning by supporting the establishment of local watershed councils. All states provide varied funding and technical assistance for watershed planning efforts.

Various federal agencies also encourage local watershed efforts with financial and technical support. Local watershed efforts often receive federal funding indirectly from state and tribal grant programs, but they also receive direct support from federal grant programs. For example, the Environmental Protection Agency supports local partnerships with Watershed Assistance Grants. These small grants provide seed money for fledgling watershed groups. The city of Alpine, TX received \$25,000 from the Watershed Assistance Grant program to form a community partnership for the restoration of Alpine Creek. The restored creek will serve as an urban wildlife refuge and an important flood control channel. Other federal agencies support similar programs, such as the Clean Streams Initiative sponsored by the Office of Surface Mining. Without such support, local watershed residents may not have enough capacity to sustain long-term restoration efforts.

### Partnerships in Government

State and federal governments own land, regulate activities, and provide assistance, and therefore governmental coordination on these issues benefits watershed health. Historically, responsibilities for watershed management have been very fragmented. In recent years, state and federal programs have reorganized governmental water programs to adopt a more unified approach. The following paragraphs identify many recent improvements to partnerships in government. However, multiple forums have observed that governmental coordination needs further improvement.

The federal government issued the *Unified Federal Policy for Ensuring a Watershed Approach to Federal Land and Resource Management* in October 2000. The policy guides management across federal lands and water resources. It calls for federal agencies to use a watershed approach; to assess watersheds on federal lands with a common, science-based method; to focus federal funding and resources in jointly selected watersheds; and to enhance collaboration with tribes, states, and interested stakeholders.



To further coordinate federal resources, regional offices of federal government agencies established Federal Coordination Teams, also known as Regional Watershed Coordination Teams, in twelve large river basins. On these teams, regional directors of federal agencies work with federal staff, state and tribal representatives, as well as nonprofit organizations to improve interagency coordination and leverage resources. For example, the Mid-Atlantic Federal Coordination Team signed an agreement to coordinate government programs to address sprawl (highlighted in this section).

The Five Star Restoration Grant Program is another example of federal coordination. The Environmental Protection Agency and National Marine Fisheries Service, along with the National Fish and Wildlife Foundation, National Association of Counties, National Association of Service and Conservation Corps, and the Wildlife Habitat Council have jointly developed this program that supports stream-bank and wetland restoration. The program provides challenge grants and technical support to community-based restoration projects. Each project involves five or more partners—“five stars”—in the restoration effort. Project partners include local government agencies, elected officials, community groups, businesses, schools, and environmental organizations. Each partner contributes funding, land, technical assistance, workforce support or other services to match the federal assistance.

### Coordinating Government Assistance with Local Watershed Actions

State and federal governments coordinate with local watershed efforts in many ways. The following paragraphs highlight a few examples.

The Tennessee Valley Authority’s Watershed Teams are an excellent example of federal government coordination with local watershed efforts. The twelve teams help local watershed coalitions build capacity, identify priorities, and implement restoration and protection activities. Each team serves a specific watershed, learning about local

### MID-ATLANTIC FEDERAL COORDINATION TEAM SIGNS MEMORANDUM OF AGREEMENT TO ADDRESS SPRAWL

Seven federal agencies committed to protect vital resources by coordinating federal programs and helping state and local governments implement 25 pilot projects in the mid-Atlantic region to manage growth. The pilot projects will use innovative approaches to achieve the following objectives:

- Provide positive incentives for environmentally sensitive development and the conservation and management of natural lands.
- Furnish technical assistance to state and local governments in understanding and addressing the impacts of development practices on the environment, natural resources, and working resource lands.
- Encourage appropriate revitalization of urban residential communities and redevelopment of abandoned commercial, industrial, and brownfields sites.
- Eliminate programmatic incentives to harmful sprawl development.
- Reinforce state and local leadership and objectives in managing growth, creating livable communities, and protecting natural resources.

The Environmental Protection Agency, Department of Agriculture, Department of Transportation, Department of the Army, Department of Commerce, Department of the Interior, and Department of Housing and Urban Development signed this agreement.



*The mid-Atlantic region has lost significant forested and wetland areas to environmentally insensitive suburban development.*



## RESTORING ESTUARINE WETLANDS WITH A FIVE-STAR PARTNERSHIP

### THREAT: HABITAT LOSS

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People for Puget Sound, a nonprofit organization in Seattle, Washington, organized a diverse partnership to restore estuarine habitat for wild Chinook salmon. This partnership includes volunteer organizations, businesses, urban youth corps, the Student Conservation Association, the Environmental Protection Agency, the Army Corps of Engineers, and the International Marine Association for Protection of Aquatic Life. The Five Star Restoration Grant Program awarded a grant to the partnership to restore previously altered parkland to tidal influence. The restored wetlands will provide mudflat and salt marsh habitat for wild Chinook salmon and other estuary-dependent species.

resource issues and building community trust. The Watershed Teams facilitate coalitions among government agencies, businesses, and community organizations, and they supply environmental assessments and monitoring data that help local coalitions establish priorities for watershed restoration and protection actions. The twelve teams have helped more than 100 stakeholder groups in the Tennessee Valley, including many groups founded with Watershed Team assistance. The Watershed Teams measure their performance by considering improvements to watershed health and local success in obtaining public and private contributions.

In addition to coordinating federal government activities (discussed under the heading “Partnerships in Government”), Federal Coordination Teams have also helped local watershed efforts. For example, the Southeast Federal Coordination Team provided technical expertise in environmental assessment, monitoring, and restoration to the Hiawassee River Watershed Coalition for a project in Brasstown Creek in western North Carolina. As a result of the Federal Coordination Team support, the Hiawassee River Watershed Coalition successfully applied for nearly two million dollars in funding for this project from the

North Carolina Clean Water Management Trust Fund. The Federal Coordination Teams have also convened the previously mentioned regional roundtables to facilitate coordination among watershed stakeholders from public, private, and nonprofit sectors. Roundtable participants have shared information about successful projects and explored new ideas. More than twenty regional roundtables have been conducted, and the National Watershed Forum in June 2001 will bring together regional participants and perspectives.

Local watershed groups recognize the efforts of governments to assist them, but many practitioners suggest that governments can still better organize their support for local actions. For example, watershed data, technical assistance, and financial assistance remain disorganized within state and federal departments, and organization across departments is rare. In addition, many government programs lack an effective point of contact for watershed groups.

## Assessing Partnership Success

While watershed practitioners suggest that partnerships are the most important element of any watershed effort, their progress in forming and successfully utilizing partnerships may be gradual. Stakeholders often hold different views, interests, and responsibilities, so trust and mutual understanding may be slow to develop. Even after watershed stakeholders form functioning, sustainable partnerships, the partnerships may not produce immediate, tangible environmental results. Because the process of improving watershed health is usually a gradual one, it is difficult to assess the success of watershed partnerships. Nonetheless, most evaluations of watershed partnerships suggest that their efforts can improve coordination, use resources more efficiently, and make decisions more effectively.

## Monitoring and Research

Watershed monitoring and research provide information about watershed health, watershed function, and the



impacts of human actions. Watershed monitoring evaluates the chemical, physical, and biological characteristics of watersheds. Water chemistry monitoring is the most traditional and common monitoring program. Monitoring of physical watershed characteristics such as sediment loading or channel stability is more rare. Biological monitoring is most rare. Biological monitoring evaluates the diversity of living organisms and is considered by many experts to be the most complete measure of watershed health. All three methods of monitoring help to identify specific impairments and threats to watershed health. Watershed groups use this information to understand threats to watersheds and prioritize their efforts.

Watershed research explains how watershed ecosystems work and how they can vary. Research also assesses the results of watershed protection and restoration activities. Ideally, this research informs future watershed actions.

Monitoring programs organized by local watershed groups, states, tribes, and federal agencies contribute valuable information to watershed management efforts. For example, the Environmental Protection Agency collects water quality data from states and synthesizes the data for the biannual National Water Quality Inventory and the List of Impaired Waters. The U.S. Geological



*Volunteer monitoring programs contribute valuable information to watershed management efforts.*

### *How is the Watershed Approach Working?*

Survey's National Water Quality Assessment program makes selected measurements of water quality in sixty river basins and aquifer systems. The breadth and consistency of this monitoring program allow for nationally consistent assessments. The National Water Quality Assessment program recently released a report assessing pesticide and nutrient levels in these sixty watersheds and will soon release further assessments. The Fish and Wildlife Service has developed National Wetland Inventory maps for more than 90 percent of the contiguous United States. The maps are available for wetland trend analysis and watershed planning. The Natural Resources Conservation Service inventories resources on private lands. The Forest Service monitors the size, health, and location of the nation's forests and woodlands.



*Water chemistry monitoring is the most traditional and common type of monitoring performed.*

The U.S. Geological Survey also works with states, local governments, and tribes to collect watershed data and develop research projects. Projects have delineated drinking water source areas; assessed water quality in lakes, rivers, and estuaries; monitored best-management practices; and identified sources of microbial contamination. In a separate program, the U.S. Geological Survey has established research partnerships with 51 universities.

Improved water quality models provide an interesting intersection of watershed monitoring and research. The U.S. Geological Survey's National Water Quality



## MONITORING SOURCE WATER FOR HERBICIDE CONTAMINATION IN PENNSYLVANIA

### THREAT: HERBICIDES

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The Philadelphia Suburban Water Company intakes water in the lower Neshaminy Creek watershed in eastern Pennsylvania. The watershed is largely suburban, but approximately 15 percent of the watershed remains agricultural. The water company works with the Bucks County Conservation District and the Penn State Cooperative Extension Service to reduce levels of herbicides occurring in peak spring runoff.

This partnership is trying to quantify the problem with a concentrated monitoring program. Philadelphia Suburban tests samples hourly at the treatment plant after significant rainfall events between May 15 and June 30. The water company also collects grab samples from key sites in the watershed. The Bucks County Conservation District and the Penn State Cooperative Extension Service organize forums at which the water company shares this information with local farmers. The information encourages farmers to follow herbicide application instructions and adopt relevant best management practices.

Assessment program is developing promising models of nationwide surface water quality. The Environmental Protection Agency is testing models that predict pesticide occurrence in streams and reservoirs.

Despite the many national monitoring programs, more and better data are needed. Watershed practitioners find that data are often incomplete because of limitations and differences in various local, state, tribal, and federal monitoring programs. For example, the Environmental Protection Agency's 1998 *National Water Quality Inventory* reflected state, tribal, and territory monitoring of only 23 percent of the nation's rivers and streams, 42 percent of the nation's lakes, ponds, and reservoirs, and five percent of the nation's ocean shoreline miles. The new "Coastal Research and Monitoring Strategy" a cooperative product of the National Oceanic and Atmospheric Administration,

the U.S. Geological Survey, the Department of Agriculture, and the Environmental Protection Agency, notes that coastal waters lack consistent, comprehensive monitoring data. Many watersheds lack data about habitat quality. Few monitoring programs consider biological indicators of watershed health.

Also, many national and state monitoring programs provide data for watersheds that encompass hundreds of square miles, whereas local actions require data related to an individual town or a specific stream reach. The existing watershed data are often uncoordinated and inconsistent. Local monitoring data, state monitoring data, and federal monitoring data may be incompatible. As a result, watershed groups may be unable to analyze trends in watershed health.

Watershed research, too, has significant gaps. For example, research is just beginning to explore linkages among watershed components—rivers, wetlands, floodplains, upland areas, groundwater, and the atmosphere. Because watershed management requires an interdisciplinary approach, more research is needed to explore integrating biology, chemistry, and physics with the social sciences.

Also needed is greater understanding of the public health and environmental impacts of chemical mixtures, chemical degradation products, and emerging contaminants such as endocrine disruptors and pharmaceuticals. Watershed models with greater accuracy and reliability would be very useful for this purpose and many others. Models can serve to reduce the overall costs of performing monitoring.

Practitioners ultimately need research that assesses individual projects. Such research could help practitioners understand the long-term effects of restoration and protection projects and the factors that most influence project success or failure.

## Planning and Prioritization

Watershed planning and prioritization activities guide public and private actions in a watershed. They ensure



that restoration actions are focused, coordinated, and efficient. State, federal, and tribal governments often establish broad plans and priorities. Local land use and watershed planning efforts address smaller-scale issues.

In 1998 and 1999, states, tribes, and territories developed Unified Watershed Assessments that identified watersheds most in need of restoration. The Unified Watershed Assessments were developed quickly with available information. Since these state, tribal, and territorial assessments required collaboration and agreement across government programs, their compilation is the nation's most comprehensive statement of watershed priorities. In developing Unified Watershed Assessments, participants used resources such as state lists of impaired and threatened waters, federal and state lists of endangered species, and data from nonprofit organizations. States, territories, and tribes determined that 60 percent of the nation's watersheds do not meet clean water and other natural resource goals requiring restoration action. They also determined that 15 percent of the watersheds need preventive action to sustain water quality and aquatic resources. Participants are developing watershed restoration action strategies for many of their highest priority watersheds. These comprehensive watershed plans allow governments to target funding and technical assistance to watersheds with the greatest needs.

The National Estuary Program's Comprehensive Conservation and Management Plan process provides a model of regional watershed planning and priority setting. Representatives of government, industry, and public interest groups work together to develop comprehensive plans for estuary activities. These plans reflect the priorities of estuary stakeholders. They strive to conserve and enhance the natural, cultural, recreational, social, and economic resources of each watershed.

Local planning increasingly considers an array of environmental issues. Local ordinances have always addressed traditional issues such as building density and land use, but in the past they have not reflected environmental concerns. Zoning decisions impact watersheds by

## RESEARCHING THE MANAGEMENT OF FRESHWATER INPUTS TO ROOKERY BAY

### THREAT: PHYSICAL BARRIERS

The 25 reserves in the National Oceanic and Atmospheric Administration's National Estuarine Research Reserve System monitor estuarine trends in 21 states and territories. The Rookery Bay Reserve (Florida) is studying how freshwater inflows affect fish species and how these inflows can be mitigated. Research by the Florida Department of Environmental Protection indicates that Hurricane Andrew and other major storm events altered the estuary's freshwater inflows, damaging habitats within the reserve. These alterations had immediate and long-term impacts on the food chain by harming species eaten by commercially and recreationally important fish.

Human impacts, such as dam or weir construction, alter the flow of freshwater and nutrients into estuaries. When storms threaten upstream flooding, freshwater is released downstream. The National Oceanic and Atmospheric Administration's National Marine Fisheries Service awarded funding to the Rookery Bay Reserve to restore natural freshwater inflow patterns during storm events. The reserve proposes to computerize a weir on Henderson Creek to allow for more natural flow of freshwater into the estuary. The reserve hopes that this project will enable other water management districts to manage water flow similarly.

## FOUR ADVANTAGES OF THE UNIFIED WATERSHED ASSESSMENT APPROACH

### PROVIDED BY THE MARYLAND DEPARTMENT OF THE ENVIRONMENT

1. Allowed the state to build on an existing analytical framework that it had been developing.
2. Gave the state an opportunity to go beyond traditional water quality issues and perform a truly integrated assessment of its watersheds, including habitat, landscape, and human-related factors.
3. Encouraged the state to bring together a truly diverse group of agencies and individuals that historically had not collaborated on management efforts.
4. Focused restoration in an integrated, watershed-based manner.



influencing the location of commercial, residential, and industrial buildings in communities. For example, construction in a floodplain often reduces wetland acreage, and environmentally oriented zoning plans attempt to prevent or mitigate these impacts. Local land trusts and national land conservation organizations preserve open space in watersheds benefiting species, water quality, and the community. In these examples and many more, local planning has important consequences for the health of local watersheds and economies. The Environmental Protection Agency has posted model ordinances on the webpage “Model Ordinances to Protect Local Resources” ([www.epa.gov/owow/nps/ordinance](http://www.epa.gov/owow/nps/ordinance)).

#### **MANAGING THE SAN MIGUEL WATERSHED THROUGH COMPREHENSIVE ASSESSMENT THREATS: FLOW MODIFICATION, SPECIES LOSS, NUTRIENTS, SEDIMENTS**

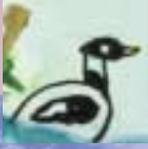
Stakeholders in the San Miguel Watershed in southwest Colorado began a comprehensive watershed management approach in 1990. Numerous studies, including rare plant and animal surveys, instream flow studies, a fish survey, a land health assessment, a hazardous waste inventory, water quality studies, and river restoration studies assessed the condition of the watershed. A broad coalition of partners used information from the studies and public meetings to draft a watershed management plan. This plan will conserve and enhance the natural, cultural, recreational, social, and economic resources of the watershed.

The management plan strives to reduce impacts to the watershed from large-scale development. Large-scale development can cause excessive nutrient inputs, heavy sedimentation, and erosion. As a result of accompanying population increases, communities often over-appropriate water and reduce instream flows. To address this problem, the San Miguel Board of County Commissioners has placed new stipulations on construction, sewage disposal, fertilizer use, blasting, and new roads in the watershed. These stipulations helped San Miguel County earn an Environmental Protection Agency Outstanding Achievement Award and a National Association of Counties Award for community-based ecosystem protection.

Despite many successful planning and prioritization efforts nationwide, watershed activities remain difficult to organize and integrate. Various government agencies and stakeholder groups address different issues at different scales.

For example, it is not clear that the Unified Watershed Assessment process has improved coordination within state and federal governments. Although these assessments are state-wide, multi-program statements of watershed priorities, many government funding and technical assistance programs have not used them to target their resources. Federal agencies do not consistently integrate voluntary programs (e.g., the Environmental Protection Agency’s nonpoint source management program, the Department of Agriculture’s Environmental Quality Incentives Program) or regulations (e.g., regulations for Concentrated Animal Feeding Operations) in the identified priority watersheds. In addition, stakeholders in high priority watersheds have not consistently implemented restoration action strategies. These priority watersheds need greater attention from watershed practitioners and these practitioners may require more financial and technical assistance to successfully implement the restoration action strategies. The process of developing statewide water quality and habitat assessments has, however, fostered greater collaboration between state agencies and amongst all decision-makers. The process may therefore serve as the starting point for the development of comprehensive natural resource assessments in the future.

Many local planning efforts and land use ordinances still need revision. For example, at a roundtable meeting for southeastern states, seven of nine state delegations identified land use planning and zoning as their highest priorities. They found that existing planning efforts and zoning ordinances often fail to protect watersheds and sometimes encourage watershed degradation. Many zoning laws unintentionally encourage urban sprawl and discourage investment in inner cities. For watershed management to be effective, these local issues must be addressed.



## Funding and Technical Assistance

Funding and technical assistance provide local watershed groups with the means to protect and restore watersheds. Watershed management requires that work be done and materials and services be purchased. Watershed actions require both human and financial resources. Governmental, nonprofit, or private sources provide this support.

The federal government has many funding programs that support watershed actions. The Environmental Protection Agency's recent revision of the *Catalog of Federal Funding Sources for Watershed Protection* ([www.epa.gov/win/resources/html](http://www.epa.gov/win/resources/html)) identifies 69 federal grant or loan programs from twelve federal departments and agencies. The catalog indexes the programs by name, agency, and keyword. These funding opportunities are critical, but many are limited to specific purposes, recipients, or geographic areas, and some offer minimal funding.

The array of funding resources for watershed management can overwhelm watershed groups. However, environmental finance centers at nine universities provide publications, analyses of financing alternatives, training, and technical assistance. The environmental finance centers at the University of Maryland and Boise State



*The Natural Resources Conservation Service provides direct technical assistance to farmers across the nation.*

### *How is the Watershed Approach Working?*

#### PLANNING FOR IMPROVED WATER QUALITY WITH NEW GRADING ORDINANCES IN MAUI, HAWAII THREATS: SEDIMENTS, NUTRIENTS

Maui County includes the islands of Maui, Molokai, and Lanai. Hawaii's Department of Health considers the waters of West Maui, Kahului Harbor, and the South Molokai Shoreline to be impaired because they often exceed nutrient and turbidity standards. The county has identified construction and grading projects as a primary source of water quality problems.

In August 1998, the Maui County Council revised its grading ordinances. The county now requires that all grading work use erosion control and sediment best management practices. The county informed the public, the construction industry, general contractors, government officials and inspectors, and Soil and Water Conservation District officials about the new ordinance, effective erosion control plans, and new technologies. This program has inspired other counties in the state to consider similar ordinances.

University develop workshops for local governments that discuss watershed financing alternatives. The Environmental Protection Agency's National Estuary Program is also conducting workshops that discuss financing alternatives for estuary plan implementation activities. These programs help watershed practitioners identify and exploit creative financing opportunities.

The federal government recently enhanced some financial assistance programs for watershed protection and restoration activities. The Department of Agriculture's Conservation Reserve Program now provides greater financial incentives to farmers that retire environmentally sensitive cropland. These incentives include rental payments, cost-share payments for best management practices, and technical assistance. The recent Transportation Equity Act for the 21st Century provides billions of dollars for transportation improvements, including environ-

## RESTORING WETLANDS WITH TRANSPORTATION FUNDS IN MISSISSIPPI

### THREAT: WETLAND LOSS

In 1990, the Mississippi Department of Transportation purchased State Line Bog and Dead Dog Bog, two wetlands on 360 acres in southeast Mississippi. The Department of Transportation used Transportation Equity Act grant funds to work with the Mississippi Chapter of The Nature Conservancy and the Mississippi Department of Wildlife, Fisheries, and Parks to restore the bogs. The restoration project is designed to offset unavoidable wetland impacts that will occur during the construction of Mississippi highways. Paper companies had owned these properties and degraded the habitat by draining the bogs and harvesting their trees.

Project partners backfilled drainage ditches to restore wetland hydrology and used periodic prescribed burns to gradually remove logging debris and create an appropriate vegetative structure. These changes are restoring



the insectivorous pitcher plant communities that once dominated the bogs.

*The Mississippi Department of Transportation used Transportation Equity Act grant funds to restore wetlands with rare insectivorous pitcher plant communities.*

mental protection and restoration projects. This act and an earlier act, the Intermodal Surface Transportation Efficiency Act, have created and protected many acres of wetlands with mitigation projects. In the last four years, states have restored or created 2.4 acres of wetlands for each acre that has been unavoidably impacted by transportation projects.

In the same period, the Department of the Interior's Office of Surface Mining has more than doubled its funding for the Appalachian Clean Streams Initiative. This program addresses acid mine drainage, nonpoint source pollution from abandoned coal mines. The program has provided \$20 million as seed money for 99 projects in 11 states. In the last few years, the Environmental Protection Agency's nonpoint source grants program has doubled its assistance to states and tribes to nearly \$240 million. The Agency's Clean Water State Revolving Fund provides loans for many types of watershed protection and restoration projects, including wastewater, stormwater, nonpoint source, and estuary protection projects. The program manages more than \$34 billion in assets.

While the federal government has enhanced and expanded existing funding programs, it has also developed entirely new programs. For example, the federal government developed both the Five-Star Restoration Grant program and the Watershed Assistance Grants program in 1998. The Environmental Protection Agency's Watershed Assistance Grants program supports local watershed partnerships during their development and contributes to watershed protection and restoration actions. In 1999 and 2000, the program awarded more than one million dollars to 60 projects. The demand for these grants far exceeds available resources: in 2000 alone, 400 proposals from local groups in 46 states requested nearly nine million dollars.

One source of technical information for watershed efforts is the *Stream Corridor Restoration Handbook* ([www.usda.gov/stream\\_restoration](http://www.usda.gov/stream_restoration)). The document presents current knowledge of stream corridors and stream corridor restoration. Fifteen federal agencies and other watershed groups developed this document to address many stream corridor restoration scenarios.

Other technical assistance programs support private landowners. The Natural Resources Conservation Service provides direct technical assistance programs to farmers across the nation. The U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program works with



landowners to restore watersheds by planting native species, removing invasive species, improving wetland hydrology, and reconstructing in-stream aquatic habitat. Landowner interest in the Partners for Fish and Wildlife program exceeds the program's resources.

The financial assistance programs highlighted in these paragraphs will help to protect and restore watershed health, but further assistance is still needed. Recent studies by the Environmental Protection Agency suggest that communities will need billions of dollars over the next twenty years to upgrade and maintain their wastewater treatment infrastructure.

Watershed practitioners at the Regional Watershed Roundtables suggest that, compared to watershed needs, watershed assistance programs are modest. Many of these practitioners suggest that substantial increases in funding and technical assistance are necessary, including additional grant and loan programs. The watershed practitioners noted that technical assistance programs cannot meet the demand for on-the-ground implementation of protection and restoration measures. Most federal agencies lack field-level, watershed-based personnel. Private practitioners increasingly provide technical assistance, but local stakeholders cannot always secure assistance when they need it most. Practitioners at the roundtables asked for expanded federal and state programs that are less restrictive and provide more financial and technical support for local watershed efforts.

In addition, watershed practitioners note that specific elements of watershed management are typically overlooked in assistance programs. Watershed groups struggle to secure funding for staff salaries, monitoring and research, and project evaluation and maintenance because many assistance programs are restricted from supporting these activities. While federal laws place restrictions on some programs, many agencies develop other restrictions themselves. Federal, tribal, and state assistance programs do not effectively coordinate their efforts to target priority watershed problems. Multiple mandates and conflicting

## RESTORING BOTTOMLAND HARDWOOD WETLANDS IN ARKANSAS WITH THE WETLANDS RESERVE PROGRAM THREAT: WETLAND LOSS

The Raft Creek Bottoms in northeast Arkansas was once an extensive tract of bottomland hardwood forest. Bottomland hardwood forests are especially valuable for wildlife breeding, nesting, and habitat. In the 1960s and 1970s, landowners converted most of the Raft Creek Bottoms to cropland. In recent years, landowners have worked to reverse these actions.

With the help of the Department of Agriculture's Wetlands Reserve Program, landowners have restored the 3,000 acres in the Raft Creek Bottoms. Landowners planted bottomland hardwoods in approximately 70 percent of the area while creating the largest manmade herbaceous wetland in Arkansas on the remaining 30 percent of the tract. Waterfowl by the thousands now visit the bottomlands in the winter. Shorebirds and water birds that recently were rarely seen are now common sights on these tracts.

The Department of Agriculture's Wetland Reserve Program is a voluntary program that offers landowners financial incentives to protect, restore, and enhance wetlands on their property. Landowners that participate in the program may sell a conservation easement to the Department of Agriculture—the landowner limits future use of the land, yet retains private ownership. Landowners may also receive cost-share funding from the Department for wetlands restoration activities. In this case, landowners and the Natural Resources Conservation Service developed plans for wetland restoration and protection. Landowners continue to control access to the land and may lease the land for hunting, fishing, and other undeveloped recreational activities. The program has enrolled 915,000 acres nationally since 1996.



scientific evidence stymie attempts to focus limited funding and technical outreach. Further coordination of governmental assistance opportunities will help local watershed groups navigate their way through the many programs in many offices of many departments that have different eligibilities, requirements, and application schedules.

## Implementation

In this report, implementation describes actions that beneficially impact watershed health. Citizen stakeholders, the private sector, and government agencies implement these actions. Implementation includes pollution prevention, wastewater treatment, wetland restoration, enforcement, invasive species control, and critical habitat protection.

### **STOPPING THE SPREAD OF THE TAMARISK ON THE MOJAVE RIVER, CALIFORNIA** **THREAT: INVASIVE SPECIES**

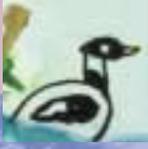
The Mojave River flows above ground year-round in the Afton Canyon of the southern California Desert. The above ground flow provides riparian wildlife habitat amid the desert. However, the salt cedar, or tamarisk, has invaded this habitat, drastically reducing wildlife populations near the river. A native of the Mediterranean region, the salt cedar creates an environment that is too salty for California's native plants. It has replaced much of the native vegetation and offers little food or shelter to wildlife. The salt cedar also consumes large volumes of water, reducing the amount available to other plants, fish, and wildlife.

Working with local conservation districts, the Natural Resources Conservation Service, the Army Corps of Engineers, and other partners, the Bureau of Land Management is removing salt cedar and replacing it with native vegetation. To date, the Bureau of Land Management has treated more than 300 acres of tamarisk and planted over 7,000 native willows and cottonwoods along the Mojave River. Native wildlife is returning to the banks of the Mojave River after a decade's absence.

This report frequently mentions “watershed protection and restoration.” National watershed health depends on both watershed protection and watershed restoration. However, watershed practitioners note that watershed protection (the prevention of degradation) is more cost-effective and more likely to succeed than watershed restoration. Practitioners also note that “restored” watersheds are rarely as ecologically valuable as protected watersheds. Nonetheless, watershed restoration is necessary because many of the nation's watersheds are already degraded.

Federal agencies account for watershed protection and restoration actions in many ways. For example, the Fish and Wildlife Service estimates that it has protected or restored more than 325 million acres of wetlands as part of the North American Waterfowl Management Plan. The Service estimates that in the last five years it has also helped to protect more than 160,000 acres of coastal habitat and reopen more than 2,200 miles of streams to anadromous fish. The Department of Agriculture reports that in the last four years it has created nearly one million miles of conservation buffers and restored nearly one million acres of wetlands. Working with state agencies and other partners, the Bureau of Land Management, the Forest Service, the Environmental Protection Agency, and the U.S. Geological Survey are restoring 120 abandoned mine sites in 12 states as part of the Interdepartmental Abandoned Mine Land Watershed Cleanup Initiative.

While new programs often command attention, long-standing programs are more important than ever for watershed health. For example, the National Pollutant Discharge Elimination System requires that states and regional offices of the Environmental Protection Agency issue permits to effluent dischargers, providing a baseline of protection for waterbodies everywhere. Even as watershed efforts do more to alleviate nonpoint source pollution, watershed health depends on permits that manage point sources. However, some Watershed Roundtable stakeholders suggest that governments do not sufficiently enforce regulatory programs. The *Green Gauge 2000*, an



annual survey tracking the American public's attitudes on environmental issues, confirmed stakeholder concerns by noting that public support for strengthening environmental regulations has been increasing over the past decade. In 2000, nearly half of the surveyed population agreed with the statement, "environmental regulations do not go far enough." Compliance and enforcement activities are necessary to prevent watershed degradation and to identify violations of environmental laws.

Three exemplary projects are highlighted among these paragraphs about implementation. Many other watershed projects deserve similar recognition. Other documents, such as *Watershed Success Stories* ([www.cleanwater.gov/success](http://www.cleanwater.gov/success)) offer more examples of successful implementation projects.

Not all watershed protection and restoration efforts are successful. Watershed stakeholders often do not fully implement solutions to watershed problems for many years, if at all. Partnerships can break down, priorities can change, and funding can cease, causing implementation to be stymied. Sometimes watershed efforts are adversely affected by droughts or storms. Even when successfully completed, many restoration projects are poorly maintained, negating their previously positive impact.

## CONTROLLING SALINITY IN THE COLORADO RIVER BASIN

### THREAT: SALINITY

The Colorado River and its tributaries provide municipal and industrial water for more than 23 million people in seven states and irrigation water for nearly 4 million acres of land. The threat of salinity is a major concern to agricultural, municipal, and industrial users in both the United States and the Republic of Mexico. Damages in Mexico are not quantified, but damages in the United States typically range between \$500 million and \$750 million per year. In the Colorado River Basin Salinity Control Program, the Bureau of Reclamation, the Bureau of Land Management, the Natural Resources Conservation Service, and seven states are implementing salinity control projects that cost-effectively remove salt from river water. The program constructs desalination plants, intercepts groundwater before it flows through saline formations, implements water conservation measures, establishes more stringent control measures at oil and gas development sites, seals flowing saline wells, and provides technical and financial assistance to land users for salinity reduction practices. Control measures are preventing approximately 500,000 tons of salt from entering the river system.

## RESTORING DEGRADED STREAMBANKS ON CHEROKEE LANDS IN NORTH CAROLINA

### THREATS: HABITAT LOSS, EROSION

Increased erosion, sedimentation, and habitat degradation caused by development, recreation, and urbanization have impaired the Oconaluftee and Ravens Fork Rivers in western North Carolina. The watershed is a popular area for tourists and is also an important source of revenue for local communities, especially the Eastern Band of the Cherokee Indians.

The Cherokee Tribe has worked with the Environmental Protection Agency and the Department of Agriculture's Natural Resources Conservation Service to plan, design, and implement best management practices for stream restoration, and to educate area landowners about watershed protection techniques. The Tennessee Valley Authority and Western Carolina University have collected and analyzed sedimentation data to identify restoration sites. Work has begun on restoration projects and on implementing a new Erosion Control Ordinance and an Integrated Resource Management Plan.

Restoration activities on the Oconaluftee and Ravens Fork Rivers have already yielded results. For example, at one site restoration actions have slowed stream flow near the riverbanks, and they are rebuilding naturally. The river has deposited six inches of new sediment along the banks and riparian vegetation is thriving.

## EVALUATING DRINKING WATER PROTECTION MEASURES IN IOWA

### THREATS: PATHOGENS, SEDIMENTS, NUTRIENTS

Lake Fisher is the primary source of drinking water for Bloomfield, Iowa. Excessive inputs of sediments and nutrients are reducing lake capacity and increasing drinking water treatment costs. To address this situation, landowners have treated 900 acres of land in the watershed with a combination of terraces, water and sediment control basins, ponds, and constructed wetlands. Septic system improvements have also reduced bacterial inputs to the lake. Preliminary results for this project have been striking. Agricultural best management practices have reduced the sediment load reaching Lake Fisher by 60 percent. Nutrients, pesticides, and organic materials flowing into the lake have been reduced by 50 percent. Septic system improvements have reduced bacteria flowing to the lake by 50 percent.

## EVALUATING RIPARIAN RESTORATION IN COYOTE CREEK, CALIFORNIA

### THREAT: HABITAT LOSS

The San Francisco Bay Bird Observatory at the south end of San Francisco Bay uses mist-netting, point counts, area searches, and nest-finding to evaluate riparian corridor restoration projects. The program monitors bird use of these managed riparian corridors by comparing data from their long-term reference site (Coyote Creek Field Station) to other restoration sites. The Observatory uses these bird data in conjunction with vegetation data to assess the success of the restoration sites, to make management recommendations, and to study the use of urban riparian sites. The program plans to monitor the reference site for at least the next 40 years. It will document changes in the avian populations over time as the site matures.



*The San Francisco Bay Bird Observatory is studying bird populations (e.g. Rufous Hummingbird) as an indicator of the success of riparian corridor restoration projects.*

## Evaluation

Watershed practitioners evaluate implementation actions to assess their effectiveness. Evaluations can consider the environmental impact of individual projects, watershed-wide efforts, state initiatives, or national programs.

Proper evaluation ensures that watershed efforts duplicate effective projects and programs and eliminate or modify less effective projects and programs. Watershed efforts that continually evaluate their work tend to achieve more positive results and can objectively demonstrate those results. Unfortunately, project-level and watershed-level evaluations of the environmental impacts of restoration efforts are not common. Some projects, however, including the two highlighted in this section, provide excellent exceptions.

At larger scales, some states and regional organizations produce useful and innovative environmental performance scorecards. For example, Florida recently developed a water quality and natural resource performance report ([www.dep.state.fl.us/ospp/report](http://www.dep.state.fl.us/ospp/report)) that the Florida Department of Environmental Protection issues on a quarterly basis. The report tracks environmental trends that are directly impacted by Florida's environmental programs. Florida's Department of Environmental Protection expects that the report will help it enhance and replicate successful efforts and change those that are not working as intended.

Federal agencies and departments are also increasingly evaluating their efforts with objective, environmentally focused measures. For example, the Tennessee Valley Authority's Watershed Teams monitor water quality ratings in the 603 watersheds managed by the Tennessee Valley Authority. In recent years, water quality ratings have improved in 210 of the 603 watersheds.

Despite this progress, many existing measurement tools and environmental indicators are complex and have only indirect linkages to on-the-ground changes. Efforts to improve these tools often have to overcome organizational inertia to replace traditional measurement approaches. Improved evaluation techniques are needed to objectively demonstrate the success or failure of watershed protection and restoration efforts.



## INTEGRATING THE THEMES OF WATERSHED MANAGEMENT: THE AMD&ART PROJECT THREATS: CHEMICAL POLLUTANTS, HABITAT LOSS

Acid mine drainage (AMD) is the most widespread and damaging environmental problem for Appalachia, as well as one of the region's worst economic and social problems. AMD&ART, a small non-profit organization, develops watershed treatment systems that are also recreational sites, art parks, educational centers, and historical exhibits. Their projects reach people, restore nature, and clean water. The "ART" in AMD&ART is not an acronym. It represents the art of blending disciplines in the design process and orchestrating citizens, contributors, and governmental agencies.

This example highlights all seven components of the watershed approach discussed in this report.



*The Vintondale Site Plan: (1) History Wetlands; (2) Community Recreation; 3) AMD Treatment System and Litmus Garden*

A pilot project in Vintondale, Pennsylvania is designing a community park to fulfill environmental, recreational, and educational needs. This project is developing new partnerships and increasing coordination. More than 10 percent of the Vintondale population has gathered for regular meetings with AMD&ART artists, historians, and scientists to discuss project planning and prioritization. The resulting design proposal incorporates ideas from everyone that contributed to the process. Participation in the process is increasing public awareness of economic and environmental issues. The project has initiated school education programs and

service projects for students of all ages in surrounding communities. Diverse partners such as the Environmental Protection Agency, the Pennsylvania Department of Transportation, AmeriCorps, and private foundations have contributed technical support and more than \$400,000 in funding to the project. Monitoring and research efforts include volunteer water quality monitoring, AMD&ART staff-conducted biological surveys, and university-conducted surveys of community attitudes, knowledge, and behavior. Twenty-five percent of the town's population gathered for the project's groundbreaking—the symbolic beginning of implementation efforts. Many aspects of project implementation have already begun, including the development of a 35-acre site that includes a wetlands treatment system for acid mine drainage. Evaluation efforts are measuring environmental change and social and economic benefits. These results will allow other communities with similar discharges and environmental conditions to build upon Vintondale's successes. The AMD&ART project is a model for a new partnership between the Department of the Interior's Office of Surface Mining and the National Endowment for the Arts. This partnership will remediate acid mine drainage with similar artful, community-driven approaches throughout eastern coal country.