A Watershed Primer for Pennsylvania

A collection of essays on watershed issues

edited by

Janette M. Novak

and

William H. Woodwell, Jr.

Sponsored by:

Pennsylvania Environmental Council

Allegheny Watershed Network

DEP

Pennsylvania Environmental Council

The Pennsylvania Environmental Council is a statewide, nonprofit, environmental education and advocacy organization devoted to promoting the protection of watersheds, the sustainable use of land and the implementation of environmental innovations. Since its founding in 1970, the Council has worked toward sensible and sustainable answers to the Commonwealth's difficult environmental issues.

The Council brings together the knowledge and viewpoints of civic and environmental groups, businesses, government, and academia to develop common understanding on environmental issues; builds coalitions and partnerships to act on these issues; advocate policies, laws, and regulations that foster sound environmental practices and responsible management of our natural resources; and provides resources, assistance, and education to the general public.

Allegheny Watershed Network

The Allegheny Watershed Network was established in 1996 as a forum for education about watershed issues and networking among the many groups, government agencies, businesses, and educational institutions that are active within the Allegheny River watershed. Already, the Network has made a great impact throughout the region and state with its publications, conferences, and coordination with other watershed groups—all of which have helped to focus more public attention on the quality and sustainable use of the Allegheny River.

Pennsylvania Department of Environmental Protection

The Department of Environmental Protection's mission is to protect Pennsylvania's air, land and water from pollution and to provide for the health and safety of its citizens through a cleaner environment. It partners with individuals, organizations, governments and businesses to prevent pollution and restore our natural resources.

Introduction

As far as we know, no one has produced a publication like this before. With the help of more than thirty experts on watershed issues, all from Pennsylvania, we have assembled a primer designed to introduce anyone to the benefits, threats, programs, and laws affecting the Commonwealth's rivers, streams and lands.

This document, really a collection of essays by some of those who care most about our watersheds, is not designed to be exhaustive. There are certainly some subjects that are not included. But in these pages you will find discussion and insight into everything from the economic benefits of watershed protection to fund-raising for nonprofits and from abandoned mine drainage to agricultural practices.

This project was spawned from the work of the Allegheny Watershed Network and supported by the Heinz Endowments and the Pennsylvania Department of Environmental Protection. Without their financial help, this primer could not have been published.

The authors, our friends and colleagues, donated their time and knowledge to share what they have learned. They, like us, believe that watersheds are crucially important to protecting, enhancing and conserving Pennsylvania's environment and natural resources.

If you look at the back cover of this publication, you will see a map of the Commonwealth outlining its major watersheds: the Upper Ohio, including the Allegheny and Monongahela; the Great Lakes, with waters flowing to both Lake Erie and Lake Ontario; the Potomac, flowing to D.C.; the Susquehanna, the major source of water and problems for the Chesapeake Bay; and the Delaware, flowing through the backyards of millions of people.

Think of where those waters all flow. Not only do most of them link us to other states, we also send our water to the St. Lawrence Seaway, the Atlantic Ocean and the Gulf of Mexico. Our impacts are great. But so are our benefits. We drink, recreate, and make industrial use of our waters. We also waste, degrade and pollute them—albeit less than we used to.

It is only through concentrated thought, education and action that we can assure the health of our watersheds from forest to farm and macroinvertebrate to man.

We at the Pennsylvania Environmental Council and Allegheny Watershed Network hope that, in reading these essays, you will be inspired to join us and the thousands of other Pennsylvanians working toward improving the health of our watersheds.

Remember, we all live downstream.

WELCOME

Andrew S. McElwaine, President, Pennsylvania Environmental Council

Pennsylvania may be home to more miles of rivers and streams than any other state save Alaska. It is home to the mightiest river east of the Mississippi, the Susquehanna. Likewise, the Allegheny, Delaware, Monongahela, Swatara, and many more are rich in both natural and human history. The importance of these riverine systems to our own health and safety has long been understood. In 1912, the Pittsburgh Flood Commission, chaired by the late H. J. Heinz, made recommendations to control the Allegheny's habit of inundating the city's business district. Foremost among these was a proposal to reforest the upper Allegheny plateau which had been cleared by logging. The Commission believed that a healthier ecosystem would provide a better environment to do business in.

Heinz's commission provided an early example of what today is called watershed management. The notion that any one parcel of property within an ecosystem can be managed or preserved independent of its surroundings has given way to a more comprehensive view of ecosystem function. Watersheds, the drainage basins of freshwater systems ranging from small headwater streams to extensive rivers, provide a comprehensive means of evaluating and ultimately restoring or protecting ecosystems.

Watersheds cover a wide variety of media, including surface and groundwater, land and air. Moreover, because flow varies over time and geography, watersheds exist on several levels. (see Jack Williams, et. al., *Watershed Restoration: Principles and Practices,* 1997). For many years conservation has concerned itself with protecting the most essential and ecologically valuable tracts of land and water. Increasingly, however, we are learning that such a strategy is not sufficient. The dynamics of ecosystems are such that a broader vision is called for, and at the level of the watershed there exist productive means of environmental intervention.

With this enhanced understanding of our surroundings, an additional concept has developed, that of ecosystem services. It might seem absurd to place a dollar value on clean drinking water, quality fishing and hunting, or on swimming and boating, but in a world of declining natural resource values, where capital can move in the blink of an eye, it seems critical to do so. The dollar value of watershed services are difficult to calculate, and highly significant. Yet those values are seldom reflected in daily economic life. Surveys by federal agencies have indicated that 81% of stream fish communities have been harmed by human impact, and that one-third of North American freshwater fish species are threatened and/or endangered or are of special concern. The value of ecosystem services, especially where freshwater is concerned, is not yet appreciated.

At the same time that our appreciation for watersheds has dramatically

increased, our understanding of the range of human impacts has also improved. The successes of the Clean Water Act and the Safe Drinking Water Act have given way to a sobering understanding of the dynamic interchange between man and nature. Some twenty-five years ago, outfalls of pollution from industrial and municipal systems—so-called "point sources"—were the Nation's primary concern. Today the debate is over "non-point sources," which translates into just about everything else. To put it in the timeless words of Walt Kelly's Pogo, "we have met the enemy and he is us." Years of end-of-pipe efforts have paid major dividends. As former U.S. Environmental Protection Agency (USEPA) Administrator William K. Reilly put it, "our rivers and streams may not yet be fishable or swimmable, but at least they are no longer flammable." Yet "non-point" sources of pollution—agricultural and urban run-off, stormwater events, and more, when combined with loss of riparian zones, stream buffer capacity, and/or groundwater recharge ability, present as potent a threat to our natural resources as toxic waste did a generation ago. The solutions to the more complex nature of "non-point" sources will not be nearly so easy to find as they were for "point sources." Moreover, the regulatory strategies that defined point-source controls are at best of limited value in managing non-point source pollution. For example, the EPA several years ago attempted to control industrial runoff by treating every trickle of stormwater from an industrial property as if it were a "point-source" deserving of regulatory treatment. The limits of regulation were clearly being reached in terms of protecting watersheds.

Today, in Pennsylvania and elsewhere, new strategies are being pioneered to intervene at a watershed level to restore and protect complex ecosystems. Increasingly these efforts involve voluntary initiatives among community organizations, landowners, local government, and environmental organizations. From French Creek in northwestern Pennsylvania to Ridley Creek in the Philadelphia suburbs, concerned citizens, property owners, and state and local government are collaborating to protect essential systems in ways that also provide for future economic opportunity. Increasingly, investment will only flow to areas where the surroundings enhance the value of the investment. The ecosystem services provided by watersheds in Pennsylvania do just that: enhance our quality of life in ways that allow both economic and environmental quality.

We at the Pennsylvania Environmental Council, for thirty years the state's leading environmental education and advocacy organization, are proud to be a part of this national effort to define new environmental solutions to long-standing problems. With our colleagues at the Department of Environmental Protection, we are pleased to present you with this Watershed Primer for Pennsylvania. We hope you will find it of value as you strive to enhance your watershed.

THE TIADAUGHTON WATERSHED— HELPING COMMUNITIES GROW GREENER

James M. Seif, Secretary
Pennsylvania Department of Environmental Protection

The 21st Century Environment Commission appointed by Gov. Tom Ridge recommended that Pennsylvania refocus its environmental protection programs on watersheds.

But what does it mean to focus on watersheds? What should be the result of this effort? How do we get there from here? Who can help?

To help illustrate how a watershed approach works, let's visit the fictional Tiadaughton Creek Watershed and see how the people there came to understand that watersheds are not only nature's building blocks, but ours as well.

Today the Tiadaughton Watershed is home to thousands of people who live and work in real, thriving communities that preserve open space, farmland and other amenities to make it a great place to raise families.

The Tiadaughton Creek and its tributaries are highly valued by the community. The creek is recognized as an important contributor to the economic health of the community because it supplies clean water, a major attraction to businesses. It is also a major recreational resource for fishing, swimming and boating, and a major attraction for potential employees.

Signs proudly tell visitors they are entering the Tiadaughton Creek Watershed.

The people of Tiadaughton Creek Watershed understand the direct connection between their economic health and the environmental health of the watershed because of an ongoing educational effort supported by local government, area schools, a progressive business community, the county conservation district and other county, state and federal agencies. But in the beginning, residents learned about their watershed in small steps.

The local high school science teacher began a water sampling program as a field project so her students could learn some basic scientific principles in an exciting way. The results of the sampling were written up in the school paper, and the students were profiled in the local newspaper and TV station.

The county conservation district began to get inquiries from local dairy farmers on how they could lower their cost of keeping cows healthy because dairy prices were dropping. District staff recommended fencing streams and putting in streamside forest buffers to keep cows clean, out of the stream, and to prevent exposure to disease. It worked! Soon other farmers became interested in doing the same things with financial help arranged by the district through the State Conservation Commission.

A local coal operator began to remine an abandoned surface coal mine in a way that eliminated an acid mine discharge that made a tributary to Tiadaughton Creek turn red. Red Run was renamed Kittanning Run after the mining was finished.

Local anglers quickly recognized that eliminating mine discharges had big benefits for fishing. They helped organize the Tiadaughton Creek Watershed Association, which used a little money and lots of volunteer sweat to do projects like constructing wetlands to permanently treat mine water seeps. The Coalition for Abandoned Mine Reclamation and the local Department of Environmental Protection (DEP) District Mining Office helped.

People from all over the community began joining the association, including local business people, contractors, public officials and citizens, all bound together by their common interest in fishing and getting rid of old polluted mine water.

As each of these successful steps was taken, community interest grew in doing more.

The manager of a local manufacturing plant, who was also an angler, became interested in how he could reduce wastewater going into the stream. He invited DEP staff to do a pollution prevention site visit and was surprised to learn about a new technology that would enable the plant to recycle wastewater back into its industrial process and entirely eliminate the plant's discharge to Tiadaughton Creek. Because the manager was active in the local Chamber of Commerce, he convinced other local business leaders to investigate pollution prevention ideas that would benefit the creek.

Using DEP's Environmental Compliance Reporting System website, the Chamber developed a profile of the kinds of air, water and waste issues faced by businesses in the watershed.

From these profiles, the Chamber was able to design business-to-business counseling services targeted specifically on the pollution prevention problems faced by its members, supported by DEP's Pennsylvania Environmental Assistance Network.

Through these efforts, the local Chamber not only helped businesses become more competitive, they were able to contribute in a major way to protecting the watershed. In one case, a local plant decided not to close because of the savings from its pollution prevention program.

The local sewage authority became interested in more effective ways of removing nutrients from its wastewater after hearing about a new technology at an environmental conference sponsored by the Pennsylvania Municipal Authorities Association. Now, instead of building a bigger treatment plant, the new technology allows the same size plant to treat more sewage while doing a better job of removing nutrients.

The authority also eliminated potentially harmful chemicals going into their treatment plant through a cooperative program with local industries. As a result, the biosolids produced as a byproduct of the treatment process are recycled and used as a soil conditioner.

County conservation district staff noticed that unpaved roads in the

watershed were causing sedimentation and erosion problems in tributaries to the Tiadaughton. With the help of the State Conservation Commission, the district organized an education program for the township road supervisors to show them how changes in maintenance procedures and projects they could do to correct problems would result in a big improvement in water quality.

A local senior citizens center formed a Senior Environment Corps and took on a service project to monitor stream quality and helped work with the local high school students on their project.

The seniors then began to promote the recycling of oil by do-it-yourself oil changers who too frequently contribute to groundwater pollution by improperly disposing of oil. One member, who owned a service station, volunteered to be a collection point for the community. Soon projects followed to expand the local recycling program to include household hazardous wastes and other materials as well as the cleanup of a local tire pile using grants from DEP.

Almost by accident, officials from several municipalities who became involved with their neighbors in the watershed association discovered their common interests. They quickly realized they could do even more through a coordinated effort by each of the local governments in the watershed.

The three townships and one borough that covered the watershed decided to do a joint watershed "visioning" process that involved asking residents how they wanted their community to grow. They used a grant from the Department of Community and Economic Development (DCED), along with assistance from the county and the Pennsylvania Center for Rural Development, to do the project.

They found the people in the watershed wanted to—

- Promote development that preserves open space and farmland;
- Encourage the redevelopment of land that was already developed;
- Encourage new development in clusters to promote ease of access to local business and public services;
- Restore and protect the Tiadaughton Creek by developing a greenway and streamside buffer system along the creek and major tributaries; and
- Identify and protect other sensitive environmental features and habitats.

With the help of the local college, the Natural Lands Trust and their "Growing Greener" Community Planning Initiative and the Tiadaughton Creek Watershed Association, the municipalities took the results of the visioning process and began to draft a comprehensive plan covering the entire watershed, as well as local ordinances to implement the plan.

The community used a grant from the Department of Conservation and Natural Resources (DCNR) to inventory local natural areas and environmental features using computerized geographic information provided with the help of DEP.

From the manual of best land use practices from the Governor's Center for Local Government Services, the community put together land development ordinances customized to their local watershed needs.

To promote redevelopment of the towns in the watershed, municipal leaders designated local Keystone Opportunities Zones to attract businesses to already developed areas.

Officials also completed an inventory of all brownfield sites in the watershed with a grant from DEP's Land Recycling Program and did detailed environmental assessments on several properties with the help of a DCED grant. One company had already occupied one of the sites and two others have good prospects.

Following through on other recommendations from the visioning process, the municipalities asked the county to develop a stormwater management plan for their watershed, with financial help from DEP.

They also updated their local Act 537 Sewage Facilities Plan to help implement their comprehensive plan and zoning with a grant from DEP.

A multi-year plan for the development of the greenway, streamside buffer system and other recreation facilities was started with help from DCNR, the county conservation district and the watershed association.

Local officials, the county farmland preservation program and the Department of Agriculture worked with local farmers to help create three new Agricultural Security Areas to protect local farms from development.

As part of a regional economic development strategy, local officials completed a study of how methane gas from a local landfill could be used not only to generate electricity, but also to serve a new industrial park built on a closed section of the landfill.

The community was able to attract two new industries to the site, including one plant that uses cardboard, glass and aluminum taken to the landfill for recycling in its product packaging and manufacturing process. This became the county's first "eco-industrial park," where the "waste" products of one operation became the raw materials for another.

Each of the communities in the watershed adopted policies that promoted buying products made from recycled content which they implemented by using some of the recycling performance grant money received form DEP under Act 101.

The township also bought vehicles powered by clean burning natural gas, following the lead of a local bakery that received a grant from the DEP to convert its delivery fleet to natural gas and install a refueling station.

Their "green" philosophy carried over to building construction, too. A new community center was built from the ground up using green building techniques that saved energy, used recycled materials in construction and provided a healthier environment for people using the building.

There was also a renewed interest in saving the older buildings in town as part of a historic preservation program. With the help of DCED's Main

Street Program and the nonprofit group Preservation Pennsylvania, the communities were able to offer help to businesses to restore their buildings and preserve the character of their town.

As part of a program to monitor the results of their efforts, the watershed association created the "Tiadaughton Creek Watershed Report Card" which annually measures the environmental health of the watershed.

The four municipalities also helped organize the annual Tiadaughton Creek Watershed Awards to recognize individuals, businesses, farmers and students who did projects that helped improve the environment in the watershed.

Recently, the *GreenWorks for Pennsylvania* TV program produced by the Environmental Fund for Pennsylvania profiled the efforts in the Tiadaughton Creek Watershed, highlighting how other communities could do the same thing.

The people of Tiadaughton Creek Watershed have been happy to share their story with others and opened a website on the Internet, courtesy of a local business, to give the public regular updates on watershed activities.

It took the people of Tiadaughton Creek a long time to discover their connection to the watershed. But through education, partnership and involving residents in shaping their own future, communities along Tiadaughton Creek are working to fulfill their vision of how their watershed should grow.

It also took the work of county, state and federal partners to provide technical and financial help in ways that support local choices, not overwhelm them.

Although this watershed is fictitious, there are now dozens of examples of how people all across Pennsylvania have done the same things—French Creek, Crawford County; Dennis Creek, Franklin County; Babbs Creek, Tioga County; Letort Spring Run, Cumberland County; Swatara Creek in Schuylkill and Lebanon Counties; and many more.

Fortunately, you have the advantage. You can learn from people in watersheds like these so that your path to growing greener can be taken more easily.

But don't wait until it's too late.

Table of Contents

Watershed Enhancement and Development

What Citizens Can Do

Government Agencies

Laws and Regulations Affecting Waterway Protection

Enjoying the Watershed

Overview:

Water Pollution in Pennsylvania

BY JOHN A. ARWAY

Arway is Chief of Environmental Services with the Pennsylvania Fish and Boat Commission.

(This article is adapted and updated from an article that originally appeared in Pennsylvania Angler in October 1996. Reprinted by permission.)

The most recent assessment of the water quality and biological conditions of Pennsylvania streams and rivers shows that 8,495 miles are believed to be supporting the federal Clean Water Act's "fishable/swimmable" goal; that's 10.2 percent of the state's 83,260[1] miles of streams. Stream uses were totally impaired in 4,407 miles of streams. In other words, 5.3 percent of our total stream miles cannot fully support swimming, fishing or both because of water pollution.

The pollution provisions of the Pennsylvania Fish and Boat Code provide the legal framework enabling Waterways Conservation Officers from the Pennsylvania Fish and Boat Commission to apprehend polluters and incur fines and penalties. The Commission also recovers damages to aquatic resources after water pollution occurs and fish and other aquatic life have been killed. A review of Bureau of Law Enforcement Water Pollution Reports, which include both pollution and watershed disturbance cases, reveals that 561 cases were investigated in 1998. These cases resulted in 297 settlements or prosecutions totaling $327,272 in penalties.

Susquehanna River near Wilkes-Barre.

Monongahela River

All of these penalties, of course, were assessed after the fact, after waterways in the state already had become polluted. A much better approach to dealing with water pollution is to prevent it from happening in the first place.

Pennsylvania's water pollution control program dates back to 1905, and the Commonwealth's first comprehensive water pollution control legislation, the "Clean Streams Law," was enacted in 1937. The Clean Streams Law has been strengthened over time by many legislative amendments. It has been used very effectively by the Pennsylvania Department of Environmental Protection (DEP) to control "point source pollution," which consists of sewage and

[1]The 1998 DEP 305(b) report estimates the total stream miles as 83,261. The number of stream miles reported in 305(b) reports has changed significantly through the years. In 1984, only 12,962 miles were reported — those listed as major streams in a 1917 publication. By 1986, an in-house estimate of 50,000 total stream miles was cited. From 1992 to 1996, EPA-calculated total stream miles were used. These were done at the 1:100,000 scale. The 1996 305(b) report listed 53,962 miles. The 83,261 miles reported in 1998 were calculated using an in-house GIS system at the 1:24,000 scale, which shows more streams.

industrial wastes. An analysis of Commission Water Pollution Report records and DEP water quality assessment reports reveals that the overall environmental health of Pennsylvania streams has been stable or slightly improving over the past 15 years—largely because of reductions in point source pollution.

Today's water pollution problems, however, are dominated by "nonpoint sources" such as abandoned mines, agriculture and other activities that produce polluted runoff. Toxic substances are also a great concern because of the potential risks they pose to natural resources and public health. The fact that these substances can now be measured in very low concentrations (parts per trillion or even parts per quadrillion) has added to the public's concern.

The following is a discussion of the major sources of water pollution affecting Pennsylvania's rivers and streams.

Nonpoint Source (NPS) Water Pollution

Nonpoint source pollution accounts for over 77 percent of the total water pollution problem in Pennsylvania, according to the Pennsylvania Department of Environmental Protection in a 1998 report to the U.S. Environmental Protection Agency (USEPA). The largest source of NPS pollution in Pennsylvania is abandoned mine drainage, which accounts for 1,764 miles (40 percent) of degraded water. Not only is it the largest source of NPS pollution, but abandoned mine drainage is, in fact, the largest source of pollution affecting stream quality in the Commonwealth. A Commission estimate of the value of recreational fishing activities that are lost to the Commonwealth due to abandoned mine drainage pollution is $67 million per year.

Yet another nonpoint source of water pollution is agriculture. The second largest source of pollution affecting stream quality in Pennsylvania after abandoned mine drainage, agriculture contributes to 1,328 miles (30 percent) of degraded streams. Other sources of nonpoint pollution include urban and stormwater runoff (10 percent), construction activities (3 percent), and acid rain (2 percent).

Abandoned Mine Drainage

Abandoned mine drainage can include both alkaline and acid mine drainage components. However, acid mine drainage (AMD) is responsible for more degraded stream miles in the Commonwealth than any other pollutant. Acid mine drainage is a byproduct of the surface and deep mining of coal.

The major sources of AMD are coal mines abandoned in the early 1900s that discharge millions of gallons of acidic water into our streams each year. Old and abandoned mines aren't the only problem, however. Even today, coal operators are abandoning their treatment systems, filing for bankruptcy, and leaving it to the Commonwealth to decide whether or not it's in the public interest to continue chemical treatment of their discharges.

Acidic discharges from coal mines are produced when soil and crushed rock containing iron pyrite, or fool's gold, are uncovered during mining. When these pyrites are exposed to air and water, a chemical reaction occurs that forms iron hydroxide and sulfuric acid. This acid then dissolves other minerals and metals from the surrounding rock. The dissolved elements ultimately find their way through the local groundwater into a nearby stream. As a result, polluted groundwater discharges resulting from mining activities can be very acidic, depending on the amount of pyrite in the uncovered soil and rock, also called the "overburden." The groundwater also can contain high levels of toxic metals such as iron, aluminum and manganese.

One of the most apparent signs of mine drainage is a yellow-orange staining, or "yellow-boy," left on stream bottoms. This results from the high levels of dissolved iron in groundwater coming into contact with oxygen that is either in the air or is dissolved in the surface water. The iron then becomes "oxidized." This can also happen with aluminum, which can make stream bottoms white, or manganese, which can make them black. The oxidation of toxic metals is the reason we have different–colored streambeds in different parts of the Commonwealth. Most of the metal "precipitates" either are directly toxic or fill in the spaces between the rocks in the stream bottom so that there is no place left for the aquatic invertebrates that fish feed on to live. The result: fish and other aquatic animals die.

Siltation is another source of pollution from mining,

especially when large surface areas are disturbed. During rainstorms the soils wash away from the mine sites into local streams. The soils then become sediment or siltation, and coat the stream bottoms in much the same way as metal precipitates pollute streams.

AMD pollution is a very serious problem in Pennsylvania and will continue to plague us for many years. There are no magical or simple solutions to solving this problem, but promising new technologies do exist. If we can stop the creation of additional AMD problems by applying and enforcing present environmental regulations, there is hope that we can restore a fishable/swimmable use to many of those 2,400-plus miles of streams that were once thought to be lost forever.

Oil and Gas Development

Oil and gas development includes the drilling and production of oil and natural gas deposits buried deep beneath the earth's surface. It occurs in more than 30 counties throughout the Commonwealth, but is concentrated mostly in the northwestern and southwestern parts of the state. It all began when Colonel Edwin Drake drilled our nation's first oil well in 1859 in Titusville, Venango County. Since then, the industry has grown substantially in response to society's demand for these fossil fuels, and the environmental effects have been significant.

Operating wells produce large volumes of brine (salty water), which contains a laundry list of toxic chemicals. These brines are discharged directly into many of our headwater native brook trout streams. They also leak from unlined pits designed to separate the oil from the brine. Untreated brine discharges and leaks contaminate ground and surface waters and can cause severe effects. Amazing as it sounds, Commission studies have found that some of our freshwater streams are saltier than seawater. Improved regulation of the oil and gas industry has compelled many developers to pollute less, but many operators still discharge directly into streams until they are caught.

Oil spills are another problem in the oil fields. In 1985, the USEPA estimated that the amount of oil spilled in a four-county area of the Allegheny National Forest in northwestern Pennsylvania qualified as a major oil spill; a U.S. Coast Guard was activated as a result. The Coast Guard team walked through individual watersheds in the area and identified all the places where oil was spilled or where brines were discharged. These places were then rated, and the most serious were systematically cleaned up by the USEPA.

Among the other pollution problems caused by oil and gas development in Pennsylvania is sedimentation resulting from forest clearing and the construction of miles of new dirt roads.

Agriculture

Agriculture is the number-one industry in Pennsylvania. And that's a good thing. The bad thing is that agricultural wastes such as manure, liquid and granular fertilizers, silo liquids, pesticides, and silt can be transported into streams during rainstorms or after snowmelt. These wastes can physically injure aquatic habitats by filling in stream channels. They may also be directly toxic to fish, other aquatic organisms and plants because of their chemical properties.

Manure and other fertilizers from farm fields that wash into streams and downstream reservoirs stimulate the growth of "nuisance aquatic vegetation." This aquatic vegetation can grow uncontrolled in downstream lakes and reservoirs. The growth is fueled by the fertilizers once intended to grow agricultural crops for our tables.

Adding to agriculture's impact on Pennsylvania water resources are pesticides, which include both herbicides and insecticides. Like fertilizers, they too can be washed from farm fields into nearby streams, but they have a much different effect. These chemicals were developed to control plant and animal pests. When they enter streams and other foreign environments, they cannot discriminate between a pest such as a potato bug and a brook trout. Pesticides can be very toxic to aquatic animals at very low levels and must be handled very carefully according to the label specifications. Many pesticides should be applied only by applicators certified by the Pennsylvania Department of Agriculture.

Yet another agriculture-related pollution problem that threatens water quality in Pennsylvania is livestock grazing in streams. Livestock allowed to graze freely through streams can cause streambank erosion

and sedimentation. A solution to the problem is to use streambank fencing to establish vegetative "buffer zones" next to streams. These buffer zones filter out sediments, nutrients and other agricultural pollutants before they reach the stream. They also decrease streambank erosion and provide important riparian (streambank) habitats for reptiles, amphibians and other wildlife.

Acid Deposition

Acid deposition is primarily the result of man-made emissions from fossil-fuel burning, automotive exhausts and other activities that produce sulfur dioxide (SO2) and nitrogen oxide (NOx) gases. These pollutants are sent into the atmosphere, where they are chemically changed and returned to the earth either as wet deposition (rain, sleet or snow) or as dry deposition in the form of sulfate and nitrate particles in dust. This deposition is declared acid when it has a pH lower than normal.

The pH of our rainfall in Pennsylvania averages around 4.1. This reading is many times more acidic than unpolluted rain. Because all surface water and ground water depend on precipitation for replenishment, nothing escapes at least some of the effects of acid deposition. Individual areas of the state may respond differently to acid deposition, depending on the region's natural ability to "buffer," or neutralize, the incoming acidity. This ability of a waterway to neutralize acids—called its "acid neutralizing capacity"—depends on the dissolved mineral content in the water.

Many watersheds in Pennsylvania, particularly those located in the mountainous Allegheny Plateau Region, have low acid-neutralizing capacities. Fish and other aquatic life found in these watersheds are adversely affected by the increased acidity. This acidity often increases toxic metal concentrations such as aluminum in the water (see AMD discussion, above). Acid deposition also affects forests, buildings, drinking water and human health and is potentially harmful to most living things.

In 1990, Congress approved new amendments to the Clean Air Act. These laws marked the first time Congress set out to control acid deposition. The legislation's tighter controls on industry smokestacks and automobile emissions are expected to improve Pennsylvania's affected streams, rivers and lakes; The Pennsylvania Fish and Boat Commission and others, will continue to monitor the condition of our most vulnerable streams, lakes and rivers to determine the impact of these new controls. As citizens, we can do our part to limit air pollution by saving energy, promoting mass-transit and supporting strict automobile emission inspections.

Point Source Water Pollution

Point sources of water pollution affecting Pennsylvania's rivers and streams include sewage discharges from municipal treatment operations and discharges of treated industrial wastes. While point sources of water pollution have been eclipsed by nonpoint sources as a threat to Pennsylvania's water resources in recent decades, they still account for more than one-fifth of the water pollution problem in the Commonwealth today.

Municipal Point Sources (Sewage)

Domestic sewage treatment traditionally has resulted in effluent discharges to streams, rivers or large lakes. Sewage discharges typically contain suspended solids, nutrients (nitrogen and phosphorus), and chemicals that exert a biological oxygen demand on the receiving body of water. These discharges also can have disrupting thermal effects that increase water temperatures in rivers, streams and lakes. In addition, pesticides, toxic organic chemicals and metals are sometimes found in sewage discharges.

Successful removal of these substances varies with the type of treatment used. Primary treatment consists of the removal of insoluble materials such as grit, grease and scum from the water. Secondary treatment usually involves the use of microorganisms (bacteria) that consume organic materials in the wastewater. This a critically important step because organic materials, when discharged into a stream or river, compete for available oxygen with fish and other aquatic life. Tertiary treatment, often called advanced waste treatment, further reduces suspended solids and decreases levels of organic and inorganic compounds.

Excessive quantities of solids and nutrients (primarily nitrates and phosphates) can cause excessive plant growth such as large blooms of microscopic algae.

Additionally, high solids and nutrient loads can affect aquatic insect communities by causing sensitive organisms to disappear and be replaced by more pollution-tolerant forms such as aquatic worms and midges. Sewage discharges can also negatively affect coldwater streams by increasing water temperatures.

Sewage pathogens are often removed in the treatment process by chlorination or exposure to ultraviolet light. Chlorine, however, is itself a problem in many discharges because it is often used in excessive quantities. A very effective biocide designed to kill bacteria that live in sewage, chlorine can also kill non-targeted aquatic animals, including fish, when it is improperly applied.

Sewage has been the primary target of Pennsylvania's water pollution control program in the past because of problems associated with malfunctioning septic systems. Much progress has been made in the collection, centralized treatment and discharge of sewage. As a result, we've seen significant improvements in water quality and fisheries in our large rivers such as the Delaware near Philadelphia and the Three Rivers area in and around Pittsburgh. However, municipal sources remain the third largest source of stream pollution in Pennsylvania, degrading more than 400 miles of streams. New sewage disposal techniques that appear promising include spray irrigation of treated sewage to land and artificial wetland treatment systems. Wetlands are composed of a variety of plant and animal communities that can perform many of the tertiary treatment functions of a sewage treatment plant but in a natural environment.

Industrial Point Sources

The Pennsylvania DEP permits and regulates the discharge of treated industrial wastes through the National Pollutant Discharge Elimination System (NPDES) program. Permit engineers in regional DEP offices use water quality standards set by law (25 PA Code, Chapter 93) and site-specific data on the water quality and flow of the receiving stream to set discharge limits for individual point sources of pollution. The Chapter 93 standards are based on the stream's designated use (aquatic life, water supply, or recreation) and use numerical water quality criteria designed to protect those uses.

The Pennsylvania Fish and Boat Commission and DEP work cooperatively to decide how individual streams should be designated. They also decide when criteria should be strengthened or lowered based on the best available scientific data. This procedure ensures that aquatic communities are protected whenever a discharge is permitted. Unfortunately, however, we cannot predict accidents, equipment failure or even negligence that might result in excessive discharges. When these occur, the frequent result is damage to aquatic communities.

Monitoring Contaminants in Fish

Pennsylvania's monitoring of toxic pollutants in fish tissue began in 1976. The purpose of this monitoring is to gather information so that the Pennsylvania Fish and Boat Commission, the DEP and the Pennsylvania Department of Health can advise the public to limit or cease consuming fish caught in contaminated areas. The three agencies compare the concentrations of various toxic compounds found in fish tissue with "Action Levels" set by the Food and Drug Administration.

Beginning in 1993, the Commission's Summary of Fishing Regulations and Laws provided to every licensed angler contains a table of all consumption advisories (do no eat) and no-kill zones.

PCBs and chlordane are the primary pollutants that cause a stream or river to be listed as contaminated. However, individual listings for other toxins such as mercury and dioxin also occur. Most of the listed waters are large rivers that are highly industrialized and contain many point and nonpoint sources of toxic discharges. Most of the chemicals of concern are extremely persistent and will remain in our environment well into the future.

Municipal, Residual, Hazardous and Radioactive Wastes

Another important source of water pollution in Pennsylvania is waste produced by households and industry. Each year, Pennsylvanians produce about 9 million tons of municipal wastes, or common household garbage. However, much of this trash does not go to the local landfill. It ends up in our streams and rivers as litter. Having to contend with broken bottles, rusty cans and other trash while swimming, fishing or playing in a stream is no fun. Yet, some people continue to use our streams as their personal garbage cans. They fail to see that a small stream is an important part of a larger ecosystem—one that we also live in.

Regional Law Enforcement Headquarters—Pennsylvania Fish and Boat Commission

NORTHWEST REGION. 11528 State Highway 98, Meadville, PA 16335; 814-337-0444. Butler, Clarion, Crawford, Erie, Forest, Lawrence, Mercer, Venango and Warren counties.

SOUTHWEST REGION. 236 Lake Road, Somerset, PA 15501; 814-445-8974. Allegheny, Armstrong, Beaver, Cambria, Fayette, Greene, Indiana, Somerset, Washington and Westmoreland counties.

NORTHCENTRAL REGION. Box 187 (Fishing Creek Road), Lamar, PA 16848; 717-726-6056. Cameron, Centre, Clearfield, Clinton, Elk, Jefferson, Lycoming, McKean, Northumberland (west of Rt. 147), Potter, Snyder, Tioga and Union counties.

SOUTHCENTRAL REGION. 1704 Pine Road, Newville, PA 17241; 717-486-7087. Adams, Bedford, Blair, Cumberland, Dauphin, Franklin, Fulton, Huntingdon, Juniata, Lebanon, Mifflin, Perry and York counties.

NORTHEAST REGION. Box 88 (Main Road), Sweet Valley, PA 18656; 717-477-5717. Bradford, Carbon, Columbia, Lackawanna, Luzerne, Monroe, Montour, Northumberland (east of Rt. 147), Pike, Sullivan,Susquehanna, Wayne and Wyoming counties.

SOUTHEAST REGION. Box 8 (Brubaker Valley Road), Elm, PA 17521; 717-626-0228. Berks, Bucks, Chester, Delaware, Lancaster, Lehigh, Montgomery, Northampton, Philadelphia and Schuylkill counties.

YOU CAN ALSO CALL THE COMMISSION'S CLEAN WATER HOTLINE AT 1-800-854-7365. THE HOTLINE OPERATES 8 AM TO 4 PM WEEKDAYS. AT OTHER HOURS, A RECORDER WILL TAKE YOUR MESSAGE.

YOU MAY ALSO CALL THE DEPARTMENT OF ENVIRONMENTAL PROTECTION'S EMERGENCY NUMBER AT 1-800-541-2050. THIS NUMBER OPERATES 24 HOURS AND DAY, 7 DAYS A WEEK.

NOTE: These phone numbers are for reporting water pollution only. For other Fish and Boat Commission business, or for more information, call (717) 657-4518. If you would like technical information about how pollution affects aquatic life, contact: Pennsylvania Fish and Boat Commission, Division of Environmental Services, 450 Robinson Lane, Bellefonte, PA 16823; phone: 814-359-5147.

Although many of today's mandatory recycling requirements and incentives are preventing trash of value from entering our streams and rivers, not all materials are recyclable. Many concerned citizens and conservation groups voluntarily remove trash from streams and rivers each year. We can all do our part in keeping our waterways free of trash by practicing proper disposal and recycling, cleaning up after others, and reporting violators.

Another category of wastes, residual wastes, range from municipal-type wastes produced in bulk by one industry to "near hazardous" materials. The Pennsylvania DEP regulates residual wastes somewhat differently than it does municipal wastes because residual wastes can contain a wide variety of waste forms. About 16 million tons of residual wastes are generated annually in Pennsylvania.

Posing an even greater threat to human health and the environment are hazardous wastes. The Pennsylvania DEP, in consultation with the USEPA, maintains a list of wastes that qualify as hazardous because of certain properties such as ignitability and corrosivity. About 0.8 million tons of hazardous wastes are produced every year in the Commonwealth.

Yet another category of dangerous wastes are radioactive wastes, which give off harmful rays that can destroy tissues in living organisms and can cause serious physical defects. Three Mile Island along the Susquehanna River just south of Harrisburg was the site of the worst commercial nuclear accident in U.S. history. On March 28, 1979, failure of the cooling system of the

nuclear facility's Number Two Reactor led to overheating and partial melting of its nuclear core. Some radioactive gases and water were released from the plant, but no signs of damage to the fishery were ever measured.

Conclusion

Although much progress has been made in cleaning many of Pennsylvania's waterways and restoring a fishable use, we now face the challenges of monitoring the "uptake" of toxic chemicals in fish living in many of these waterways. Important decisions must be made about the fate and effects of these chemicals on the health of fish, as well as these chemicals' effects on the health of the anglers and their families who consume the fish.

Major advances in the ways in which we identify chemical pollutants allow us to detect concentrations in parts per trillion or even parts per quadrillion. Similar advances in aquatic and human health toxicology allow us to protect both our water resources and the public more effectively because of our advanced knowledge about the health risks posed by these toxic compounds. In fact, new human health-based risk assessment guidelines supported by medical experts in the Great Lakes states should soon replace the outdated "Action Levels" used by the U.S. Food and Drug Administration.

If you have concerns that water pollution is occurring in your area, or if you have information about a suspected incidence of pollution, contact the Commission office nearest you (see sidebar, page 6). Together, we can clean up Pennsylvania's rivers and streams so that they remain a wonderful and enjoyable resource for years to come. ■

What does the future hold?

Pennsylvania's 21st Century Environment Commission, convened by Governor Ridge on July 1, 1997, outlined the future of Pennsylvania's environment. With the help of thousands of Pennsylvanians, the Commissioners—who represented businesses, environmental organizations, academics, philanthropies, and local and state governments—created a vision for Pennsylvania that is committed to cultural values, strong communities, and a stewardship ethic among all citizens.

The Commission outlined five major environmental needs:

1. Promoting responsible land use;
2. Conserving natural resources for sustainable use;
3. Making a healthy environment for healthy people;
4. Developing a new foundation for teamwork; and
5. Promoting environmental education, training, and stewardship.

While all of these factors contribute to the overall health of the watersheds, the Commission also explicitly outlined goals relating specifically to water quality. These include protecting surface water quality and restoring degraded systems, balancing water consumption with water supply, and developing comprehensive watershed management strategies.

For more information about the 21st Century Environment Commission and their recommendations, visit their web site: www.21stcentury.state.pa.us

Overview:

The Economic Benefits of Restoring and Protecting Pennsylvania's Waterways

Watershed Protection Pays

BY BRAD CLEMENSON

Clemenson is Communications Director in the office of U.S. Congressman John Murtha

Individuals and groups working to restore and protect rivers or develop river-based recreation activities often make impassioned arguments about why a local stream or river ought to be cleaned up, protected, enhanced or made more accessible. Their pitch may inspire conservationists, outdoor enthusiasts and others of like mind, but let's be blunt: some people think fish are slimy, some have no interest in how many bugs are in the water, and some question whether we should spend any money at all on streams. As a result, waterways advocates need to articulate stream benefits in terms that build support among a broad spectrum of the community—especially elected officials, business and economic-development leaders.

Often, the secret to winning over skeptics is to articulate the economic impact and benefits of stream protection and restoration activities. The fact is, streams and rivers that are clean and healthy offer a wealth of recreational opportunities—including fishing, boating, bird watching, picnicking and wildlife observation—as well as opportunities for people simply to "get away from it all." When trails, greenways, boat ramps and parks are built along streams, more people come to use and enjoy these resources. And when people come, they spend money.

Kittanning

Adding It Up: The Economic Impact

Pennsylvania has lost many jobs in recent decades from the decline of the steel and coal industries. This makes citizens and government and business leaders in the Commonwealth especially sensitive to and supportive of activities that can help spur job creation and retention. By clearly articulating the economic benefits of Pennsylvania waterways—as well as their role in improving quality of life and creating and supporting jobs— we can go a long way to building popular support for stream protection and restoration.

People come to streams not just to fish. They come to boat. They come to cool off on hot summer days. They come to picnic. They come to walk or hike, often with or without good trails. They come to ride bicycles if a suitable road or trail parallels the stream. They come to watch birds, deer or other wildlife. And sometimes they come just to relax and sit beside the water.

Of course, these activities may be limited or virtually nonexistent on streams that are badly polluted, that offer little or no access, and that aren't promoted as recreation resources. But on streams that are clean and accessible and that are promoted as such, these activities can create a wealth of economic benefits for the surrounding community. Even dirty streams, in fact, have been known to attract people if they have particularly exciting scenery or boating opportunities.

Dollars spent by recreational users of streams or stream corridors have direct impact in grocery stores, sporting-goods shops, restaurants, campgrounds,

lodging facilities, gasoline stations and other businesses. Spending by these businesses, in turn, creates indirect impact as they buy products or materials to resell, have things delivered, and pay sign-makers and brochure publishers, accountants, bank interest and fees, phone and electric bills, taxes, and so on. The indirect impact reaches diverse sectors of the economy, including trucking, farming and manufacturing. Recreation supports jobs making products that range from binoculars to boats, and from bug spray to beef.

The wages and salaries paid to people employed at these businesses—both those serving visitors and those selling to recreation-based enterprises—create an induced impact, which reaches every sector of the economy. Of course, some of the dollars spent on recreation will leave the local economy, especially those spent on durable goods or groceries produced somewhere else. But the money that gets passed on from a business to a wage earner or to another local business providing services to the first business may spin through the local economy several times. This is what economists refer to as a "multiplier" effect. A typical multiplier for recreation dollars is 1.5 to 3.0, which means that each dollar spent by a river visitor will be spent 1.5 or 3.0 times, on average, before it leaves the local economy.

In terms of total dollars, the impact of recreational spending on a local economy can be enormous, depending on the resource. A 1993 study of nine counties for the Southwestern Pennsylvania Heritage Preservation Commission estimated that people from inside the region spent 794,384 days fishing and/or boating in the region, while the total for people from outside the region was 563,772 days. According to the analysis by Penn State University faculty, the average spending per day exceeded $26 for each regional and nonregional fisherman and boater. Direct expenditures by people fishing and boating thus were $35.6 million, including $14.7 million spent by people from outside the nine counties.

Focusing on the $14.7 million spent by "outsiders," the study's designers created a regional model showing how these dollars moved through the economy. Of the $14.7 million total, $4.5 million immediately left the regional economy to pay for gasoline or other products produced elsewhere, while $10.2 million stayed within the region, including $5.3 million to cover services and $2.6 million on wholesale and retail trade. This $10.2 million then generated $17.7 million in secondary impacts, including wages and salaries, for a total economic impact of $27.9 million. These figures are impressive enough, but the total economic impact of the region's streams and rivers was even higher because people who came to waterways but did not fish or boat were counted separately, as was spending on vacation homes.

And let's not forget the $20.9 million spent fishing and boating by people who call the nine-county region their home. It may not be coming from outside the regional economy, but the money clearly has a major impact within local communities that attract thousands of visitors from other communities and cities within the region.

Other studies have found equally impressive impacts from recreation activities:

- The Pennsylvania Fish and Boat Commission has determined that warm-water fishermen spend on average about $28 per day of fishing, while trout fishermen spend on average $42 per day. Put the fishermen on larger boats on Raystown Lake, and the average daily impact per visit, according to an Army Corps of Engineers assessment, is $76.

- Rivers that attract large numbers of whitewater rafters for guided excursions, such as the Gauley River in West Virginia, have produced economic impacts ranging from $60 to $133 per person per day, according to another study.

- A study of canoeing on the St. Croix River in Maine showed average daily spending of $15, while studies of people using the hiking and biking trails along rivers in Western Pennsylvania have shown average daily expenditures ranging from $9.29 per day by the average user of the Youghiogheny River Trail to $25.85 per user day on the Oil Creek State Park bike trail.

Projecting exact economic impacts in a particular community contemplating a stream or river restoration project is difficult. The number of users and their expenditures will vary depending on the quality of the resource, the type of activity, accessibility, the local and regional population, and the availability of similar resources within the community or region. The best

advice is to hire an economist to conduct a study. Some groups have succeeded in convincing faculty members at nearby colleges or universities to develop economic-impact analyses as class projects. If that's not possible, then you might want to locate a study of a similar resource in a similar community on the assumption that the local impacts should be roughly comparable.

Quality of Life Attracts and Retains Jobs

The firm of Cushman and Wakefield is in the business of helping companies find locations for new plants and other corporate facilities. Here, according to the firm, are the most important factors leading a company to select one site over all the dozens or hundreds of other potential locations it is considering:

1. Access to markets
2. Availability of skilled labor
3. Quality of life

More recently, the Kiplinger Letter reported on July 11, 1997, that the top factors in location decisions were quality labor at a reasonable price and quality of life.

The fact that "access to markets" leads the Cushman and Wakefield study and not the Kiplinger Letter's does not necessarily put the two at odds. The difference between the two reports reflects the stages of corporate decision-making. Communities that have the basic sewer and water infrastructure and that meet company-specific needs for rail, airport or highway access can make the "first cut" in the corporate site-selection process. In the next stage of the process, more subtle factors about the community come into play. The first of these is the quality and quantity of the local workforce. The second is quality of life. On these points the two reports agree.

Many states and regions are capitalizing on their outdoor recreation opportunities in promoting themselves as sites for industry. The New England States' Governors Association has hailed "Open Space" as the key to the region's quality of life. The San Antonio Riverwalk and the American River Bike Trail in Sacramento are cited frequently as recreational resources that have helped attract jobs.

Some Western Pennsylvania counties now are using this approach as well. Armstrong County has adopted the slogan, "Best Thing Next to Pittsburgh," and is aggressively promoting its open space and the scenic Allegheny River as reasons to locate there. The Cambria-Somerset region's promotions cite access to nine state parks within an hour as a reason to consider the area.

Other Economic Benefits

In addition to quality of life improvements and increased spending on recreation, stream restoration activities can result in a number of other economic benefits. For example, people want to live near these assets, to take advantage of recreation opportunities that cost little or nothing. And that helps drive up real-estate values—a clear benefit to current property owners.

In addition, public costs for utilities often are reduced by stream restoration because of the need for less purification and treatment of water supplies. The Hooversville Borough in Somerset County, for example,

What's In It for Your Community?

Recreation and stream conservation can create a number of benefits for your community, including:

- Dollars spent on recreation create and sustain businesses, that employ people and purchase a broad spectrum of goods and services in the community.
- Recreational amenities contribute to enhanced quality of life, an increasingly important factor in business decisions about where to locate jobs-producing facilities. Recreational amenities also can help communities retain a quality workforce, yet another key to attracting business.
- Opportunities for exercise, recreation and stress reduction help reduce health costs to a community.
- Stream and river restoration can lead to reductions in public utility costs as cleaner water supplies mean less spending on purification and treatment or new water resources.
- Recreational amenities typically contribute to higher property values.
- Flood damages often are reduced as communities pay more attention to restoring and protecting streams.

is benefiting twice over from a mine-drainage treatment project on Oven Run, a tributary of the Stonycreek River. Not only is the community getting a cleaner stream, but it is also reducing the cost of treatment and maintenance for the community water supply.

Another mine-drainage treatment project, also in Somerset County, is enabling a community to avoid the high cost of developing a backup water-supply system and providing extra water capacity to enable the community to continue to grow. After the community of Farrelton lost its water supply to mine drainage and was forced to buy water from the neighboring township, the Quemahoning Creek Project was launched to clean up the drainage. The result: the old water treatment system has become the new backup system—at major cost savings. And because the neighboring township's water system was near capacity, the restored Farrelton water source will enable future community growth.

The benefits of stream and river restoration are equally clear in larger communities and cities. In Pittsburgh, about a million people still get their drinking water from the Allegheny River. Over the years, the water quality of the river has improved significantly, which has greatly reduced local treatment costs. Nevertheless, the Allegheny still contains some iron and other corrosive minerals. Cleaning up the remaining pollution would further reduce treatment costs for Pittsburgh residents.

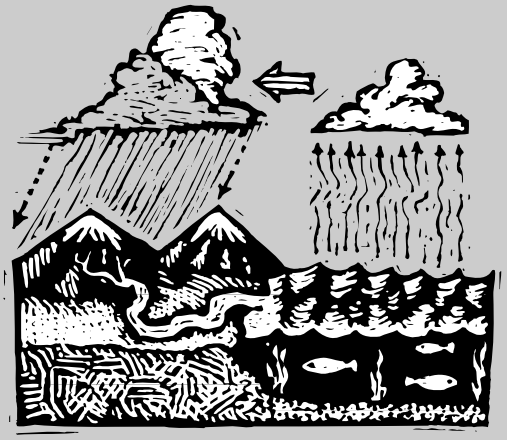
Fewer expenditures on health care and natural disaster clean-up are among the other benefits of stream and river restoration activities. Stream-based recreation can help reduce health costs by providing opportunities for people to exercise, relax and reduce stress. In addition, stream and river restoration can help reduce loss of life and property damages from flooding. How? By creating recreation and wetland areas along rivers that receive minimal damage from floods and provide open land to retain flood flows.

"Everybody Benefits"

A prime example of the multiple economic benefits that stream restoration can bring to a community can be found in Kittanning, a small town along the banks of the Allegheny River in Armstrong County. With a large park in development along the river including an amphitheater for concerts, a dock for boats, and other amenities, economic activity in Kittanning picked up noticeably. In anticipation of the visitors and riverfront activity, a new bed and breakfast opened up, a meat shop and other business moved in, many downtown businesses were restoring their storefronts, and the community was buzzing about the new development.

The Kittanning story shows how quality of life attracts business. It makes the community a great place to live and contributes to community pride. The benefits of clean streams and rivers thus go far beyond the insects and the fish that grow and multiply when afforded the proper aquatic environment. Everybody benefits—businesses, residents, everybody. ■

Land Use and Associated Watershed Health Topics



Land Use and Associated Watershed Health Topics

Preventing Runoff and Erosion

The Streambank Stabilization Solution

BY HARDY VANRY
VanRy is former Assistant Director of the French Creek Project.

When many people think of water pollution, they picture an oil spill, or purple ooze pouring out of a factory pipe, or a little kid catching an old shoe on a fishing pole. However, up to 65 percent of water pollution in the United States and Pennsylvania stems from nonpoint sources—those that can't be traced to one identifiable source. Nonpoint source pollution comes from many different small contributing sources, which often makes it difficult to reduce or prevent. The three causes of nonpoint source pollution are:

- Stormwater runoff—rainwater running across land and entering streams and lakes;
- Erosion—the breaking up of soils and detachment of soil particles due to the force of runoff; and
- Sedimentation—the buildup of these detached soil particles in nearby streams and rivers.

Same stretch of French Creek after streambank fencing.

Erosion along French Creek before streambank fencing.

Although these are all natural processes, human decisions and land-use practices can accelerate the degree to which the processes occur, thereby contributing to water pollution in Pennsylvania's streams, rivers and lakes. This pollution can be reduced significantly by making sure that adequate stream-side vegetation is planted along the banks of Pennsylvania's 83,261 miles of streams and rivers.

Many environmental scientists believe that stream-side vegetation can remove up to 95 percent of the nonpoint source pollution that would otherwise enter a stream system. Unfortunately, however, much of the vegetation that once existed along Pennsylvania waterways has been removed over time through a variety of human activities. These have included unwise logging practices, overdevelopment, poor land-use planning, and the location of croplands, buildings, yards and cattle grazing too close to waterways.

The Impacts of Erosion

So why should we care? Why is it so important to restabilize a streambank that is eroding at an unnatural rate? The answer: If left uncontrolled, erosion has the potential to cause a variety of economic and environmental damage. Among the negative impacts:

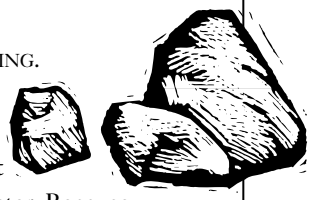
- Further loss of vegetation and topsoil, including grazing fields and cropland;
- Contamination of water by heavy metals, phosphorus and excessive nutrients that otherwise remain bound within soils;
- Increased suspended and settled sediments that destroy habitat and impact the ability of fish to feed and reproduce;
- A reduction in drinking water quality together with the added costs associated with water purification;
- In cases where cattle are allowed direct access to the stream, an increased potential for leg injury as streambanks crumble and increase drop-off;
- In extreme cases where sediment partially clogs a stream channel, an increase in flooding and a disruption in the volume and/or velocity of stream flow.

What Is Streambank Stabilization?

Stream corridor management and riparian buffers are two methods of protecting Pennsylvania's waterways from various types of pollution, including sedimentation, nutrient loading, pesticides, flood damage and habitat loss. (More information on these issues is provided elsewhere in this publication.) Unlike these other methods, streambank stabilization is normally used to reduce pollution in streambank areas that are already suffering from vegetation loss and erosion. In this sense, streambank stabilization is more than stream protection; it's stream restoration.

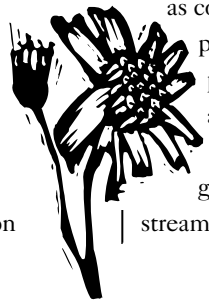
There are two principal reasons why a streambank becomes unstable. They are: removal or disruption of stream-side vegetation and/or soils by humans or cattle; and erosion resulting from the movement of water past the streambank site. Often, a streambank's instability results from a combination of these two things. And, depending on the cause and the pollution occurring at a specific site, there are a variety of streambank stabilization methods that can be used. These include:

STREAMBANK FENCING. Fencing can keep cattle away so that their hooves do not trample vegetation and disrupt soil. Streambank fencing also can help prevent the removal and erosion of vegetation, except through natural processes. Fencing is especially beneficial when used in conjunction with streambank stabilization methods to ensure that any reestablished vegetation has a chance to take root without risk of injury from cattle, humans or all-terrain vehicle traffic. (For more information on fencing, see the article, "Stream Corridor Management on Agricultural Lands: Stream-Friendly Farming," page 23.)



"RIP-RAP," OR STREAMBANK STONING. This means placing concrete or stone between the streambank and the stream so that soils cannot be eroded by the movement of water. Because the particles that make up rocks are much more tightly packed than those in soils, placing stones along streambanks can be an effective means of stabilization. This method is particularly useful in areas where the banks have too steep a slope for vegetation to take root, or in areas where vegetation otherwise would not flourish—for example, in highly shaded areas where low-growing vegetation cannot get light, or in urban areas with nutrient-poor soils.

Note: Rip-rapping activities should be carefully planned. Normally, the energy created by the movement of water through a stream channel is dissipated by the break-up of soil particles. In other words, some of this energy is "used up" through the process of erosion. However, placing tightly packed substances such as concrete or stone on a section of streambank will prevent erosion, and therefore prevent the dissipation of the water current's energy. Therefore, as the water moves past the rip-rapped site, it brings almost all of its energy with it. This energy is then used to erode soil particles downstream—often on the opposite streambank. As a result,



heavy reliance on concrete or stone for stabilization can often simply move an erosion problem downstream.

REVEGETATION. Planting grasses, shrubs and trees along a streambank can accomplish a number of important functions to prevent erosion. First, leaves, blades and branches absorb the energy impact of falling rain, so vegetation serves as a sort of umbrella for the soil particles. Vegetation also helps maintain the soil's "absorbative capacity"—water is more likely to soak into vegetation-rich soil than to run over its surface and create erosion. In addition, vegetation slows runoff velocity and "catches" some runoff sediment before it enters a stream system. Lastly, once their root systems are established, plants can help to anchor streambank sediments and prevent them from washing out into the stream. (See sidebar for more information.)

Making Sure Your Streambank Stabilization Project Is Effective

Streambank stabilization projects are under way all across Pennsylvania as farmers and other landowners attempt to reclaim miles of eroded streambanks. Although it is often difficult to measure the water quality improvements that result from restoring a single stretch of bank, there is no doubt that all the work is paying off. Here are a few more things to keep in mind as you undertake a streambank stabilization project on your property or in your area.

- Any stream restoration project should be approved by your county conservation district and/or by the Pennsylvania Department of Environmental Protection (DEP). Unless the project will result in major soil disruption, the permitting process for streambank stabilization efforts is very straightforward. Moreover, DEP and county personnel often can provide suggestions to enhance the benefits of the stabilization work.

- It's important to take steps to minimize erosion and protect water quality during the actual stabilization itself, especially if heavy equipment such as a backhoe is going to used to slope a streambank or place materials. To have well intentioned volunteers scrambling up and down a muddy streambank, inadvertently kicking eroded sediment into the stream, would be counterproductive. Often, a sediment fence (usually a strip of black plastic, about two feet high) can be staked along the edge of the stream to catch all or most of the sediment that is disrupted during a restoration project. Other times, this is not necessary—consult with your county conservation district for recommendations.

The Best Plants for Streambank Revegetation

The most effective plant species to use in streambank revegetation will vary depending on the soil make-up of the area, the slope of the streambank, the volume of water passing the site and other factors. However, any plants used for revegetation should possess the following characteristics:

- They should be native to the watershed in which you are working and should resemble, as closely as possible, the vegetation in the immediate vicinity of the restabilization site.
- They should be species that thrive in wet soils. Because the restabilization area is on a streambank, it will be prone to flooding at various times throughout the year.
- They should be relatively fast-growing and able to firmly establish themselves within one or two seasons, so that a harsh winter or heavy rain will not wash them out before they even take root.
- They should have a wide and deep enough root system to make a significant difference in holding soil in place and preventing erosion.

Cool-season grass species commonly used for streambank stabilization include reed canary grass, redtop, perennial ryegrass, Johnstone tall fescue and red fescue. Planting warm-season grasses such as switchgrass, deertongue, indiangrass and big bluestem will provide protection when cool-season grasses have become dormant and lose much of their erosion-control effectiveness.

In addition, some species of shrubs can provide stabilization to streambanks. Effective shrub species include basket willow, bankers dwarf willow, red-ozier dogwood, silky dogwood, alder and ninebark. Generally speaking, shrubs with deep and thickly spreading root systems provide more stabilization potential than do trees, because most trees do not extend their roots very deeply in wet soils. Trees can also become top-heavy and fall over relatively easily. Still, trees set back from the streambank can provide an added means of erosion control when used in addition to grasses and shrubs.

Also, pay close attention to the weather both before and after a stabilization effort is set to begin. If the site is going to be too muddy to work on, or if a heavy storm is going to wash much of it away within a week, you should think about postponing your project.

- Except in some cases of concrete or rip-rap stabilization, the streambank should be sloped whenever possible before stone and/or vegetation is reestablished on the site. The more gradual the slope, the less erosion will occur. Typically, you should allow a slope ratio of 3:1, grading back at least three feet horizontally for every one vertical bank foot. Sloping the streambank will prevent undercutting of the banks by stream flow, which in turn will prevent cave-in. It does little good to establish thick vegetation at the top of a steep streambank that will be undercut and fall in anyway.

- Streambank stabilization should be a final solution to a problem that already exists. In other words, it should only be used on sections of streambank that have already begun to erode. The best way to prevent erosion of one's property and to protect water quality is to implement best management practices before a problem occurs. Preventive efforts covered in other sections of the primer—such as streambank fencing, stream corridor management and vegetative buffer zones—are often easy, cheap and low-labor measures that can vastly reduce the likelihood of erosion and resulting sedimentation. In many cases, a landowner can lose several feet of streambank per year, so it certainly pays to take a good look at preventing erosion rather than attempting to reduce it once it has begun.

- Quite often, a streambank stabilization project does not require a great deal of time, energy or money in order to have success. Sometimes merely putting up a fence along a streambank is enough because it keeps cattle from walking there and allows the existing vegetation to grow up again. In addition, many tree-planting projects can be finished in an afternoon with only a handful of volunteers, and hundreds of small saplings can be purchased for less than $100. Always consult with your county conservation district before doing any work on your streambank. County personnel can give you a lot of free advice and help you find materials.

Education is Key

For conservation organizations or environmental groups thinking about conducting streambank stabilization projects in their own watersheds, education is an essential component of the effort. Quite often, landowners are skeptical of such projects, believing they will lead to increased government regulation, or that they will negatively impact their ability to tend their fields, access the stream or provide water for their cattle. Still others do not see streambank erosion as a real problem unless they are losing significant amounts of their property. Consequently, it is critically important to discuss the goals and benefits of streambank stabilization with landowners before work begins so that the stabilized streambank will remain so in the future.

Some amount of streambank erosion, of course, is naturally occurring. Streams meander. They cut away at one bank and deposit sediment on the other. Human beings, however, have disrupted this natural process in a major way, and we must all do what we can to restore unstable streambanks—not just for aesthetic reasons but to improve water quality in our streams, rivers and lakes. One specific streambank might not normally contribute a huge discharge of pollution into the stream, but it makes a smaller contribution to a very large cumulative problem as erosion occurs at perhaps thousands of sites. The more stretches of streambank we can stabilize, the more we can reduce, little by little, this major form of nonpoint source pollution.

It may be pie-in-the-sky to think that every stream mile in Pennsylvania will someday have a 50- to 100-foot strip of buffer vegetation on either side, but with every stabilization project we undertake, the water quality of Pennsylvania's streams and rivers improves. ■

For more information contact your County Conservation District or the Pennsylvania Department of Environmental Protection at (717) 787-5267

Riparian Forest Buffers:

Protecting Streams With Nature

BY MATT EHRHART

Ehrhart is Pennsylvania Habitat Restoration Specialist with the Chesapeake Bay Foundation (Reprinted with permission).

The proper development and management of riparian forest buffers is an issue of increasing importance in the Chesapeake Bay watershed and throughout the country. A little-understood resource, riparian forest buffers play a vital role in promoting healthy ecosystems and a healthy environment.

What is a Riparian Forest Buffer?

To understand what a riparian forest buffer is, it's important to look first at the meaning of the word "riparian." When something is described as "riparian," it means it has something to do with the bank of a natural course of water such as a river or stream. The U.S. Forest Service defines a "riparian area" as:

> The aquatic ecosystem and the portions of the adjacent terrestrial ecosystem that directly affect or are affected by the aquatic environment. This includes streams, rivers, lakes and bays and their adjacent side channels, flood plain, and wetlands. In specific cases, the riparian area may also include a portion of the hillslope that directly serves as stream side habitats for wildlife.

For its part, a "riparian forest buffer" has been defined by the Executive Council of the Chesapeake Bay Program as:

> An area of trees, usually accompanied by shrubs and other vegetation, that is adjacent to a body of water nd is managed to maintain the integrity of stream channels and shorelines, to reduce the impact of upland sources of pollution by trapping, filtering, and converting sediments, nutrients, and chemicals, and to supply food, cover, and thermal protection to fish and other wildlife.

Simply put, a riparian forest buffer consists of a forest ecosystem existing in the riparian zone, with the forest protecting that riparian zone from adjacent land-use practices.

Why Are Riparian Forest Buffers Important?

Riparian forest buffers (RFBs) have a tremendous impact on their immediate surroundings. RFBs provide nutrient uptake, sediment and nutrient filtering, bank-stabilizing root mass, and enhanced stream and riparian habitat. The woody stems, herbaceous vegetation, and detritus on the forest floor filter overland runoff, trapping sediment and nutrients before they can make it to the river or stream. The dense network of woody vegetation in a forest ecosystem, both above and below ground, creates a massive demand for nutrients. Thus, once the nutrients are trapped, they are rapidly utilized by the vegetation and the microbial community in the forest floor.

During large rainfall events, rainfall infiltrates into the soil. As the soil becomes saturated, this moisture

What About Nonforested Buffers?

While nonforested buffers provide some of the same benefits as forested ones—e.g., filtering and trapping nutrients—it is generally accepted that they do not accomplish these tasks as well as forested buffers. They provide a minimal amount of bank stabilization and little, if any, benefit to the aquatic ecosystem in the form of organic input, large debris and shading. As a result, while a nonforested buffer is definitely better than no buffer at all, it is decidedly inferior to a forested buffer.

begins to flow downslope under the influence of gravity in a process called subsurface flow, or interflow. This subsurface flow, in turn, can transport large volumes of nutrients and other soluble chemicals into the nearest waterway. The deep-reaching root mass and "duff layer" of a forest can intercept some of this flow and utilize the dissolved nutrients.

The dense root mass of the forest community has other environmental benefits as well. One of these is that it creates an ideal stabilizer for the streambank. Observe the bank of any stream with a mature forested buffer, and you'll see the network of roots holding the soil in place. The cost of artificially providing the same kind of erosion protection along a stream or river is staggering, ranging from $50 to $500 per linear foot, depending on the terrain, access and other environmental factors.

RFBs also provide excellent wildlife habitat. The trees and shrubs, with the mast crops and berries they produce, provide food, cover and nesting habitat for a variety of birds and animals. Riparian forests also provide essential cover adjacent to water for reptiles and amphibians.

Equally important, however, is the habitat provided to the adjacent stream or river. The forest canopy shades the stream, reducing peak temperatures in the summer and providing a more steady temperature throughout the year. The reduced temperatures contribute to high levels of dissolved oxygen in the water, which is essential for fish and macroinvertebrates (primarily insects, crustaceans and bivalves). The forest buffer also is a source of large woody debris for the stream. Far from a nuisance, the boles and branches that wind up in the water serve as essential cover and habitat for fish, turtles, insects and more.

Perhaps most importantly, the forest's contribution of detritus (fallen leaves) to the stream provides the organic material that serves as the base of the food web in an aquatic ecosystem. The native stream community in northeastern North America has developed for thousands of years with leaf litter as the prime source of organic carbon. Recent studies at Stroud Water Resources Research Center indicate that without these native leaves, a large number of species could not survive.

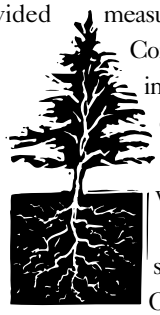
The positive impact of RFBs on their immediate surroundings thus are many and varied, but riparian forest buffers also are essential in the context of the larger landscape. In addition to the benefits described above, RFBs serve as important travel corridors for wildlife. These protected pathways are all the more essential in areas with intense agriculture or development.

Last but not least, forested buffers provide excellent recreational opportunities. They can be used for hunting, fishing, birding, wildlife observation, hiking, bicycling and even running.

The Status of Pennsylvania's Riparian Forest Buffers

Dr. Rick Day at the Pennsylvania State University has conducted the only comprehensive inventory of forested buffers in Pennsylvania. Dr. Day's inventory used satellite imagery to evaluate forest buffer widths in the Chesapeake Bay Watershed. His key finding: 40 percent of the stream miles in Pennsylvania's portion of the watershed have less than 100 feet of forested buffer.

Dr. Day's findings shed some light on the issue, but the reality of the situation is that we don't have any accurate measure of riparian forest buffer areas in the Commonwealth. All we know is that streams and rivers in the northern tier of Pennsylvania are better protected than those in other areas, and that urban and agricultural areas across the Commonwealth have a very low proportion of RFBs.



Pennsylvania's RFBs have been under siege since the Commonwealth was an English colony. Over the centuries, vast amounts of forest have been cleared for agriculture, cities and the timber industry—the supply of trees in "Penn's Woods" must have seemed endless. While the timber industry was initially responsible for the majority of the lost acreage, much of this acreage has since returned to a forested state. The current shortfall of RFBs in Pennsylvania can be explained by two factors: 1) economic demands on the agricultural community that compel farmers to force every possible

acre into production; and 2) the predominant view among urban, suburban and even rural residents that manicured landscapes are desirable and that natural areas are "messy and unkempt."

Nevertheless, more and more people now are beginning to recognize the importance of riparian forest buffers. Why has it taken so long? The answer is fairly simple. For the past three decades, society has been addressing more pressing environmental problems such as air and water pollution—problems that, in many senses, are relatively easy to deal with. Now that we've cracked down on point-source discharges of pollution, however, it has become increasingly apparent that nonpoint source (NPS) discharges are an issue of equal if not greater concern.

Agriculture, of course, is a leading source of NPS pollution, but it is not the only source. Other sources contributing substantially to the problem are construction and earth disturbance, which send large volumes of sediments and attached nutrients to streams and waterways throughout Pennsylvania. The most widespread nonpoint source of pollution, however—not by volume but by number of polluters—is us. American homeowners, businesses and municipal governments are using increasing amounts of fertilizer, herbicides and pesticides every year. And these compounds often make their way into streams via storm sewers, drainage swales and overland flow.

Key Issues and Programs

The Chesapeake Bay Program Executive Council has called for the restoration of 2,010 miles of riparian forest buffer throughout the Chesapeake Bay watershed by the year 2010. The "2010 by 2010" effort has pushed RFBs to the top of the list of urgent environmental issues in the watershed, even though the Executive Council has yet to decide how much funding and how much "on-the-ground" support will be provided for the campaign.

Fortunately, a number of state and federal agencies and private groups have been avid supporters of efforts to protect and restore riparian forest buffers, and can be counted on to continue their support in the future. Among these are: the U.S. Fish and Wildlife Service; the Natural Resources Conservation Service; the U.S. Forest Service; the Pennsylvania Department of Conservation and Natural Resources; the Pennsvlvania Department of Environmental Protection; the Pennsylvania Game Commission; the Pennsylvania Fish Commission; the Chesapeake Bay Foundation; the Alliance for the Chesapeake Bay; Ducks Unlimited; Trout Unlimited; and the Isaac Walton League. These and many other organizations provide technical advice and financial support for riparian restoration. However, site requirements, easement lengths, landowner compensation, and support of forested vs. nonforested buffers will differ. The Alliance for the Chesapeake Bay has published an excellent brochure that lists and describes many of the available programs (see resource and contact information below).

How Wide's Your Buffer?

The width of a riparian forest buffer can vary. While there is general agreement that wider is better, opinions differ over the minimum width necessary to provide a functional forest buffer. Many factors, including slope, soils, watershed and hydrology, can influence the effectiveness of the forest buffer. The Chesapeake Bay Program has established a minimum width of 35 feet for the "2010 by 2010" initiative.

Physically establishing more forested areas around Pennsylvania's streams isn't the only priority. In agricultural areas, streambank fencing is essential to establishing and maintaining functional RFBs. Forests will not develop in areas with free cattle access. As a result, landowner education and technical guidance are essential and can be as helpful in suburban and urban settings as in agricultural areas. In order for people to support the establishment of RFBs, they need to understand the many benefits that society receives from these areas.

Perhaps the most effective means of ensuring the development and protection of RFBs in Pennsylvania is to generate more support among local citizens and local government officials. Municipal ordinances to protect existing riparian forest buffers and provide incentives for establishing new buffers will promote RFBs as an effective land management tool. Several communities throughout the state already have adopted ordinances that could serve as models for other communities to modify and improve upon.

Improving Riparian Forest Buffer Protection and Restoration

Ultimately, the fate of riparian forest buffers depends on people. Individually and collectively,

Pennsylvania Stream Releaf—
A Plan for Restoring and Conserving Buffers Along Pennsylvania Streams.

In cooperation with American Forests Global Releaf 2000, Pennsylvania has launched a statewide effort known as Stream Releaf to replant the Commonwealth's streamsides. This initiative identifies objectives for streamside buffer restoration, conservation, education and outreach, public relations, and tracking progress. Projects will be locally driven with assistance from state agencies. For more information, including a forest buffer toolkit or a list of resources, contact DEP's Bureau of Watershed Conservation at 717-787-5267 or visit their website www.dep.state.pa.us

we must take ownership of and responsibility for this vital resource. One important step to protecting and promoting riparian forest buffers is the formation of local watershed organizations. These organizations typically form alliances with citizens' and sportsmen's groups, landowners, government, planning and zoning boards, utilities, and others to protect local water resources. Watershed organizations promote ordinances, volunteerism and management practices addressing not only RFBs, but a vast array of other environmental concerns.

The scientific and academic communities also play a crucial role in protecting and restoring riparian forest buffers. The physical, chemical and ecological complexity of riparian zones dictates a multidisciplinary approach to their protection and restoration. Engineers, hydrologists, ecologists, soil scientists and others must work together to solve problems and answer questions, and, most importantly, to communicate possible solutions and answers to individuals working at the local level.

Riparian forest buffers are an integral part of the landscape in communities across Pennsylvania. Today, the challenge is to convert the recent surge in media and political interest in these little-understood yet environmentally vital areas into actual measures to protect and restore RFBs. ■

References and Resource Materials:

Chesapeake Bay Riparian Forest Buffer Inventory (1996); Rick Day, Paul Richards and Robert Brooks; The Pennsylvania State University.

Chesapeake Bay Riparian Handbook: A Guide for Establishing and Maintaining Riparian Forest Buffers (1997); USDA Forest Service.

Montgomery County Riparian Corridor Conservation Ordinance; Montgomery County Commissioners; Montgomery County, Pennsylvania.

Riparian Forest Buffers: Function and Design for Protection and Enhancement of Water Resources (1991); David Welsch; Doc. #NA-PR-07-91; USDA Forest Service.

Restoration of Aquatic Ecosystems (1992); National Academy of Sciences; National Academy Press.

Streambank Fencing: Green Banks, Clean Streams (1991); Louis Davis et al.; Extension Circular 397; The Pennsylvania State University.

Streambank Stabilization and Management Guide for Pennsylvania Landowners (1996); PA Department of Environmental Resources, Office of Resource Management, Bureau of Water Resource Management, Division of Scenic Rivers.

Watershed Hydrology (1990); Peter Black; Prentice-Hall, Inc.

Wetland and Riparian Stewardship in Pennsylvania: A Guide to Voluntary Options for Landowners, Local Governments and Organizations (1997); The Alliance for the Chesapeake Bay.

For More Information:

Alliance for the Chesapeake Bay—717-236-8825
Chesapeake Bay Foundation—717-234-5550
Chesapeake Bay Program—800-YOUR-BAY
PA Association of Conservation Districts—717-236-1006
PA Department of Conservation and Natural Resources—717-787-2869
PA Department of Environmental Protection—717-787-5267
U.S. Department of Agriculture, Natural Resources Conservation Service—717-782-4403
U.S. Department of Agriculture, Forest Service—304-285-1592

Stream Corridor Management on Agricultural Lands

Stream-Friendly Farming

BY JOHN DAWES

Dawes is Administrator of the Western Pennsylvania Watershed Protection Program of The Heinz Endowments.

The sound management of stream corridors by the agricultural industry is vitally important to stream protection in Pennsylvania. Farmers and others involved in agriculture have more miles of streams under management than any other group. Combine this with the fact that agricultural practices can have an enormous impact on stream quality, and it's easy to see why the agricultural industry needs to be a key player in cleaning up Pennsylvania streams.

Farming's impacts on stream quality are many and varied. The chief problems are soil erosion and runoff, both of which can result in excess pesticides, fertilizers and animal nutrients being carried into waterways. Historically, the combination of overgrazing, the clearing of forests for farming and certain cultivation practices has increased the amount of soil washed away by rainfall. A large proportion of the nonpoint source (NPS) pollution that is today's biggest threat to stream quality in the Commonwealth comes from agricultural activities in the form of sediment, pesticide and nutrient pollution. Excess nitrogen from farm fertilizers also makes its way to streams through groundwater.

The Problems:

- Historically, the clearing of forests for agriculture has increased the amount of soil washed away by rainfall.
- Additional problems have been caused by the introduction and use of chemicals and fertilizers near streams lacking buffers.
- Livestock grazing in riparian areas has produced a variety of herd health issues as well as further sedimentation.

The Solutions:

- Streambank fencing programs and funding.
- Planting of native tree and understory species and warm season grasses.
- The use of rotational grazing, livestock watering facilities, filter strips and other practices.

Unmanaged stream corridor.

Cows In the Stream: A Special Problem

One of the most serious agriculture-related impacts on stream quality stems from the fact that cows often are allowed free access to streams. By defecating directly into the streams, cows can contaminate huge amounts of water every day. The following are a few of the alarming facts about the problems caused by cows in and around streams:

- One cow produces approximately 5.4 billion fecal coliform bacteria per day. If a cow is allowed to graze for a 24-hour period with unrestricted access to a stream, approximately 565 million fecal coliforms could enter the stream.

- Water with a fecal coliform count of 100 per 100 milliliters is unsafe for swimming. A fecal coliform count of 2 per 100 milliliters means the water is unsafe to drink.

- One defecation by a dairy cow produces enough bacteria to make the equivalent of six backyard swimming pools unsafe for swimmers.

Streambank fencing project in Southwestern PA.

- Fifty cows allowed unrestricted access to a stream for a 24-hour period could contaminate the equivalent of one day's water supply for the city of Baltimore.
- Bacteria entering a stream can result in disease transmission between and within livestock herds.
- Persistent exposure to wet conditions can lead to soft hooves and lame cows.
- Cows with free access to streambanks can eliminate fish habitat by trampling and silting, destroying habitat and elevating stream temperatures.

The best solution to keeping cows out of streams is streambank fencing on agricultural lands, considered the first step in sound management of stream corridors. (See page 25 for program and contact information.)

Planting in Riparian Areas— The Three-Zone Buffer

Centuries of horticultural experimentation have led to the introduction of many nonnative plants to western Pennsylvania. The majority of these plants can "muscle out" native plants, generating a habitat that is unfamiliar or undesirable to wildlife. Moreover, when a non-native pest plant such as the multiflora rose is removed, the native plants do not return to the riparian area. Thus, there is an urgent need to develop replanting initiatives in riparian areas throughout the Commonwealth.

A recently developed method for replanting riparian zones is the "Three Zone Buffer System," which is designed to incorporate the filtering systems of a forest into a smaller tract of land next to a stream. The zone closest to the stream is a wood lot managed with the stream in mind, with little or no impact by people. The middle zone contains woodland that can be used by the landowner. The outside zone consists of grasses planted to filter and permit infiltration of runoff.

The three-zone buffer won't necessarily work in every situation; riparian planting should be done on a case-by-case basis. One of the major design challenges is deciding on a width for the riparian forest buffer. Factors including slope, soil type, adjacent land uses, floodplain, vegetation type and watershed condition influence what can and should be created. The most commonly prescribed minimum buffer widths for use in water quality and habitat maintenance are 35 to 100 feet. Buffers of less than 35 feet cannot sustain long-term protection of aquatic resources.

Trees for Zones One and Two

In order to select trees for riparian buffers in zone one, several factors must be considered. Trees located close to the waterway are most likely to be flooded, and require a high tolerance of high water tables. If the area has been recently disturbed, trees with a quick growth rate will establish soil stabilizing root systems more quickly. Fast-growing trees aren't necessarily long-lived, however. Therefore, an interplanting of slow-growing trees is also advised.

Eventual tree heights are another important issue. Some questions to consider: At maximum height, will the tree provide enough shade for the stream? What are the landowner's aesthetic preferences (to screen or frame a view, for example, or to provide a windbreak)? Are there safety concerns such as avoiding power and telephone lines?

Trees with shallow root systems hold surface soils well but don't provide as much stability on high banks and steep slopes as trees with deep root systems. Deep root systems also anchor trees better where there are repeated flooding and drying cycles. The following are

Streambank Fencing Available to Landowners

A number of streambank fencing programs are available to farmers and landowners from the federal and state governments and other sources. These streambank fencing programs provide a variety of cost-sharing options up to a 100-percent match. Also, several of the programs have provisions for funding of limestone-lined livestock crossings. The following is a summary of available programs and contacts.

Government Agencies

Pennsylvania Department of Environmental Protection (DEP)—Streambank Fencing Program. Funds are available for fencing, energizers and crossings. This program provides up to 100-percent funding. Fencing must be 12 feet from the streambank and must meet DEP specifications. There may be a waiting list for this program. Another DEP program for streambank fencing, the Financial Assistance Funding Program, focuses on sediment control. The cost share is 80 percent to a maximum of $30,000. Fencing is five strands of high-tensile wire. CONTACT: DEP Streambank Fencing Program, 717-772-5645

Pennsylvania Game Commission. The Game Commission will pay for a contractor to build a fence on farm property and will provide a solar charge unit if necessary. Fencing must be placed a minimum of 10 feet from the streambank. The landowner must agree to cooperate with either the Farm-Game or Safety-Zone public access programs that require continuous maintenance of the fencing. There may be a waiting list for this program. Two-strand electric fencing is standard. Cost share is 100 percent within the Chesapeake Bay drainage system. CONTACT: Pennsylvania Game Commission, RD 2, Box 2584, Reading, PA 19605, 1-800-228-0791 or 717-787-6400.

Pennsylvania Forest Stewardship Program. This is a statewide program, with 65-percent cost sharing, administered by the Pennsylvania Department of Conservation and Natural Resources' Bureau of Forestry. Fencing consists of wood posts and high-tensile wire. CONTACT: Pennsylvania Forest Stewardship Program, 7 Ferguson Building, University Park, PA 16802, 814-863-0401.

Chesapeake Bay Program. Funds are available for fencing, crossings and bank stabilization for farms within the Chesapeake Bay watershed. The cost-share rate for stream protection best management practices is 50 percent. Fencing is normally part of a comprehensive program that includes erosion control, a conservation plan and a nutrient management plan. The limit for all cost-share monies received under this program is $30,000 per person or farm. All best management practices must meet Natural Resources Conservation Service (NRCS) specifications and be certified by NRCS. A demonstration site shows best management practices in action. A streambank planting program is in the planning stages. CONTACT: Chesapeake Bay Foundation Pennsylvania Office, 717-234-5550.

U.S. Fish and Wildlife Service. This federal organization, part of the Department of the Interior, has the mandate to protect migratory species that naturally cross state boundaries. Funding is cost-shared at 100 percent, and fencing is two strands with wood posts. Pennsylvania Game Commission cooperators receive priority. CONTACT: U.S. Fish and Wildlife Service, Allenway Building, State College, PA 16801, 814-234-4090.

Pennsylvania Fish and Boat Commission. This program provides technical guidance and planning for comprehensive stream corridor management and can provide up to $500 for materials per project year. Participating landowners must agree to open their land for public fishing purposes for 10 years. CONTACT: Pennsylvania Fish and Boat Commission, Habitat Management Section, 450 Robinson Lane, Bellefonte, PA 16823, 814-359-5185.

Chesapeake CARE—Pennsylvania. This program provides 100-percent funding for wetlands and riparian restoration in the Octoraro Creek watershed. Funds are available for fencing, energizers, crossings and wetland creation. CONTACT: U.S. Fish and Wildlife Service, 315 South Allen Street, Suite 322, State College, PA 16801, 814-234-4090.

Donegal Creek Restoration Project. Funds are available for fencing, crossings, tree planting, bank stabilization and fish habitat improvement. The cost-share rate is 100 percent for landowners in the Donegal Creek watershed. Fencing must meet Conservation District specifications. All fencing systems will be maintained by the Conservation District and the Donegal Creek Fish and Conservation Association. CONTACT: Donegal Creek Conservation District, Farm and Home Center, Room 6, Lancaster, PA 17601, 717-299-5361.

Pequea—Mill Creek Project. Funds are available for fencing, energizers, crossings and bank stabilization. This program provides 75-percent cost-sharing within the Pequea-Mill Creek Project area. The landowner must be a conservation district cooperator. Funds are also available for crossings and bank stabilization if the stream has been fenced previously through the Pennsylvania Game Commission's public access programs. Located east of Lancaster, this Conservation District Office-led project is not looking for more cooperators because of large demand. Partnerships include Trout Unlimited chapters and Pheasant Forever. CONTACT: Pequea-Mill Creek Project, P.O. Box 211, Smoketown, PA 19565-0211, 717-396-9423.

Conservation Reserve Program. This is a federally funded USDA program administered through the Farm Service Agency. An underutilized program, it makes payments to farmers for acreage in a riparian zone, much like payments made to farmers for crop acreage that is set aside. The program pays approximately $40 per acre to a farmer for leaving these environmentally sensitive areas alone. Contracts are for 15 years, 30 years or in perpetuity. CONTACT: Farm Services Agency, State Office, 717-782-4547.

Private Organizations

French Creek Project. Sponsored by the Pennsylvania Environmental Council (PEC) and the Howard Heinz Endowment, this project provides 75-percent cost sharing for streambank fencing. The initiative focuses on in-stream preservation of endangered species, as well as the health of the watershed. Wood posts and three strands of high-tensile wire are standard. CONTACT: French Creek Project, Box 172, Allegheny College, Meadville, PA 16335, 814-332-2946.

Partners for Wildlife. This streambank fencing program is targeted at 10 demonstration areas across the state, mostly in western Pennsylvania so far, to provide and create woodlot-field interfaces with crop fields to benefit wildlife. Warm-season grasses are planted in the riparian zone. Funding is from the Richard Mellon Foundation, Howard Heinz Endowment and the Foundation for the California University of Pennsylvania. Projects are 100-percent cost-shared with permanent high-tensile wire and wood posts. CONTACT: Partners for Wildlife, California University of Pennsylvania, California, PA 15419, 412-938-4215.

Octoraro Watershed Association. This private, nonprofit education organization works in the Octoraro watershed and has coordinated streambank stabilization projects along the west and east branches of the Octoraro Creek. The Octoraro Watershed Association has cooperated successfully with FFA students, the Farmer's Sportsmen Association, Trout Unlimited, the Game Commission, and the U.S. Fish and Wildlife Service. CONTACT: Octoraro Watershed Association, P.O. Box 98, Kirkwood, PA 17536, 717-529-2607.

a few of the trees that could be used in zones one or two (This is a general list and is not site specific):

- Willow Oak
- Sycamore
- Black Walnut
- Hackberry
- American Beech
- White Ash
- Eastern Cottonwood
- White Oak
- Silver Maple
- Red Maple
- Red Oak

Understory for Zones One and Two

The understory plants of a riparian zone are in both zones one and two. Understory tree shrubs are tolerant to shade but some are more adapted to an edge situation. Most native shrubs in riparian zones prefer moist growing conditions and are good filters for overland waterflow. Planting understory trees and shrubs increases the biodiversity of the riparian buffer and enhances both water quality and wildlife habitat. Following are understory species that could be used in zones one or two:

- Buttonbush
- Arrowwood
- Box Elder
- Witch Hazel
- Pussy Willow
- Bayberry
- Common Alder
- Shadblow
- Winterberry
- Silk Dogwood
- Sweet Bay
- American Holly
- Elderberry
- Spicebush
- Flowering Dogwood

Grasses for Zone Three

Zone three is the interface between the wooded area of a riparian buffer and any other adjacent land use. Its width may range in size from a few feet to an entire pasture. This zone spreads waterflow, filters sediments from runoff and absorbs nutrients. This is an excellent place to establish native warm-season grasses for wildlife.

It is a common misconception that improving wildlife habitat means providing winter foods. Much of the decline seen in populations of ground-nesting birds, in fact, results from a lack of nesting and brood-rearing cover. By planting native, warm-season grasses rather than foreign or exotic species, a landowner can meet the needs of quail, turkeys, meadowlarks, songbirds and other species. Small mammals such as voles, mice and cottontail rabbits will inhabit these areas as well and provide food for birds of prey and foxes. In addition, by including some wildflowers and forbs in a zone three planting, the landowner will be supporting a variety of valuable insects such as butterflies.

Recommended warm-season grasses should have the following characteristics:

- A strong root system to hold the soil;
- A tendency to grow in bunches (these are not turf grasses);
- The ability to remain standing during the winter, providing cover and continuing to filter sediment from runoff;
- The ability to grow well in low-fertility soils;
- The ability to provide high-quality pasture forage and hay if use is controlled to prevent negative impacts on nesting birds.

Warm-season grasses are slower to establish than the more familiar cool-season grasses that are normally planted. It may take two growing seasons for a zone planted with warm-season grasses to establish itself. Once a stand is established, however, the benefits of

low maintenance, increased wildlife and improved water quality far outweigh the initial effort.

Three known types of warm-season grasses are Big Bluestem *(Andropogon gerardii)*, Little Bluestem *(Andropogon scoparius)* and Switchgrass *(Panicum virgatum)*.

BIG BLUESTEM. Big Bluestem is a long-lived erosion control plant for stream sides, mine spoil and road sides. It is excellent forage for livestock and cover for wildlife. Big Bluestem should be seeded in the early spring. Seed at 15 to 20 pounds per acre, and compact the soil after seeding. Big Bluestem is slow to germinate. Although it establishes the first year, it will not produce fair to good cover until the end of the second year. It tolerates medium- to low-fertility, acid, sandy, loamy, and clayey soils, has poor shade tolerance, and prefers well-drained sites.

LITTLE BLUESTEM. Little Bluestem is a persistent, low-maintenance, warm-season, bunch-type perennial grass. As a native grass, Little Bluestem is almost always incorporated into mixes used to produce long-living native stands. It is drought tolerant and adapts to a wide variety of soil types but is not very shade tolerant. Seed at 12 pounds per acre when used alone and at four pounds when used in mixes. Little Bluestem reaches two to three feet in height.

SWITCHGRASS. Switchgrass is a valuable stabilization plant for streambanks, strip mine spoil and other critical areas. It provides food, excellent nesting, and fall and winter cover for wildlife. Switchgrass should be seeded at 10 pounds per acre and requires one to two years to become totally established. Little or no management is required after that.

Project Grass

Project Grass, an outgrowth of the Commonwealth's Nutrient Management Law, is a "grassroots effort"—excuse the pun—to teach and promote best management practices on livestock farms. Operating for several years in the 15 counties of southwestern Pennsylvania, the project promotes rotational grazing as a nutrient management tool, as well as a low-input farming method that will lead to cleaner streams.

Research has shown that rotational grazing cuts production costs, but it also has other benefits that are often overlooked. When a good rotational grazing system is adopted and livestock are rotated through the system, forage quality and yield are improved. The forage is kept in a vegetative state, meaning it is constantly growing and absorbing nutrients from the soil .

Another benefit of rotational grazing is less pollution. One of the main sources of agricultural nonpoint source pollution is concentrated animal populations around animal housing facilities. When the livestock are out on pasture grazing, however, the amount of time the livestock spend around animal housing is reduced, along with the chances of pollution.

Rotational grazing also means the farmer has less manure to handle. When the livestock are on pasture, the manure is distributed onto the fields by the animals. In a confinement system, however, manure has to be hauled and spread daily, or an expensive storage facility must be built to hold it. Among the many downsides of daily spreading is that the heavy spreader-tractor combinations compact the soil, whereas livestock do minimal compaction.

Among its other benefits, rotational grazing reduces the amount of farm equipment a farmer has to use. If the animals are harvesting their own feed for a portion of the year, the farmer has less feed to harvest mechanically. In addition, when a grazing system is installed, the amount of row crops is usually reduced—along with person hours, wear and tear on equipment, fuel usage, pesticide and herbicide usage, and soil erosion. A reduction in fuel use has the added benefit of reducing the nitrogen and carbon dioxide emissions that contribute to acid deposition.

In addition to promoting rotational grazing, Project Grass promotes streambank fencing and improved water quality in waterways on the farm. Project Grass farms are also required to develop and implement a nutrient management plan. This is a tool that tells farmers how much manure and fertilizers to apply to the land at safe levels to insure both that the impact on the environment is minimal and that crop nutrient needs are met.

The following are initial results from surveys of 13 of the 38 demonstration farms installed in 1997 by Project Grass:

Average size of grazing system:	42.5 acres/farm
Average amount of soil saved as a result of grazing:	54 ton/yr/farm or 1.3 ton/acre/yr
Average amount of commercial fertilizer saved:	1.4 ton/yr/farm
Average number of days the grazing season was extended:	57 days/yr/farm
Average amount of money saved as a result of grazing:	$62.76/animal/yr
Average amount of diesel fuel saved as a result of grazing:	188 gal/yr/farm
Average amount of oxides of nitrogen not emitted to atmosphere:	0.75 lb/yr/farm
Average amount of carbon dioxides not emitted to the atmosphere:	3,122 lb/yr/farm
Total amount of streambank fencing installed:	11,710 feet

Although these numbers are impressive, they are the result of installing fence for paddocks and streambank fencing only. If more best management practices were used on the surveyed farms, these numbers would be even better.

Conclusion

According to the Bureau of Watershed Conservation at DEP, there are 1,168 miles of impaired rivers and streams in the Allegheny Watershed alone. While resource extraction (acid mine drainage) is the main culprit, agricultural runoff is the second largest factor in the pollution problem. And, more importantly, it is a factor that can be easily changed. Pennsylvania has an established system of Conservation Districts, Farm Service Agency and Extension Service offices to teach best management practices to those managing agricultural lands.

According to research done for Pennsylvania's Chesapeake Bay Program, 60,000 tons of nitrogen are deposited into waterways that feed the Susquehanna River each year. The Allegheny Watershed—home to as much or more agricultural activity as the Susquehanna basin—suffers from a comparable volume of pollutants, including both nitrogen and phosphorus. These excess levels of nutrients result in harmful algae blooms that deplete oxygen supply and block out sunlight necessary to aquatic plant and animal life.

The wide availability of streambank fencing programs in Pennsylvania is a sign that the Commonwealth is prepared to stand up to the problem of agriculture-related stream and river pollution. But streambank fencing alone is not the answer to soil erosion and other problems. The planting of native species in our agricultural riparian zones—together with other environmentally beneficial practices from planned grazing to diversions and filter strips (see below)—all are important elements of stream corridor management on agricultural lands. ■

Other Farming Practices That Are Good for Streams

Livestock Watering Facilities. Troughs or tanks installed to provide livestock water supplies from a spring, pond, well or other source. This keeps cows out of the stream and does not require a pump to fill because it is placed downhill from the water source. Key benefits: permits piping of water to rotational pastures; provides clean water supply for livestock; improves forage utilization through distribution of grazing.

Filter Strips. Strips of vegetation—a minimum of 15 to 25 wide—that remove sediment, organic matter and other pollutants from runoff. Key benefits: can be used on cropland next to streams to reduce sediment loads.

Diversions. Channels and ridges that divert excess runoff for use or safe disposal in other areas. Key benefits: can be used to divert water from a feedlot, cropland or farm buildings.

Water and Sediment Control Basins. Short earthen dams built across slopes and minor drainageways. Key benefits: traps sediment, reduces gully erosions and reforms the land surface.

Reducing Nutrient Pollution in Pennsylvania's Streams and Rivers

Too Much of a Good Thing

BY LAMONTE GARBER

Garber is former Agriculture Policy Analyst with the Chesapeake Bay Foundation.

(Reprinted with permission)

Nutrients are essential to life. Nitrogen, for example, is used by organisms in the production of plant and animal tissue. And phosphorus is essential to cellular growth and reproduction. This is why most agricultural crops require ample amounts of these and other nutrients in the soils in which they grow. Corn, the most widely planted row crop in Pennsylvania, requires roughly three-quarters of a pound of nitrogen for every bushel of corn that's harvested.

When nutrients from farming make it into Pennsylvania streams and rivers, however, they can cause very serious problems. Excessive nutrients in streams, rivers, lakes and estuaries spur the growth of algae, particularly single-celled plants called phytoplankton. Dense populations of phytoplankton, called "blooms," usually occur in slow-moving or stagnant water bodies and can cause all kinds of trouble for other aquatic life. Algae compete for sunlight that other, more beneficial plants need for photosynthesis. And when the algae die, the oxygen in the water is consumed as bacteria decompose the dead plant material. This, in turn, reduces oxygen levels to the point where aquatic organisms cannot survive.

A Real Threat to the Chesapeake Bay and Other Water Bodies

Excessive nitrogen and phosphorus are the most damaging pollutants in the Chesapeake Bay. During the summer, when algae production is at its highest, the water in many areas of the Bay becomes dangerously low in oxygen. When all dissolved oxygen is depleted from water, a condition known as "anoxia" results. Watermen who work on the Bay refer to anoxic

water as "dead water," a reflection of the uninhabitable conditions for fish, crabs, oysters and other aquatic life. Recently, excessive nutrients have been implicated as a contributing factor in the outbreak of *Pfiesteria piscicida*, a single-celled organism that killed tens of thousands of fish in the Chesapeake Bay during the summer of 1997.

Excessive nutrients and algae also have caused the loss of many thousands of acres of bay grasses, called "submerged aquatic vegetation." These grasses, which provide important food and shelter for many organisms, once blanketed hundreds of thousands of acres in the Bay. Although they have begun to make a comeback in recent years, bay grasses have reclaimed only a small fraction of their potential habitat.

Estuaries such as the Chesapeake Bay are not the only water bodies to suffer from nutrient pollution. The cycle of high nutrient levels leading to algae production and low dissolved oxygen plagues many lakes and rivers in the Commonwealth and throughout the country. This cycle, also called "eutrophication," is driven primarily by the presence of phosphorus in freshwater systems. According to a 1991 study, nutrients are the leading cause of degradation in 59 percent of lakes

and 13 percent of U.S. rivers that do not meet water quality goals.

The problem is especially pronounced in Pennsylvania. Pennsylvania's Department of Environmental Protection (DEP) has measured the trophic status, or degree of nutrient enrichment, of several of Pennsylvania's publicly owned lakes. According to DEP's 1998 Water Quality Assessment, there are many lakes affected by nutrient loading. The same report classified 4,407 miles of Pennsylvania rivers as totally impaired, that is, not fully supporting swimmers, fishing, or both. Of this total, 1,297 river miles were degraded by pollution related to agriculture. It is important to note here that acid mine drainage is the leading cause of degradation of Pennsylvania streams.

Nitrogen:

A Health Concern for Humans and Animals

Nitrogen is a concern for groundwater quality because nitrates can leach readily through soils and contaminate groundwater. According to the U.S. Environmental Protection Agency, contamination exceeding 10 parts per million (ppm) for nitrate nitrogen is unsafe for infants less than six months old. At high levels, nitrates can lead to methemoglobinemia, a condition called "blue baby syndrome," in which an infant's blood cannot carry sufficient oxygen. In Pennsylvania, high nitrates in groundwater typically are observed in areas underlain by carbonate bedrock and supporting intensive agricultural production (mainly southeastern and southcentral counties).

Controlling Nutrient Pollution: What's Happening?

Reducing nutrient pollution is so critical to the health of the Chesapeake Bay that Pennsylvania, Maryland, Virginia, the District of Columbia and the U.S. Environmental Protection Agency (USEPA) have pledged to reduce nitrogen and phosphorus "loadings" to the Bay by 40 percent by the year 2000. This is an especially ambitious goal for Pennsylvania because the Susquehanna River is the largest tributary to the Chesapeake Bay and carries more nitrogen to the Bay than any other waterway. To meet the 40-percent nutrient reduction goal, Pennsylvania will have to reduce the Susquehanna River's nitrogen load by roughly 20 million pounds and the phosphorus load by roughly 2.5 million pounds.

Pennsylvania's efforts to reduce nutrient pollution to waterways in the Commonwealth began in the 1970s with new limits on phosphorus discharged by sewage treatment plants in the lower Susquehanna River basin. Additional reductions in point-source discharges of phosphorus came in 1990 with the adoption of a phosphate detergent ban in Pennsylvania.

As sewage treatment improved throughout the state, attention shifted to reducing nutrient runoff from farms. Pennsylvania officially entered the Chesapeake Bay Program in 1984 as part of a major initiative to reduce nutrient and sediment pollution in the Susquehanna and Potomac River watersheds. This voluntary program provides up to $30,000 of state and federal funds for individual farmers to implement agricultural best management practices (BMPs). These BMPs emphasize the proper collection, storage and application of animal manures and control of stormwater runoff and cropland erosion. Program funding has grown from approximately $2 million in 1984-85 to $6 million in 1997-98. As of June 1996, the Chesapeake Bay Program has helped farmers implement animal waste management systems on nearly 700 Pennsylvania farms.

Also helping to reduce nutrient pollution from farms are streambank fencing programs administered by the Pennsylvania Game Commission, the U.S. Fish and Wildlife Service and the Pennsylvania Department of Environmental Protection (DEP). Streambank fencing enables landowners to restrict cattle from stream banks. This prevents animals from defecating in streams and allows natural buffer strips to develop that help filter runoff from adjacent pastures and cropland. (For more information, see "Stream Corridor Management on Agricultural Lands: Stream-Friendly Farming," page 23.)

Although most programs to reduce nutrient pollution from Pennsylvania farms emphasize voluntary measures, a number of regulatory requirements also exist. First, the Pennsylvania Clean Streams Law includes animal waste in its definition of sewage and prohibits the discharge of these wastes into state waters. This law also gives DEP broad authority to regulate all potential sources of pollution, including nutrients from agricultural waste. Under regulations implementing the Clean Streams Law, the State developed a special publication—"Manure Management for Environmental Protection" (also called the "Manure

Management Manual")—that serves as a compendium of BMPs for manure management. Farmers are required to follow the Manure Management Manual or to get a permit from DEP if they cannot. As of this writing, however, no manure handling permits have been issued.

In addition, the federal Clean Water Act gives DEP added regulatory authority and responsibilities with respect to certain large livestock operations, which the federal act refers to as "Concentrated Animal Feeding Operations," or CAFOs. CAFOs that have potential to discharge to a waterway are required to get point-source permits. As of 1997, DEP adopted an independent permitting program to address large animal operations.

The Nutrient Management Act

Despite the many voluntary and regulatory measures in place to reduce nutrient pollution from agricultural operations, documented progress has been modest. In the hopes of accelerating the adoption of nutrient management plans on farms, the Pennsylvania General Assembly passed the Nutrient Management Act in May 1993. The Act's requirements became effective on October 1, 1997.

The Nutrient Management Act calls for mandatory nutrient management plans for all concentrated animal operations, or CAOs. Defined differently than the federally designated CAFOs described above, a CAO is a farm having at least 2,000 pounds of livestock or poultry per acre. In other words, the Act focuses its mandatory measures on farms producing a high number of animals on limited acreage. Only approximately 5 to 10 percent of Pennsylvania farms fall into the category of a CAO. The majority of these are located in southeastern Pennsylvania, primarily in Lancaster County. Under the Nutrient Management Act, farms that violate the state's Clean Streams Law may also be required to implement nutrient management plans. In addition, non-CAOs are encouraged to implement plans of their own on a voluntary basis.

Nutrient management plans are designed to balance applications of fertilizer, manure and other nutrients with the nutrient needs of crops receiving those applications. Plans also address manure storage construction, proper management of barnyards and control of concentrated stormwater runoff. CAOs with too much manure for their cropland must record how and where it is disposed. They must also maintain records of soil tests, nutrient applications, crop yields and annual manure production. Plans can be developed by private consultants or individual farmers and must be certified by the Department of Agriculture before their submittal to a conservation district for review and approval.

There are several important aspects of the Nutrient Management Act to which farmers and others need to pay close attention. These include:

- In addition to encouraging voluntary compliance with the Act, the State Conservation Commission is charged with taking enforcement actions and imposing civil penalties of not more than $500 for the first day of each offense and $100 for each day of continuing violation. In the event of a violation,

Sources of Nutrient Pollution

Nutrients that contribute to water pollution come from many human and natural sources. These generally fall into two categories: point sources and nonpoint sources. Point sources are those sources discharging pollutants into waterways from a "discrete conveyance," such as a pipe. The primary point sources of nutrient pollution are municipal sewage treatment plants, which typically discharge nutrients from treated human waste directly into streams. Nonpoint sources, on the other hand, convey nutrients to waterways and groundwater from more widespread and dispersed sources. Nonpoint source pollution—also called "polluted runoff"—includes stormwater runoff from the land, pollution from septic systems and air pollutants that wind up in the water.

Statewide, nonpoint sources contribute much more nutrient pollution to Pennsylvania waterways than do point sources. Moreover, of all pollution sources, agriculture contributes nearly 70 percent of the nonpoint phosphorus load and 40 percent of the nonpoint nitrogen load to surface water and groundwater in the state (The Pennsylvania State University, 1997). Agricultural nutrient pollution originates mainly from fertilizers and animal wastes. The next largest nonpoint pollution source is air pollution, which contributes 49 percent of the nonpoint nitrogen load of Pennsylvania water resources. Airborne nitrogen comes from automobiles, utilities and animal wastes.

the existence of a fully implemented and approved nutrient management plan may be used as a mitigating factor in assessing any penalties or damages.

- CAOs had one year from October 1997 to develop nutrient management plans and to have them approved by the State Conservation Commission or by a county conservation district that is delegated this authority. Once its plan is approved, a CAO has three years to fully implement it.

- The Nutrient Management Act preempts local ordinances "related to the storage, handling, or land application of animal manure and nutrients if the local ordinance or regulation is in conflict with this Act or its regulations."

- In addition to its requirements regarding nutrient management plans, the Act established an educational program for nutrient management and required DEP to assess other sources of nutrient pollution. It also created a financial assistance program to help farmers finance the costs of implementing nutrient management plans.

- The State Conservation Commission and county conservation districts administer the nutrient management program with assistance from DEP and the Pennsylvania Department of Agriculture. Penn State's Cooperative Extension Service is contracted to provide educational services.

The impact of the Nutrient Management Act on water quality in Pennsylvania and the Chesapeake Bay will probably not be evident for several years. Given the limited number of farms that are required to develop plans, the impact may be small in regions outside of southeastern Pennsylvania. Moreover, there are serious weaknesses in the requirements for nutrient plans. For example: soil testing is required only once every six years; manure can be spread throughout the year, including during winter months; there are no limits placed on phosphorus applications; erosion control plans are not required by the Act as part of the nutrient management plan; and no groundwater or surface water monitoring is required.

Nevertheless, passage of the Act represented a positive step in Pennsylvania's efforts to reduce nutrient pollution from agricultural sources. This is the first law in the Commonwealth that requires regulatory oversight of nutrient management plans on farms. Also of note, it established requirements for farms with the intent of preventing pollution, in contrast to the traditional policy of reacting to pollution events. While it relies on voluntary measures, which may reduce its effectiveness, the Nutrient Management Act provides Pennsylvania with the foundation for a more comprehensive and proactive regulatory program to reduce nonpoint source nutrient pollution from agriculture.

What Citizens Can Do

County conservation districts play a central role in implementing the requirements of the Nutrient Management Act, as well as other programs dealing with agriculture and the environment. In recent years, district offices have taken on increasing responsibilities in outreach and enforcement of a wide variety of state regulatory programs. Unfortunately, however, districts in many counties have very limited staff and funding to implement these programs. Moreover, the degree to which districts have made the transition from their traditional role of providing education and technical assistance to one that includes regulatory responsibilities has been inconsistent.

Citizens need to work with their local district to increase recognition of the district's roles in protecting the local environment and to advocate for additional financial and human resources for the district. At the same time, citizens need to monitor how effectively county conservation districts, DEP and the Department of Agriculture are addressing agriculture-related pollution problems.

Last but not least, it's important to remember a vital but often-overlooked role for citizens—that is, reporting any and all pollution events to DEP or a local conservation district so that action can be taken to address the problem (For more information on citizen involvement, see the articles in *What Citizens Can Do.*) By working together, citizens, farmers and government can help reduce nutrient pollution in Pennsylvania and the Chesapeake Bay—and protect our waterways for future generations. ■

References:

Beegle, D., Lanyon, L., and D. D. Lingenfelter. 1997. *Agronomy Facts 40 - Nutrient Management Legislation in Pennsylvania: A Summary of the Final Regulations*. The Pennsylvania State University, Cooperative Extension.

Carey, A. E. 1991. "Agriculture, Agricultural Chemicals, and Water Quality." Pp.78-85 in *Agriculture and the Environment: the 1991 Yearbook of Agriculture*. U.S. Government Printing Office.

Frey, R.F. ed. 1992. *Water Quality Assessment - 305(b) Report*. Pennsylvania Department of Environmental Resources.

Mueller, D. K., Hamilton, P. A., Helsel, K. J., Kerie, J. H., and B. C. Ruddy. 1996. "Nutrients in Ground Water and Surface Water of the United States." Pp. 1-6 in *NWQEP Notes*. ISSN 1062-9149. North Carolina State University.

Nizeyimana, E., Evans, B. M., Anderson, M. C., Peterson, G. W., DeWalle, D. R., Sharpe, W. E., Hamlett, J. M., and B. R. Swistock. 1997. *Quantification of NPS Loads within Pennsylvania Watersheds*. The Pennsylvania State University.

Nygren, L .1997. Personal communication

Garber, L., and P. Gardner. 1989. *Improving Water Quality through Effective Implementation of Pennsylvania's Manure Management Regulations*. Chesapeake Bay Foundation.

Pennsylvania Department of Agriculture, 1995. *Crop Production – 1994*. Pp 37-38 in Annual Report and Statistical Summary. Pennsylvania SS-117. Pennsylvania Department of Agriculture.

Pennsylvania Department of Environmental Protection. 1996. *Chesapeake Bay Nutrient Reduction Strategy*. 3900-BK-DEP1656 Rev. 1/96. Pennsylvania Department of Environmental Protection.

The Pennsylvania State University. 1996. Pp. 29-30 in *The Agronomy Guide 1997- 1*. The Pennsylvania State University.

Reshetiloff, K. ed. 1995. *Chesapeake Bay: Introduction to an Ecosystem*. U.S. Environmental Protection Agency—Chesapeake Bay Program.

U.S. Environmental Protection Agency. 1995. *Guide Manual on NPDES Regulations for Concentrated Animal Feeding Operations*. EPA 833-B-95-001. U.S. Environmental Protection Agency.

U.S. Environmental Protection Agency — Chesapeake Bay Program. 1994. *Environmental Indicators: Measuring our Progress*. U. S. Environmental Protection Agency.

For more information:

For those interested in more information on the Nutrient Management Program, ask for Penn State Cooperative Extension's Agronomy Facts 40 - Nutrient Management Legislation in Pennsylvania: A Summary of the Final Regulations. This publication is available from your local legislator or the State Conservation Commission, Agriculture Building, 2301 N. Cameron Street, Harrisburg, PA 17110-9408; or call (717) 787-8821.

7

Forestry Best Management Practices

The Woods and the Water

BY CAREN GLOTFELTY
Glotfelty is Goddard Chair at Pennsylvania State University.

Over the centuries, Pennsylvania's vast forests have been a vitally important resource, both economically and environmentally. Before European settlement in the 17th century, Pennsylvania was almost completely forested. The Commonwealth's early economy was built on timber and wood products. By 1920, nearly every acre from east to west and north to south had been clearcut at least once to fuel iron furnaces, supply mine and building timbers or make turpentine, varnish and other wood-based compounds.

Approximately 60 percent of Pennsylvania's land, about 17 million acres, is now reforested, more than half of it growing trees that are 70 to 100 years old. This is the most forest the Commonwealth has had since the mid-1800's. Although forests are more abundant in the northern half of Pennsylvania, there are significant reforested areas throughout the state; Philadelphia is the only county with less than 15 percent of its area in forest cover.

With timber prices now at an all-time high, Pennsylvania's renewed forests have become a vital economic resource once again. Often overlooked, however, is the status of the Commonwealth's forests as an environmental resource as well. The fact is that forests play a crucial role in promoting and maintaining environmental quality in Pennsylvania. Forests help protect water resources and promote water quality. They are also important for wildlife habitat, biological diversity and the promotion of healthy ecosystems.

Insuring that forests remain an important environmental resource for Pennsylvania is the goal of efforts to promote best management practices (BMPs) for forestry. The primary benefit of BMPs is that they can help prevent any environmental degradation that might result from increased timber harvesting.

Characteristics of Forest Land in Pennsylvania

Compared to other states, Pennsylvania has a large proportion of its forest land in public ownership—about 29 percent. More than one-third of the public land in the state (12 percent of forest land) is owned and managed by the Bureau of Forestry as state forest. Another 9 percent of forest land is managed by the Pennsylvania Game Commission. The Allegheny National Forest comprises 3 percent of Pennsylvania's forest land, and other public entities, such as county and local parks and water suppliers, own another 5 percent.

The remaining 71 percent of forest land in Pennsylvania is in private ownership, with farmers owning 15 percent and corporations 16 percent. Individuals own about 40 percent of the state's forest land. There are approximately 500,000 individual private forest landowners in the state.

The forest products industry in Pennsylvania is currently a $5 billion per year enterprise, employing more than 90,000 workers. It is the fourth-largest sector of Pennsylvania's economy, and it is growing. Pennsylvania has the largest hardwood inventory in the nation, with standing timber in the state valued at more than $15 billion, as estimated by the U.S. Forest Service. The predominant timber species are Allegheny hardwoods (cherry), northern hardwoods and mixed oak. Forests also contribute indirectly to the state's economy as an important resource for recreation and tourism, the state's second-largest economic sector.

In addition to the economic pressures resulting in an increase in timber harvesting on both public and private lands in Pennsylvania, suburban sprawl throughout the state continues to fragment forest ecosystems and threaten forest uses, including timbering, recreation, water resource protection and biological diversity conservation.

Forest Impacts on Water Quality and Quantity

More than half of Pennsylvania's total stream miles flow through totally forested watersheds. These are the cleanest of Pennsylvania's clean streams. Forests are good for water quality and quantity because their soils have a high "infiltration capacity." Forest soils, in other words, are able to act like a sponge, absorbing large quantities of water. For this reason, rainfall or melting snow in forests produces relatively little surface runoff. Rather, the water is held for a long time in the forest soil and is gradually released to a surface stream or groundwater. Streamflow in a forested watershed is therefore more even over time—less "flashy"—than in an agricultural or urbanized areas. Forested watersheds also are less prone to flooding than nonforested watersheds.

Generally, streams flowing through stable forests have very low turbidity (cloudiness due to suspended sediments) because the problems of soil erosion and sedimentation associated with high surface runoff are less in forested than in nonforested areas. Sediment harms water resources by degrading or destroying fish habitat, reducing the storage capacity of reservoirs and increasing treatment cost for water supplies.

Trees are a major contributor to the high infiltration capacity of forest soils; a large leafy tree can take up as much as a ton of water from the soil every day through its root systems. In addition, because of their rich organic content, forest soils are well-structured and contain a great deal of interconnected pore space through which water can easily drain; soil pores thus act as miniature reservoirs for the storage of additional water. Also contributing to the forest soils' porous structure are microorganisms, insects and small animals living on or under the forest floor and growing tree roots.

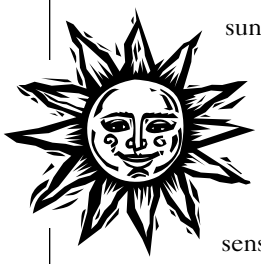
Soil pores in forested areas are able to stay unclogged and open for water storage because much of the rainwater and snowmelt never even makes it into the soil. Rain falling on the forest is intercepted by the leaves and branches of canopy trees and understory vegetation, allowing as much as 70 percent to evaporate back into the atmosphere and reducing the impact of raindrops on the soil.

Forests that are substantially thinned or clearcut can cause increased runoff to streams because there are fewer leaves and branches to intercept rainfall—and also fewer roots take up water from the soil. In the northeastern United States, the greatest increase in streamflow occurs during the first growing season after harvesting. In subsequent years, as the forest grows new vegetation, stream flow lessens, usually returning to pre-cut levels within five to ten years.

Timber harvesting doesn't just affect water quantity, however. It also can affect water quality, not only by increasing the soil erosion and sedimentation that accompanies increased runoff, but also by potentially accelerating soil erosion through logging practices. The greatest problems do not occur from the cutting of trees, but from their removal from the forest, which requires heavy equipment on a system of cleared trails, landings and roads. In fact, erosion and sedimentation from logging roads accounts for most of the water quality problems associated with timber harvesting.

Another critical environmental benefit of forests is their ability to hold and recycle nutrients, particularly nitrogen, instead of allowing them to pass into nearby waterways. Erosion and sedimentation can produce increased phosphorus concentrations in streams because phosphorus binds to sediment. Moreover, studies in Maine have shown that nitrate concentrations in streams may rise after timber harvesting; the remaining vegetation is insufficient to utilize the nitrogen in the soil. This "nitrification" also can lead to soil and stream acidification, which in turn results in high aluminum concentrations in soil solutions and surface waters.

Logging can also cause thermal impacts on water quality. Removal of trees and understory vegetation from the bank of a stream often allows direct sunlight to shine on the stream's surface. The temperature of the stream will increase as a result, affecting the cold water-dependent aquatic ecosystem. Warmer streams may be unsuitable habitats for sensitive fish species such as trout, which thrive within a narrow range of temperatures. Trout have high oxygen requirements, and warm water contains less dissolved oxygen than cold water.



Debris from logging is another problem. When debris from logging ends up in a stream, it creates dams and channel splits that can cause stream bank erosion and new channel or pool formation, producing a negative effect on water quality. While some in-stream woody debris provides essential cover for aquatic wildlife, excessive amounts can be detrimental.

The Regulatory and Legislative Picture

Theoretically, state environmental laws and regulations protect water quality and aquatic habitat from damage due to logging. These regulatory requirements include the Chapter 102 and Chapter 105 regulations resulting from the Clean Streams Law and the Dam Safety and Encroachments Act. Under these regulations, any activity that disturbs more than 25 acres of earth at one time requires a permit from the state Department of Environmental Protection (DEP). Most timber cutting operations disturb less than 10 percent of the harvested area, so a permit is not usually required for logging a site of fewer than 250 acres. However, all timber harvesting operations of any size must prepare a site-specific erosion and sediment control plan and keep it on site during the operation.

Also requiring permits are timber harvesting operations that require access roads and skid trails to be constructed across streams. To minimize impacts on water flows or quality, stream crossings are allowed only under certain circumstances. Chapter 105 requires permits for all types of crossings, including culverts, bridges and fords. Permit applications must be accompanied by an erosion and sedimentation control plan approved by the county conservation district.

Also, permits are required under both state and federal law for all crossing of wetlands by logging access roads and skid trails. Wetlands are regulated jointly by the U.S. Environmental Protection Agency, the U.S. Army Corps of Engineers and Pennsylvania DEP. Timber harvesting in forested wetlands is not regulated, but road and skid trail crossings, considered "encroachments," are. DEP Chapter 105 prohibits the encroachment into any wetland without a permit. Although the Army Corps of Engineers issues a separate permit, the DEP permit requirements will satisfy federal rules as well.

Fish habitat is protected by Chapter 25 regulations under the Pennsylvania Fish and Boat Code, which requires permits for any alteration or disturbance of streams, fish habitat or watershed that in any way may damage or destroy habitat. Chapter 25 also prohibits any substance harmful to fish life to run,wash or flow into the waters of the Commonwealth. Enforcement of the Fish and Boat Code is the responsibility of the Pennsylvania Fish and Boat Commission.

Despite these and other requirements, it is difficult to monitor compliance of logging operations in order to protect water quality and aquatic habitat from the negative effects of timber harvesting. Although responsibility for permitting and inspection has been delegated by the state DEP to many county conservation districts, the remote nature of many logging sites and the staffing limitations of conservation districts make enforcement a real challenge. Some municipalities have enacted local ordinances to regulate timber harvesting, earth moving and other activities associated with forest management, but in most areas there is little active enforcement.

In addition, there are no state-level legal requirements in Pennsylvania that govern other aspects of

logging, such as potential damage to non-timber plant species, terrestrial habitat, aesthetics or the standing timber that is left behind. There is also no certification or licensing program to help ensure that foresters or loggers in Pennsylvania are educated in proper forestry practice.

The Right to Practice Forestry Act was passed by the Pennsylvania General Assembly in 1992 to prohibit local governments from using zoning ordinances to unreasonably restrict landowners and others involved in timber harvesting. In response, Penn State University Cooperative Extension and the Pennsylvania State Association of Township Supervisors have developed a model timber harvesting ordinance for adoption by local government that would meet the requirements of the law.

Actions Needed Now

A timber harvest assessment of 85 randomly located sites in Pennsylvania was conducted in 1995 and 1996 under the direction of Penn State University researchers. The study showed that only 53 percent of the sites—all of which were timbered during the period of 1992–94—appeared to be "sustainable" or "possibly sustainable" after harvesting. The assessment used the American Forest and Paper Association's (AFPA) definition of forest sustainability, which defines sustainable operations as those that conduct timber operations "without compromising the ability of future generations to meet their own needs." For the purposes of the Penn State study, the AFPA guideline was interpreted to mean that following the timbering operation, there was evidence that the forest appeared capable of producing a future forest with timber value. The researchers' key conclusion: relatively simple forestry practices, including the use of BMPs, could have prevented the "unsustainable" outcome for 47 percent of the timbered sites.

While it could be argued that additional state-level regulation of forest management activities to protect water quality and other values is required, it has become increasingly clear that the regulations that already exist have not been aggressively enforced. Many responsible forestry professionals believe that a better approach to improving environmental compliance would be to certify professional consulting foresters and loggers. A certification system would promote minimum acceptable standards while creating a system of peer accountability.

Two important initiatives are under way in Pennsylvania to increase the sustainability of forest

Forestry Best Management Practices

Because there are so few practical legal restrictions on logging practice in Pennsylvania, compliance with best management practices (BMPs) is essential to protect water quality and quantity, as well as the other environmental values of the forest. BMPs are widely accepted activities that have positive effects or that minimize negative effects on the forest ecosystem from timber harvesting and other forest management activities. Some BMPs serve multiple purposes. Buffer strips along streams, for example, are designed to control erosion and sedimentation but can also serve as wildlife movement corridors, protect habitat diversity, and maintain stream water temperature and nutrient levels.

The following BMPs are the minimum acceptable standards of good forest management to protect water quality and quantity. Forest landowners should be encouraged to do these things and more:

- Comply with all provisions of Chapters 102 and 105 of the DEP regulations.
- Design roads to shed surface water quickly.
- Design roads and landings to prevent or divert surface water flow.
- Avoid locating roads and landings on seasonally wet soils associated with wetlands.
- Lay out roads and landings along the contour as much as possible.
- Provide adequate riparian buffers between disturbed areas, such as roads or landings, and streams or wetlands.
- Wherever possible, use bridges and culverts to cross streams, both intermittent and perennial.
- When fords are used for crossings, stabilize the stream bed with clean rock.
- Cross wetlands only when absolutely necessary.
- If logging requires moving heavy equipment into wetlands, do so during the driest periods of the year or when the ground is solidly frozen.
- Do not skid through water courses or spring seeps.
- Do not contaminate water bodies and soil with forest management chemicals, fertilizers and pesticides and petroleum products.
- Retire the road system properly upon completion of the logging operation.

References and Resource Materials:

Brown, Darlene B., ed. 1993. *Best Management Practices for Silvicultural Activities in Pennsylvania's Forest Wetlands.* College of Agricultural Sciences, Penn State Cooperative Extension, University Park, PA.

Chunko, Shelby E., ed., 1996. *Best Management Practices for Pennsylvania Forests.* College of Agricultural Sciences, Penn State Cooperative Extension, University Park, PA.

Chunko, Shelby E., and Wilbur E. Wolf, Jr., *Forest Stewardship Bulletin No. 12: Best Management Practices for Pennsylvania Forests.* College of Agricultural Sciences, Penn State Cooperative Extension, University Park, PA.

Department of Environmental Protection (DEP), Bureau of Land and Water Conservation; Cambria County Conservation District; and College of Agricultural Sciences, Penn State Cooperative Extension. 1992. *Controlling Erosion and Sedimentation from Timber Harvesting Operations.* College of Agricultural Sciences, Penn State Cooperative Extension, University Park, PA.

Finley, James C., Stephen B. Jones, and Joshua Pell. 1997. *The Effects of Timber Harvesting on Pennsylvania Forest Sustainability, report to the Center for Rural Pennsylvania.* College of Agricultural Sciences, School of Forest Resources, University Park, PA.

Kahl, Steve. 1996. *A Review of the Effects of Forest Practices on Water Quality in Maine*, report to the Maine Department of Environmental Protection. Water Research Institute, University of Maine.

Makuch, Joseph R., *Forest Stewardship Bulletin No. 10: Watershed Management.* College of Agricultural Sciences, Penn State Cooperative Extension, University Park, PA.

School of Forest Resources, College of Agricultural Sciences; Department of Conservation and Natural Resources, Bureau of Forestry; Pennsylvania Forestry Association; Hardwood Lumber Manufacturer's Association; Allegheny Society of American Foresters, Pennsylvania Division; and Pennsylvania State Association of Township Supervisors. 1994. *Timber Harvesting Issues in Pennsylvania: Information for Citizens and Local Government Officials.* College of Agricultural Sciences, Penn State Cooperative Extension, University Park, PA.

management practices. The first is the "green certification" program managed by the Bureau of Forestry. The Bureau of Forestry hopes the program, which certifies timber harvested with environmentally sound methods, will accomplish two important objectives: 1) increase the supply of "green-certified" timber in the marketplace to satisfy and further stimulate consumer demand; and 2) serve as a model for other public agencies and private landowners of how to practice sustainable forest management. The second initiative was launched by forest industry leaders to promote the AFPA's Sustainable Forestry Initiative (SFI). The ultimate goal of the industry-led effort: to encourage sawmills and pulp mills to exclusively buy logs that are harvested in a sustainable way.

Pennsylvania's SFI program already has resulted in the training of several hundred loggers, landowners and other forest industry personnel to use best management practices for logging operations. These practices promote: optimum forest regeneration and renewal; residual stand protection; management of insects, disease and fire; and protection of site and water resource quality.

Both of these programs are laudable and could potentially yield improvements in forest management throughout the state, but for true progress to happen more outreach is required to Pennsylvania's private forest landowners. Only a small percentage of private forest landowners in the state have written forest management plans.

Encouraging more private

landowners to adopt forest management plans is the goal of Pennsylvania's Forest Stewardship Program. Managed cooperatively by the Bureau of Forestry and Penn State University Cooperative Extension, the program has produced many fine written materials for landowners (see page 38). The Forest Stewardship Program also has conducted many educational and training programs. Nevertheless, it has been unable to reach the vast majority of private forest landowners in the state.

Surveys have shown that the vast majority of private forest landowners own their land for reasons other than to produce timber. Yet when a financial crisis occurs, these same landowners often decide to sell their trees to raise cash. It is important that these landowners have a good understanding of how forests contribute in a positive way to the environment and how forest management plans can help protect this vital resource. This is the challenge and the opportunity for the future. ■

8

Dirt and Gravel Roads

Road Maintenance Ahead . . . for a Cleaner Environment

BY KEVIN ABBEY AND WOODROW COLBERT

Abbey is former Executive Director of the Senate Transportation Committee and President of Abbey Associates; Colbert is Dirt and Gravel Road Program Coordinator, on loan from the Pennsylvania Department of Transportation to the State Conservation Commission.

(This article is adapted from The Status of and Future Directions for the Pennsylvania Task Force on Dirt and Gravel Roads 1997 Status Report)

Pennsylvania's dirt and gravel roads are here to stay. Although many people perceive of dirt and gravel roads as a nuisance—relics of a slower-paced time in our history—the facts show that these roads are important links in Pennsylvania's overall transportation network. Covering more than 27,000 miles throughout the Commonwealth, dirt and gravel roads provide vital access for Pennsylvania's major industries—agriculture, mining, forestry and tourism—while weaving the fabric of rural community life for more than 3.6 million residents.

Paved roads and highways carry high maintenance costs. Local municipalities and state agencies—with jurisdiction over more than 90 percent of the state's dirt and gravel roads—can ill afford to pave dirt roads and then adequately maintain them. Given their dual purpose of carrying low traffic volumes yet accommodating high-weight loads, dirt and gravel roads are ideally suited for their job as low-maintenance pathways to Pennsylvania's remote areas.

Paved Roads Waiting to Happen?

For many people, a dirt road is nothing more than a paved road waiting to happen. One might call it a "paved road wannabe." From this perspective, an ideal world is one where all roads would be wider, flatter and straighter. Line-of-sight problems would be "corrected" and speeds would be "enhanced." The nuisance of dirt roads would be eliminated. Such a world, of course, does not exist, and we are left with a mix of paved and dirt roads.

Although both dirt roads and paved roads are part of the same transportation network, they do not—and, more importantly, should not—look alike. Their form and function are significantly different. They both provide access but only one provides speed. They both play a role in tourism—dirt roads by conveying quaintness, and paved roads by getting people where they want to go as quickly as possible. The geometry and architecture of each are different (as evidenced by line of sight, contour, base, surface and curvature), and it only makes sense that their maintenance standards and management requirements be different as well.

Dirt roads play a different game with different rules. It is wholly inappropriate to apply the same standards, the same engineering assumptions and, worst of all, the same operating expectations to dirt roads as we commonly apply to those that are paved.

Environmental and Health Hazards

If not properly cared for, dirt and gravel roads can become a source of sediment-laden runoff that finds its way into streams and adjacent waterways, choking off the insect populations and ruining the aquatic habitat that supports trout and other fish. Known as "nonpoint source pollution," this "poison runoff accounts for up to 80 percent of the degradation of U.S. waters," according to a 1996 National Geographic article on the subject. The U.S. Environmental Protection Agency cites nonpoint source pollution as the most common cause of stream habitat damage in our nation's forests. Curbing this problem is now a national goal.

Fugitive dust from dirt roads is a serious human health hazard as well. Long known as a cause of allergies, dust and its companion particulate matter have been shown in a preponderance of recent studies to contribute to lung disease and to precipitate thousands of respiratory-related early deaths each year.

Task Force on Dirt and Gravel Roads Created in 1993

Pennsylvania Trout, a Council of Trout Unlimited, brought the problem of sediment pollution in the state's premier trout streams from dirt and gravel roads to the attention of government officials and advocated that a "no nonsense" working group tackle the issue. In response, the Task Force on Dirt and Gravel Roads was created in 1993.

Participants in the task force include: state agencies (PennDOT, Department of Environmental Protection, Department of Conservation and Natural Resources); sportsmen (Pennsylvania Trout and the Pennsylvania Federation of Sportsmen's Clubs); environmental resource agencies (Fish and Boat Commission, Game Commission, U.S. Fish and Wildlife Service, County Conservation Districts); local government (Pennsylvania State Association of Township Supervisors); private companies (Pennzoil, Penelec); Penn State University researchers and training specialists; legislative staff; and citizen environmental groups.

From its creation, the Task Force was directed to recognize and promote the value of unpaved roads in Pennsylvania's overall transportation scheme and to find ways to reduce the erosion, sedimentation and other pollution occurring along these rural roadways.

Legislation Enacted to Promote Environmentally Sound Maintenance of Roads

After a number of unsuccessful attempts, the Pennsylvania General Assembly on April 17, 1997, approved the Transportation Revenue Bill (House Bill 67). Governor Ridge promptly signed the measure into law as Act 3 of 1997. This new legislation generates over $400 million per year for transportation investments in highway/bridge construction and improved road maintenance.

Included in the law is a new Section 9106 of the Motor Vehicle Code creating a $5 million annual, nonlapsing appropriation earmarked for "Dirt & Gravel Road Maintenance." This appropriation, targeted for environmentally sound maintenance of the Commonwealth's unpaved roads, has been a high priority of the Dirt and Gravel Road Task Force since the group's inception.

The new program is unique. To achieve its streamlined purpose and bypass state level bureaucracy, the bulk of the new funding is directed to the State Conservation Commission as a "pass through" agency. Created by Pennsylvania's Conservation District Law more than 50 years ago, the Commission's purpose is "to provide for the conservation of the soil, water, and related resources of this Commonwealth...and protect and promote the health, safety and general welfare of the people (of the Commonwealth)."

Under Section 9106 of the Motor Vehicle Code, the Conservation Commission will administer and apportion the new monies for dirt and gravel road maintenance based on written criteria for the prevention of dust and sediment pollution. An important consideration in the Commission's allocation criteria is the total miles of dirt and gravel roads within watersheds protected as Exceptional Value or High Quality Waters (as of November 1996).

At the local level, County Conservation Districts (CCDs) will create Quality Assurance Boards (QABs) to define and administer a grant program for local municipalities and/or state agencies with jurisdiction over dirt and gravel roads. Municipalities may submit a grant application "not to exceed one page" with "mini-

mal handwritten information" to the local QAB for funding consideration.

The legislation provides a unique opportunity for local decision-making about local pollution problems. Education and training grants, road demonstration projects, maintenance project work, and skills training for road managers and equipment operators will be eligible activities for funding. The new program became effective on July 1, 1997, and was up and running in the spring of 1998.

Resources from the Task Force

The Task Force has produced a multimedia education and training program for those involved in the maintenance of dirt and gravel roads. The program emphasizes low-cost techniques and environmentally sensitive procedures. Developed by technical experts and training specialists from the Pennsylvania Transportation Institute (PTI) at Penn State University, the program consists of seven interrelated modules—ranging from "road surface drainage characteristics" to "erosion control measures" and "laws, regulations, and compliance." The education and training is targeted at policymakers (e.g., township supervisors, planning commissions, and state agency personnel), as well as road maintenance personnel (road managers and equipment operators). The goal: to promote common-sense principles based on available equipment and machinery. Participation in the training program will be a pre-condition of Section 9106 grant eligibility.

The Task Force also has prepared reports on pertinent dirt and gravel road topics and created demonstration areas to highlight techniques that prevent erosion and runoff pollution. In addition, the Task Force is developing a baseline Geographic Information System on a watershed basis. ■

For More Information

Until a permanent Center for Dirt & Gravel Road Maintenance is created, questions or information requests about this important pollution prevention topic should be directed to the following address:

Dirt & Gravel Road Maintenance Program
C/O State Conservation Commission
2301 North Cameron Street
Harrisburg, PA 17110-9408
717-787-2103 (voice); 717-705-3778 (fax)

Environmental and Watershed Impacts of Extractive Industries in Pennsylvania

Natural Resources, Unnatural Hazards

BY RICHARD DIPRETORO
diPretoro is a Registered Professional Geologist.

The federal Surface Mining Control and Reclamation Act of 1977 sums up the potential impacts of extractive industries on the environmental health of the state:

> ...mining operations result in disturbances of surface areas that burden and adversely affect commerce and the public welfare by destroying or diminishing the utility of land for commercial, industrial, residential, recreational, agricultural, and forestry purposes, by causing erosion and landslides, by contributing to floods, by polluting the water, by destroying fish and wildlife habitats, by impairing natural beauty, by damaging the property of citizens, by creating hazards dangerous to life and property, by degrading the quality of life in local communities, and by counteracting governmental programs and efforts to conserve soil, water and other natural resources.

Sixty-three of the 67 counties in Pennsylvania are home to extractive industry operations that have the potential to adversely affect watershed health. The major extractive industries include coal, oil and gas, and industrial minerals such as stone, sand and gravel. The following is a discussion of how the extraction of these natural resources can cause environmental problems to waterways throughout the state.

Coal Mining in Pennsylvania

Coal mining creates the most profound and widespread effects on watersheds of any extractive industry in Pennsylvania. Even if we ignore, for the moment, the acid and alkaline drainage that is carried

from abandoned mines into waterways throughout the state, coal mining still has all other extractive industries beat. (For more information on acid mine drainage, see "Abandoned Mine Drainage: Cleaning Up After a Century of Mining," page 48.) Compared to the extraction of other minerals, such as limestone, coal mining requires the disturbance of significantly larger areas of land for a given ton of minerals. There are two reasons for this:

1) Coal beds are much thinner than limestone beds; and

2) Coal weighs less than most mined minerals in Pennsylvania; by volume it weighs 70 percent of sand and gravel and 52 percent of limestone. The result is that while one acre may yield 10,000 tons of coal, another acre may yield several hundred thousand tons of limestone.

Pennsylvania contains two basic varieties of coal, bituminous and anthracite, which are mined in different parts of the state. In 1996, 19 western counties produced about 75 million tons of bituminous coal, with Greene County producing about half the total.

The next five counties in order—Washington, Somerset, Armstrong, Indiana and Clearfield—produced 40 percent of the total, meaning the top six counties produced 90 percent of the bituminous coal in the state in 1996. Underground mining accounted for 77 percent of the state total for bituminous coal, which is generally found in seams that cover large areas and lie nearly flat.

At the other end of the state, seven eastern counties—Schuylkill, Luzerne, Carbon, Northumberland, Lackawanna, Columbia and Dauphin, in that order — produced almost all of Pennsylvania's 12 million tons of anthracite coal in 1996; Schuylkill County produced almost half the total. Nearly 70 percent of this was produced from waste piles left by older mining operations. Remining of existing sites accounted for most of the rest. Anthracite seams can lie in any posture, from flat to vertical to folded over on themselves.

Environmental and Watershed Impacts

Mining operations use two basic methods to extract coal from coal seams: surface and underground mining. For surface mining, the operator removes the vegetation, soil and rock from coal seams that lie near or at the surface of the land. The operator then removes most of the coal, typically more than 90 percent, and fills and revegetates the void. The backfill takes up about 25 percent more space after mining than before. This is because the recovered coal removes only a small part of the total volume and the remaining mined material swells by bridging over voids. Sometimes operators dispose of the excess material by placing it in stream valleys.

For underground mining, operators gain access to the coal either directly from the surface, in a procedure similar to surface mining, or through shafts excavated down to the seam from the surface. Mining proceeds to remove typically between 50 and 80 percent of the coal. Upon abandonment of the mine, the operator leaves the rest of the coal behind along with voids. Most underground mines eventually cause subsidence, or cave-ins that affect the surface. In areas with low stream gradients, underground mine subsidence can cause ponding of streams and the creation of wetlands or marshlands where dry land had existed before.

Underground mines also may capture streams or cause them to run below the surface. Examples of places where this has occurred are Sugar Run in Washington County, Two-Lick Creek in Indiana County and Roaring Run in Cambria County.

Underground coal mining also can cause streams to experience greater-than-normal flow. The Jeddo Tunnel in the anthracite fields near Hazelton discharges 50,000 gallons of water per minute from an area of several square miles. Had it not been collected by the system of underground mines, this water would have discharged elsewhere into other streams. The stream resulting from the Jeddo Tunnel discharge is much larger at its discharge point than the original stream for which the valley is suited.

Underground mines essentially act as reservoirs, accumulating water during the winter and spring and releasing it slowly during summer and fall. The changes in water flow to receiving streams can affect their ecological health. Surface mines, on the other hand, often act as a sponge, soaking up more rain and melting snow than natural land, and then letting it out more slowly over a longer period.

Another environmental impact of mining results not from the mining process itself, but from what happens after the coal is mined. Coal usually requires cleaning before delivery to the market—typically an electric power plant. Since up to 40 percent or more of the material removed from the mine may be unusable rock, voluminous waste results from the cleaning process. Leaving mining waste on the surface is less costly than returning it underground, a process known as "backstowing," as is often done in Europe. One result is that operators increasingly are placing the waste in "valley fills" that often cover headwater streams. Allowing the encroachment of fills into valleys is an important regulatory issue involving coal mining and watersheds.

Operators abandoned more than 250,000 acres of

surface mines in Pennsylvania before 1977, the year the Surface Mining Control and Reclamation Act was passed; thousands more acres have been abandoned since. Before 1977, many mines were abandoned with little or no reclamation. Today, many of these mines are causing erosion and sedimentation in streams. This sedimentation, in turn, can smother aquatic life and fill voids in gravel stream bottoms needed for reproduction of aquatic insects and fish. The cumulative impact of this sedimentation can affect fishing birds and animals whose diets rely on aquatic life.

In efforts to reclaim these abandoned mines, state government officials in Pennsylvania increasingly stress the beneficial use of industrial wastes to aid in the filling and revegetation of abandoned mines because the mines often lack organic matter and/or are producing acid that needs neutralization. These wastes include power plant ash, flue-gas desulfurization sludge, paper mill waste, incinerator ash, cement kiln dust and East Coast harbor dredgings, among others. Such wastes may well contain elevated levels of toxic or hazardous components such as lead and dioxin, leading to new questions and problems even as we try to address historic impacts.

The largest single type of industrial waste used in mine reclamation is coal-fired power plant waste. However, as air pollution regulations tighten and higher-ash fuels are used, power plants produce more and more waste. At the same time, space in ash landfills is becoming scarcer and more expensive. Because of these trends, ash disposal has been identified as a major constraint on expanded coal use. This, in turn, provides the strong incentive to find ways to dispose of the ash beneficially, especially on abandoned mine lands.

Regulatory Issues Affecting Coal Extraction

Among the top regulatory issues involving underground coal mining are valley fills (see above), Cumulative Hydrologic Impact Assessments (CHIAs), and the definition of a perennial stream.

CHIAs. Because of the importance of the flow of water above and below the ground (hydrology) on natural systems, the Surface Mining Control and Reclamation Act requires the state to conduct a CHIA for every mine. This CHIA must be based on hydrologic information supplied by the mine operator, as well as other information available to the state. Pennsylvania prepares CHIAs for surface coal mines. It does not, however, do so for underground mines, which can and do create significant cumulative effects on the hydrology. This is significant in that the mines in the Pittsburgh Coal Seam in southwestern Pennsylvania, along with the mines across the state line in West Virginia, probably represent the largest set of potentially interconnected mines in the world and therefore the largest impact on hydrology. The Office of Surface Mining, the federal agency charged with overseeing Pennsylvania's coal regulatory program, is conducting an investigation into the state's performance of CHIAs with respect to underground mines.

DEFINING A PERENNIAL STREAM. For underground mining, the state defines a perennial stream simply as "a stream or part of a stream that flows continuously throughout the calendar year as a result of ground water discharge or surface runoff." This is a different definition than the one used in other environmental regulations in the state, even those covering surface coal mines. For all activities except underground coal mining, the state defines a perennial stream as: "A body of water flowing in a channel or bed composed primarily of substrates associated with flowing waters and is capable, in the absence of pollution or other manmade stream disturbances, of supporting a benthic macroinvertebrate community which is composed of two or more recognizable taxonomic groups of organisms which are large enough to be seen by the unaided eye and can be retained by a United States Standard No. 30 sieve (28 meshes per inch, 0.595 millimeter openings) and live at least part of their life cycles within or upon available substrates in a body of water or water transport system."

The difference between the two definitions — hydrology controls the first and biology the second — makes it legal for the state to allow more damage to streams from underground mines than from other activities. According to the first definition, operators can say a stream is not perennial — that it is "intermittent" — based on one documented occurrence of dryness. For instance, an operator can use data from the early 1950s to show that a stream went dry once. If the company were to succeed, it would reduce the level of protection the stream would enjoy if it were judged according to the second definition.

Another problem with using the hydrologic as

opposed to the biologic definition of a perennial stream is that there is no turning back. Once a stream experiences a single dry episode, it is permanently consigned to intermittent status, no matter how continuous its flow might become or how prolific it is as a biological ecosystem.

Oil and Gas Extraction

Pennsylvania has the oldest commercial oil industry in the world. State officials estimate that some 200,000 to 300,000 wells have been drilled in the state since the famed Drake well was drilled in Titusville in 1859. The state has information on the location of some 160,000 wells, which means that many wells are uncharted. About 130,000 wells are either in active production now or were in the recent past. The state closes, or "plugs," about a dozen wells per year based on their danger to lives, properties and the environment. At the same time, about 1,000 new wells are drilled each year, a number that is higher than the number plugged by operators.

The state began regulating the oil and gas industry's impact on the environment in April 1985, after the passage of the Oil and Gas Act of 1984. Regulations were adopted in 1989. Therefore, the program is relatively new and still maturing.

The major environmental and watershed threats posed by oil and gas extraction are associated with two things: the extraction of large volumes of brine along with the oil and gas; and the spreading of waste pit sludge.

WASTE PIT SLUDGE. A waste pit is built to contain fluids drawn from the well during drilling. A surface impoundment study in 1980 located about 19,000 open pits connected to oil and gas activities; about 10,000 of these were associated with oil. Most of the pits were unlined and subject to leakage into groundwater, which eventually discharges to surface water. Adding to the environmental threat, operators can legally spread the sludge from the bottom of the oil well pits on the land nearby. This sludge contains metals, oil, salinity, additives and radioactivity, all of which have the potential to impact surface water quality.

BRINE. Perhaps the most significant watershed issue stemming from oil and gas extraction, however, is the disposal of unwanted brine, which is salt water that is often saltier than ocean water. This brine contains all the same pollutants as oil pit sludge, and large amounts of the brine are spread on the land for dust control and road stabilization. In 1995, Pennsylvania produced about 75 million gallons of brine; 5.8 million gallons were spread on roadways and other land areas across the state. This marked a 55-percent increase in brine spreading from the previous year and reversed a three-year decline. Of the 17 western counties where brine was spread, Clearfield, Crawford, Indiana and Armstrong counties, in that order, accounted for about two-thirds of the total. Other counties with significant volumes (more than 100,000 gallons each) were Cambria, Centre, Somerset, Erie, Jefferson, Forest and Mercer. Spreading took place on township roads (59%), mining haulroads (22%), race tracks (8%), private lots and roads (7%) and Pennsylvania Department of Transportation roads (4%).

Industrial Minerals

Pennsylvania produces more tonnage of industrial minerals than of coal. In 1996, more than 400 operators produced 113 million tons of these minerals from almost every county in the state. The leading counties, in order of production, are Bucks, Lancaster, Northampton, Berks, York and Montgomery. Each of these counties produce more than 5 million tons of industrial minerals; together they are responsible for 38 percent of the state total. Most of the extracted minerals are limestone, and public authorities use much of this for public roads. Extraction of these minerals needs to occur in scattered locations because crushed rock, sand and gravel are high-volume, low-value products which cannot economically be transported long distances.

A small but environmentally significant component of the state's industrial mineral economy involves commercial dredging of rivers for sand and gravel. Dredging takes place on the Allegheny and Ohio Rivers and has taken place on the Beaver River in the past. These rivers have significant (but finite) sand and gravel resources. They have special value because they are in areas of the state that lack high-quality limestone deposits near enough to the surface to be quarried. Several of the dredging companies have appealed various permits required by the DEP for the protection of freshwater mussels.

Conclusion

The Commonwealth's extractive industries have played a long and important role in the development of Pennsylvania and the nation. But this development has come with environmental and social costs for which we continue to pay. Because mineral resources are finite and because of potential increases in other sources of energy and raw materials for industry, extractive industries will, eventually, greatly lessen their impacts on our watersheds.

However, until this happens it is vitally important that the state as well as citizens ensure that regulatory programs be enforced to their full extent.

10

Abandoned Mine Drainage

Cleaning Up After a Century of Mining

BY ROBERT S. HEDIN, PH. D
Hedin is President of Hedin Environmental.

Pennsylvania has a long and rich coal mining history. Some of the most heavily mined areas are in the Allegheny River watershed of Western Pennsylvania. Among the distinguishing features of the near-surface geology in the watershed are sedimentary strata that contain economically important coal reserves. Important coal seams, typically named for the locality where they were first described and exploited, include the Clarions, the Kittannings and the Freeports. These coal seams have been mined throughout the watershed for approximately 100 years.

Before 1940, all significant mining was done underground. During the first half of this century, the Allegheny River watershed was home to dozens of mining towns where the economic and social life revolved around the underground coal mines. With the development of large earth-moving machinery in the latter half of the century, however, surface mining became the dominant coal extraction technique. Tens of thousands of surface mines were operated and abandoned in the watershed during the last 50 years.

A century of mining has had a major effect on the Allegheny River basin. The exhaustion of many coal reserves resulted in the shutdown of dozens of large underground mines and a dramatic decline of once-thriving mining towns. Surface mining, which concentrates for economic reasons on coal near the surface of the earth, has removed significant portions of the most desirable, "low-cover" coal reserves. As a result, the mining industry in the watershed today is less than half the size it was earlier in the century. Currently, there are less than a dozen underground mining operations in the watershed and between 50 and 75 active surface mining operations. These numbers are dwarfed by the thousands of abandoned mine sites that continue to impact environmental quality and land values throughout the watershed.

Tinkers Run, Irwin.

Stream Quality Improvements: What's Happening?

For decades, the polluted condition of many Pennsylvania streams was accepted as an unavoidable consequence of the economic prosperity that

accompanied coal mining. Recently, however, it has become clear that water quality in many streams in the watershed is improving. The improvement is a likely result of a variety of developments over recent decades:

REGULATORY CHANGES. For most of its history, the mining industry in Pennsylvania operated under minimal regulation. Coal mines in the basin were run for decades without significant concern for the environmental problems they created. Mining regulations stiffened considerably during the 1970s, however. Currently, all mining operations must obtain permits that regulate reclamation activities and the quality of water discharged from the site. Bonds are required that assure that mining and reclamation will occur as planned and remain in compliance with current regulations. When mining companies declare bankruptcy, these bonds can be used to finance reclamation of the abandoned mine sites by the Commonwealth. The result of the current regulations is that mining is more responsive to environmental concerns.

Today, many permitted mine sites exist in Pennsylvania. Where the mine drainage is contaminated, the responsible parties treat it with chemical or other procedures. In many cases, stream quality has been significantly improved by inflows of treated alkaline water from permitted mine sites. As long as these sites are operated under permits by financially solvent companies, they pose no threat to the waters of the basin.

NATURAL AMELIORATION. In some watersheds, water quality improvements over the last 20 years have resulted in part from the "natural amelioration" of contaminated discharges from unpermitted, abandoned sites. In laymen's terms, the sites have cleaned themselves up. The improvements most likely stem from a variety of causes, including: decreased contaminant production by aging mines, natural revegetation of unreclaimed mine surfaces, and the natural development of filtering wetlands between discharges and receiving streams.

RECLAMATION THROUGH REMINING. Reclamation of abandoned mine sites can dramatically decrease AMD production by lessening the contact of water with acidic materials. On many abandoned mine sites, acidic materials produced during the processing of coal were left on the surface in piles that readily contaminate surface water. Surface mining creates pits that, when abandoned in an unreclaimed state, can collect water that eventually becomes an acidic discharge. Reclamation lessens the production of AMD by burying toxic acidic materials, filling in abandoned pits, promoting the revegetation of the mine surface, and recontouring the mine so that water flows rapidly off the site.

The most cost-effective way to achieve the reclamation of abandoned sites is through the "remining" of the abandoned site for remnant coal reserves. During the remining process, the abandoned AMD-producing mine is reclaimed to current standards. Because current mining and reclamation practices are less likely to produce AMD than older, unregulated ones, the net result of a remining process is usually decreased production of untreated AMD.

Pennsylvania mining regulations were amended in the 1980s to encourage remining. Mining companies that remine abandoned sites are absolved of any water treatment liability as long as the mining activities do not increase contaminant production by the abandoned site. Experience has shown that the reclamation of abandoned mines almost always decreases contaminant generation. As a result, there is little financial risk to the mining companies, and the environmental benefits to the Commonwealth are obvious.

Abandoned Mines:
The Threat Defined

Abandoned mines pose a threat to waterways because they discharge acidic, metal-contaminated mine waters. Under unmined conditions, the natural weathering of acidic strata in the earth is very slow, and acids often are neutralized by alkaline materials that naturally occur in coal-bearing sedimentary strata. The weakly acidic waters produced by this natural process pose little or no harm to indigenous aquatic insects and fish.

Mining, however, greatly accelerates the weathering process by exposing coal-bearing strata to oxidizing atmospheric conditions. Mining also eliminates the alkaline strata that can help reduce the acid content of the water. The result: a highly acidic drainage that is contaminated by elevated concentrations of iron and aluminum. Today, these inputs of acid mine drainage (AMD) pollute hundreds of miles of Pennsylvania streams.

RECLAMATION BY PUBLIC AGENCIES. Thousands of acres of abandoned mine lands in Pennsylvania have been reclaimed by public agencies, including: the Pennsylvania Department of Environmental Protection's (DEP) Bureau of Abandoned Mine Reclamation; and the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS). These projects are generally funded by a tax on coal intended to finance reclamation projects on abandoned sites. For most of these projects, the primary focus has been the elimination of hazardous conditions such as highwalls, open pits or steep slopes. A side benefit of some of these reclamation projects has been improvements in water quality. During the last three years, the federal rules associated with spending these funds have been revised so that DEP can do projects whose primary focus is the treatment of contaminated drainage at abandoned sites.

The NRCS completed numerous reclamation projects in the 1980s under its Rural Abandoned Mine Reclamation Program (RAMP). Recently, funding for RAMP projects has been spotty, and most of NRCS's efforts have been focused on water quality projects conducted under Pamphlet Law 566 (PL 566). Under this law, projects must complete a watershed study that identifies specific water quality problems and solutions. Completion and approval of a PL 566 watershed study can lay the groundwork for subsequent funding of projects. The NRCS has approved PL 566 studies for the Oven Run and Monastery Run watersheds, both in the Allegheny basin. In addition, several NRCS mine water treatment projects have been completed or are in progress in these watersheds. A PL 566 watershed study currently is being developed for Mill Creek, a tributary to the Clarion River.

TREATMENT OF AMD BY PUBLIC AGENCIES. The Pennsylvania DEP's Bureau of Abandoned Mine Reclamation operates several active mine water treatment systems in the basin. These systems operate by adding lime or limestone to acidic water and using sedimentation ponds to separate metal contaminants from the water. During the last two years in the Toby Creek watershed, the Bureau has opened a new treatment plant and is planning a second one. The Bureau also is experimenting with automated "stream dosing" devices that add lime or limestone directly to an acidic stream.

TREATMENT OF AMD BY STREAM RESTORATION GROUPS. During the last ten years, new passive minewater treatment techniques have been developed that rely on natural chemical and biological materials and processes. The main attraction of passive systems is that they can operate for years with little operational oversight or maintenance.

Example of AMD treatment system.

The hope that passive treatment can provide cost-effective remediation of long-polluted headwater streams has prompted the formation of a dozen stream restoration groups in the Allegheny basin. These groups are using public and private resources to construct passive treatment systems throughout the basin. The result is that the basin, which for years was considered a hotbed of AMD production, is now considered a hotbed of innovative stream restoration activities.

A Passive Treatment System

Fourmile Run, near St. Vincent College, Latrobe, was polluted by a deep mine that discharged 300 to 550 gallons of polluted water a minute. A passive treatment wetland system was developed that reroutes the contaminated water to an uphill location, where it is released into a series of gradually descending treatment ponds called "cells." Iron oxide naturally settles to the bottom of the cells before the water is released to the stream. It is estimated that the cells will collect an inch to an inch and a half of iron oxide sediment each year, which can then be removed, allowing the ponds to be reused. Cattails that naturally grow at the site provide a surface to which iron-oxide particles can adhere and slow the water flow through the system. Additionally, the cattails provide habitat for wetlands organisms.

National attention has focused, in particular, on the Mill Creek Watershed in Jefferson and Clarion Counties, where a dozen passive systems have been constructed and where measurable improvements in water quality have been documented as a result. During the last two years, the Institute in Watershed Restoration at St. Vincent College has attracted students from throughout the basin to study the AMD-polluted Loyalhanna Creek and the passive systems constructed in Latrobe in an effort to clean up the waterway.

The Future of AMD Remediation

Water quality is improving in the Allegheny basin and across Pennsylvania, but AMD remains a devastating water pollution problem. Improved regulations have slowed the rise of new sources of mine water pollution. The remaining challenge is the remediation of thousands of discharges of contaminated water flowing from abandoned sites. Stream restoration, once considered technically and economically impossible, is now being discussed and attempted throughout Pennsylvania.

Achieving the Commonwealth's restoration goals will require a continued emphasis on a varied approach. Reclamation of abandoned sites by mining companies and government agencies must continue. Stream restoration groups, as well as government agencies, must keep working to construct passive treatment systems at appropriate sites. And to deal with the many serious AMD discharges that are not readily corrected with passive techniques, government and stream restoration advocates will have to work together to craft innovative solutions or to construct active chemical treatment plants.

Given the progress of the last 20 years, the remaining problems are not insurmountable. All it takes is the will to turn back the clock to the days a century or more ago when mine drainage wasn't an issue and Pennsylvania's streams flowed free and clear. ■

For more information on AMD remediation projects, contact:

Eastern Pennsylvania Coalition for Abandoned Mine Reclamation (EPCAMR) - 570-628-3377
Western Pennsylvania Coalition for Abandoned Mine Reclamation (WPCAMR) - 724-837-5271

11

Preventing Sanitary Sewer Overflows and Combined Sewer Overflows

When the Sewers Pollute

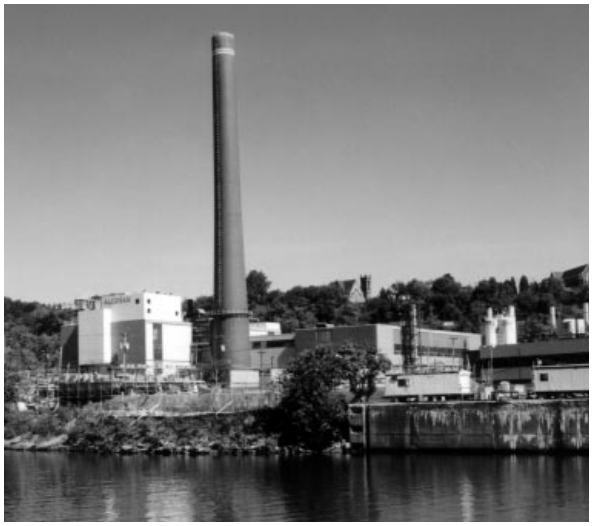
BY KEVIN J. GARBER, PH. D, ESQ.
Garber is an Environmental Attorney with Babst, Calland, Clements & Zomnir, P.C.

Sanitary sewer overflows (SSOs) and combined sewer overflows (CSOs) occur when raw sewage with or without stormwater flows directly into rivers and streams instead of a sewage treatment plant. Most SSO and CSO events occur during heavy storms. Some of these overflows significantly pollute the receiving waters, causing local health departments to issue warnings about human contact with water.

The U.S. Environmental Protection Agency (USEPA) recognizes that SSOs and CSOs are a serious water quality problem in the United States. According to recent USEPA estimates, $45 billion is needed over the next 20 years just to control CSOs. Another $32 billion will be necessary to upgrade existing publicly owned wastewater treatment systems and to construct new sewers to control SSOs. In all, USEPA estimates that $140 billion must be spent on wastewater treatment systems over the next 20 years. These are extraordinary costs.

Background: Who Pays?

Towns and cities often build and operate a central wastewater treatment facility to receive wastewater from the surrounding municipalities. There are presently about 16,000 publicly owned treatment systems serving about 72 percent of the U.S. population. The municipalities served by these systems typically own and maintain the sewers within their jurisdiction. Individual homeowners usually pay a treatment fee to the treatment authority and/or a service fee or other tax to their home township to maintain the treatment and collection system. Homeowners are then responsible for the sewer lines from their homes to the public connection point, which is usually at the street.



In Allegheny County, for example, the Allegheny County Sanitary Authority (ALCOSAN) owns and operates a large treatment plant in McKees Rocks that serves 83 surrounding municipalities and the City of Pittsburgh through several hundred thousand miles of pipelines, most of which are owned by the municipalities. Alcosan has "tap-in" and service agreements with each municipality but generally has only limited authority to require townships to correct problems in their municipal lines. The primary regulatory authority—and authority over SSO and CSO problems in general—rests with several agencies.

The federal Clean Water Act generally prohibits unpermitted overflows from municipal sewers and treatment plants. USEPA enforces this law. It has the power to assess civil penalties of up to $25,000 per day for each day of violation and can obtain a court order requiring a municipality to upgrade its sewage collection system to eliminate SSOs or CSOs. States often have similar laws. In Pennsylvania, the Department of Environmental Protection (DEP) enforces the

Pennsylvania Clean Streams Law, which, like the Clean Water Act, prohibits unpermitted discharges of pollutants into waters of the Commonwealth. DEP also can assess penalties and order municipalities to eliminate illegal overflows.

Finally, local health departments and municipalities sometimes have authority to order a township or homeowner to correct a public health hazard. The Allegheny County Health Department, for example, has authority to require municipalities in the County to adopt corrective action plans to eliminate sewer overflows and basement flooding.

The cost of correcting an SSO or CSO problem generally falls on individual homeowners through higher taxes, service fees or actual sewer replacement assessments. The federal, state and local government have authority to initiate a program to address SSOs or CSOs, but usually the federal government (acting through USEPA) prompts or actually orders a municipality to act. As a result, the extraordinary costs involved in correcting SSOs and CSOs ultimately become a local issue for individual residents and must be borne by them.

Sanitary Sewer Overflows

USEPA defines sanitary sewer overflows as "discharges of untreated water from a separate sanitary collection system which occur before the headworks of a sewage treatment plant." A "separate sanitary collection system" is one designed to collect sewage from homes and businesses and wastewater from industries and convey it to treatment plants without admitting storm water, snow melt or groundwater into the system. Water from these extraneous sources, if allowed to flow unchecked into a treatment plant, could overwhelm a treatment system during heavy precipitation, causing it to become "hydraulically overloaded." Incoming sewage and industrial wastewater would not receive the designed degree of treatment, and the effluent from the treatment plant might not meet its permitted discharge standards. Therefore, a well constructed and maintained separate sanitary system promotes the good operation of a treatment system by preventing the treatment plant from becoming overwhelmed with stormwater and groundwater.

Presently, there are about 18,500 separate sanitary sewage collection systems serving about 135 million people in the United States. Many of these systems, particularly those constructed in the early to middle part of the twentieth century, are now admitting storm water and groundwater through broken sections of pipe, unsealed joints in pipes, illegal connections—for example, from homes where gutters and downspouts are tied directly into the sewer system in violation of local building codes—and many other entry points. Treatment plants and sewer systems often have insufficient capacity to handle this extra water. As a result, SSO discharges may appear throughout the system, particularly at manholes, when the infiltrating stormwater and groundwater exceed the pipeline's design capacity. The resulting discharges of raw or diluted sewage from separate sanitary sewer systems before treatment can cause significant public health and environmental problems.

The federal Clean Water Act prohibits SSO discharges to surface waters of the United States unless authorized by a National Pollution Discharge Elimination System (NPDES) permit. Some treatment plants have permits that specifically allow SSOs under certain circumstances, such as when there are no feasible alternatives to a discharge or when circumstances arise beyond the plant's control. Other permits specifically prohibit SSOs, while others are simply silent on the issue. USEPA unequivocally states that SSO "discharges without an NPDES permit are illegal," but the agency recognizes that it has limited information about how permitting authorities are addressing the problem of SSOs.

To gather more information and to promote uniform enforcement, USEPA issued an important guidance document in 1996 entitled "Setting Priorities for Addressing Discharges from Separate Sanitary Systems." The document is official agency policy and has been incorporated as a chapter (Chapter X) in USEPA's Enforcement Management System for the Clean Water Act. USEPA relies on this enforcement document to evaluate compliance with the Act.

USEPA's guidance states that all SSOs should be considered high risk because discharges of raw sewage can present serious health or environmental threats. Separate sanitary systems that have SSOs during dry weather are the highest priority for enforcement and/or corrective action. Systems with wet-weather SSOs are the next highest priority. Enforcement responses

depend on the specifics of each case and can include telephone inquiries, notices of violation, administrative orders or lawsuits in state or federal court. Municipalities can be requested or ordered to implement a broad spectrum of corrective actions ranging from low-cost, "noncapital improvements" (such as improving daily operations and maintenance or replacing pipes) to more capital-intensive discharge control plans such as treatment plant reconstruction. USEPA and state agencies typically will allow a municipality to create a compliance schedule but often insist that timelines in the schedule be as short as possible.

The Chapter X guidance further directs USEPA and state governments to be sensitive to the special needs and financial capability of each municipality. Governmental agencies are therefore directed to consider a municipality's bond rating, indebtedness, grant eligibility, and population and income information when requiring the municipality to address SSO issues.

In Pennsylvania, a state law entitled the Pennsylvania Sewage Facilities Act (also known as "Act 537") seeks to prevent SSOs by requiring municipalities to develop comprehensive sewage plans for their jurisdictions. These so-called "537 Plans" must delineate existing SSO areas, account for sewage needs within a 10-year period, and provide for adequate treatment facilities to prevent the discharge of untreated sewage. The plans must be updated regularly and submitted to DEP, which can disapprove a 537 Plan if it does not serve present and future development. DEP is able to enforce Act 537 in several ways to minimize SSOs, including by banning additional tap-ins to hydraulically overloaded facilities.

Combined Sewer Overflows

Combined sewer overflows are overflows from combined sewer systems. Also called a CSS, a combined sewer system is one that's designed to carry sanitary sewage (i.e., domestic, commercial and industrial wastewater) and stormwater through a single pipe to a treatment facility. Unlike a separate sanitary system, a combined sewer system is intended to carry stormwater to a treatment facility for treatment and subsequent discharge. Presently, about 1,100 communities in the United States, serving about 43 million people, have combined sewer systems. Most of these communities are located in the Great Lakes and Northeast regions.

CSOs usually develop during wet weather when rain water or snowmelt exceeds the capacity of the combined sewer system and/or treatment system. A CSS is intentionally engineered to overflow directly to surface waters during these high-flow periods, and the resulting CSO discharge often contains untreated domestic, commercial and industrial wastes and other contaminants that are present in stormwater. USEPA estimates that CSOs discharge 1.2 trillion gallons of raw sewage and stormwater annually to streams, lakes and bays across the country. The agency has linked CSO discharges to degradation of waterways, shellfish bed closures, human health problems and fish kills.

On April 19, 1994, USEPA published a new national policy to control CSOs. "The Combined Sewer Overflow Control Policy" encourages states to coordinate the CSO planning process with their regular review of state water quality standards. Municipalities are encouraged to make environmentally sensitive receiving waters their highest priority for action. The policy requires municipalities to implement nine

The Costs of Compliance

Two studies have looked at the cost of complying with USEPA's policy on Combined Sewer Overflows (CSOs):

- A 1996 study sponsored by the Association of Metropolitan Sewerage Agencies (AMSA) concluded that CSO control is very expensive and largely dependent on local funding, in large part because Combined Sewer Systems and the impact of CSO discharges are very site specific.
- A similar 1996 survey of major cities by King County (Seattle, Washington) found that Detroit spent or will spend $20 million, Seattle $60.5 million and San Francisco $1.1 billion in total capital costs to comply with the USEPA policy. Average annual costs to implement the controls among the ten cities surveyed ranged from $42.9 million to $65.4 million depending on the city.

Both studies found that CSOs should be controlled through watershed management because there are a range of non-CSO sources that contribute to water quality. Non-CSO sources include stormwater runoff from urban areas, erosion and sedimentation problems from poor land-use practices, and runoff from agricultural lands. The AMSA study recommended a group of performance measures (e.g., nutrient loads, CSO frequency and dry weather overflows) that municipalities should use to track the results of CSO control.

"minimum technology controls" by January 1, 1997. These controls include: properly operating and maintaining the sewer system and CSO discharge points; maximizing the flow of water to the plant for treatment; controlling solid and floating material; notifying the public of CSO occurrences; and monitoring the collection system to assess the impact of CSOs.

In order to comply with the nine minimum controls, municipalities may use either the "presumption" approach or the "demonstration" approach. Under the presumption approach, compliance is presumed if four or fewer CSOs per year do not receive minimum treatment, if at least 85 percent of the combined sewage/stormwater flow is eliminated or treated, or if pollutants responsible for water quality problems are eliminated or reduced. Under the demonstration approach, a municipality must demonstrate how water quality standards will be attained through a monitoring and control plan.

In the Pittsburgh area, USEPA Region III (headquartered in Philadelphia) in 1994 requested 80 municipalities that contribute wastewater to the ALCOSAN system to submit information to help the agency identify CSO points. The goal was also to provide the affected communities with enough time to implement the nine minimum controls before the January 1, 1997, deadline. In March 1997, USEPA issued a separate request for information under the Clean Water Act to about 50 of these municipalities to check on their compliance with the CSO policy. The municipalities also were asked to begin daily monitoring of the flow of water at CSO points. Monitoring began in August 1997. In August 1998, EPA advised the communities that they could discontinue monitoring and encouraged them to address any overflows detected by their monitoring. Many municipalities believe they will have to undertake significant corrective action on their collection systems to achieve the USEPA's recommended flow rate. When this article was written, EPA had not taken any action to enforce its March 1997 information request or to penalize communities that missed the January 1, 1997 compliance date. ■

12

On-lot Sewage Treatment and Disposal

The On-Lot Onslaught

BY MILTON LAUCH

Lauch is Chief of the Division of Wastewater Management with the Pennsylvania Department of Environmental Protection.

Many of Pennsylvania's non-urban areas are dependent on on-lot wastewater treatment and disposal systems. If improperly sited, constructed or managed, these systems have the potential to create both pollution and public health problems. There are currently more than 1.2 million homes served by on-lot systems in Pennsylvania. Many of these systems were constructed before siting or design standards were legislated by the Pennsylvania General Assembly in 1966. These older systems (cess pools, dry wells, seepage lines and abandoned wells) may discharge improperly treated sewage to surface water, groundwater or to the surface of the ground itself.

A recent evaluation of Pennsylvania's older systems indicated that a rural population of more than 997,000 may be served by substandard or malfunctioning on-lot systems; the cost of providing public sewers to this population was estimated at more than $1.6 billion. In many areas, public sewerage is simply not practical because of the terrain and/or the housing density. Moreover, repairing or replacing these systems one by one is hardly feasible because of the costs and/or the physical constraints related to site conditions and lot size. Local agencies across the state issue fewer than 2,250 permits per year to repair existing, malfunctioning on-lot systems.

New Systems Misunderstood

In addition to the substandard, existing on-lot systems throughout the state, about 25,000 permits are issued each year by local agencies for on-lot systems to serve new land development. These systems are permitted under siting, soil testing, design and construction standards established by the Pennsylvania Department of Environmental Protection (DEP) for the entire state. Sewage Enforcement Officers who issue these permits and inspect the systems prior to their use are certified by the Commonwealth and must attend mandatory training courses. If it is properly operated and maintained, the modern on-lot system will function for the life of the dwelling. On-lot systems consist of a septic tank designed to retain and digest solids; a distribution system made up of plastic piping with perforations to distribute treated effluent across a soil or sand absorption area (including a pump in some cases); and the underlying soil in which most of the treatment occurs.

Stream in Loyalhanna basin.

It is the owner's responsibility to insure the proper functioning of an on-lot system. However, past evaluations have documented that owners of new dwellings served by on-lot systems do not understand their systems. They do not know, for example, that septic tanks retain solids and must be pumped out at least every three years or more; if the solids are not removed periodically, they will move out of the septic tank and into the absorption area. Most owners also do not know that the mechanical parts of the system must be maintained

to prevent system malfunction, nor do most owners understand that the absorption area must be protected from heavy equipment and surface water runoff.

The failure to properly operate and maintain a new system means that the life of the system is shortened and a malfunction is likely to occur. This, of course, adds to the existing problem of malfunctioning on-lot systems in the Commonwealth and presents additional challenges to local agencies and municipalities in dealing with these problems.

Another problem is the fact that both new and older on-lot systems do not treat nitrogen loads well and transfer these directly to groundwater. Nitrate-nitrogen at levels of greater than 10 parts per million in drinking water is considered a public health hazard and is associated with cyanosis in infants.

What DEP Is Doing About On-lot System Malfunctions

The DEP has reevaluated its approach to the on-lot system problem in recent years. A number of new, key initiatives were put in place to direct new attention to the problem and to create the tools needed by local government to deal with old, substandard systems, as well as new land developments served by on-lot systems. Elements of DEP's new emphasis include the following:

Developing New On-lot Technology

The costs to replace malfunctioning on-lot systems with public sewers are prohibitive for some areas of the Commonwealth. In addition, many lots with malfunctioning systems have very limited soil suitability and require the installation of systems that are very expensive to construct or operate. Responding to these problems, DEP entered into a contract with Delaware Valley College (DELVAL) to do a worldwide search for new, low-cost on-lot technologies that could be used in the climate and soil conditions prevalent in the state. Once these systems were proven to work, according to the plan, their use would be expanded statewide through policy and regulation changes. The DELVAL project is in its third year of monitoring six new or modified technologies for a wide range of soil conditions across the Commonwealth. A drip irrigation system that will function in very limited soils will be released for statewide use during 1999.

In addition, DEP is cooperating with the Pennsylvania Department of Conservation and Natural Resources to use some of the DELVAL technologies, as well as other new systems, to repair existing, malfunctioning systems in state parks. DEP also is carrying out an experimental/alternate on-lot system program under which several private corporations have developed new technology to denitrify septic system wastes. In other developments, a technology has been approved that uses open, plastic-lined infiltration chambers to replace the gravel aggregate that is normally used in the absorption area of on-lot systems. This allows for a 40-percent reduction in the size of the absorption area. The use of the chambers also allows for a reduced-size system repair on lots that normally would be too small to support an on-lot system repair.

Recent regulatory changes have classified nine previously experimental systems or system components as standard technology. This will allow for their use without previous restrictions, including DEP review and monitoring. Also included in the regulations was a new spray irrigation system that is capable of functioning on sites with as little as 10 inches of soil. Other on-lot systems require between 20 and 60 inches of soil to treat sewage adequately before it reaches groundwater or bedrock. The new spray system can thus be used to repair malfunctions on lots that were previously unsuitable for on-lot technologies. Another benefit of spray irrigation is that it reduces the amount of nitrate-nitrogen reaching the groundwater.

Providing Financing for On-lot System Repairs

State and federal funding for sewage traditionally has been available only for pubic sewerage projects. But DEP, in cooperation with PENNVEST and the Pennsylvania Housing Finance Corporation, has created a low-interest (1%) loan program to help finance on-lot system repairs. These loans are available through local banks and have a generous payback term. Applicants must have a repair permit issued by the local agency or DEP prior to applying. To date, a total of $2.1 million has been loaned through this program.

In other activities, federal and state funding agencies are looking closely at financing strategies for those areas that must replace malfunctioning on-lot systems with

public sewers. The primary concern is how these agencies can make the sewerage systems more affordable to users. The problem is being evaluated both in terms of making affordable technology available and in terms of providing loans and grant money to reduce costs.

Stimulating Development of Up-to-Date Sewage Facilities Plans

The primary tool available to municipalities for evaluating the condition of on-lot systems is an Act 537 Sewage Facilities Plan. By developing and adopting such a plan, the municipality can help assure the provision of adequate on-lot systems, as well as public and private sewerage facilities. These plans:

- Identify areas where systems are malfunctioning and causing public health or pollution problems.
- Identify growth areas where some method of sewage treatment will be needed in the future.
- Assess all available options and identify which options will be implemented.
- Evaluate sources of financing available to implement the options selected.
- Establish an implementation schedule identifying major steps needed to carry out the plan.

An Act 537 plan, when closely linked with zoning and land-use ordinances, provides a roadmap portraying the future of the municipality in terms of anticipated development and needed infrastructure. These plans also serve as the basis for establishing priority to receive funds from PENNVEST and other funding agencies to finance sewerage projects. While urban areas have used the Act 537 planning process to their advantage, rural municipalities in Pennsylvania have not. A recent evaluation of the status of Act 537 planning revealed that 1,407 of the 2,571 Pennsylvania municipalities have sewage facilities plans dating to 1974 and earlier. This means that approximately 55 percent of all Pennsylvania municipalities have not evaluated the status of their sewage facilities for more than 24 years. DEP's new emphasis includes strategies to identify municipalities with the most critical, planning-related problems and to foster planning through outreach and assistance.

Encouraging Sewage Management Programs

In the early 1990s, DEP attempted to force municipalities to develop and implement sewage management programs through their Act 537 plans. These programs are intended to assure the long-term functioning of on-lot systems through system inspection, mandatory septic tank pumping and a maintenance program administered through local governments. Programs may also include the identification and repair of on-lot system malfunctions. While DEP was successful in obtaining from municipalities sewage facilities plans that proposed the establishment of such programs, few of these plans were implemented. The reason often was public opposition to the cost of such a program ($150 every three years to pump the septic tank plus fees charged by the municipality for inspection and record keeping). These costs, however, are minor compared to providing public sewers to an area because of the lack of maintenance and eventual failure of on-lot systems.

The Department has changed its approach from attempting to force municipalities to develop management programs to providing outreach and assistance to municipalities that want to develop these programs. In order to encourage sewage management programs, DEP has provided the Pennsylvania State Association of Township Supervisors (PSATS) with funds to develop the publication, "A Municipal Official's Guide to Managing On-Lot Sewage Disposal Systems," which is now available for use. DEP also has passed regulations to reimburse municipalities for between 50 percent and 85 percent of the annual administrative and staffing costs associated with running a sewage management program. In addition, DEP will reimburse a

Evaluating Your Municipality's Act 537 Plan

Citizens, government agencies and businesses can increase their knowledge of sewage facilities within a municipality by evaluating the municipality's Act 537 Sewage Facilities Plan. Key factors to consider when evaluating these documents include: the age of the plan, consistency of the plan with current land-use patterns and land-use planning/zoning ordinances, and the operational status of on-lot systems in the municipality. If your review reveals problems in any of these areas, it is time for municipal officials to consider an update to the plan. Citizens also should learn about the on-lot system serving their dwelling or business to assure that it is properly operated and maintained.

municipality for 50 percent of the cost of evaluating sewage management programs in its Act 537 Sewage Facilities Plan. This allows local governments to weigh the advantages of such programs without being put off by the costs.

The Future of On-lot Treatment and Disposal Systems in the Commonwealth

DEP's new focus on on-lot systems is already paying dividends. A number of municipalities strongly opposed to mandatory sewage management are beginning to embrace the concept as a good idea. This attitude should become increasingly prevalent as DEP's on-lot system research, education and outreach, and financial support activities become more firmly established. Many of the new on-lot technologies being developed by DEVAL require maintenance and periodic inspection. Municipalities with sewage management programs in place will be in an excellent position to provide these system options to their residents upon their release for statewide use.

It's a fact that Pennsylvania will continue to depend heavily on on-lot systems to serve at least one-third of the state's population well into the next century. The tools that are currently in place, as well as those that are being developed by DEP and others, will provide municipalities with the support they need to assure that these systems are managed to prevent public health or pollution problems in the future. ■

For more information:

The following information on on-lot systems is available from DEP:

Sewage Disposal Needs Identification Guidance - Act 537

Fact Sheets #1 through #10 regarding on-lot systems

Consumers Guide to On-lot Sewage Disposal System Operation and Maintenance

Consumers Guide to On-lot System Permits

A Guide to Multi-municipal Local Agencies

Sewage Facilities Planning Guidance for Municipal Officials

To obtain these and other materials, call the Division of Wastewater Management at 717-787-8184, or visit DEP's website at: www.dep.state.pa.us (choose information by subject/Water Management).

13

Wetlands

Nature's Water Quality Protectors

Information compiled by the Allegheny Watershed Network

Wetlands are complex ecosystems that can be found around the globe. Not all wetlands are alike, however. They can vary by location, hydrology, soil composition, vegetative composition, and function. Certain wetlands are flooded the entire year, while others have saturated soils for only part of the year. Despite these variations, wetlands are important elements in any watershed because of the many services they provide. A fuller understanding of wetlands and their functions will lead to better land-use decisions and positively affect the health of our watersheds.

What's A Wetland?

All wetlands share three main characteristics: wetland hydrology, wetland soils, and the presence of wetland plants.

WETLAND HYDROLOGY refers to the presence of standing water on the ground or within the root zone for at least part of the year. The depth and duration of this flooding varies.

WETLAND SOILS, OR HYDRIC SOILS, develop anaerobic conditions (i.e. they lack oxygen) due to their saturation. These soils are quite distinctive from other soils and usually can be identified by their bluish-gray appearance.

WETLAND VEGETATION, OR HYDROPHYTES, are plants that are adapted to living in wet conditions. Wetland plants can range from those that have adapted to living in either wet or dry conditions to those that only can live in a wet environment.

Black Moshannon State Park

All of these characteristics are used to determine the existence of a wetland and to define its boundaries, a process called wetland delineation. Because of the varying nature of wetlands, the delineation process can be difficult and requires expertise in botany, hydrology and soil science.

Pennsylvania's Wetlands

Less than 2 percent of Pennsylvania's land surface is covered by wetlands. The most concentrated areas of wetlands are in the glaciated northwestern and northeastern parts of the state. In these areas, glacial activities (scouring and deposition) created conditions favorable to wetland development. In unglaciated areas, wetlands typically are associated with headwaters and floodplains of streams and rivers.

Forested wetlands (often called swamps) are the most common type of wetlands in Pennsylvania. These wetlands, characterized by trees greater than 20 feet tall, are found on more than 220,000 acres. Other types of wetlands found in the Commonwealth are scrub-

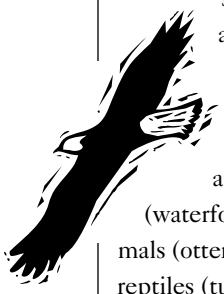
shrub wetlands and emergent wetlands (also known as marshes), covering approximately 139,000 acres and 70,000 acres, respectively. Scrub-shrub wetlands are characterized by woody plants less than 20 feet tall, while emergent wetlands contain primarily non-woody plants.

The Functions and Values of Wetlands

Wetlands serve a variety of functions in the natural environment and offer a variety of environmental values. Not all wetlands perform all of the functions outlined below. Factors such as vegetation, adjacent land use, location in a watershed and geology all can influence what a wetland can do.

Habitat

Wetlands are essential for the survival of many aquatic and terrestrial species. These habitats provide essential spawning, breeding, and feeding grounds for a variety of fish and wildlife. In Pennsylvania, more than 100 species of fish, including many sport fish, utilize our wetlands for reproduction and for food sources. Other animals that rely on wetlands include: birds (waterfowl, songbirds, shorebirds and raptors); mammals (otters, minks, raccoons, muskrats and beaver); reptiles (turtles and snakes); and amphibians (salamanders and frogs). Invertebrates also are important residents of wetland communities. Many of Pennsylvania's rare and endangered species are found in wetlands.



Flood Control

Wetlands provide natural flood control by intercepting storm runoff, snowmelt and high-water discharge from adjacent streams. Flood waters are slowed by wetland vegetation and are released gradually to adjacent lands or surface waters. For this reason, wetlands are sometimes referred to "natural sponges."

Nutrient and Sediment Removal

Water quality is improved as water passes through a wetland. As the water velocity is slowed by wetland vegetation, sediments can settle out of the water. Additionally, plants can use nutrients in the water, typically nitrogen and phosphorus from fertilizers, for growth and maintenance. Wetlands are so effective in improving water quality that artificial wetlands have been created to treat wastewater and water contaminated by mine drainage.

Buffering and Shoreline Stabilization

Wetlands act as buffers along shorelines during harsh storms and as a means of erosion control along the shores of rivers and lakes. Plants slow water velocity, while their roots anchor the soil, preventing it from being washed away with the flowing water.

Groundwater Recharge and Discharge

Wetlands can act as groundwater discharge areas when they receive their water supply from groundwater sources, such as springs or seeps. When water seeps from a wetland into a local aquifer, on the other hand, it is acting as a groundwater recharge area. Usually this occurs when the wetland is located above the water table.

Harvesting

Food products such as blueberries and cranberries are harvested from wetlands, along with other products such timber and peat. Some of these harvesting activities can have negative impacts on wetlands.

Recreation

Finally, wetlands are important recreation areas. Activities such as fishing, hunting, hiking, canoeing and wildlife observation are made possible or are enhanced by the presence of wetlands. These activities are important economically; water–related recreation expenditures nationally are in the billions of dollars.

Wetland Losses

Despite the many values of wetlands, wetland areas were seen by early settlers as unproductive and even dangerous places. The draining and filling of wetlands was common throughout our nation's history. About half of the 220 million acres of wetlands that existed in the contiguous 48 states prior to European settlement have disappeared. Most of the land was put into crop production and other development.

Since the mid-1970s, however, wetlands have been offered more protection at the federal and state levels, and sometimes locally as well. Laws such as the Federal Clean Water Act and Pennsylvania's Dam Safety and Encroachment Act have reduced the acres of wetlands lost each year by requiring permits for dredging or filling wetlands. For a complete, and current, description of the wetland permitting process in Pennsylvania, contact the Department of Environmental Protection and the U.S. Army Corps of Engineers.

Replacement Wetlands

The creation or restoration of wetlands to compensate for those that are lost to some type of construction activity is a process known as mitigation. At one time, ponds were considered to be replacements for wetlands because they provided habitat for some species, primarily waterfowl. However, ponds do not necessarily provide habitat for other wetland species, nor do they accomplish many of the other environmentally beneficial functions of wetlands. Although it would be ideal to have replacement wetlands perform all the same functions as the wetlands that are destroyed, this is not always possible. As a result, the best option for protecting wetlands and their functions is to avoid disturbing them in the first place.

The success rates for replacement wetlands vary. Wetlands that were created where none have existed before are not as successful as wetlands that are restored after they were degraded or filled. Actions that help in the creation of a functional wetland include: selecting a site with appropriate water supply, such as an area that is fed by groundwater; using an area with nutrient-rich soil; locating the wetland in a similar area; designing the wetland for the desired functions; and using natural revegetation when possible.

Landowners often wish to have wetlands restored on their property, usually to support wildlife. The U.S. Fish and Wildlife Service's Partners for Wildlife Program cooperates with landowners, conservation organization and other government agencies to make wetlands restoration possible on private lands. Although the Partners for Wildlife Program originally was formed to restore degraded wetlands on nonfederal lands, the program has been expanded to restore forests, grasslands and riparian areas as well. ■

For More Information:

There is a wealth of information about wetlands available from government agencies, academia and environmental organizations. The following list is only a sample of the useful information available:

Department of Environmental Resources. 1990. *Wetlands Protection: A Handbook for Local Officials.* Environmental Planning Information Series Report #7.

EPA Wetlands Hotline: 1-800-832-7828

Heist, A.C. and A.G. Reif. (no date) *Pennsylvania Wetland Resources.* Published by U.S.G.S.

Mitsch, W.J. and J.G. Gosselink. 1993. *Wetlands.* Published by Van Nostrand Reinhold.

National Audubon Society. 1994. *Valuing Wetlands: The Cost of Destroying America's Wetlands.*

Natural Resource Conservation Service. (no date). *Wetlands: Values and Trends.*

The Volunteer Monitor. 1998:10 (1). "Monitoring Wetlands."

Wetlands Ecology and Conservation: Emphasis in Pennsylvania. Eds. Majumdar, S.K.; Brooks, R.P.; Brenner, F.J.; Tiner, Jr, R.W. 1989, The Pennsylvania Academy of Science.

Also, be sure to check the Internet for important wetland web sites such as:

The Wetlands Regulation Center: www.wetlands.com

National Wetlands Inventory: www.nwi.fws.gov

Protecting Groundwater

How Safe Is Your Aquifer?

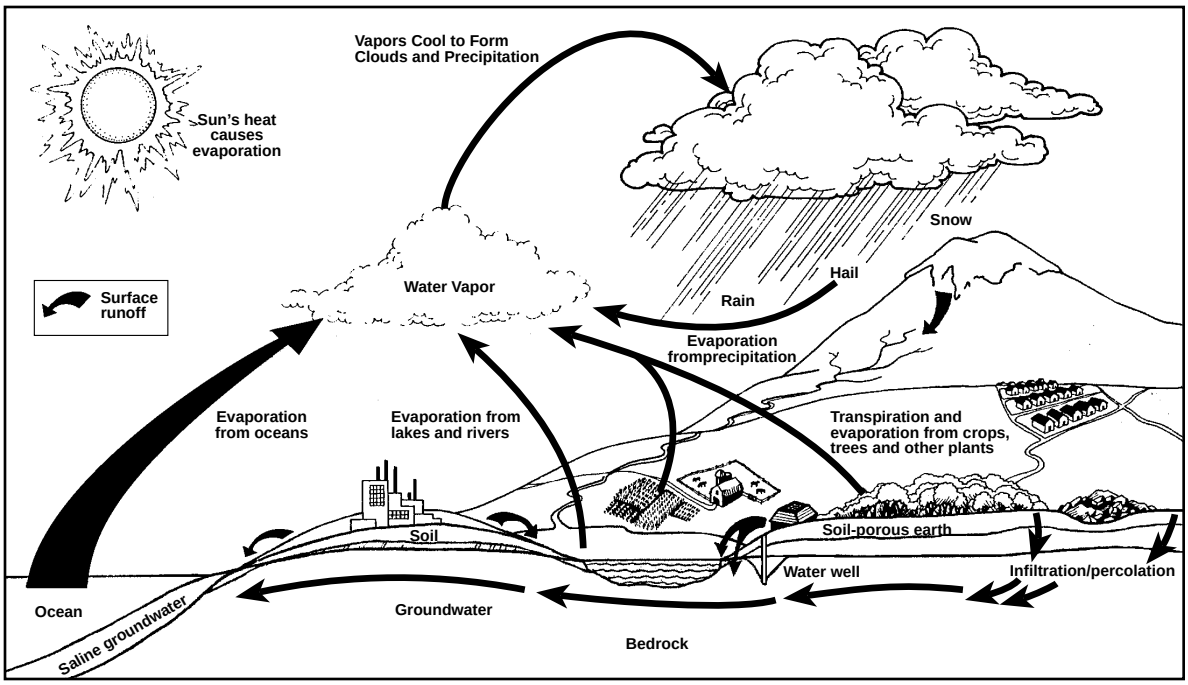
BY EDITH STEVENS

Stevens is Water Resources Specialist with the League of Women Voters of Pennsylvania.

Almost half of all Pennsylvanians get some or all of their drinking water from groundwater. It is a vital resource in more ways than one. In addition to providing drinking water, groundwater provides the base flow of water to streams. During dry periods, in fact, the water flowing in streams can be 100-percent groundwater. Year round, it is estimated that groundwater provides as much as 50 percent of stream flow. The relationship between streams and the aquifers that hold groundwater isn't entirely one-sided, though. During wet seasons, streams may contribute water to adjacent aquifers. At this time, the stream is called a "losing stream."

Groundwater provides protection for the quality as well as the quantity of water in our streams. A clean, cool discharge of groundwater to a stream is one of the

The Hydrologic Cycle



Source: Groundwater—A Primer for Pennsylvanians: PA League of Women Voters

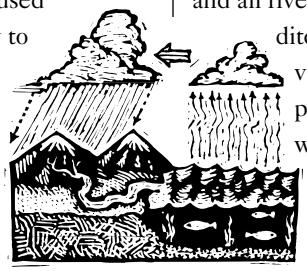
Groundwater is water at one stage of the hydrologic cycle through which all water moves. Water found underground gets there from precipitation falling on the land and infiltrating through the soil until it reaches an aquifer—a zone of saturation where all the spaces between soil particles or cracks in bedrock are filled with water.

Water on its way to the aquifer in the upper-layer soil is called "soil water." Some of this water will be taken up by plants and wind up back into the atmosphere—just one of the ways that the water cycle continues. Water that makes its way to the aquifer, on the other hand, continues its journey through the cycle, moving from the aquifer toward a discharge point—e.g., a spring, stream, lake, wetland or ocean. Most water seeping into the soil moves only a few miles to the point where it is discharged; in most instances it stays within the same watershed.

key predictors of a healthy stream, providing fresh water uncontaminated by surface impacts. On the other hand, if groundwater becomes contaminated, it will carry most of that contamination to the stream. A polluted stream can harm an aquifer in much the same way by contributing polluted water to the groundwater supply.

How is Groundwater Polluted?

The quality of our groundwater depends on how we use the land above it. Activities and land uses that have the potential for harming groundwater include: agriculture, mining, storage tanks, home lawns and gardens, golf courses, chemicals used on highways, landfills and storage lagoons, malfunctioning on-lot septic systems and improper disposal of used motor oil. While the soil has some ability to filter out harmful substances from the water moving through it, an excessive amount of pollutants can easily overwhelm the soil's filtering capacity.



Once contamination reaches groundwater it stays there and can be very difficult to detect. Depending on the type of contaminant, it may "float" on the top of the groundwater like gasoline, may dissolve in groundwater like highway salt, or may sink to the bottom of the aquifer like coal tar, a heavier-than-water substance that is a byproduct of the coal-gasification plants that dotted Pennsylvania in the early 1900s.

Cleanup of groundwater is also difficult. Sometimes, contaminated groundwater can be cleaned using a "pump and treat" method. Frequently, the treatment in these cases is air stripping, a process by which the contaminated water is allowed to flow through a column of air so contaminants are transferred to the air. A treatment method used for "sinkers"—pollutants that are heavier than water—is to install a pump in the solid bedrock below the aquifer.

Groundwater quantity is also dependent on what is done on the surface of the land. As wetlands are filled and the impervious cover of rooftops, parking lots and roads shuts off the passageways for rain and snow to infiltrate the soil, the replenishment of aquifers with rainwater and snowmelt decreases. This causes groundwater levels to drop and decreases the groundwater available to provide base flow to streams in dry weather.

Laws to Protect Groundwater

The best way to protect groundwater is to control activities on the land that have the potential for harm. Some of these activities, such as landfills or storage tanks, are regulated by the state or federal government. However, for the most part, it is up to local governments and individual citizens to take action to protect groundwater. Some of the laws and regulations applying to groundwater protection are explained below:

PENNSYLVANIA'S CLEAN STREAMS LAW. The Clean Streams Law was first passed in 1937 and has been strengthened by amendments a number of times, most recently in 1989. The law states that "... the waters of the Commonwealth shall be construed to include any and all rivers, streams, creeks, rivulets, impoundments, ditches, and other bodies or channels of conveyance of surface and underground water, or parts thereof, whether natural or artificial, within or on the boundaries of the Commonwealth." The Clean Streams Law thus provides a legal framework that could be used to protect groundwater quality in Pennsylvania. However, both the law and the regulations implementing it are most often used in relation to surface water.

WELLHEAD PROTECTION MEASURES. The Federal and state safe drinking water laws (See "Statutes and Regulation's Affecting Waterways Protection," page 143) contain provisions for the protection of groundwater that supplies public water supply wells. These "wellhead protection" measures establish rules for defining the land area that supplies the groundwater that reaches a well. Arriving at this definition can be as simple as drawing a circle around the well or as complicated as doing intense hydrological studies that determine how fast and from what direction ground-water is flowing toward the well. Wellhead protection plans focus on:

1) Identifying potential sources of contamination within the wellhead area; and

2) Developing and implementing strategies to limit the risk of contamination of the water supply.

In Pennsylvania, a wellhead protection plan is required for a new or expanding public water supply well. Water suppliers are required to develop such plans, although the plans can be hard to implement if the wellhead protection area falls on someone else's land. Municipal cooperation is necessary to enact zoning regulations or performance standards such as extra safety designs for underground storage tanks on this neighboring land.

SOURCE WATER ASSESSMENTS. In 1996, the federal Safe Drinking Water Act was amended to include "Source Water Assessment" provisions that require states to develop plans for assessing the water sources for all public drinking water systems and identifying contamination threats to those sources. The Pennsylvania Department of Environmental Protection (DEP) is developing plans for implementing this part of the Act and is currently planning to conduct the source water assessments itself for all public water supplies. The new rules will guide surface water suppliers on how to define their "source water" and how to identify and control possible sources of contamination within the source water area.

"PRINCIPLES FOR GROUND WATER POLLUTION AND PREVENTION AND REMEDIATION." This document was adopted in 1996 by DEP and provides the basis for all policy decisions relating to groundwater in the state. The goal of the principles is the prevention of groundwater contamination whenever possible and the protection of human health and the environment.

PENNSYLVANIA NUTRIENT MANAGEMENT LAW. This law applies to large agricultural operations and requires that such operations develop plans for controlling nutrient pollution. (See "Reducing Nutrient Pollution in Pennsylvania's Streams and Rivers: Too Much of a Good Thing," page 29, for more information.)

PENNSYLVANIA PESTICIDES PROGRAM. The Pennsylvania Department of Agriculture has adopted a Pesticides and Groundwater Strategy to provide a reasonable approach to managing pesticides and preserving groundwater quality. The goal of the strategy is to protect all drinking water sources from degradation. For more information on the strategy and its implementation, contact the Department of Agriculture at 717-787-4843.

MUNICIPAL PLANNING CODE. The Pennsylvania Municipalities Planning Code (MPC), also known as Act 247, gives municipal officials the right to regulate the use of land in their communities. Amendments to the MPC in 1988 provided specific authority to plan and zone for protection of natural resources and water supply. Section 604(1) lists among the purposes for which zoning may be enacted "...preservation of the natural, scenic, and historic values in the environment and preservation of forests, wetlands, aquifers and flood plains."

Sections 301(b) and 603(1d) of the MPC allow a municipality to plan and zone to regulate "the siting, density, and design of residential, commercial, industrial and other development in order to assure the availability of reliable, safe and adequate water supplies to support the intended land uses within the capacity of available resources." In other words, Pennsylvania municipalities are able to adopt ordinances requiring land developers to demonstrate an availability of safe and adequate water supplies for their proposed developments.

The MPC does not make it mandatory for municipalities to plan and zone to protect these resources, however, and few have adopted zoning rules with water resource protection goals in mind. Since this is a fairly new concept in Pennsylvania, any zoning adopted should be based on good science in order to survive a court challenge.

Water-based Land Use Planning Assistance Available

The Environmental Management Center at Brandywine Conservancy in Chadds Ford has developed a science-based program designed to ensure that the natural hydrologic system of a community or watershed remains unchanged as development occurs. The program, called the Water-Based Land Use Regulatory Program (WBLUR), uses a water budgeting computer model (WATBUG) and geographic information system (GIS) to evaluate the impacts of various land and water use scenarios or development proposals in a community to determine what will be a sustainable development pattern. WBLUR must be adapted to a community's resource protection goals and its ability to implement different regulatory programs. The Center has developed sample ordinances that can be adapted for water sustainability. For more information contact the Environmental Management Center at P.O. Box 141, Chadds Ford, PA 19317. Phone: 610-388-2700.

Next Steps

The quality of groundwater in your watershed, and thus the quality of water in your streams, will depend on the action, or inaction, of local citizens. Individuals need to understand the impact that their actions have on the water they drink and the water resources of their watershed. Municipal officials need to understand that the actions they take to regulate the use of the land will affect the drinking water of local residents, as well as the quality and quantity of water in local streams.

The key to groundwater protection is local action. And local education must precede local action. Water suppliers can be a key ally in your education efforts. Large suppliers are well aware that cleaner source water (whether ground or surface) reduces their treatment costs. They also understand that consumer faith in their product is shaken and needs to be restored. Small water suppliers, on the other hand, may need some help in understanding that educating the public about taking care of their groundwater will provide positive benefits for their water supply job.

Citizen groups, local officials and water suppliers can make a powerful team to get the message out about watershed and groundwater protection. ■

For More Information:

THE WATER RESOURCES EDUCATION NETWORK (WREN). A project of the League of Women Voters of Pennsylvania Citizen Education Fund, WREN supports local groups undertaking water resource education projects. Through the WREN Resources Center (call 1-800-692-7281), the WREN website (http://pa.lwv.org/pa/wren) and a quarterly newsletter, *Water Policy News*, WREN helps community groups share information, network and learn from each other. WREN also provides small grants to community coalitions working on water education projects.

Publications available from WREN include: *Groundwater: A Primer for Pennsylvanians*, 12 pages (1994); and *Groundwater Protection and Management in Pennsylvania: An Introductory Guide for Citizens and Local Officials*, 58 pages (1997). Also available from the WREN Resource Center is the Pennsylvania Department of Environmental Protection publication, *Sand Castle Moats and Petunia Bed Holes*, a book about groundwater for junior high students, 28 pages (1994). The Resource Center also maintains a collection of educational videos about groundwater.

THE GROUNDWATER FOUNDATION. Located in Lincoln, Nebraska, the Groundwater Foundation supports communities through its Groundwater Guardian program and Groundwater Festival training. Call 1-800-858-4844 or visit the foundation's website, http://www.groundwater.org.

Other Resources:

Penn State Cooperative Extension produces many useful publications on groundwater. Contact your county Cooperative Extension office.

DEP's guiding policy document, *Pennsylvania's Comprehensive Groundwater Protection Program*, was issued in May 1997 and is available from DEP

The Pennsylvania Environmental Council publication, *Guiding Growth, Building Better Communities and Protecting Our Countryside*, has useful information on groundwater and watershed protection. Contact: PEC, 64 S. 14th Street, Pittsburgh, PA 15203. 412-481-9400.

15

Water Toxins in Streams

Taking On Toxics

BY BARBARA L. KOOSER

Kooser is an Environmental Scientist with the Chesapeake Bay Foundation.

(Reprinted with permission)

TOXIC: adj. 1. of, affected by, or caused by a toxin, or poison. 2. acting as a poison.

—*Webster's New World Dictionary of the American Language*

The very definition of the word "toxic" illustrates the problem in trying to define "toxic pollutants" in relation to aquatic systems; the definition is often not very specific. At the federal level, the problem is illustrated when you look at the various toxics or hazardous substances that are covered by different regulatory programs. Each major federal program has a different list, and there is not much overlap.

According to John Dernbach, associate professor at Widener University School of Law, only 49 chemicals are covered in all five of the major environmental and worker health programs. On the other hand, one of these programs, by itself, covers 768 chemicals. The Clean Water Act, for its part, defines a "toxic pollutant" as one that, alone or in combination with other substances, will cause death, disease, behavioral abnormalities, genetic mutations or similar problems for organisms or their offspring.

How Do Toxic Pollutants Get Into Our Waterways?

There are four primary "pathways" for toxic pollutants to enter rivers, lakes and streams. The first is from "point sources" of pollution, which make direct discharges of toxics from a specific source such as a factory or a sewage treatment plant discharging through a pipe into a stream. Second, toxic pollutants can come from water running off of the land; this diffuse source of pollution is referred to as a "nonpoint source." Third, the deposition of toxic pollutants from the air can also

be a source of toxics in our waterways, affecting large lakes, bays and estuaries more than small streams. A fourth source of pollutants can be contaminated groundwater, if the stream is fed by water from the ground.

It is hard to say precisely how many chemicals get into our waterways. Currently, there are more than 73,000 chemicals in use (Kooser and Savitz, 1996). Large manufacturing facilities report the release of 599 chemicals through the federal government's Toxics Release Inventory (TRI). The U.S. Environmental Protection Agency (USEPA) has identified 126 of these chemicals as "priority pollutants." Confusing the picture even more, the Commonwealth of Pennsylvania regulates the discharge of approximately 140 toxic chemicals by setting specific water quality standards for each.

Data on the quantity of chemicals that reach our waterways is not much clearer. Looking at the TRI, we find that large manufacturing facilities discharged 22,736,860 pounds of specific toxic chemicals into Pennsylvania waterways in 1996, and the same group of facilities sent 8,461,731 pounds of toxic chemicals to local sewage treatment plants. Numbers aren't available to gauge water pollution stemming from other point sources that aren't required to report to the TRI—such as sewage treatment plants and smaller manufacturing facilities. Similarly, it is hard to measure

the extent of pollution from nonpoint sources and polluted air and groundwater. In other words, no one really knows how much of which toxic pollutants are entering our waterways each year.

How Are Toxic Pollutants Regulated?

Water quality standards are the tool used to protect streams from toxic pollutants. There are actually two parts to a standard. First, the state has to decide how a stream is used—i.e., who or what uses the stream and its water and for what purposes. This entails going out to a stream and assessing its use according to a list of designated uses developed by the state. These include:

- "Aquatic life"—cold water and warm water fishes, migratory fishes, and trout stocking;
- "Water supply"—potable, industrial, livestock or wildlife water supply, and irrigation;
- "Recreation"—boating, fishing, water contact sports and aesthetics;
- "Other"—e.g., navigation; and
- "Special protection"—high-quality and "exceptional-value" waters

Until recently, the state would assess streams on an as-needed basis, usually in response to a permit request to discharge into a specific stream or a request to change the stream's designation. As a result, less than half the streams in the state have been assessed to date. The state is now under a court order, however, to assess the remaining streams and plans to do so by examining stream "biota" (flora and fauna) and habitat. Based on its findings, the state will make a determination as to what use is appropriate for the stream, and will then decide whether the stream is meeting that use. Instream aquatic biota (macroinvertebrates such as mayflies and caddisflies) are often used as an indicator of the quality of a stream because they are not very mobile, live most of their life in the same area, and can be noticeably affected by changes in water quality.

To arrive at the second part of a water quality standard, the state has adopted "water quality criteria" for each chemical on its list of 140 toxics in order to protect the designated uses. When the waterway in question is a stream, the state uses the water quality criteria resulting in the most protection, thereby protecting all stream uses.

There are two types of water quality criteria: a narrative criteria and a numeric criteria. The following is an example of a narrative criteria found in the regulations: "Water may not contain substances attributable to point or nonpoint source waste discharges in concentrations or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal plant or aquatic life."

A numeric criteria, on the other hand, is the concentration of a chemical that can be allowed in a stream without harming the stream biota or affecting human health. An example of a numeric criteria would be 2.0 milligrams of fluoride per liter of stream water. Notice that water quality criteria apply to instream concentrations, not necessarily to the concentrations of a pollutant as it comes out of a discharge pipe. Because of this, USEPA allows states to adopt policies so that areas of a stream immediately downstream of a discharge pipe can have higher concentrations of a pollutant; this area is called a "mixing zone."

In addition to state water quality criteria, some of the major drainage basins have specific criteria that need to be met. For example, the Delaware River Basin Commission has adopted its own toxics management strategy that in some ways is more stringent than the state program. Also, because of the Great Lakes Initiative, a federal effort to establish consistent requirements for certain chemicals in the entire

Water Quality Standards Needed

A water quality standard determines the amount of a toxic pollutant that can be found in a stream and still be considered "safe" for aquatic life and human health. Water quality limits in discharge permits are based on the instream limits set by water quality criteria. The state calculates what amount is deemed "safe" for the stream and then allows a facility to discharge up to that amount.

To determine limits for permits, the state currently uses a water quality model that looks at only one discharger at a time, and only one chemical at a time. The interaction between facilities discharging the same chemical, and the interactions between different chemicals, are not taken into account. In addition, discharge permits could well be too lenient and could cause damage if a stream is cleaner than it needs to be to protect its designated use. This is why is it so important to have a protective water quality standard for Pennsylvania streams.

drainage area of the Great Lakes System, there are more stringent controls in place in Great Lakes drainage areas than in the rest of the state.

Public Participation Opportunities

The public has several chances to provide input to DEP regarding toxic pollutants and streams. The first is in connection with the development of water quality standards for streams. Every three years, the state is required to review its water quality standards and present its proposed changes to the public; this process is called the "triennial review." The public usually has 45 to 60 days to submit comments. Notification of changes to regulations are published in the PA Bulletin, a weekly state government publication found in all county libraries. In addition, hearings are sometimes held to gather public comments. The state is required to publish both proposed drafts and final versions of changes to water quality standards found in the PA Bulletin; these drafts must undergo "complete regulatory review."

Changes to the toxics criteria (Pennsylvania Code, Title 25, Chapter 16) are different. This is because Chapter 16 is not a regulatory chapter, it is a statement of policy. Chapter 16 is thus reviewed annually, with only one opportunity for public comment. Full regulatory review is not in effect. This difference allows the criteria for toxics to be amended more quickly by the state.

Another opportunity for public input is in the implementation of these standards through water quality permits. Pennsylvania has been delegated the authority by USEPA to issue National Pollutant Discharge Elimination System (NPDES) permits for all point-source discharges. The state determines the amount of a pollutant a given facility is allowed to discharge, and then compares this amount with what is actually "coming out the pipes."

A limit for a toxic pollutant is written into a facility permit if: 1) the amount of a pollutant in the discharge has a "reasonable potential" to violate an instream water quality standard; or 2) the USEPA has issued discharge guidelines for that type of facility for a specific chemical. It is important to remember that facilities are not required to monitor for all the toxics that may be in their discharges—only for those identified by the state or federal government as a possible threat. The state

Ideas for Citizen Action on Toxics

1. **Get to know your stream.** If the water quality of your stream is better than needed to protect its designated use, put together a petition to have the stream redesignated. Citizens can petition DEP to get greater protection for high-quality streams.

2. **Become informed.** Find out who is discharging what into your waterways. The USEPA has a web site listing the discharge permits on an individual watershed basis, along with information on facilities reporting to the TRI and designated Superfund sites.

3. **Check up on facilities discharging toxic pollutants.** Arrange with DEP to do a file review. Ask not only for permit files and DMRs (discharge monitoring reports prepared by facilities as a permit condition) but for the correspondence files as well.

4. **Partner with local facilities to do a toxics audit showing what toxic chemicals are used and where they go.** You might also want to set up a Good Neighbor Agreement where local facilities pledge to reduce their use and discharges of toxic chemicals. This is a way to open up the lines of communication with local facilities and provides the facilities with input from citizens about problems they perceive

5. **Support efforts to get access to more information.** Currently, the best information available on the release of toxic chemicals comes from the TRI program. This program is scheduled for some revisions soon, and your comments can help get more information to the public. Join in the call for the reporting to cover a broader range of industries, smaller facilities, and the amount of chemicals that are used, not just released. Currently, a reduction in the release of a chemical could mean that the chemical is being incorporated into the product.

6. **Fight efforts to weaken current protections.** Every three years, the state evaluates the water quality standards. Watch for any changes, and fight efforts to reduce the number of water quality criteria. Except for a limited number of industrial guidelines established by USEPA, the state cannot regulate toxic pollutants in permits if it does not have criteria for those pollutants. Encourage the state and federal governments to start accounting for exposures to multiple chemicals, and to further examine the effects of hormone-mimicking chemicals. Challenge the state and federal governments to change their focus from end-of-the-pipe solutions to solutions that reduce the use of toxic chemicals.

7. **Make your own contribution to reduction.** Look under your sink and in your basement to see what ingredients are in the household cleaners you use every day. Often, there are alternatives to harsh chemicals and chlorine. Remember: what goes down the drain may make it into the stream. Think twice about the pesticides and herbicides you use on your lawn and garden. Try natural pest controls or less toxic chemicals first. Investigate other ways your household can reduce the amount of toxic chemicals getting into our streams!!

publishes proposed permits in the PA Bulletin as well. The public usually has 30 days to comment and can request a public hearing.

Toxic Trends

The TRI is the primary source of information on the release of toxic chemicals in the United States. Even though it includes only a portion of the total number of facilities releasing toxic chemicals, the TRI is one of the few places we can find readily available data on toxic releases. A review of the TRI data for Pennsylvania reveals some clear trends:

- Total production-related toxic waste has recently begun to decrease. In 1996, manufacturing facilities in Pennsylvania produced an astonishing 896 million pounds of toxic waste.

- Releases of toxics into streams were down from 0.42 million pounds in 1993 to 0.31 million pounds in 1995. However, due to an increase in chemicals reported, toxic releases increased to 22.8 million pounds in 1996.

- Transfers of toxics from manufacturing facilities to municipal sewage treatment plants were down from 7.4 million pounds in 1993 to 5.5 million pounds in 1995, and up to 8.5 million in 1996. This category is important because most sewage treatment plants are not designed to remove toxic chemicals, and these chemicals often get incorporated into the sewage sludge or are passed through the plant and discharged.

- Some of the recent declines in toxic discharges can surely be attributed to the fact that businesses now are realizing that reducing the production of toxic waste at a facility is actually a sound business practice, considering the costs of disposing of hazardous chemicals. Some businesses are truly attempting to reduce their release of toxic chemicals by incorporating pollution prevention techniques into their facilities. A number of these businesses have received recognition from the state through the Governor's Awards for Environmental Excellence.

The focus of toxics pollution to date, however, has been on how to reduce what comes out of the discharge pipe. Companies need to look at larger issues and to try to design products that do not use toxic chemicals in the first place. In addition, as mentioned above, the current regulatory program focuses on the toxic effect of each chemical separately. This despite the fact that facilities rarely release just one chemical; more often it is a mixture of different chemicals. The effect of all these chemicals together is not an issue when permit limits are written for each chemical. Periodically, the state will require a facility to examine "whole effluent toxicity" in an effort to determine the effect of its discharges on a culture of water fleas or small fish. But the use of this type of test is variable, with some regional DEP offices using it and other regions not using it at all.

Adding to the limitations of toxics regulation, USEPA has so far focused only on its 126 priority pollutants. Continuing this chemical-by-chemical approach will require a huge amount of research to determine the precise toxicity of all the chemicals that could possibly be discharged into our streams. At the same time, there is not much research being done on the chronic, or continuous, low-level exposure effects that chemicals have on organisms. Much more work needs to be done to determine the effects other than cancer that chemicals have on organisms and humans. A new area of research focuses on the hormone-mimicking effects of chemicals, where the effects of exposures cannot be seen until the next generation is of reproductive age. ■

References and Resource Materials:

Kooser, B. L. and J. Savitz. 1996. *The Illusion of Safety: Regulation of Toxic Chemicals to Pennsylvania Waters*. Chesapeake Bay Foundation, Annapolis MD.

Dernbach, J. C. 1997. "The Unfocused Regulation of Toxic and Hazardous Pollutants." *Harvard Environmental Law Review*, vol. 21: 1. pp. 1-81.

U. S. Environmental Protection Agency. 1998. *1996 Toxics Release Inventory Public Data Release*. EPA 745-R-98-005, Washington, D.C. pp. 27-64.

PA Department of Environmental Protection. 1997. *1997 Governor's Awards for Environmental Excellence*. Office of Pollution Prevention and Compliance Assistance, Harrisburg, PA.

16

Preventing Flood Losses

The High Costs of High Waters

BY EUGENE E. COUNSIL, P.E.

Counsil is Assistant Director, Bureau of Waterways Engineering, Pennsylvania Department of Environmental Protection.

Coastal and river flooding is the most frequent type of natural disaster in the country, and it's happening with more and more frequency every year. In Pennsylvania, the combination of approximately 83,261 miles of streams and the existence of several major storm tracks across the state spells trouble. Storms in Pennsylvania produce average annual precipitation ranging from 36 to 39 inches of rain in the north and west of the state to 41 to 45 inches in the south and east. In addition, all parts of the state receive snowfall during the winter. Flooding due to excessive rains and snowfall has caused fatalities and major damage throughout the state.

Washington's Landing, Pittsburgh Flood of 1996.

Flooding in Pennsylvania: A Special Threat

Pennsylvania's rivers and streams are winding, sometimes with rapid rates of fall, and are often restricted by the rugged mountain ranges through which they flow. The development of towns, industry, highways and railroads largely followed the state's rivers and streams; they have served as pathways of commerce and development throughout Pennsylvania history. With over 90 percent of its municipalities having identified flood-hazard areas, Pennsylvania is one of the most flood-prone states in the country. The major floods that have hit the Commonwealth are widely known. The list starts with the Johnstown Flood in 1889 and continues through the twentieth century to the 1936 Flood, Hurricane Eloise in 1975, Gloria in 1985 and the 1996 ice floods. Between 1936 and 1976, Pennsylvania suffered 17 major floods that cost the state more than $5.3 billion in damage.

According to researcher William H. Shank, Pennsylvania can expect to be hit by major flooding once every 25 years or so. Locally damaging floods of great intensity occur almost yearly across the state but have not been well documented. Because of existing and continuing development in floodplains and construction of new impervious surfaces in watersheds, this pattern of localized flooding can be expected to continue—and with increasing frequency—in the years ahead.

Flood Protection in Pennsylvania: A Legislative and Regulatory History

The Pennsylvania General Assembly has enacted several laws aimed at reducing the threat of flooding. One of the earliest of these was the Water Obstructions Act of 1913, which required a state permit for the construction of any dam or water obstruction or the changing or diminishing of the course, current or cross section of any stream or body of water in the state. The provisions of the Water Obstructions Act

were expanded by the Dam Safety and Encroachments Act of 1978, which remains the primary law regulating dams and water obstructions in Pennsylvania to this day.

Under the law, applications to the Pennsylvania Department of Environmental Protection (DEP) for dam safety and water obstruction permits must be accompanied by engineering studies that analyze the effects of the proposed project on flood waters and life and property. Applicants must also provide an environmental assessment showing that the proposed project will have no significant environmental impacts. Applications and assistance for water obstruction permits are handled by the regional DEP offices listed in the Government Agencies section of the Primer. Applications for dam safety permits are administered by the Bureau of Waterways Engineering in the Harrisburg Central Office.

Other laws have authorized state and local governments to undertake public works to reduce the potential for flood damages. Under a 1931 law, the state Water and Power Resources Board (WPRB) was empowered to determine the course, width and depth of any river or stream and to have this determination fixed by recording it in the office of the county recorder of deeds. The WPRB was also authorized to protect the bed and banks of streams; to build dams, retaining walls and other structures; and to prevent "percolations from streams through holes in the beds and banks thereof for the protection of property, fish, life, and the lives of riparian owners." A subsequent review concluded that this authority had rarely, if ever, been used.

Two laws that did result in real changes were the Flood Control Law and the Stream Improvement Law, both enacted after the 1936 floods to provide local flood protection and stream improvements.[1] The Flood Control Law authorized the WPRB to make appropriate surveys and to prepare plans for any proposed flood control district in order to "control, store, preserve, and regulate the flow of rivers and streams and diminish or eliminate floods inimical to the public health and safety and destructive to public and private property and works."

Under the law, a flood control district is established when the WPRB adopts official plans for the district and publishes notice of these plans in two local newspapers for two consecutive weeks. In order to carry out the plans, the WPRB was empowered to: "clean out, widen, alter, deepen or change the course, current, or channel of any river or stream; fill up any abandoned canal or water course; construct and maintain levees, dikes, walls, revetments, dams, lakes, reservoirs, and other works and improvements deemed necessary to prevent floods; and control, preserve, and regulate the flow of rivers and streams." The agency also was granted other related powers including the acquisition of land by donation, purchase, lease, or condemnation, for which the act specifically granted power of eminent domain.

Under the Flood Control Law, a Flood Control Fund was established in the state treasury to receive monies appropriated by the general assembly or received from the federal government and other sources. The WPRB was also empowered and directed to aid, assist and cooperate in the carrying out of any

[1] These laws use the terms "flood control" and "stream clearance," but the current preferred terminology is "flood protection" and "stream improvements."

Why Floods Cost Us So

Flooding is a natural phenomenon that occurs when the capacity of a stream channel to move water is exceeded by the rate of inflow from rainfall or snowmelt runoff. As the stream fills up, it overtops the streambanks and sends water into the floodplain, which is the level land bordering the stream channel.

While floods may be natural, flood damage is usually the result of human activities and development of flood-prone lands. A major part of the problem is the almost mystical, innate human need to be close to and able to see the water. In addition, the ease of construction on the level lands of the floodplain—together with the need to be close to the river for water supply, transportation, waste water disposal and other economic uses—have resulted in homes, businesses, industries and entire communities being susceptible to damage from direct overbank flooding. Not only are houses and other structures in danger, but they also obstruct the flow of water and thereby cause even greater depths of flooding locally, plus increased downstream flooding due to loss of "floodplain storage."

In addition, flood damages can be aggravated by natural obstructions in the channel such as ice, brush, debris and gravel deposits, and by manmade impediments such as bridges, culverts, piers, abutments and fills on the floodplain. Moreover, the volume and velocity of runoff from a storm can be increased when development throughout the watershed replaces pervious soils with buildings, streets, parking lots and storm sewers.

federal flood control project. Subsequent amendments authorized flood forecasting and warning systems, and allowed the Department of Forests and Waters—which was merged into the Department of Environmental Resources in 1970, the precursor of today's DEP—to occupy and use as recreational areas any dams, reservoirs, and lakes and adjoining lands constructed and acquired by the WPRB for flood control purposes.

The Stream Clearance Law, for its part, empowered the Department of Forests and Waters to: dredge and remove flood waste, deposits, flood water obstructions, gravel, bars and debris from any river or stream; restore or rectify flood-damaged or destroyed stream channels; construct dams, lakes and other improvements to impound flood waters and conserve the water supply; provide additional recreation areas; and construct flood forecasting and warning systems. The department also was authorized to: purchase or lease power shovels, bulldozers, and other necessary equipment for stream clearance and stream channel rectification; execute contracts for construction of dams, reservoirs and lakes; purchase flood forecasting and warning systems; and acquire lands, easements and rights-of-way or other property by lease purchase or eminent domain.

While the powers granted by the Flood Control Law and the Stream Clearance Law may appear redundant for many purposes, several important distinctions can be made. First, the Flood Control Law is based on the establishment of flood control districts and the development and formal adoption of flood control plans. Also, the Flood Control Law devotes considerable attention to guiding the Commonwealth's participation in federal flood control projects. In fact, it appears that flood control districts have been formally established under the law only for the administration of Pennsylvania's participation in federal flood control projects.

The Stream Clearance Law, on the other hand, addressed the issue of removing flood wastes and deposits and restoring flood-damaged stream channels. Among its many provisions, the law allows expedient execution of smaller projects through the rental of equipment and the supervision of work by department engineers. Although awarding of contracts has become more commonplace in recent years, the Stream Clearance Law continues to provide the authorization to facilitate rapid response to needed restorations and other emergency work following flood disasters.

50 Years of Service

In 1997, the Flood Protection program of the Pennsylvania DEP celebrated its 50th year of service to the citizens of Pennsylvania. Since 1947, the Department has constructed more than 200 major flood protection projects with a 1996 dollar value estimated at about $400 million. In that same period, more than 1,250 smaller stream improvement projects have been constructed costing nearly $11.5 million (actual dollars).

The Department continues to participate with local sponsors as a financial partner in federal projects undertaken by the U.S. Army Corps of Engineers and the Natural Resources Conservation Service. These projects, both state and federal, have more than paid for themselves in damages prevented over the years. Nevertheless, despite the efforts of the state and federal flood protection programs, Pennsylvania continues to sustain substantial annual flood damages.

The Municipal Role in Flood Control

The laws discussed in the preceding section establish a clear role for state government in regulating activities in watercourses and in providing flood protection and stream improvement projects. Although these services are often viewed as the exclusive responsibility of the state, local governments also have been authorized, and in some cases required, to administer programs to protect their communities from flood damage.

Pamphlet Law 95 (PL 95), adopted in 1936, empowered cities, boroughs, towns and townships to construct dikes, river bank protection, and other flood-control works, and to widen, deepen, straighten and otherwise improve the channels and banks of creeks, streams and rivers. It is interesting to note that this statute authorizes the local government not only to undertake work within its own municipality, but also to construct public works outside its boundaries and even outside of the county, provided that benefits will accrue to the municipality's residents.

Under the law, a municipality may acquire property by purchase and by eminent domain and may make assessments against owners of private property within the municipality's corporate limits who benefit from

any public works or improvements; the county court is charged with appointing a "board of viewers" to make these assessments. The law stipulates that all property that would be damaged by flood waters should be considered to benefit, whether or not the property directly abuts the stream or river on which the work is done. Municipalities also are authorized to undertake joint flood protection projects with the federal government. Again, "authorized" is the key word here. As with the state programs discussed above, the law authorizes, but does not require, municipalities to provide flood protection and stream improvement projects.

Two statutes enacted in 1978, however, go the next step and require local governments to take action in certain circumstances. The Flood Plain Management Act requires each municipality identified by the U.S. Department of Housing and Urban Development as having areas subject to flooding to participate in the National Flood Insurance Program (now administered by the Federal Emergency Management Agency). This means municipalities must adopt regulations, codes and ordinances to regulate development in the flood plains. Currently, approximately 2,400 of about 2,600 municipalities across the state are participating in the program, which provides 50-percent reimbursement to counties and municipalities for the costs of preparation of official plans, administration, enforcement and implementation. Since funding for the program kicked in in 1982, annual reimbursements by the Department of Community and Economic Development have averaged between $60,000 and $70,000.

The other 1978 law, the Storm Water Management Act, requires municipalities to enact and implement ordinances and regulations to control development in a manner consistent with a Watershed Storm Water Management Plan. These plans are required to be adopted by counties and approved by DEP for 356 watersheds designated by the Environmental Quality Board. The Storm Water Management Act provides 75-percent reimbursement to counties for watershed planning and to municipalities for enactment and administration of codes and ordinances. To date, 54 Watershed Storm Water Management Plans have been adopted with the participation of 38 counties and 541 municipalities. Over $7.5 million has been reimbursed since initiation of the financial assistance component of the program in 1985.

The Flood Plain Management Act and the Storm Water Management Act proceeded through the legislative process as a package. The idea was to prevent further damages by: 1) limiting future flood-susceptible development; and 2) encouraging the development of storm water management plans to prevent expansion of the flood plain by accelerated runoff.

What the Future Holds

The natural and random occurrence of intense rainfall and overbank floodflows will be a problem for Pennsylvanians and others as long as we live and conduct commerce on and near rivers and streams. As one hydrologist has commented, "It is certain that a devastating flood will occur (at any given location), we just don't know when." And as long as floods continue to be a problem, state, federal and local agencies will continue to provide disaster relief following each major flooding event. Humanitarian and financial relief will be offered to individuals, and the streams and floodplains will be cleaned up and restored to the greatest extent possible in light of increasingly limited government budgets. Likewise, state and federal agencies, within the limits of their budgets and eligibility criteria, will continue to construct flood protection and stream improvement projects.

Despite all this, however, there is always the concern that disaster relief efforts do not fully restore or make whole those who have been damaged. There is also concern that we never learn from our past mistakes. From a national perspective, despite the billions of dollars invested in structural flood protection and the demonstrated effectiveness of these measures, flood losses continue to rise because of unwise occupancy of the floodplains. This is as much a problem in Pennsylvania as it is anywhere else. Anecdotal evidence suggests, among other things, that despite the participation of some 2,400 municipalities in the National Flood Insurance Program, local floodplain codes are not vigorously implemented in many locations.

Nevertheless, it is abundantly clear that "nonstructural measures" such as flood warning and preparedness and clearing of floodplains can help reduce the cost of flood damage. Maintaining floodplains in open

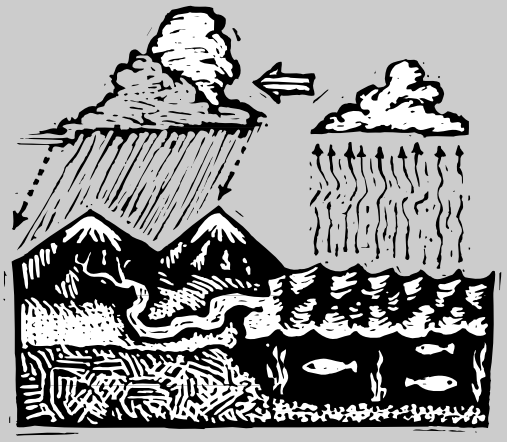
space or allowing only land uses that could sustain inundation by floodwaters would be an ideal goal for all communities with flood-prone lands. Acquisition and removal of buildings and restoration of flood plains to open space uses would represent the ultimate non-structural solution for developed flood-prone areas. Although this approach hasn't been applied broadly in Pennsylvania, there is some experience. One example is in Homer City, where in the late 1970s state funding to the local redevelopment authority provided for the removal of flood-prone homes.

In March 1997, the Federal Emergency Management Agency (FEMA) published interim final rules for flood mitigation assistance, which can include acquisition of flood-prone properties. Following the series of disastrous floods in the summer of 1994 in Bradford and Tioga counties and the statewide ice floods in January 1996, more than 300 properties in Pennsylvania have been acquired under the FEMA hazard mitigation program. Although these have been disaster response actions, the future application and local eligibility for this program will stress flood plain management, land-use regulation and hazard mitigation planning by counties and municipalities.

As we look ahead to the future, it is important to remember that flooding is a natural phenomenon, but that flood damage is a result of humankind's economic use of flood-prone areas. Damaging floods occur somewhere in Pennsylvania every year. The Department of Environmental Protection continues to respond to the problem in many communities by providing structural flood protection and stream improvement projects. In spite of these investments, however, floods continue to inflict large economic losses and loss of life.

The only way to reverse the trend to ever-increasing flood losses is through increased efforts, primarily at the local government level, to control flood plain development and accelerated storm water runoff. Also necessary is the increased use of nonstructural measures by state and federal flood protection programs. ■

Watershed Enhancement and Development



Watershed Enhancement and Development

Waterfront Redevelopment

New Ideas for the Water's Edge

BY JOHN STEPHEN

Stephen is Cofounder and Property Committee Chair with Friends of the Riverfront.

As rivers, streams and watersheds regain their health, pressure becomes strong to create a greenway or a trail that allows citizens to enjoy the cleaner waters. In Western Pennsylvania, the closing down of old industrial facilities offers a unique opportunity to make both public access and watershed enhancement important parts of riverfront development. The shuttering of large steel mills and ancillary industrial facilities has allowed for a new type of riverfront development based, at least in part, on an appreciation for our natural environment.

Examples of Successful Projects

There are a number of examples in Western Pennsylvania of riverfront redevelopment of industrial property rendered useless by a previous owner:

- Washington's Landing, located on Herrs Island on the Allegheny River three miles upstream of Point State Park, has been transformed from an industrial district with slaughterhouses and fabricators into a mixed-use community with more than 100 residential units and professional offices. In 1998, the conversion of an abandoned railroad bridge on the downstream end will connect the island community with Pittsburgh's North Side and Golden Triangle via the Three Rivers Heritage Trail.

Pittsburgh—redeveloped brownfield

Philadelphia brownfield

- Similarly, the city's Urban Redevelopment Authority (URA) continues to manage the development of office buildings on the north side of the Monongahela River at the site of the LTV Corporation's former Eliza blast furnace.

- On the site of a former slag dump in the city's East End, the URA is proposing a "neotraditional" neighborhood with more than 700 units bisected by a riparian greenway protecting Nine Mile Run.

- Beaver County has provided over $1 million for riverfront development since 1993. As a result, the river community of Bridgewater has a revitalized business district with a riverfront park and new condominiums and offices; a new park has been

created at the confluence of the Beaver and Ohio Rivers; and new marinas are located all along the county's riverfront.

- McKeesport has announced a program that will lead to new riverfront parks, a crossroads for riverfront trails, and a more vital downtown. As part of the plan, McKeesport has developed a 210-boat slip marina called McKees Point.

These developments certainly improve access to the cleaner waters of Western Pennsylvania rivers; however, they may not yet be doing all they can to protect these waters from further degradation. The traditional liability-based reclamation of industrial sites focuses on economics—preparing the site to make it financially attractive for the next industrial user—without adequately examining how to avoid the practices that created the wasteland in the first place. A more qualitative, open and community-based process will help restore the historic, ecological and spatial value of these types of parcels. This is crucial if we wish to avoid repeating the mistakes of previous generations.

The Many Benefits of Greenways

Jack Ahern, a professor in the Department of Landscape Architecture and Regional Planning at the University of Massachusetts, Amherst, defined greenways in a recent article as:

> networks of land containing linear elements that are planned, designed and managed for multiple purposes, including ecological, recreational, cultural, aesthetic and other purposes compatible with the concept of sustainable land use.

Greenways are a wonderful means of mitigating environmental damage along streambanks on former industrial sites. A riparian greenway will moderate the flow of streams during rain events, filter nutrients and chemicals out from surrounding land uses, regulate temperature, stabilize banks, and provide food and habitat for aquatic communities. The greenway thus will function to minimize the risk of flood damage and unanticipated erosion, reduce the need for downstream water treatment, and improve the number and variety of flora and fauna.

It is easy to see why we are just beginning to recognize the many benefits of greenways and other environmentally sensitive redevelopment efforts. The ecological services these activities provide are not accounted for under our current economic and accounting systems and thus are not a consideration in redevelopment projects. In order to draw more attention to the benefits that accrue from greenways and similar initiatives, riverfront development advocates need to enlist nontraditional partners who are concerned about the quality of the environment.

The Brownfields Initiative

The U.S. Environmental Protection Agency (USEPA) defines brownfields as abandoned, idled or underused industrial and commercial properties where expansion or redevelopment is complicated by real or perceived environmental contamination. Under the Clinton Administration, USEPA launched the Brownfields Initiative to empower states, local governments and other stakeholders in economic redevelopment to work together to assess, clean up and reuse brownfields in an environmentally sustainable way. Grants from the USEPA Superfund program were provided to communities through the agency's Brownfields Pilot program to assess the scope of contamination at brownfield sites.

In Pittsburgh, the URA received a Brownfields pilot grant to develop a process for conducting timely and flexible environmental assessments of contaminated, abandoned sites that the city intends to target for redevelopment. Using the pilot project funds, the URA developed an inventory of brownfield sites and completed Phase II site assessments at two sites, including the Nine Mile Run site. A Phase II assessments is a systematic investigation and evaluation of a brownfield site that defines and characterizes potentially impacted areas. An important objective of the URA pilot project is to integrate citizen input throughout the brownfields redevelopment process.

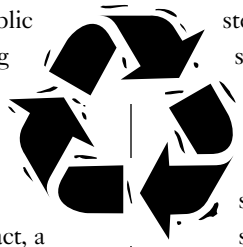
The Brownfields Initiative is a grant program, not an enforcement program. Despite the high profile of USEPA activity at brownfield sites across the country,

the agency's enforcement jurisdiction is in large part limited to sites posing an imminent risk to public health and safety. In Western Pennsylvania, only three sites qualify for federal oversight: the Lindane Dump in Harrison Township; the Breslube-Penn site in Coraopolis; and the Ohio River Park site.

In 1976, the latter of these sites—Ohio River Park at the downstream end of Neville Island on the Ohio River—was donated to Allegheny County, which began to develop the site as a park. The county stopped, however, as soon as it discovered the scope of contamination caused by years of disposal of coking sludges, cement production wastes and pesticides. Only in the past year has a Remedial Action Plan been approved allowing park development to continue. This type of delay is all too familiar at Superfund sites. In fact, only one southwestern Pennsylvania Superfund site, the Resin Disposal site in Jefferson Borough, has completed a cleanup plan in the 20 years of the Superfund program. Frustration with the delays caused by the Superfund program contributed to the enactment of Pennsylvania's Land Recycling Act.

Pennsylvania's Land Recycling Act

Pennsylvania's Land Recycling and Environmental Remediation Act (the "Land Recycling Act") applies to any contaminated site in the state. These are not to be confused with Superfund sites, however, which pose an imminent risk to public health and safety. Rather, the Land Recycling Act applies to industrial sites that do not pose a big enough risk to trigger federal involvement.



In the first two years of the Land Recycling Program implemented under the act, a total of 298 sites submitted formal notices of intent to clean up; 26 of these sites were in Allegheny County. These sites tend to be larger industrial sites that historically have impacted watershed and stream ecology in a big way. The Land Recycling Program provides an opportunity to influence future land use at these sites based on the lessons we learned after they became unproductive.

The Land Recycling Act sets forth a clear process for site cleanup, setting groundwater and soil standards, simplifying the approval process and limiting future liability. In addition, it provides grants and loans to help finance environmental assessments. The act focuses cleanup on actual risk reduction and realistic site use, rather than a return to pristine conditions.

The primary incentive for the landowner to undertake a voluntary remediation is the law's offer of liability protection. Protection is afforded to any cleanup that achieves any of the four standards set forth in the act, as follows:

- Background— the aim is to restore a site to its condition before the contamination occurred (not to a pristine condition).

- Statewide Health—the site must attain uniform, media-specific statewide health concentrations established for regulated substances by the Technical Advisory Board.

- Site Specific—this is a more detailed cleanup process that involves developing a risk assessment based on land use, cost effectiveness and human exposure pathways at the site.

- Special Industrial Areas—a remedial investigation is required to eliminate contamination and exposure pathways at abandoned sites and sites in enterprise zones.

The primary incentive for citizen watershed stewards to get involved in the cleanup of these sites is the opportunity to promote responsible land-use practices. Unfortunately, however, that opportunity is limited to cleanups in special industrial areas or cleanups to "site-specific" standards. For these cleanups, the surrounding community may be involved in each step of the process by request of the host municipality. And, if the municipality requests it, those responsible for cleanup must develop a community involvement program proposing measures to involve the public in the development and review of the remedial investigation report, risk assessment, cleanup plan and final report.

The community involvement program may include public meetings, discussions, the creation of community groups, and other activities as appropriate. Attainment of the site-specific standard may be accom-

plished through a combination of remedial measures, including engineering and institutional controls, and innovative or demonstrated measures.

New Ideas of Stewardship and Development

Waterfront redevelopment creates a vibrant opportunity to bring new ideas of stewardship and development into practice. In a state with more miles of streams than every other state except Alaska, it is startling that streams and adjacent lands aren't easily accessible to the public, nor are they an integral part of the everyday lives of residents. Joining brownfield recycling with environmental stewardship and citizen participation can change our relationships with rivers and streams. The aim should be to capture the true and lasting values of these waterways as catalysts for responsible economic growth, as daily amenities and as forces for shaping public habit.

Pittsburgh is the site of several initiatives that are applying innovative strategies to brownfields recycling. The City of Pittsburgh Planning Department, for example, in partnership with a broad cross section of other organizations, is developing a comprehensive riverfront development plan. The objectives are to: insure the highest possible quality for both building development and the treatment of the rivers' edge; illustrate the city's expectations for riverfront development, and therefore guide private and public development; and provide a level of consistency in the treatment of the riverfront, that cuts across all properties. The plan will include opportunities for citizen participation in brownfield redevelopment projects such as the South Side Works Site, Chartiers Creek watershed and the Nine Mile Run slag pile.

A separate riverfront conservation plan will assess the ecological status of the riverfront and determine how best to preserve and enhance an environmentally diverse habitat.

On the South Side of Pittsburgh, the former LTV site is currently undergoing a site-specific remediation. The land-use plan for the site has been developed with guidance provided by a task force including representatives of the South Side Planning Forum, a coalition of South Side community organizations. Extending across the site will be the Three Rivers Heritage Trail, a 12-mile trail along the city's riverfront. With the endorsement of the South Side Planning Forum, the URA has included the trail in its site master plan and is partnering with the Friends of the Riverfront, the citizen-led sponsor of the trail, to engineer the trail across the site. The trail is expected to attract about 770,000 users per year who will spend over $10 million on food, transportation and services along the trail.

At Nine Mile Run, a partnership between the Environmental City Network and the City of Pittsburgh has been formed to support the creation of 100 acres of public greenspace in conjunction with the development of a new urban community. The URA has begun the planning for a new housing development adjacent to the proposed greenway. The project aims to turn the massive slag pile into a thriving urban community by showcasing innovative solutions and addressing the full range of development challenges for urban brownfield sites. The project is guided by a public process managed by the Nine Mile Run Greenway Project of the STUDIO for Creative Inquiry at Carnegie Mellon University.

The Nine Mile Run Greenway Project connects the expertise and concerns of artists, scientists, engineers, historians and the community with the site developers. This is a broad-ranging, interdisciplinary effort to address challenges and explore the opportunities presented in transforming a post-industrial urban brownfield site into a sustainable environment. It suggests a replicable model to expand opportunities for responsible redevelopment on brownfield sites. But it demands an active citizenry and political leadership willing to intervene as a broker between the public and private interests. The Land Recycling Act opens the door to making it work. But, as in other locations across the state, it is up to those who care about their watershed to turn the promise of the act into reality. ■

Greenways

Great Ways to Keep Open Spaces Green

This article was adapted from Creating Connections by Russ Johnson, a publication of the Pennsylvania Greenways Partnership (1998) .

Pennsylvania has more greenway and trail projects underway than any other state; many of these adjoin waterways in the Commonwealth. As of 1994, local land trust organizations had preserved 326,616 acres of Pennsylvania's open spaces. The natural ridge-and-valley topography of Pennsylvania's waterways—with stream miles and ridge tops running from one border to another—provides an abundance of areas with the potential to become part of a greenway.

Greenways—defined as corridors of open space—provide several direct and indirect benefits that have begun to reconnect Pennsylvania's cities and towns to open spaces. The state's evolving network of greenways plays an important part in protecting the natural, historic and recreational river resources that are a defining geographical feature of the Commonwealth. Positive economic impacts linked to greenways include tourism and increased property values. Greenways also enhance quality of life, maintaining sustainable resources that will continue to provide benefits to future generations.

Another important benefit of greenways stems from their use as a conservation tool. For example, floodplain forests and wetlands protected by greenways can help to mitigate floods, reduce stormwater drainage

and recharge aquifers. And consider the case of the angler who catches fish in a creek where a greenway upstream has protected water quality and provided a healthy habitat for the species. This is just one example of the important ecological functions of water-based greenways.

Defining and Distinguishing Greenways

An individual greenway or corridor may fit more than one definition and perform more than one function. Generally, greenways can vary greatly in scale. Greenways can be land- or water-based, running along stream corridors, shorelines or wetlands. A greenway also may include both public and private property. Overall, a greenway network may protect natural, cultural and scenic resources, provide recreational benefits, enhance the natural beauty and the quality of life in neighborhoods and communities, and stimulate economic development opportunities.

The types of greenways that have relevance to waterways include conservation greenways, recreational greenways, riparian buffers, landscape corridors and natural areas. Again, none of these qualities is exclu-

Greenways in Pennsylvania: They Can Be Everywhere

Although the Pennsylvania topography can be characterized by a wide variety of land features and uses, greenways have the potential to protect the environmental and aesthetic qualities of waterways in many different areas of the state. Waterways are natural connectors between mountain and valley. And the banks, unless they are channeled between manmade structures or severely impacted by construction, erosion, grazing or other human-associated activities, often are bordered by green swaths. The Schuylkill River Greenway is an example, and it is being created to connect conservation lands and riparian buffers along a major river system.

"Natural" or "flowing" waterways are not the only characteristic areas where a greenway may be found. The shorelines of lakes and ponds, undeveloped wetlands, and watershed protection areas around reservoirs and wellheads may constitute de facto greenways. For example, a conservation buffer protects Lake Scranton, a reservoir that provides water to the city of Scranton.

In addition, the rights-of-way of canals and railroads often accommodate a band of natural or naturalized vegetation functioning as a greenway. The Delaware and Lehigh Canal in Bucks County is an example. In urban watersheds, opportunities for greenways exist along rivers, streams and creeks.

sive; a single greenway may serve a number of important functions for the protection of water resources.

Conservation Greenways

Conservation greenways exist primarily for the value of their ecological functions, providing critical habitat or mobility for wildlife. A greenway along a stream corridor may provide food, shelter and/or cover to numerous species. An example is the Loyalhanna Creek Greenway, created by the Latrobe Foundation in Westmoreland County, a conservation greenway that also contains a waterside trail.

Riparian Buffers

Riparian buffers are conservation greenways along a river or creek that trap sediment and nutrients, shade and cool the water, protect banks from erosion, and, in some cases, discourage access by humans or cattle. The Pennsylvania Fish and Boat Commission has assisted in the planting of many miles of riparian buffer throughout the Commonwealth.

Recreational Greenways

Recreational greenways are created primarily for informal, low-impact recreation. Recreational use by residents and tourists may take place over the land or along a river enclosed in a riparian buffer greenway.

Landscape Corridors

Landscape corridors are tracts that are managed to maximize greenway values, even within conservation lands. One such corridor connects the Clarion River to the Tionesta National Scenic Area, continues on to the Heart's Content National Scenic Area and ultimately connects to the Allegheny River National Recreation Area.

Natural Areas

Natural areas are greenspaces or greenways that provide nature observation or environmental education functions, serving as an important outdoor learning resource.

Distinguishing "Greenways" from other Corridor Concepts

Although trails may be part of a greenway system, the two concepts are not always synonymous. Trails are usually defined by a predominant activity, such as hiking or snowmobiling. A trail's use depends on the amenities offered along the trail, its length, its proximity to population centers, its access points, the terrain it passes through and the trail surface.

Greenways also should not be confused with blueways, although the two can be similar in many ways. Blueways are primarily recreational routes through scenic areas where rivers themselves form the corridor

and are used for extended trips by canoe, kayak or raft. For example, campsites on islands and shorelines provided by the National Park Service in the Delaware Water Gap National Recreational Area provide a functional water trail between Milford in Pike County and Water Gap in Monroe County. In some cases, protected areas of wilderness habitat along the shorelines of these corridors effectively act as a greenway.

Pennsylvania has recently initiated a Water Trails Program. Water trails are designed to promote environmentally responsible recreational use of rivers, lakes or coastal areas, along with encouragement of waterway conservation and stewardship. To date, one water trail has been opened to the public in Pennsylvania, the Susquehanna River Trail. The Pennsylvania Water Trails Program is administered by the Fish and Boat Commission. It is anticipated that the program will be fully under way by the end of 1998, with the hopes of adding five more water trails by the end of 1999. For more information on Pennsylvania's Water Trails Program, contact: Tom Ford, Resource Planning Coordinator for the Fish and Boat Commission, at 717-657-4394. To learn more about the Susquehanna River Trail, call 717-236-8825.

Formulating a Vision for Greenway Development

The initial vision for a greenway most often originates locally. In Pennsylvania, the vast majority of trail and greenway development is initiated by local volunteers who share a vision with the local community, eventually forming a partnership with local, county and state officials. The process might get under way, for example, when local citizens fishing on a creek notice the threat of habitat destruction along its banks.

Often, greenways may be part of a broader vision that encompasses other river conservation planning efforts. Greenway planning includes physical, natural and scenic resource inventories, development of a greenway master plan, and subsequent management and maintenance. An example of combining a River Conservation and a Greenways Plan is one developed for the Swatara Creek by the Dauphin County Park and Recreation Department. ■

For more information:

If you want to find out more about water-related greenways, there are several available resources you can turn to. The following list is by no means comprehensive; its only purpose is to serve as a beginning reference point for more information.

The Pennsylvania Greenways Partnership, a joint endeavor of several nonprofit organizations and the Pennsylvania Department of Conservation and Natural Resources (DCNR), was created to develop a coordinated approach for the planning, promotion and funding of greenway projects throughout the state. Contact: Bureau of Recreation and Conservation at 717-783-5877. Website: http://www.dcnr.state.pa.us.

The Bureau of Recreation and Conservation at DCNR also offers a wide range of park, recreation and conservation-related technical assistance, particularly through its Division of Conservation Partnerships. Grant funding is provided for river conservation planning and for subsequent actions under the division's Keystone funding program. This funding is available for greenways planning and implementation if the greenways project also meets river conservation planning guidelines.

Another possible collaborator is the Pennsylvania Fish and Boat Commission, which can be an important resource if a greenway follows a waterway. Check with the Commission to see if the stream is on its priority stream list; if so, conservation efforts may be eligible for funding for in-stream habitat improvement, livestock control installations and streambank stabilization. Occasionally, the Commission also has federal funds available to acquire land to protect streams. When the Commission acquires such land it creates de facto greenways, such as the corridor of Spring Creek in Centre County. Phone: 717-657-4518.

The National Parks Service offers assistance to local efforts for river and greenway planning by providing expertise in ecology, recreation development and landscape architecture. The Service also aids communities in consensus building and the identification of local resources. Contact: Rails, Trails and Conservation Assistance Program at 215-597-1581.

The U.S. Army Corps of Engineers cannot acquire land primarily for conservation or recreation but can include trails in designs for flood control projects—an example is the trail atop the levee at Lock Haven—and can work on wetland creation and stream restoration.

At the district level, the Corps conducts reconnaissance studies that define problems and opportunities related to water resources while identifying potential projects. If the federal government and a local cosponsor agree on a project and commit to a cost-share arrangement, the Corps will conduct a full feasibility study and environmental impact study. Then, after approval by the Secretary of the Army and/or congressional authorization, the district can complete engineering design work. Project construction is handled by private contractors under Corps supervision, and facilities are either retained by the Corps or turned over to local authorities to be managed. Contact your local Corps office for information.

Scenic River Designations

It's Official: It's Scenic

Information compiled by the Allegheny Watershed Network

Federal and state protection is available for many scenic rivers and other waterways possessing unique historical, cultural, environmental and recreational characteristics. Scenic river designation can be an important tool in promoting waterways conservation. By securing a scenic river designation for a local river segment or stream, residents and watershed organizations can go a long way in protecting the important features of the waterway.

Federally designated Wild and Scenic Allegheny River.

The National Wild and Scenic River System

The National Wild and Scenic Rivers Act (NWSRA) (16 USC 1271-1287; PL 90-542) was enacted on October 2, 1968, to protect rivers or river segments that possess "outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values in free-flowing condition." More than 150 rivers or river segments are designated in the National Wild and Scenic River System. In Pennsylvania, segments of the Allegheny, Delaware and Clarion rivers are listed in the national system.

Nominating a River for Wild and Scenic Designation

The rivers currently in the national system represent only a small percentage of rivers potentially eligible for wild and scenic designation. New rivers can be nominated for designation in two principal ways:

1) First, rivers that are protected under state river designation programs can be recommended for national designation by the Governor. This adds protection from the adverse impacts of federal projects to the state and local protection that has already been granted to the river. Strong public support for national designation is generally needed before a Governor chooses to take this important step. The Governor's application is reviewed by the National Park Service, and if the river is found to meet eligibility requirements, the

Wild, Scenic or Recreational: What's the Difference?

Each river in the national system is classified and administered as either wild, scenic or recreational, based on the extent of development and accessibility along each section.

- Wild rivers are "primitive" in that they are free of impoundments and are generally inaccessible by roads. Their watersheds and shorelines are essentially undeveloped and the waters are unpolluted.
- Scenic rivers also are free of construction. They are accessible by roads but the shorelines and watersheds are largely undeveloped.
- Recreational rivers are readily accessible by road. They may have some development and may have been impounded in the past.

Secretary of the Interior can designate the river without an Act of Congress.

2) Second, constituents interested in pursuing national designation can work through their congressional delegation to initiate river studies under section 5(a) of the Wild and Scenic Rivers Act. It is recommended that such groups consult the Nationwide Rivers Inventory, a state-by-state listing of potential wild and scenic study candidates, to help identify eligible river segments. The National Park Service maintains this inventory and can provide technical assistance to communities in laying the public involvement groundwork for 5(a) studies. The Park Service also serves as the federal coordinator for wild and scenic studies where the study river is located on nonfederal lands. Rivers found eligible and suitable for wild and scenic designation as a result of 5(a) studies are added to the national system through congressional legislation.

To be eligible for designation, a river (or river segment) must be free-flowing and contain an outstandingly remarkable value (ORV) such as scenic, recreation, historical, cultural, etc. One river may be classified differently on separate segments of the river.

The Management of Designated Rivers

Designated rivers are managed according to several laws and regulations. These include: the provisions of the NWSRA; the Guidelines for the Management of River Areas issued by the Departments of Agriculture and Interior in 1982; the Act designating the river; and the River Management Plan for the designated river. Rivers can be managed by a federal agency (Bureau of Land Management, U.S. Forest Service, U.S. Fish and Wildlife Service, National Park Service), by a state or local government agency, or cooperatively by both a federal agency and state or local agencies.

Management plans for designated rivers are developed with extensive public input. If one of the federal agencies is responsible for administering the river, the procedures of the National Environmental Policy Act guide the development of management plans.

A management plan outlines the objectives for protecting the river's ORVs and may include voluntary guidelines for development. It is important to remember that designation of a river does not give the federal government control of private lands within the corridor. Rather, the protection of the river and its corridor are the responsibility of state and local governments and the landowners. If a private landowner proposes a development that is incompatible with the river's designation, the federal government typically will assist the landowner to minimize the potential threat. Management restrictions in the river corridor only apply to public (federal) lands and those projects that require federal funding or licensing.

For more information, contact the Interagency Wild and Scenic River Coordinating Council. This Council, which consists of the four administering agencies for the Wild and Scenic Program, exists to improve interagency coordination, serve the public and enhance the protection of the nation's rivers.

For more information:

National Park Service
National Center—Recreation and Conservation
202-565-1175 or 202-208-4290

Contact for the Upper Delaware River
717-729-7135

Contact for the Delaware Water Gap
717-588-2435

U.S. Forest Service
202-205-0925

Contact for the Allegheny and Clarion Rivers
814-723-5150

The Pennsylvania Scenic Rivers Program

(Special note to readers: At the time of this writing, the Pennsylvania Scenic Rivers Program is undergoing a reevaluation study that has the potential to change many of the fundamental characteristics of the program. Details of this modification are expected to be completed in September 1999. At that time, a Scenic Rivers Fact Sheet will be available from the Department of Conservation and Natural Resources (DCNR) to further advise individuals or groups interested in the Scenic Rivers Program. Contact information is provided at the end of this article.)

The Pennsylvania Scenic Rivers Act of 1972 was designed to protect the "outstanding aesthetic and recreational values" of Pennsylvania waterways. To date, approximately 500 miles of waterways have been designated under the state's Scenic Rivers Program.

The Scenic Rivers Act creates a detailed set of procedures and criteria for the inclusion of a waterway in the Scenic River System. What are the factors in a river's designation? They include a range of "values" such as: outstandingly remarkable wild features having minimal perceptible human influence; scenic value; recreational value; geological features; existing or potential quality of fisheries, wildlife and/or vegetation; historical value; cultural value; and scientific value. Particular emphasis is placed on the quality of experience and scenic value offered by the river in connection with its recreational use. Based on the degree of modification, access and development, an eligible river segment can be classified in one of five categories—Wild, Scenic, Pastoral, Recreational or Modified Recreational.

A variety of flowing bodies of water can fall under the definition of "river" in the Scenic Rivers Act, including: streams, creeks, runs, kills and small lakes. However, specific requirements are placed on the water volume and flow of the waterway, as well as on the length of the river segment—all must be sufficient to sustain river values and seasonal recreational activities. Exceptions are provided for exceptional value waters.

River Studies and Public Participation

To determine if a waterway meets the applicable criteria, the Scenic Rivers Act requires that a study be performed to verify the eligibility of the waterway for scenic designation by the Pennsylvania Department of Conservation and Natural Resources. The major components of a study include: identification of the river study area (the "river corridor"); an inventory of natural and man-made resources and associated uses; and identification of the concerns and problems of local and state importance. Part of the study process requires the development of recommended solutions to identified concerns, as well as a strategy to encourage practical conservation and management of the river corridor.

The study is broken into three stages, as follows:

1) The first stage involves the collection of information, with the purpose of determining whether the waterway is qualified for designation, and, if so, under what classification. During this initial stage of the study, a citizen advisory committee is organized to ensure the accuracy of the collected information.

2) The second stage of the study focuses on the development of management guidelines recommending ways of maintaining the waterway in its present condition. These guidelines are drafted with the help of private landowners, local elected officials and other parties with interests in the corridor area, such as businesses. It is important to note that these guidelines are voluntary—they are not, nor will they become, state regulations on private land activities.

3) The final stage of the study is public hearings. The Scenic Rivers Act requires that DCNR conduct a public hearing in the county or counties where the studied waterway is located. At the hearing, DCNR personnel are required to explain

both the intent and scope of the Act, as well as their study findings and recommendations. A transcript of these hearings is included with the study when the final recommendation is submitted to the Governor and General Assembly. If the General Assembly and the Governor support the designation of a specific river or river segment, they will prepare designating legislation that makes it official.

What's So Great About a Scenic River Designation?

Once a river segment is designated as a scenic river, state agencies follow management guidelines based on the river's classification. The guidelines outline how to deal with a tremendous range of issues, including: dams and encroachments, earthmoving activities, floodplain management, forest management, mineral and fuel extraction, recreational use, utility and transportation corridors, waste disposal, and water quality and quantity. State agencies are required by law to act in consistency with the designation and guidelines when granting permits for activities such as mining, solid waste operations, obstruction and floodplain management, hydroelectric power generation, and large-scale earthmoving activities. Consequently, state agencies require a permit applicant to demonstrate that any proposed project will not have an adverse impact on the public resources of the designated waterway. It is important to note, however, that these considerations often overlap with existing environmental statutes and regulations.

Scenic river designation does not override local land-use ordinances. The authority and initiative to regulate land use remains with the municipality; the state, in other words, cannot require adoption or implementation of the scenic river guidelines. Rather, local governments, citizens' groups and private property owners within the designated corridor are encouraged to follow the management guidelines voluntarily. ■

For more information:

In addition to scenic river designation and oversight, the Scenic Rivers Program offers various resources to support or supplement local river protection efforts. These resources include technical assistance, financial support and interagency cooperation.

Contact: Department of Conservation and Natural Resources, Bureau of Recreation and Conservation, P.O. Box 8475, Harrisburg, PA 17105-8475. Phone: 717-787-2316

Land Trusts

In Conservation We Trust

BY ANDREW M. LOZA
Loza is Executive Director of the Allegheny Land Trust.

(This article is based on chapter one of the Pennsylvania Land Conservation Handbook available from the Allegheny Land Trust (1995).)

The surest methods for permanently conserving land involve acquisition of property rights by land trusts. Approximately 1,100 land trusts work in all 50 states, conserving land using a variety of techniques. Working to protect Pennsylvania's wild, scenic, agricultural and recreational assets are more than 50 land trusts.

Land trusts vary in character and conservation priorities, which can range from farmland and forest to wetlands and streams, scenic open space, and recreation areas or hunting grounds. Most land trusts are private, nonprofit corporations. Some are governmental or quasi-governmental agencies that operate with much of the flexibility and freedom of a private land trust. Some are quite small, run entirely by volunteers and doing their work in just one municipality or neighborhood. Others have large staffs of professionals and work on a regional or nationwide basis. Some own and operate preserves and recreation areas open to the public. Others own no land at all but hold conservation easements that protect certain natural resources on properties. Still others work to acquire and then transfer critical land to government for use as parks, gamelands and more.

Land trusts also can work on land use planning, nature education, trails and in many other areas. However, it is the regular use of property acquisition as a conservation tool that most clearly defines a conservation organization as a land trust.

Land Ownership and Conservation Easements

To understand the powers of a land trust, one must have a basic grasp of the types of property ownership available to the organization.

"Fee-simple" ownership of land gives a landowner maximum control over the use and management of the property and its resources. Generally, when someone owns land in fee simple, the individual has title to the land. A land trust holding title to a property may provide the strongest guarantee of long-term conservation, but fee ownership is not always the best option or even a viable one.

A land trust may not wish for fee ownership for any number of reasons. For instance, an owner may not wish to give up all control over the land. Also, an organization may lack the resources to purchase the property or to meet the long-term demands of ownership—e.g., maintenance and insurance. In these cases, a land trust may work with a landowner to secure a conservation easement.

A conservation easement is a legal agreement between a qualified conservation organization and a landowner that permanently limits certain specified

uses on all or a portion of a property for conservation purposes while leaving the property in the landowner's ownership. Conservation easements are based on the fact that landowners have the right to use their property for many different purposes, subject to local zoning and public health and safety requirements. For example, an owner can plant trees or cut them down, build buildings or demolish them, grow crops or dig holes, allow public access or prohibit it, or subdivide the property. To understand the conservation easement concept, it is helpful to think of these rights as a bundle of rights. A landowner may donate or sell the whole bundle, or just one or two of the rights in the form of a conservation easement.

Every conservation easement is unique, the terms of the easement tailored to the particular property and to the particular needs and goals of the landowner and conservation organization. An easement might state, for example, that no building or road may be placed within 200 feet of a stream passing through a property but allow for a house to be built on another portion of the same property. Another easement might permit farming on a property but forbid residential, retail and industrial development. Yet another easement might prohibit all activities except for sustainable forestry and recreation. The flexibility and applicability of conservation easements are nearly endless.

A variety of methods exist for acquiring conservation easements and fee interests in land. Some transactions are quite simple—for example, a landowner may donate a property or conservation easement to a land trust. Other transactions may be rather complicated, involving combinations of techniques. Because each property is unique, the key to saving land is finding the technique or the combination of techniques that is best able to provide the protection desired by the parties involved. Complicated projects may involve several different players, including conservation organizations, developers, government agencies and individuals, as well as various sources of funds.

Donation of Property Rights

A land trust's preferred method of acquisition, of course, is outright donation by the landowner. Donations can generate substantial benefits for the landowner as well. The donor's federal income and estate taxes often can be significantly reduced with a properly structured donation. In addition, some form of conservation donation may be critical in cases where the landowners have an emotional attachment to the land and wish for all or part of it to stay in the family. Although many donors have a strong philanthropic motive, the tax benefits certainly offer an appealing additional impetus for conservation donations. The specific tax benefits and the requirements for receiving these benefits are described at length in other publications.

Landowners may donate almost any property right or interest in their land—including the entire parcel in fee, a conservation easement, or other property rights such as an option or lease. Some of the types of donations are described below:

BEQUESTS. A landowner may leave land, a conservation easement or other assets to a land trust in his or her will. Donation by bequest can reduce the estate tax for the donor's heirs by removing the value of the donation from the taxable estate. However, because the gift does not vest until the donor dies, there are no income tax benefits.

CONSERVATION EASEMENTS. Conservation easements are usually acquired by way of donation. To qualify for a deduction, an easement must first be donated in perpetuity. Second, it must be given to a qualified organization such as a land trust or public agency. Third, it must be given exclusively for conservation purposes.

REMAINDER INTERESTS. Landowners may donate their land to a land trust but reserve the right to live on or use the land for their lifetimes. Donations of remainder interests can result in considerably smaller tax benefits than outright donations, especially if the donor is relatively young.

UNDIVIDED INTERESTS. An undivided interest is a portion of an entire interest in a property. Landowners may donate undivided interests in property over a period of time. An owner of undivided interests in a property becomes a co-owner of the property, sharing in all ownership rights. While a conservation organization may be uncomfortable with a coownership arrangement, even when temporary, a landowner may find the donation of undivided interests over time preferable for tax purposes.

BARGAIN SALE. In a bargain sale, the landowner and land trust negotiate a purchase price below fair market value. Bargain sales can be an attractive option for landowners who wish to preserve their land but who also need income from the transaction. Although a landowner will receive more from a sale at fair market value than from a bargain sale, certain tax benefits can substantially reduce or eliminate the disparity.

Purchase at Fair Market Value

Purchasing land or conservation easements at fair market value is obviously an expensive acquisition method. However, if the land in question is important enough and the landowner has absolutely no philanthropic interest, there may be no other option for the land trust. Fortunately a number of approaches to funding the purchase exist:

PRIVATE DONATIONS. Individual people are the largest source of donations in American philanthropy and are therefore critical to long-term conservation efforts. This can not be overemphasized. Foundations and businesses also are sources of potentially substantial contributions that can fund purchases of land or conservation easements.

GOVERNMENT GRANTS. A variety of federal, state and local government agencies fund conservation projects. Land trusts sometimes qualify for these government funds. The Pennsylvania Department of Conservation and Natural Resources, for example, manages the Keystone Land Trust Program, which supports 50 percent of the costs of priority land trust acquisitions. County and local governments vary widely in their commitment to conservation. Several eastern Pennsylvania counties have passed multimillion dollar bond issues for the preservation of open space.

LOANS. A crisis situation may warrant a land trust buying a property using a loan to finance the purchase. Loans may be obtained from banks, individuals, foundations, other nonprofits or businesses. A loan may also be available from the seller or adjacent landowners who would benefit from the transaction. A land trust could obtain a no-interest loan or a usurious loan depending on the organization's history, its fundraising potential and other factors. The Trust for Public Land has helped many communities across the United States with interim financing for their conservation projects.

TRADE LANDS. Land that has no specific conservation value may still be donated to a land trust for its monetary value. The land trust can then sell the property to finance other land protection projects or possibly trade the land for conservation property.

Buying Time

Conservation organizations do not always have the resources on hand to conserve a highly desirable property. On the other hand, landowners are not always prepared to take an action that would permanently conserve their property. Several approaches exist for dealing with these types of situations.

INSTALLMENT SALE. If the landowner is agreeable, the property could be purchased in an installment sale. Under this type of arrangement, the land trust makes payments over a period of time for a single land transaction, or property interests are conveyed in a series of purchases.

OPTION. An option grants an exclusive right to purchase a particular property under certain terms and conditions by a certain date. Acquiring an option through sale or donation from a landowner gives a land trust time to raise funds for the ultimate purchase of the property without fear that the property will be sold to another bidder in the meantime. If the land trust fails to raise the necessary funds before the option expires, it forfeits any money it paid for the option and the landowner is free to sell the property to another party.

RIGHT OF FIRST REFUSAL. A right of first refusal is an agreement between a landowner and land trust that gives the organization the opportunity to match any legitimate purchase offer made on a property that is acceptable to the landowner. If the land trust does not match the offer within a specified period of time, the landowner may sell to the prospective purchaser. A right of first refusal places no obligation on the land trust to acquire the property and places no obligation on the landowner to sell the property.

Other Conservation Methods

CONSERVATION BUYER. A land trust may be able to introduce a landowner who wants to sell land having conservation values to a "conservation buyer." A conservation buyer is someone who wishes to purchase and own a property but who also wishes to preserve the property's conservation values. When the conservation buyer purchases the property, a conservation easement should be transferred to the land trust. This method requires little or no financing by the land trust; obviously, the trick is identifying interested conservation buyers.

PURCHASE AND RESALE. A land trust can purchase land and then resell the land subject to a conservation easement. The land trust can accomplish its conservation goal through the easement and also recover much of its expense associated with the original purchase.

Land trusts often acquire land in need of quick protection with the expectation of later selling it to a government agency for parkland, gameland, forest or other open space purposes. This involves some risk, since the agency may—perhaps counter to earlier assurances—choose not to acquire the land from the conservation organization. However, this approach has many advantages. Unlike most government agencies, land trusts usually can move swiftly to complete critical land transactions. Also, in some cases a landowner may not be willing to deal with government but would be happy to work with a private land trust.

LIMITED DEVELOPMENT. In a limited development project, a land trust acquires a piece of property and opens a portion of the property to development in order to help finance the original acquisition and the permanent protection of the remainder of the property. The conservation organization may simply subdivide the property into two parcels and sell one to a developer who will further subdivide, or the organization may take a more active role in the development of the property. Limited development can be complex, time-consuming, controversial and financially risky. A land trust must be very cautious and well-informed and have good access to a variety of experts in the real estate and development fields before taking on such a project.

Starting a Land Trust

If a conservation need is not being met in your area and you think a land trust might be the answer, you may want to get a copy of the Land Trust Alliance's *Starting a Land Trust*. This excellent publication covers a lot of ground.

The Land Trust Alliance, a support organization for land trusts nationwide, can refer you to land trusts whose experience or geographical location meshes well with your conservation interests. You may ultimately start a wholly new organization, modify the mission of an existing organization such as a watershed association, or have an existing land trust expand its geographic interest into your area. No matter how you do it, you will find that people are at the root of accomplishing conservation. Success comes with identifying and tapping the energies and resources of all who are sympathetic to your conservation concerns. ■

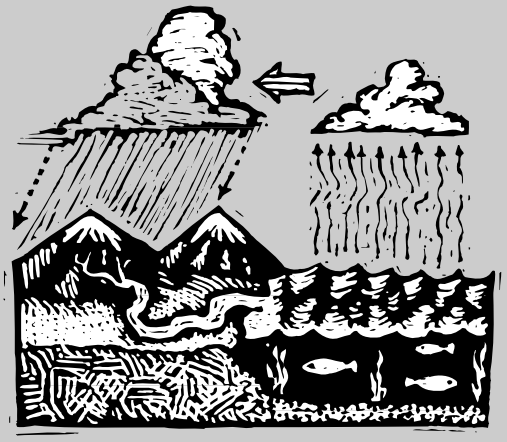
For More Information:

Land Trust Alliance
1319 F Street, NW, Suite 501
Washington DC 20004
(202) 638-4725
(202) 638-4730 fax

Pennsylvania Land Trust Association
3701 Orchid Place
Emmaus, PA 18049
(610) 965-4397
(610) 965-7223 fax

Allegheny Land Trust
425 Sixth Avenue, Suite 800
Pittsburgh, PA 15219
(412) 350-4666
(412) 642-2217 fax

What Citizens Can Do



What Citizens Can Do

Volunteer Environmental Monitoring

Testing the Waters

BY DIANE WILSON

Wilson is Citizens' Volunteer Monitoring Coordinator, Bureau of Watershed Conservation, Pennsylvania Department of Environmental Protection.

Across the state of Pennsylvania, volunteers are monitoring the condition of streams, rivers, lakes, estuaries, wetlands and wells. A recent survey by the Citizens' Volunteer Monitoring Program of the Pennsylvania Department of Environmental Protection (DEP) counted at least 70 groups involving more than 6,000 individuals in some sort of voluntary monitoring in the state. The number and variety of monitoring programs are continually on the rise. Also increasing is the complexity of the monitoring activities that volunteers undertake.

Surveys of monitoring efforts under way in Pennsylvania paint a picture of community-based, grassroots environmental protection. The majority of groups are small, with a median size of 20 individuals. Even those participating in large-scale efforts usually monitor a body of water they live on or near. It's hard to escape the conclusion that volunteers across the state are showing a strong sense of ownership for aquatic resources close to home.

With more than 83,000 miles of streams in Pennsylvania, it is not surprising that close to 90 percent of all groups indicated they are monitoring a stream or river. Twenty-five percent of the groups reported they are evaluating a stream in conjunction with a wetland, lake or groundwater source. This indicates a movement toward a whole-watershed approach to monitoring.

Why Monitor?

Most volunteer monitoring programs assess the physical, chemical or biological conditions of the waters in a given watershed. Environmental monitoring provides an in-depth view of complex ecosystems. It also can alert residents of the watershed to elements that may threaten the delicate balance of natural systems. Insights gained into the physics, chemistry and biology of aquatic resources are educational, for sure, but they may also provide a documented record of the status of a watershed's health. Therefore, care must be taken in choosing sampling methods, deciding where to sample, and selecting a level of monitoring that will provide reliable answers in an affordable way.

Volunteer monitoring can supplement professional monitoring in a variety of important ways:

- Volunteer monitoring can provide the only data available for a particular subwatershed, especially in remote areas;
- It can provide environmental data during unusual conditions such as rainfall events;
- It can provide data more frequently than routine sampling carried out by resource agencies;
- It can help watershed residents develop an understanding and appreciation for the resources they

wish to protect, as well as an awareness of the natural variability in ecosystems;

- It can help document the presence of important flora and fauna in a watershed through observation near established monitoring stations;

- It can result in informed individuals who are better equipped to review and comment on government actions during public meetings and hearings related to the environment.

Developing a Watershed Monitoring Plan

Before undertaking any sort of monitoring, it is critical to develop a program design. The following tips were created for groups wishing to begin whole-watershed monitoring, but the same steps can be followed in designing a monitoring plan for a single stream stretch, lake or wetland.

Define the scale of your study.

A watershed is a geographic area in which water, sediments and dissolved materials drain into a common outlet such as another stream, an estuary or ocean, a lake or an underlying aquifer. It is important to define the size of the watershed you wish to study. A determining factor, of course, is the resources available to carry out your study—the amount of time and money your group has to spend on the project. It may be best to begin with a small area associated with a "lower-order stream," or a stream in the upper reaches of the watershed, where the magnitude of change in water quality will be easier to determine.

Set specific goals for your monitoring efforts.

Goal-setting is a vital step in your overall monitoring design and one that is often overlooked by groups. It involves answering a series of questions about your chosen watershed, such as:

- What data already exist about the watershed? Are there reports available that can give you the background necessary to determine the state of the watershed?

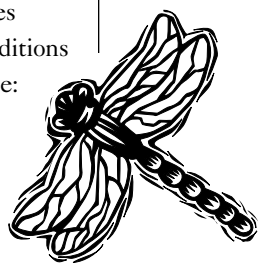
- What water quality standards are already in place in your watershed? Are they being met?

- What are the uses, values and threats in your watershed? What are your goals for the uses, development or management of the watershed?

- What questions do you want to answer with your monitoring efforts?

Determine what watershed indicators you will monitor.

An indicator is a measurable feature that provides insight into environmental or human health conditions and trends. Major categories of indicators include:



- Chemical and physical indicators such as water temperature, flow/gauge, pH, dissolved oxygen, nitrates/nitrites;

- Biological indicators such as macroinvertebrates (insects), aquatic plants, fish and wildlife;

- Physical habitat indicators such as stream gradient, streambank condition, streambottom composition; and

- Watershed-level stress indicators such as pollution and land use.

Determine your data quality objectives.

Uses of volunteer data vary greatly. Data can be used to: promote citizen education and stewardship; influence local planning decisions, such as where to locate a highway; direct local priority setting by determining which wetland or lake requires restoration; screen for potential pollution problems that can then be investigated more closely by resource agencies; or provide data for state water quality reports such as the 305(b) report, which is used for state and national priority setting for watershed restoration.

Once the data use and potential users have been determined for your monitoring project, it's time to set data quality objectives (DQOs). These are statements establishing the quality and quantity of data that will be acceptable and useful for the end users. Parameters include such things as accuracy, precision, representativeness, comparability and completeness. DQOs spec-

ify the quality of the data needed in order to meet the monitoring project's goals. Some of the important considerations are:

- Completeness: How many samples do you need?
- Representativeness: How representative are your samples of the conditions you are monitoring?
- Precision: How close should the values of repeated measurements be?
- Accuracy: How close should the measurements be to a "true" value, or standard? A true value is one that has been sufficiently well established to be used for the calibration of instruments.
- Sensitivity: What is the minimum level of an indicator you must detect?

DQOs should be determined and recorded for each indicator you plan to assess.

Decide which methods you will use.

After you have determined which indicators you will assess in your chosen watershed and have decided on DQOs for each of these, the next step is to select a method for sampling and analyzing each indicator. The main methods you can choose from are summarized below:

VISUAL SURVEYS. Monitors estimate and record observations about certain indicators in the field. Indicators that may be monitored in this way include: water clarity; river bank erosion; habitat characteristics; sedimentation; pollution threats; water color; and water odors.

WATER SAMPLING AND ANALYSIS. Water samples are collected in specially prepared containers from the stream, river, lake or wetland and analyzed in a lab for certain indicators. These indicators can include nutrients, dissolved oxygen, pH and more.

FIELD MEASUREMENTS. The indicator is measured directly in the field by volunteers using hand-held meters or field test kits. Indicators that can be monitored in this way include: dissolved oxygen; pH; conductivity; water clarity; nutrients; temperature; and water quantity (flow/gauge).

BENTHIC MACROINVERTEBRATE SURVEYS. This is a special type of monitoring that involves the collection and identification of insects that live in the water for most of their life cycle. Nets may be used, or artificial substrates (a leaf pack in a net bag or a sampler made of rough textured boards) can be placed in the stream for a period of weeks to be colonized by the insects. No matter the collection method, it's the job of the monitors to identify the insects to a taxonomic level appropriate to the level of skills and resources available.

Decide where you will monitor.

Sampling locations should be selected on the basis of which locations and how many will provide adequate answers to your questions. For example, if you want to establish baseline information on the overall health of a watershed, sampling sites should be established throughout the entire watershed, from the headwaters to the mouth. On the other hand, if you want to measure the impact of a specific human alteration such as a housing development or some other change in land use, sampling locations should be chosen to "bracket" the impact—for example, immediately upstream and downstream of the site—and to isolate the site from other potential impacts on the watershed's health. A few suggestions for selecting sites:

- Use a topographical map to delineate the watershed. Then select monitoring sites within the watershed's boundaries that will help answer your questions.
- Field-check each site for accessibility and safety.
- Always obtain landowners' permission, and avoid sites where permission can't be obtained or ownership can't be determined. Also avoid slippery slopes or eroding banks.
- Photograph each site at the sample collection point.
- Map each site.
- List all the sites selected along with the rationale for choosing them in your study design.

Determine when you will monitor.

Decisions about how frequently and at what times of the year and day to sample depend upon the questions you ask about your watershed. For example, if you are trying to establish a baseline of information, it's important to sample at regular intervals throughout the year and in a range of weather conditions. If you are trying to determine the impact of human alteration in the watershed, sampling before and after storm events may be a part of your study. For consistency's sake, samples should be taken at the same time each day because some indicators, such as dissolved oxygen, fluctuate throughout the day. Other indicators, such as macroinvertebrates, are best sampled in the spring and fall, while visual surveys are easier to conduct in the fall after trees in the watershed have lost their leaves.

Final Notes

It is very important to write down your study design and to keep the documentation as part of your group's files. To insure that your monitoring is giving you the answers you need, reevaluate your study design regularly and compare your results with your goals for the project. It may be necessary to change course as the project progresses. With a clear written record of what you're doing, along with notes about any changes in the design of your project, you'll have the makings of a meaningful monitoring program that can play a vital role in improving local watershed health. ■

References and Resource Materials:

EPA Rapid Bioassessment Protocol; 1989; J.L.Plafkin, M.T. Barbour, K.D. Porter, S.K. Gross and R.M. Hughes; EPA Assessment and Watershed Protection Division; #EPA/440/4-889/001

EPA's website for Monitoring Water Quality: www.epa.gov/OWOW/monitoring

Field Manual for Water Quality Monitoring; 10th Edition; 1996; M. Mitchell and W. Stapp; Global Rivers Environmental Education Network (GREEN); 721 E. Huron St.; Ann Arbor, MI 48104.

PA Code Title 25. Environmental Protection, Chapter 93. Water Quality Standards; 1997; DEP, Bureau of Watershed Conservation.

River Monitoring Study Design Workbook; 1995; G. Dates; River Watch Network; 153 State St.; Montpelier, Vermont 05602.

Streamwalk Manual; 1994; EPA Region 10; #EPA 910-B-94-002.

Testing the Waters - Chemical and Physical Vital Signs of a River; 1996; S. Behar; River Watch Network; 153 State Street; Montpelier, VT 05602.

The Volunteer Monitor's Guide to Quality Assurance Project Plans; 1996; M.Hunt, A.Mayio, M.Brossman, and A.Markowitz; EPA: Office of Wetlands, Oceans, and Watersheds; #EPA 841-B-96-003.

Volunteer Lake Monitoring: A Methods Manual; 1991; J.T.Simpson; EPA; Office of Water (WH -556); #EPA 440/4-91-002.

Volunteer Stream Monitoring: A Methods Manual; 1997; EPA Office of Water (4503F); #EPA 841-B-97-003.

Water Quality Assessment, Commonwealth of Pennsylvania (Section 305(b),Federal Clean Water Act);1998; PA DEP; Bureau of Water Quality Management.

Wetland Walk Manual: A Guidebook for Citizen Participation; 1996; EPA; Region 10: Office of Water; #EPA 910/R-009.

For more information:

There are a variety of support groups in Pennsylvania to assist you in creating and implementing an environmental monitoring program. The Citizens' Volunteer Monitoring Program (CVMP) at DEP can offer assistance in creating a monitoring program design to meet your goals. The program can also help you identify other technical support groups that can be of assistance. Last but not least, the CVMP attempts to link volunteer monitoring groups to specific programs within DEP that may have a need for a particular type of data.

The following publications are available from the CVMP: Water Quality Monitoring of Pennsylvania Streams by Citizens Groups: A Primer in Quality Assurance and Quality Control; CVMP Fact Sheet; Potential Funding Sources for Watershed Groups Fact Sheet; Statewide Directory of Citizens' Volunteer Monitoring Groups - First Edition; Monitoring Matters (a statewide newsletter for volunteer monitors). Coming soon from CVMP is a handbook for volunteer monitoring programs.

For more information, contact: Citizens' Volunteer Monitoring Program, Department of Environmental Protection, Bureau of Watershed Conservation, P.O. Box 8555, Harrisburg, PA 17105-8555. Phone: (717) 787-5259. E-mail: Citizens.Monitoring@a1.dep.state.pa.us.

Stream Cleanups

Hands-On Environmental Protection

BY SUE WISEMAN
Wiseman is Executive Director of PA CleanWays.

Litter and unsightly pollution are a threat to both our lands and waters. Litter is everywhere, and some areas are plagued by large amounts of illegally dumped trash. Waterways are prime victims of all the mess because rainwater usually flushes litter to the nearest waterway, and trash that's dumped "over the hill" usually makes its way down the hill to a stream or other water resource. Also contributing to the trash problem are floodwaters, which pick up large amounts of debris, both natural and manmade, and deposit it downstream.

Illegal dump surveys performed by county-based PA CleanWays chapters have identified between 75 and 200 dumpsites across the state. One survey showed that at 50 percent of the sites there was trash in a nearby waterway or within 50 feet of it.

Volunteer cleanups are a great way to deal with the never-ending problem of trash and litter in our waterways. And the fact is we need more and more volunteer cleanups every year. Of all the pollutants entering our waters, trash is one we can easily do something about.

A Ten-Step Program

Many organizations and individuals may be reluctant to get involved in waterway cleanups because of the risks posed by working with trash and being near waterways. Others may simply be unaware of how to organize and perform a cleanup. To counter this apprehension and lack of know-how, PA CleanWays, with funding from the Howard Heinz Endowment's Western Pennsylvania Watershed Protection Program, compiled a list of ten steps to organizing a successful waterway cleanup. The steps are illustrated in a 12-minute video entitled, "People: A Solution to Waterway Pollution," available from PA Cleanways (105 West 4th St., Greensburg, PA 15601. Phone: 724-836-4121). The ten steps are as follows:

Step 1 Find Someone to Organize

All it takes to get a waterway cleanup started is someone willing to organize it. Experience in organizing events is not necessary. All that's needed is for the organizer to have the time and the desire to rid our waterways of trash. Others, of course, should be willing to help in the effort, but one person is all it takes to get the ball rolling. And, once the ball is rolling, you'll find that others will rally behind the organizer and give their support. The amount of time needed depends on many factors—the volume of trash, the surrounding terrain, the willingness of the community to be involved, and unanticipated problems that may arise during the planning.

Step 2 Scout the Waterway

To determine what you'll need in the way of volunteers and supplies, it's important first to scout the

stream. The best time for any cleanup is in early spring, when temperatures are comfortable and before vegetation makes seeing trash and getting to it difficult. Therefore, to allow yourself plenty of time to make arrangements for your cleanup, you should scout the stream in late fall. If you can't scout the stream until early spring, you may be limited in how much you can accomplish.

Walk along the waterway and take notes—if possible, on a map—of all the trashy areas along the stream. (Note: topographical maps from the U.S. Geological Service are inexpensive and can be purchased at outdoor recreational stores or from your local Conservation District.) Be aware that high waters and spring flooding may move or add some debris. Invite others to join you. The more people you have along, the more ideas, contacts and support you'll have in your planning. Don't feel that you have to clean the entire waterway the first year. Target a section of waterway that's easily doable and save the difficult sections for future cleanups. The more difficult sections won't seem as monumental once you've gained experience and have community support. The trash didn't accumulate in one year and it may take more than one year to remove.

If you'd like to accomplish more or if high waters and other circumstances will prevent removal of some items, consider another cleanup in late summer when waters are lower, or in the fall when vegetation is gone. Also, when defining your cleanup boundaries, keep in mind that volunteers should not work more than three or four hours. While some may have the strength, stamina and desire to spend a whole day cleaning a stream, the majority will not. Moreover, you'll want your volunteers always to be alert so they avoid injuries and sloppy work. A 9:00 a.m. start with lunch at noon usually works well.

While you and your partners are scouting the waterway, make note of the following:

- Amounts and types of trash—estimate the number of truckloads or rolloff boxes it will take to remove the trash, as well as the number of appliances, tires and other large items;

- Trash items that will require special tools, equipment and/or consultations to move;

- Safety concerns such as steep embankments, proximity to roadways, railways and other traffic areas, unsafe bridges, etc.;

- Locations where trash can be piled for pickup;

- Locations suitable for younger volunteers with parental supervision;

- Landmarks along the waterway so you can gauge your progress;

- Neighboring businesses and homeowners.

Based on what you see during your scouting, you should be able to make a rough estimate of the number of volunteers you'll need. If it looks like you'll be creating a disturbance in the waterway as a result of your work, be sure to contact the Pennsylvania Fish and Boat Commission and Pennsylvania Department of Environmental Protection (DEP) prior to the start of the cleanup to obtain permission. Local phone numbers for these agencies can be found in the blue pages of your phone directory.

Note: If you encounter suspicious or possible hazardous materials, contact your local DEP solid waste specialist to have him or her inspect the materials. It's also a good idea to take photos of trouble spots, or particularly trashy areas. These may prove helpful as you seek support, and they can definitely be used to help increase public awareness of the problem.

Step 3 Recruit Volunteers

It takes a large number of volunteers to complete a waterway cleanup. Setting the date for the cleanup well in advance will allow time to publicize and promote the event and will increase volunteer response. Use a variety of approaches to find the most volunteers possible:

- Distribute and post fliers at public places—storefronts, bulletin boards, bus stops, restaurants, etc. Don't forget to ask permission—this may lead to cleanup support from area businesses and their employees.

- Visit homes located near the area you will be cleaning up and talk to the residents or leave information for them to read.

- If you are affiliated with an organization that publishes a newsletter, use the newsletter to publicize the event.

- Ask other organizations to put information on the cleanup in their newsletters and announce the cleanup at their meetings. Provide them with the necessary contact information. Note: sportsmen's groups, watershed associations, conservancies and scout troops all are active in conservation activities and could be good targets for volunteer recruitment.

- Contact your local newspapers, radio stations, and public access TV stations. Call to introduce yourself and then send a press release well in advance of the cleanup. Some newspapers will also accept a brief news release just prior to an event to remind the public.

- Encourage families with older children to be involved.

Suggested information for public announcements includes: date of cleanup; meeting time and place (include a map if the location is not well known); who is organizing the event; sponsors' names (businesses and agencies providing support); contact name and number for further information; number to call for rain cancellation or rescheduling; proper apparel (boots, gloves, long pants, long sleeves); "Free Lunch."

Step 4 Get Permission to Enter

Well in advance of the cleanup, it's important to contact all landowners adjacent to the waterways. Ask them to sign a "permission to enter" form for the cleanup and maintenance (see page 107). Be willing to work with property owners. They may agree to allow your group to perform an initial cleanup but may not be willing to grant an open-door policy for maintenance cleanups.

If you don't know the property owners, a search at your municipal or county tax office will provide their names and addresses. Neighbors may also provide you with information on who owns what parcels of land. If the property owner does not live in your community, you'll probably need to send him or her a letter along with the permission to enter form. Allow plenty of time for a reply.

A personal contact is the most friendly and successful way to work with property owners. These contacts may even inspire them to help you on the day of the cleanup. There will be some property owners, of course, who will refuse entry. Respect their wishes and work around their properties. If you perform another cleanup, ask them again. They may have been leery of your initial efforts and will reconsider after they've seen your good work.

Step 5 Obtain Releases of Liability

To address landowners' concerns about liability and to protect yourself and your organization, require all volunteers on the day of the cleanup to sign a form releasing the property owner and your organization from liability (see page 107). For additional protection, you might also want to look into general liability insurance.

Step 6 Secure Community Involvement and Support

In every community, there are people and groups that value clean waters and that will be more than willing to donate what they can to support your work. Local businesses, utilities, governments and government agencies all are valuable sources of support. Ask them to help in your cleanup in any way they can. Start out by letting them suggest how they might be able help, but be ready with a few suggestions of your own. Can they help recruit volunteers among their employees? How about getting them to contribute bags or gloves, food and refreshments? Or maybe they can help with disposal and hauling of trash—often the biggest challenges in any cleanup.

Landfills that serve your community can usually be counted on to support community efforts. In addition, your municipal government might be interested in helping citizens clean up their community and might allow municipal crews and equipment to take trash to the landfill during the week (don't expect Saturday support). If your municipality can't help with the cleanup, contact your local trash hauling companies. Other businesses with work crews and equipment might also be willing to help transport trash. And don't

forget to make arrangements with a scrap dealer or local recycler to recycle scrap metals, appliances, auto batteries and more.

If your waterway flows through public lands—lands open to hunting, fishing, camping, nature walks, etc.—be sure to contact the government agencies that maintain the lands and ask for their support. The Pennsylvania Bureau of Forestry, Bureau of State Parks, Game Commission, and Fish and Boat Commission all are eager to work with citizens to keep public lands clean. Also, the U.S. Army Corps of Engineers may have jurisdiction along your waterway and may be able to help.

In all of your requests for help, stress that you are organizing a community project and that you'd like the people and organizations you are contacting to be part of the team. Keep track of everyone who becomes part of your team and write down what they contributed so you can personally and publicly thank them down the line. These records will also be helpful when planning future cleanups. Along the way, don't be discouraged by those who won't or can't help—not every business or group places the same level of importance on the environment, and some may not be in a position to help.

A final note about community support: Major cleanups have been successfully performed without any money exchanging hands. Keep seeking new sources and new partners until you get everything you need. If time runs out, save a section of the waterway for next year, and continue to work on gaining the necessary support. Unfortunately, many waterways do need yearly maintenance cleanups, so make your community involvement efforts a continuing activity. Keep everyone excited about the progress you're achieving.

Step 7 Designate Individuals to Enter the Water

If entry into the waterway is necessary to remove trash, assign the job to individuals with professional training, such as divers and rescuers; these will be your "entry volunteers." Recruitment of this group shouldn't be a problem. These individuals and the organizations to which they belong are generally dedicated to community service and ought to be more than willing to help. Another possible source of "entry volunteers" are military reserve units. These men and women are trained to work together and know how to respond in emergency situations.

Invite your "entry volunteers" and their organizations to your waterway prior to the cleanup. They need to become familiar with the trashy areas so they can determine what tools and equipment they'll need. Under no circumstances should an untrained individual who has not been designated as an entry volunteer prior to the cleanup be permitted to enter the waterway. Even though the water may seem shallow and perfectly safe, you never know what dangers you might run into below the surface.

Step 8 Put Together a Plan for the Day

After all your pre-planning, it's critical to have a well thought out plan for the day, from arrival to departure. Here are some basic guidelines:

BEFOREHAND—Since waterway cleanups can cover a considerable distance, the best approach may be a team approach, with each team covering a designated section of the stream. Team leaders should be designated before the cleanup and given a written list of jobs to be done along with a sketch of the area. Make arrangements to have a sufficient supply of tools and equipment available on the day of the cleanup. Also: Make plans for inclement weather. Heavy and/or constant rains can make waterways treacherous and the banks slippery. Publicize a phone number for possible cancellation and rescheduling information.

Remember: the safety of each and every volunteer comes first! Make arrangements for communications and know the phone numbers of local emergency agencies. If there isn't a public phone nearby, have cellular phones or other forms of radio communication available. This is absolutely essential for safety but will also prove helpful if you need additional support.

Make sure there will be plenty of parking available for your volunteers. Ask local emergency personnel, fire and police officials, and even ham radio operators for help with communications and traffic safety. Make arrangements for drinking water, refreshments and/or lunch for the volunteers. Not only will food replenish their energy, but taking time out for breaks or lunch will give them an opportunity to share their cleanup stories and feel good about what they are doing.

THE DAY OF THE CLEANUP—As the volunteers arrive, have them sign a release form, assess them for proper attire, and make sure young volunteers have suf-

ficient adult supervision. Once everyone has signed the release form, it's time to get to work. Before starting:

- Welcome everyone and thank them for coming.
- Review and discuss safety precautions. (Many precautions seem like common sense, but volunteers will need to be reminded.)
- Assign volunteers to team leaders. The team leaders should be easily recognized by bright-colored armbands, hats, vests, etc. The team leader will give volunteers specific instructions on what needs to be done and how to do it.
- Instruct volunteers to give any evidence that may lead to prosecution of individuals intentionally trashing our waters to their team leaders; you can then present this evidence to the Pennsylvania Fish and Boat Commission.

Waterway Cleanup Safety Precautions

- Wear sturdy shoes, hats, long sleeves and long pants to avoid falls, sun exposure, scratches and exposure to poisonous plants.
- Always wear heavy-duty work gloves and bring a spare pair. Leather work gloves work best.
- Do not work during inclement weather.
- Avoid overexertion.
- Do not enter the waterway unless you have been designated as a waterway "entry volunteer."
- Do not work on steep banks and slopes.
- Do not attempt to remove heavy or partially buried objects.
- Use teamwork for difficult tasks.
- Do not remove any unknown, suspicious or known hazardous substances such as chemicals and toxic materials in containers.
- Do not remove animal carcasses.
- Be alert for snakes and rodents.
- If working near roadways: 1) erect safety signs that are available from your municipality or PennDOT (depending who is responsible for the road's maintenance); and 2) always wear orange safety vests.

- Tell volunteers when and where refreshments/lunch will be served.
- Give everyone instructions about what to do in emergency situations.

Step 9 Public Education and Awareness

Major waterway cleanups may be a perpetual event in your watershed if you don't educate the public and create an awareness of the problems created by trash and pollution. You may always have to remove items swept into the waters by heavy rains or floods, but you can impact the amount of trash entering the waterways as a result of people's carelessness or intentional actions.

Of course, you've already started your education process as you get to work organizing and completing the cleanup. For the volunteers, a positive environmental experience such as this can help shape or even change their values. Young volunteers are especially impressionable and will perhaps gain the most and return the most from this experience. These volunteers unknowingly will become models and educators, through example and through personal communications.

To maximize your educational efforts, send press releases and invite local newspapers and TV stations to attend the event. This should be done well in advance of the cleanup. It may also be helpful to identify a reporter or editor who is interested in the environment.

Even if some reporters and camera crews show up, be prepared to do your own publicity for the media that don't. Have someone take action photos, and send post-cleanup press releases announcing your success and recognizing your volunteers. You can also use the photos in your own newsletters or other publications. Be sure to identify volunteers in every picture as a way of giving them credit and saying "Thanks."

Step 10 Acknowledge Your Volunteers

There are three main reasons why most people get involved in stream cleanups and similar efforts:

1) They are concerned about the environment;

2) They like working with and meeting other volunteers; and

3) They like seeing the difference that they made.

To encourage these feelings, you might want to have a lunch afterward or a gathering to give people the opportunity to share experiences and build on new friendships. In addition, a spoken word or a personal letter will go a long way toward letting volunteers know you appreciate their work. You might also consider giving out awards or certificates suitable for framing. Donated t-shirts and coupons for food and other products and services are nice ways for local businesses to say thank you and show their appreciation.

Last but not least, be sure to give public recognition where it is due. Take every opportunity to mention your supporters and their contributions, especially when talking with the media. A letter to the editor or a small ad in a local paper might be just the thing to publicly recognize those who help.

If you follow these ten steps, everyone will be glad they decided to be part of the solution. They'll feel great about the job they've done, and your local watershed will be a cleaner and a better place. ■

Sample Permission to Enter

I, (name), being owner of a property situated at (description of property location) in (name of municipality) do hereby grant permission to (group's name) represented primarily by (name of organizer) and the volunteers recruited by this group and/or organizer for a cleanup on my property to remove refuse from my property which borders (name of waterway).

By granting this permission, I do hereby, with intent to be legally bound, release (group's name) and the volunteers from any liability and do not assume liability for actions incurred during the cleanup to be held on (date) with an alternate date on (alternate date) .

Signature of property owner _____ Date _____ Signature of witness _____

Printed name of property owner: _____

Signature of group's representative _____ Date _____ Signature of witness _____

Printed name of representative owner: _____

–OPTIONAL–

Also, I do hereby grant this group and recruited volunteers permission to enter my property henceforth to help maintain this property as a refuse-free property and to remove any trash as may be deemed necessary by them.

Signature of property owner _____ Date _____ Signature of witness _____

Printed name of property owner: _____

Signature of group's representative _____ Date _____ Signature of witness _____

Printed name of representative owner: _____

Sample Release from Liability

Date: _____

Name: _____

Address: _____

Phone Number: _____

Cleanup Location: _____

Notice: the undersigned, recognizing and assuming all risks of accident and injury, hereby agrees, with the intent to be legally bound, that the following sponsors:

(Name of landowner and sponsors)

will not be liable or legally responsible for any injury sustained by the participant, or for loss or damage to property owned or in the possession of the participant during, or as a result of, participation in the cleanup project at the above location whether such personal injury or property damage is caused by the negligence of the sponsors or their respective employees, officers, agents, or otherwise.

Signature, Date _____

Parent/guardian signature if signatory is less than 18 yrs of age: _____

Witness, Date _____

Working With Landowners

The Five C's

By Hardy VanRy
VanRy is former Assistant Director, French Creek Project

In the past quarter century, environmental protection and pollution prevention have too often meant the choosing of sides, the division of a community, and the development of rather unneighborly attitudes among neighbors. The classic stereotype of economy versus environment dooms one to failure from the very beginning, and leaves little room for each "side" to meet in the middle.

In the 1990's, however, environmental protection has expanded beyond merely cleaning up factories and waste dumps to encompass a greater focus on non-point sources of pollution. As landowners, government agencies, and environmental groups struggle with these new changes and challenges, the most long-lasting successes have evolved from a new kind of conservation. There is a growing recognition from all sides that a handshake is more effective than a punch in the nose, that dialogue gets more results than a shouting match, and that serving on a collective committee is much better than serving someone court papers. And at the heart of this new environmental ethic are five very basic concepts: the five C's.

Connection. Knock on someone's door and start preaching to them about how their pesticides are disrupting the mating behavior of the pigtoe freshwater mussel, and more often than not you'll find the door shut in your face. Knock on someone's door and engage them in a dialogue about their drinking water or how good the fishing is in the local stream, and you are more apt to have a longer conversation. Many landowners and environmentalists have clashed in the past because both sides fail to see that they have anything in common. In other words, they have no converging reference point; they have no connection.

Members of the French Creek Project working with area landowners.

Making a connection often requires more up front leg-work and dialogue, and may require a bit more patience than many landowners and environmentalists have been willing to give in the past. Unless there is a readily apparent problem (a stream bank has caved in, trees are dying, a well has gone dry, etc.), many landowners may assume that their impacts on the environment are rather minimal. It may take several conversations and a slow, gradual building of trust before a landowner and an environmentalist finally reach a level of understanding. Often, a connection will never be made with a given landowner, and time is better spent reaching out to others within the watershed.

Workshops, community meetings, or even conversations over a cup of coffee can often lead to an environmental partnership down the road. Sometimes, providing educational materials or informally exchanging ideas can be enough to spark a future interest in working together. If an environmentalist is too quick to jump at the main issue—"Listen, I think you should stop cutting down so many trees on your land"—a landowner may become disenchanted with the con-

versation and refuse to continue the relationship. On the other hand, a landowner who is too quick to dismiss an environmentalist as an "eco-nut" or an "agitator" may lose out on future opportunities to improve his property or make his operations more efficient.

Making a connection means finding something in common that may relate (no matter how remotely) to pollution prevention or environmental protection. For example, perhaps both parties like to hunt, fish, canoe, or hike, or maybe an environmental group can provide some information that is useful to the landowner, or perhaps both parties have a common acquaintance. Regardless of the exact connection made, success results when each party stops viewing the other as an outsider or opponent, and begins to see that there is common ground on which they walk.

COMMUNICATION. Too often, environmentalists view certain landowners as unfeeling polluters or "the bad guys," and landowners see environmentalists as unrealistic do-gooders with little sensitivity for a lifestyle that grows more difficult every year. Obviously, each party will possess his or her own agenda and seek to benefit from the partnership, but it pays to understand the other party's point of view if both parties are to truly benefit.

Entering into such a partnership can be difficult for some landowners (particularly those in Pennsylvania) who have become distrustful of government and environmentalists, and often view even a conversation as a first step towards increased regulation and a reduction in private rights. This makes connection and especially communication all the more important. The long-term success of the relationship greatly depends upon the manner in which the relationship is originally formed. But it also depends upon a continued and consistent dialogue in which all viewpoints are shared. In this way, both parties can discuss concerns, offer solutions, and provide feedback that will prove useful as things move forward.

CARING. This word might conjure up images of lessons learned on "Sesame Street," but its fundamental simplicity serves us well as we attempt to foster positive relationships between landowners and environmentalists. In the past, environmental protection focused on heavy-handed governmental regulation and non-profit watch-dogging, which tended to alienate landowners. Many times, the first contact a landowner had with environmentalists was when he was served with a fine by an agency, or accused by his neighbors of polluting a stream he shared with them. Wrist-slapping and finger-wagging constituted a majority of landowner-environmentalist interaction. Environmentalists at all levels must acknowledge the needs, responsibilities and challenges of landowners. It is rare that a landowner will purposefully destroy the environmental health of his property if a reasonable alternative can be identified. For environmentalists to care about what happens to the land, they must first care about what happens to the landowner.

On the other hand, many landowners fail to act quickly enough, if at all, to reduce a potential impact on the environment. For example, some farmers have been known to remove vegetation from a stream bank to allow easier access to water for their cattle, and then contact an environmental group or government agency a few years later to ask what they can do to stop their stream banks from eroding. They might also over-fertilize or over-pesticide their crop land, which could eventually affect the water supply for their family, neighbors and cattle. Farmers and landowners almost always recognize the importance of environmental protection, but they must truly care about the watershed in which they live and take steps that will actually protect it.

COOPERATION. No matter how nicely you ask, and how willing a landowner is to institute pollution-prevention measures, cooperation must be present and paramount for the measures to be successful. The point is obvious in reference to the landowner: he or she must be willing to cooperate with government and non-profit entities, to rely on their expertise, and to carefully weigh their suggestions.

Cooperation on the part of government and environmentalists might mean taking a more active role in assisting the landowner with instituting change. For example, many non-profit organizations now offer economic assistance to landowners who willingly enroll in pollution prevention programs. Many community groups will now provide volunteers to help a landowner plant trees, put up a stream bank fence, install waste collection devices, or teach new agricultural methods. State government officials, and especially county conservation district representatives, will provide technical assistance in addition to money so a landowner feels

comfortable with making positive changes on his or her property. Conservation through cooperation has become an effective strategy for enhancing environmental quality with fewer bad feelings and a longer-lasting impact.

COMPROMISE. Preventing or reducing non-point source pollution is rarely a black–or–white, all–or–nothing venture. Because we all contribute in some way to non-point source pollution, it is often difficult to pin all blame on one given landowner or to measure the impact on environmental health if that landowner institutes positive changes on his property. Still, with effective communication and cooperation, landowners and environmentalists can devise strategies to protect both the environment and the landowner's rights. Such strategies are only possible through compromise.

About the French Creek Project

In 1995, the Pennsylvania Environmental Council joined with Allegheny College and the Western Pennsylvania Conservancy to initiate a cooperative, five-year watershed project in northwest Pennsylvania. The project brings together conservationists, landowners, farmers, the business community, local government officials and academic institutions in a collaborative effort to protect one of the state's premier streams.

Few streams in the Commonwealth are more attractive or more diverse than French Creek, a nationally renowned waterway that begins in Chautauqua County, New York, and flows for 117 miles through the northwestern Pennsylvania counties of Erie, Crawford, Mercer and Venango. French Creek provides habitat for more species of fish (more than 80) and freshwater mussels (26) than any other stream in the state.

There are still extreme cases in which a governmental regulator must take a hard stance on a landowner's activity: for example, if a landowner was illegally dumping extremely toxic substances like lead or mercury, or digging a quarry without a permit, or somehow impacting an area known to provide habitat for an endangered species. In such cases, compromise is not an option; the activity must stop immediately to prevent dire consequences for the environment. Usually, however, an agreement can be reached through an open dialogue that includes a variety of options and a willingness of both parties to meet each other halfway.

For the landowner, this might mean developing a new method of doing business that could be slightly more expensive or inconvenient. For example, agreeing to put up a stream bank fence to prevent erosion might mean having to install alternative water sources for cattle. Reducing reliance on pesticides and fertilizers might mean slightly smaller crop yields. Disposing of barnyard wastes properly might mean adding an extra hour onto the work day. Still, most landowners see the logic behind such pollution- prevention measures, and would rather live with a compromise than participate in a system of fines and heavy regulation.

For environmentalists, compromise means listening to landowners and recognizing their dependency on the land around them. For example, perhaps a landowner feels he is unable to provide a 150–foot buffer between his crop land and a stream band because it would require taking too much land out of production. Although it would be slightly less effective as a means of water protection, a 50–foot buffer zone might be an agreeable compromise with which the landowner is willing to live. The environmentalist must often accept the less effective buffer distance as a reasonable alternative to a slammed door.

Conclusion.

As we approach the 21st century, many landowners, government officials, and environmentalists are recognizing their interdependency. The command and control mandates of the past thirty years are not usually applicable to today's prevention and reduction of non-point sources of pollution. Similarly, the in-your-face finger pointing once employed by environmental organizations now serves only to turn off the average citizen to the ecology ethic. For their part, more and more landowners are benefiting from programs that can improve both the green of their property and the green of their wallet. A new common sense approach to the environment is being played out across Pennsylvania and the country: conservation through connection, caring, communication, cooperation, and above all, compromise. ■

Working with Business to Protect the Watershed

The Corporate Connection

BY MARTIN H. SCHEERBAUM
Scheerbaum is Supervisor of Environmental Engineering with PPG Industries, Inc.

Success in maintaining or improving the quality of life along a watershed can only be achieved if everybody gets involved. And that includes the businesses operating in the region. Businesses often are searching for ways to become involved in their communities in a positive way. A store may depend for its success on the image of the area where it's located. A manufacturing facility's continued growth may hinge on attracting a well educated workforce to the area. And the quality of life along the watershed may dictate whether the infrastructure and tax base can support the services that these and other businesses require. If you are active in an organization that's involved in watershed issues, interaction with an individual business or business organization is an excellent way to achieve further success.

It may be that a particular issue directs your organization to contact a business. For example, maybe the small tributary you are interested in protecting or revitalizing flows predominantly through the property of one business. If multiple businesses are involved, then you might want to approach a broad-based organization such as the Chamber of Commerce, or perhaps a trade organization or mutual association if your region is dominated by a particular type of industry. In certain cases, multi-industry groups may already exist to address these and other issues.

Understanding areas of mutual interest or concern is the key to building a lasting partnership with business. In almost every instance, a common issue linking business and other community organizations is education; everyone supports improving local schools and increasing citizen understanding of important local issues. Often, major retailers, manufacturers and other businesses will have published commitments to supporting local educational efforts. When a particular issue is of concern to your organization and area businesses, combining forces to make the public more informed may benefit both parties. Involvement in educational opportunities can lead to lasting associations with area business as well as the local school district.

USX employees participate in the United Way Day of Caring at Dead Man's Hollow, Allegheny County.

Making Contact

In the same way that many successful organizations start small, making an initial contact with a business on a small scale can lead to later success. An initial contact with an appropriate business can be as simple as two people sharing comments at a community meeting. Or perhaps the two are volunteering together to support a community asset or historical treasure. Establishing this kind of "common interest" early on is essential to fostering a relationship and developing trust and understanding.

Early discussions between your organization and a business contact will often center around an exchange

of viewpoints. During this period, each party will be trying to convey its views and priorities to the other. Extended back-and-forth may be needed to sort through gaps in understanding or competing points of view. A business, for example, may view a tangle of briars or an unsightly mass of trees along its rear property line as a nuisance that needs to be removed. Your organization, however, may identify the area as a vital riparian zone and consider the vegetation in question an ecological necessity. Similarly, the truck traffic your organization sees as contributing to smog in the area may be viewed by business as a necessity to supply "just-in-time" parts to a growing auto assembly industry in the region.

Discussing these and other issues is an opportunity for your organization to broaden understanding of its goals and mission while gaining credibility. For businesses, it's a chance to demonstrate the demands they face in trying to remain profitable. This exchange of ideas usually will lead to both parties expanding their viewpoints.

Once you have made your initial contact and have started some conversations about shared concerns and potential areas of conflict, the next step is to take time to understand the business and its customers. Make inquiries about the business's products or services. Is it a single-location business, or is the facility part of a larger corporation?

Often, a corporation will have an individual on staff who is accountable for interaction with the community or regional organizations; he or she will surely be able to provide more information about the business. Sometimes learning more about the business is as easy as asking the plant manager to address your organization at your weekly luncheon or monthly meeting. And be sure to get a hold of the business's annual report (if it's a public corporation) or other published information describing its accomplishments and goals. In addition, more companies are publishing annual environmental, health and safety activity summaries that might focus on issues and activities of specific interest to your organization. So long as your inquiries are straightforward and direct, you should have no problem getting the information you need.

Introducing Your Organization

Just as you will find it useful to understand the business you are contacting, that business will be interested in the goals, objectives and successes of your organization. Provide a short, concise written summary of your organization. Are you a nonprofit organization? Are you affiliated with a national organization with published objectives? Succinctly point out the history of your group, and emphasize your present and future objectives. Have you authored any news articles? What other partnerships do you have? What segments or components of the watershed are of interest? Do you have an upcoming major project that would be of interest to the businesses in the region?

This stage of communication is critical in fostering positive interactions in the future. A well organized, "business-like" summary of your organization will provide the needed information and demonstrate your organization's professional approach to its work.

Once you and the business or businesses have exchanged information, it's important to suggest a framework for your future interactions. (It may be that the business representatives will suggest a format.) In many instances, the best approach may be to establish a watershed coalition made up of various individuals, businesses and organizations. On the other hand, a simple, unfunded association may be all that's needed if your community group is requesting the assistance of a business to provide volunteers to clean a nearby creek. If you are planning to request funding from a large corporate foundation, you might be expected to file as a formally chartered, 501(c)3 organization. The structure of your organization and your partnerships with local businesses will depend on your objectives.

Presenting your position

Your efforts in introducing yourself to business can lead to a collaborative effort to tackle issues impacting the watershed and the region. To be successful, you need to present your vision of how the area can and should change, and how any strategies you propose can lead to success. Clearly communicating your ideas to your potential partners—businesses and others—is perhaps the most difficult and important task you'll face. Time and effort spent to make your

case will lay the foundation for the success you are pursuing in the future.

In order to communicate a clear and successful strategy, you first must achieve some level of consensus within your organization. Your philosophy will probably be based on your organization's existing positions and already-written materials. Nevertheless, making sure that the current members of your team are all in agreement about your goals and the thinking behind them is critical. Remember: one-size strategies usually do not fit all situations or all regions. Be sure to gather all the relevant background information you can about the matter at hand. Research arguments both for and against your position. If you are presenting a long-range vision, it may be advisable to select a series of tangible, short-term goals as well.

The critical question, however, is a simple one: What do you want? Do you need additional people to complete a yearly stream cleanup? Do you need your business partners to provide advice and a "business perspective" to help shape your ongoing efforts? Are you soliciting for a senior business person to provide leadership on your board or to meet with state elected officials to request support? Are you in need of funding for a proposed or an ongoing program? Be prepared to answer questions about your proposal. Ask the toughest ones of yourself in advance—e.g., are you expecting too much or too little from any one member of the group?

A well thought-out approach will be welcomed by the business you are seeking to work with. You won't be expected to bring all the answers to the table but a thorough effort up front shows that you are serious about achieving success.

Achieving Success Together

Your organization's decision to collaborate with business is now off to a good start. If you have selected a business that shares your goal of improving the quality of the watershed, then it's a good bet that both parties are beginning to communicate better. Each of you is now more able than before to understand the other's perspective and priorities. Use this broader knowledge base to spur ongoing creative discussions and positive changes to your program.

A Partnership Success Story

In northwestern Pennsylvania, PPG has been a long-time supporter of the French Creek Project and other initiatives to protect the Creek, Pennsylvania's most biologically diverse stream. When the Project began in 1995, PPG provided support financially and with people. Plant Managers Joe Stas and Gary Danowski, as well as the plant environmental engineer, Doug Mehan, have served on the Project's advisory committee and helped to shape the vision plan for the watershed that is the guiding document for conservation and education efforts. With support from plant managers, Mr. Mehan has also served on the Board of Directors for the Conneaut Lake and French Creek Valley Conservancy, an organization that focuses on land conservation and management. Finally, PPG has underwritten the costs for student symposiums on French Creek and rails to trails efforts.

Note: It's important to understand that the priorities and direction of your program may have changed by now; it may not be the program you first conceived. That's not necessarily a bad thing; it's probably just the result of getting input from the broader knowledge base of other participants.

To help insure your partnership's success, you will probably want to document, in writing, the mission and objectives of the effort to keep focused on the task ahead. Your written description of the project and its objectives, when shared with all participants, will be a good way to reaffirm the ideas agreed to by all.

Just communicating with business and defining the goals you share can be counted a success. But the ultimate goal is not to achieve just one small step but to make a major impact on improving the watershed or some portion of life around it. Try to avoid scaling back the project's objectives out of compromise or convenience. You'll never want to look back on what's been accomplished and say, "I wish we could have done more!" Challenge the group to set its sights high. Remind everyone of the combined energies and resources that your organization, your business partners and others bring to the effort. Tell them this is an important opportunity to make a difference.

Achieving success together has many tangible and intangible benefits. Often, you meet interesting people who may change the way you view your watershed and your community. By starting with that initial contact

PPG Industries Inc. works: Meadville, PA. Plant Environmental Engineer checking the pH of discharge water from plant operations.

and following up with good discussions, projects that were impossible to imagine can end up being the stuff of your wildest dreams. ■

Residential Water Conservation

Plugging the Drain: Saving Water and Money at Home

BY CURTIS B. MAGNUSON
Magnuson is Program Manager with Conservation Consultants, Inc.

I grew up in Erie, Pennsylvania. As a young boy, I remember my parents and neighbors getting upset when the city decided to charge for water service. Our neighbor figured that at the rate the city proposed to charge per gallon, one could flush a toilet three times for a penny. Charging for water seemed an outrage at the time, but today when we are paying at least five times as much for the same water, those early charges look more and more like a deal.

Clean water, which was once so plentiful we could provide it to communities for free, is now a valuable commodity. It is not even available in some places. There are entire communities and counties in Pennsylvania where public water is actually considered poisonous. Whole communities are advised to purchase bottled water to avoid agribusiness pollutants. If this continues, we may soon be living the famous line from Samuel Taylor Coleridge's *Rime of the Ancient Mariner*: "Water, water everywhere and not a drop to drink!"

Across the country, the majority of Americans turn to authorities for solutions to such problems as insuring a sustainable water supply. We feel that this problem lies outside our range of influence, and we hope that our local and federal governments are working to provide clean, potable water to our homes. But the problem isn't going away. The Earth's supply of water continues to dwindle and most of us feel unable to help. There is good news, though. Every one of us can do something right now to correct the problem by using water more effectively.

The one place where most of us still have some control over water is in our homes. We pay utility bills and maintain the property whether it is mortgaged or rented. Most of us pay a water bill and are increasingly aware of the rising costs of this vital utility; in many communities, sewage charges are levied in direct proportion to a home's water use. Despite this increasing awareness, most of us are using more water than we intend to, according to residential water conservationists. By making a small investment of time or money, we can achieve lower water and sewage bills and aid in sustaining the water supply. We can save our water.

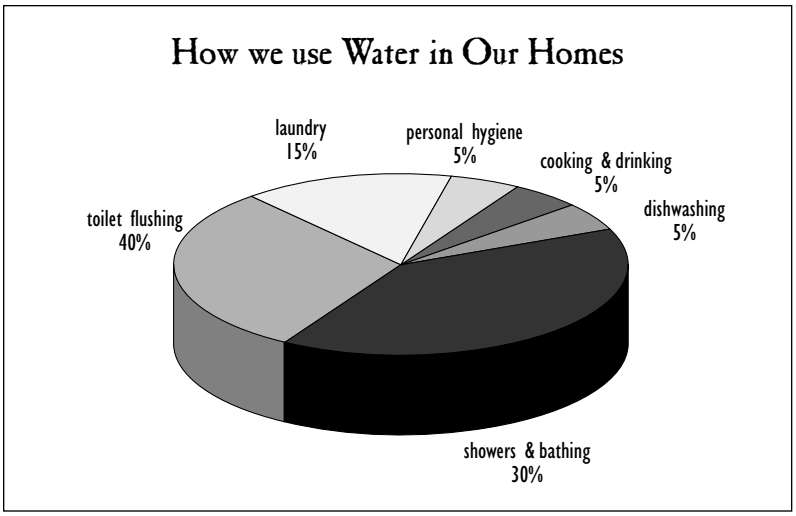
Huntsville Reservoir, a drinking water reservoir in Lehman Township.

Using New Technology

Before we can make effective changes in water usage, we need to know what works best. As a first step, we should know where water may be wasted in our homes without our knowledge. On the next page is a chart showing how our water is being used in our homes. The facts are truly surprising!

In the Bathroom

From the pie chart, we can see that the largest, single user of water in our homes is the toilet. Few of us consider this because the water is hidden in an opaque tank and, as a result, we are not aware of it. Although



many newer homes are equipped with water-saving tanks using one to three gallons of water, many older houses and apartments still have toilet tanks holding five to seven gallons. In other words, an older toilet can use two to three times as much water for the same task!

Nevertheless, we may become discouraged at the cost of installing a new toilet or at the difficulty involved in convincing a property owner to replace the old toilet. But the fact is there's no need to replace the toilet at all if we spend about two to four dollars on a device called a toilet dam. A simple tool made of a sheet of flexible stainless steel and bordered with soft, durable plastic, a toilet dam is slightly wider than a toilet tank and easily bends to conform to the interior of the tank. Once installed, it holds back between 20 and 25 percent of the water used to flush the toilet. In some larger toilets, two dams can be installed for up to 50 percent in savings. If your home has more than one bathroom, each toilet should have a dam.

A second new-technology approach to reducing your water bill is replacing the shower head. If your home is ten years old or more, and if you haven't remodeled the bath or replaced the showerhead in that time, this is an option you should consider. A typical showerhead installed ten years ago is designed to use five to ten gallons of water a minute. A high-efficiency showerhead, on the other hand, uses two gallons a minute, keeping up a comfortable flow of pressure thanks to internal pressure devices. High-efficiency showerheads cost no more than standard models, and they come in several designs, including shower massagers. In many places, they are the only showerheads available.

Check the flow of your current showerhead by catching the water in a bucket for a full minute. Then measure it to determine the flow for that time. This tells you whether your showerhead is efficient or not. If struggling with a bucket in the shower seems like too much work, look at the neck of the showerhead. Most manufactures are required to stamp the flow there (e.g., "2.5 GPM") to verify flow for building code.

Because bathroom use demands up to 75 percent of all the water in the home, it stands that we should do all we can to reduce use in this room while still providing what we need. Besides the toilet tank and the showerhead, we should also look at the faucet in the bathroom sink. Most faucets have a removable aerator, which should be replaced every one to two years. These aerators work to mix air into the water to produce a better quality flow while using less water. They can be purchased within a range of one to two dollars each.

In the Laundry

The laundry is the next area to think about for bill reduction and water savings. One way to reduce wasted water in the laundry is by washing full loads. Washing full loads or using a low water cycle can save several gallons per load. For large families, full loads are usually not a problem, but for single people or couples, this may require a little planning. If there are people in your family who occasionally wash one item of clothing, talk with them about finding like items to complete a full load. Another approach is to replace older clothes washers with newer, high-efficiency models. American manufactures are now making front-loading washers that use a fraction of the water a top-load washer does while giving a better quality wash. Although they are currently more expensive, the extra cost of these newer-model washers is returned thanks to a permanently lower water bill.

In the Kitchen

The kitchen offers two primary opportunities for water reduction. The first is achieved by replacing the faucet aerator, as in the bathroom. A second approach is installing a flow control on the end of the faucet. These devices typically sell for about five dollars and attach like an aerator. The device is controlled by a small lever that can shut off water to a drip. Using a flow control, one can set the water temperature at the faucet, and then shut it off and turn it on by the flow control. If you are washing dishes by hand, you can shut off the water while you're washing and then turn it on with the small control at the end of the faucet to rinse each dish. The water temperature thus remains constant, and you can save several gallons of water each time you do dishes.

Changing Daily Behavior

Of course, you don't have to rely exclusively on new technologies to change your water use patterns. As mentioned above, when you're doing your laundry, it's best to always wash full loads. The same can be said for the dishwasher, which should only be run when it's completely full. Not only does this save water, but it also saves electricity and the gas used to heat the hot water tank. You can then use the dishwasher's air dry cycle to save even more on your electric bill.

Repairs and Maintenance

When I moved to Pittsburgh and bought an older house, I was surprised that my water bill was over $100. I argued with the water authority that it couldn't be right. And, after several meter readings, we discovered that the problem was a silent leak in the powder room toilet. This constant leak, although undetectable, was tripling our water and sewage bills! Not long after, I entered the conservation field and found that toilet leaks aren't the only culprits that can double or triple water and sewage bills; joint leaks and faucet leaks can do the same thing.

Often, we think that the cost of hiring a plumber defeats the savings of the repairs, but the truth is that

Tips for Conserving Water Every Day

Changing daily behavior requires no money, and, at the most, just a small adjustment to our schedules. There are many ways to conserve water throughout the day and year. Listed below are some techniques suggested by Pennsylvania American Water Company for lowering the water bill by using only what we need:

- Shorten shower time to ten minutes.
- Take a shower instead of a bath; you'll save 20 gallons each time.
- Don't use the toilet as a trash can; save 1 to 7 gallons per flush.
- Shut off water while brushing teeth and shaving; save 3 gallons.
- Use watering cans to catch the cool water that runs while you're waiting for the hot.
- Keep a gallon of drinking water in the refrigerator; save 200 gallons per month.
- Defrost frozen food in a pot or pan of water instead of running water; save 50 gallons a month.
- Compost vegetable waste instead of using disposal; save 50 gallons.
- Water gardens and grass once a week instead of daily; save 750 to 1,500 gallons per month.
- Use a pool cover on swimming pools to save up to 1,300 gallons a month.
- Run a hose from the central air conditioner and use draining water on gardens.
- Wash cars with a bucket, turning on the hose only to rinse; save 150 gallons.

the unending expense of wasted water can exceed a plumbing bill in just one to three months. Proper maintenance is essential for controlling water use. If someone in the home can do repairs, that's even better. Most repairs cost a small fraction of what a plumber charges. Costs usually run from less than $1 to less than $20 to stop most water leaks.

Detecting leaks in pipes and faucets is relatively easy. Finding a silent leak in a toilet, however, can be a challenge. The most obvious way to check a toilet is to listen for the "ghost in the bathroom." If the toilet flushes on its own, that indicates a major leak. If the surface of the water in the bowl ripples, that's another sign of a leak. If neither of these things is happening but you suspect a leak, put a few drops of food dye in the tank and do not flush the toilet for at least twenty minutes. If the bowl shows color from the food dye, there is a leak. Most leaks can be fixed by replacing the flapper and scrubbing the flapper opening with a scrubber pad. If the problem continues, call a plumber.

Conclusion

Most of the high-efficiency devices mentioned in this article are available at any building supply outlet. Flow controllers and toilet dams might be more difficult to find, but they are often sold by plumbing suppliers and environmentally focused stores and catalog companies. In addition, some water companies and authorities offer water conservation kits for direct purchase by customers. Call your local conservation or environmental center to locate suppliers if other avenues fail.

A family of four using 12,000 gallons of water a month can save 47 percent of that water by making the improvements and behavior changes covered in this article. Over a year's time, these savings can have a substantial effect on the water supply. If a community can take on these measures house by house, the savings can be significant enough to encourage local officials and commercial users to apply conservation techniques as well. One of the greatest motivators for individuals and organizations is money. When we show a neighbor or a local official or business person how these simple conservation techniques have lowered our water and sewage bills, we have their attention. And we've proved once and for all that each of us can help to establish sustainable resources! ■

Watershed Education

Resources for Education

BY TINGLE BARNES
Barnes is Director of Environmental Education with the Audubon Society of Western Pennsylvania.

"Environmental education is a process of developing a world population that is aware of and concerned about the total environment and its associated problems, and which has the knowledge, skills, attitudes, motivation and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones." (UNESCO, 1978)

Teaching learners of all ages about local watersheds provides the opportunity to engage them in the process of watershed protection. Beginning with awareness and knowledge, learners can understand how natural systems interact within watersheds and how humans have affected and continue to affect their local watersheds. Learners who understand these concepts can then move on to select responsible actions that will improve or maintain the quality of the water in a local watershed.

Environmental education is based on a simple premise: We can't be motivated to fix something if we don't know it's broken. Likewise, we can't decide to change our behaviors if we don't know how those behaviors connect to environmental problems.

Selected Watershed Resources for Environmental Educators

The list of resources below is by no means complete and should serve merely as a way to get educators started in seeking out resources for environmental education in both formal and informal settings. To find out what programs are available for learners of all ages in your specific area, contact a local nature center, Audubon chapter or state park. Or call the Pennsylvania Alliance for Environmental Education (PAEE) at 717-236-3599.

Curricula and Activity Packets

Animal Tracks Water Action Pack (Grades 4-8). National Wildlife Federation, 8925 Leesburg Pike, Vienna, VA 22184-0001. Phone: 800-822-9919.

Keystone Aquatic Resources Education (KARE) Workshops. These workshops are available through trained facilitators from the Pennsylvania Fish and Boat Commission. They include: *Aquatic Project Wild: An Aquatic Education Activity Guide* (Grades K-12), produced by the Western Regional Environmental Education Council and Project WILD; and the *Living in Water Aquatic Science Curriculum* (Grades 4-6) produced by the National Aquarium in Baltimore. Phone: 717-657-4518.

Project WET Curriculum and Activity Guide (K-12). Available from the Watercourse and the Council for Environmental Education, Montana State University, Bozeman, MT 59717-0570. Workshops held throughout Pennsylvania are sponsored by the Pennsylvania Department of Education. Phone: 717-783-6994.

Pollution: Problems & Solutions. Ranger Rick's Naturescope (Grades K-8). National Wildlife Federation, 1990. Phone: 800-822-9919.

Leaf Pack Experiment Kits. Can be used as part of science curricula for schools and nature centers. Stroud Water Research Center. Phone: 610-268-2153, extension 247.

Water, Water Everywhere. Student reading unit for grades 6-12. Contact: HACH Company, P.O. Box 389, Loveland, CO 80539. Phone: 800-227-4224

Hands-On Save Our Streams Teacher's Manual (Grades 1-12). Izaak Walton League, 1995. Contact: 800-BUG-IWLA. $18.

Earth: The Water Planet. By Jack Gartrell et al. National Science Teachers Association, 1840 Wilson Blvd., Arlington, VA 22201-3000. Phone: 800-722-NSTA.

Water Precious Water. Produced by AIMS (Activities Integrating Math and Science). Collection of activities for grades 2-6. AIMS Foundation, P.O. Box 8120, Fresno, CA 93747-8120. $14.95.

Field Manual for Water Quality Monitoring. Activities focusing on monitoring techniques. Produced by GREEN (Global Rivers Educational Network), 721 East Huron St., Ann Arbor, MI 48104. $19.95. Website: http://www.econet.apc.org/green/.

Children's Literature and Song

(Note: Look for these titles in your local library or bookstore.)

The Magic School Bus at the Waterworks. By Joanna Cole. Scholastic, 1986. Ms. Frizzle's class shrinks to the size of raindrops to experience the water cycle.

A River Ran Wild. By Lynne Cherry. Harcourt Brace and Co., 1992. A true, richly illustrated environmental history of the Nashua River in New Hampshire. Chronicling man's interactions with a river, positive and negative, this book shows how individuals can make a difference.

Our Endangered Planet: Rivers and Lakes. By Mary Hoff and Mary Rodgers. Lerner, 1991. This is an introduction to water pollution. The authors set the stage with an introduction to the water cycle and the importance of water to all living things. Includes sources and examples of water pollution worldwide, as well as how young people can help.

Our Endangered Planet: Groundwater. By Mary Hoff and Mary Rodgers. Lerner, 1991. Addressing the depletion and pollution of this water source, the authors explain how it can be polluted by landfills, fertilizers and pesticides. They highlight a teenage winner of the Environmental Youth Award who alerted her town to the danger of household chemicals to groundwater.

Where the River Begins. By Thomas Locker. Dial, 1984. Two young boys who live along the river hike with their grandfather through the watershed in search of their river's source. Through fields and forest to a small pond in a high meadow, the boys and their grandfather have a wonderful adventure.

Videos

The Streamkeeper. Science guy Bill Nye takes potential streamkeepers on a zany journey through a watershed and shows how to investigate your stream and how to monitor and take action to protect it.

Adopt-A-Stream Foundation, 600 128th St. SE, Everett, WA 98208. Phone: 206-316-8592. 25 minutes. $19.95.

The Mighty River. This animated video focuses on the St. Lawrence but parallels the environmental history of many rivers in the Northeast. Over the ages, the river has served as a subject of fascination for adventurers and explorers as well as the object of neglect of settlers and industry.The Video Project, 5332 College Ave., Suite 101, Oakland, CA 94618. Phone: 800-4-PLANET. 24 minutes. $35.

The Murky Water Caper. A humorous, fast-paced introduction for 5- to 10-year-olds to water pollution and practical steps for preventing it. A variety of aquatic organisms enlist the help of Detective Tuesday to discover who has been polluting the local stream. The Video Project. Phone: 800-4-PLANET. 30 minutes. $35.

Acid Rain: The Invisible Threat. The story of how acid rain affects forests, lakes and our human environment is illustrated for grades 7-12. Scott Resources, Inc., P.O. Box 2121, Fort Collins, CO 80522. Phone: 800-289-9299. 20 minutes.

OTHER RESOURCES: The Audubon Society of Western Pennsylvania houses a Teacher Resource Center (TRC) at Beechwood Farms Nature Reserve, 614 Dorseyville Rd., Pittsburgh, PA 15238. Educators may borrow from a library of more than 800 environmental education references and curricula, videos and CD-ROMs. Call for more information or to be placed on the mailing list of "Seasonings," the TRC newsletter containing: information on the flora and fauna of Pennsylvania; activities to season your existing curriculum; and environmental education resources and workshops for teachers. Phone: 412-963-6100.

Professional Development

Environmental education workshops are regularly scheduled throughout Pennsylvania by Project WET and Project KARE (Keystone Aquatic Resources Education). Both are for teachers of grades K-12 and youth leaders. Find out where and when there's a workshop near you. Contact for Project WET: Patti Vathis, Pennsylvania Department of Education, Office of Environmental Education. Phone: 717-783-6994. For KARE: Pennsylvania Fish and Boat Commission. Phone: 717-657-4518. In southwestern Pennsylvania, these workshops are held at the Audubon Society of Western Pennsylvania's Beechwood Farms Nature Reserve in Pittsburgh (Phone: 412-963-6100); Powdermill Nature Reserve in Rector (724-593-6105); Lutherlyn Environmental Education Center in Prospect (724-865-9079); and Jennings Environmental Center in Slippery Rock (724-794-6011)

Another workshop series is the Pittsburgh Voyager Environmental Science Expedition Professional Development Workshops. Each workshop takes teachers aboard Voyager's floating science laboratory and introduces them to the freshwater ecology of the Three Rivers. Participants conduct water quality tests; collect and examine algae, plankton and macroinvertebrates; and observe waterfowl, birds and shoreline flora. An orientation to Voyager's classroom program and curriculum materials is included. Phone: 412-488-5602 for dates and registration information.

Global Rivers Environmental Education Network (GREEN). GREEN works with schools and communities around the world to support local efforts in watershed education and sustainability; produces a newsletter, field manuals and handbooks; and provides professional development meetings and conferences. Website: http://www.econet.apc.org/green

What Is EE?
Environmental Education in a Nutshell

EE includes a human component in the exploration of environmental problems and solutions.

EE rests on a foundation of knowledge about social and ecological systems.

EE includes the affective domain: the attitudes, values and commitments necessary to build a sustainable society.

EE includes opportunities to build skills that enhance learners' problem-solving abilities.

(Source: Defining Environmental Education, EE Toolbox, John Disinger and Martha Monroe, NCEET, School of Natural Resources and Environment, University of Michigan, Ann Arbor, MI 48109-1115.)

Field Trips (Southwestern Pennsylvania only)

A Drop in the Bucket—a multidisciplinary, day-long field experience offered to students in grades 9-12 by the Audubon Society of Western Pennsylvania at Beechwood Farms Nature Reserve. Focusing on watersheds in general and on Beechwood's pond within its watershed, students investigate the chemical and biological parameters of water and man's interactions, both positive and negative, within a watershed. Phone: 412-963-6100 for registration information.

For more information:

In 1996, Governor Tom Ridge signed an Executive Order that created the Pennsylvania Center for Environmental Education (PCEE). This partnership among eleven prominent Pennsylvania environmental education institutions ensures that the citizens of the Commonwealth have access to quality environmental education. Assistance is provided to schools, non-government organizations, individual citizens, business and industry, and other agencies. For more information, visit the Centeris website at http://www.pcee.state.pa.us or call 724-738-4502

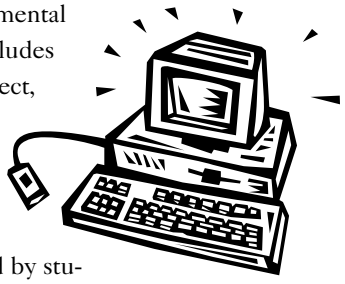
.

Pittsburgh Voyager— Pittsburgh Voyager provides a day-long field trip on Pittsburgh's Three Rivers for students in grades 5-12 that includes a teacher training component and pre- and post-trip curriculum. Students actively learn about the freshwater ecology of the Three Rivers. They conduct water quality tests; collect and examine algae, plankton, and macroinvertebrates; and observe waterfowl, birds and shoreline flora. Phone: 412-488-5602 for enrollment information.

ALCOSAN Tour—To "follow the flush" in Allegheny County, call 412-734-8353. Appropriate for middle- and secondary-school students, tours at this sewage treatment plant along the Ohio River are available April through October. After this informative tour, students will be able to answer questions about where their waste and stormwater goes.

Online Resources

Online Discussion/Watershed Idea Exchange. Post questions about watersheds. Website: http://dep.state.pa.us.



French Creek Environmental Project Homepage. Includes information on the project, participating schools, a question-and-answer bulletin board, and water quality data from the watershed collected by student monitors. Website: http://merlin.alleg.edu/FCEEP/FCEEP/index.htm.

EPA's Office of Water. Information on water quality, regulations and watersheds. Website: http://www.epa.gov/ow/.

EPA's Acid Rain Program. Includes *Acid Rain: A Student's First Sourcebook*. Background information, what can be done, experiments and activities for students and teachers. Website: http://www.epa.gpv/acidrain/student/studentz.html.

Other Resources

Watershed Education Program. DCNR Bureau of State Parks. The Watershed Education Program is a pilot project being offered to grades 6-12 at several State Parks and Environmental Education Centers throughout Pennsylvania. It takes a comprehensive approach to learning about natural resources, using monitoring, research, and decision-making skills. It also uses the Internet to allow students to compare and share their data. Phone: 717-783-4356.

Delaware Watershed Education Consortium. The consortium is a network of teachers and students in the Delaware River basin and is coordinated by the Jacobsburg Environmental Education Center. Phone: 610-746-2801.

For more information:

For an excellent recap of watershed programs in Pennsylvania schools, contact PAEE (Pennsylvania Alliance for Environmental Education) at 717-236-3599. A recent edition of the PAEE Journal (1997, Vol. 5, No. 4) was devoted to watershed education.

Environmental Advisory Councils

Ensuring Community Input in Environmental Decisions

BY ANDREW W. JOHNSON
Johnson is Vice President with the Pennsylvania Environmental Council.

(This article is adapted from the EAC Handbook published by the Pennsylvania Environmental Council (1996).)

In 1973, the Pennsylvania General Assembly passed Act 148 authorizing any municipality or group of municipalities to establish, by ordinance, an environmental advisory council (EAC). The council's role is to advise the local planning commission, park and recreation board, and elected officials on matters dealing with the protection, conservation, management, promotion, and use of natural resources located within the municipality's territorial limits.

Act 148—What It Says About EACs

Act 148 empowers Environmental Advisory Councils to:

- Identify environmental problems and make recommendations to the appropriate municipal agencies. Recommendations can include plans and programs for the promotion and conservation of natural resources and for the protection and improvement of the quality of the environment within municipal boundaries.
- Promote a community environmental program.
- Keep an index of all open space, publicly and privately owned, including flood-prone areas, swamps, and other unique natural areas, for the purpose of obtaining information on the proper use of such areas.
- Make recommendations for the possible use of open land areas in the municipality.

- Advise the appropriate local government agencies, including the city or town council, the planning commission, and recreation and park board, on the acquisition of property, both real and personal.

Multi-Municipal Councils

Act 148 gives individual municipalities the authority to join with neighboring municipalities to form regional, or multi-municipal, environmental advisory councils. Multi-municipal councils are desirable because they provide a mechanism for neighboring local governments to join together and focus on cross-jurisdictional natural systems such as watersheds, forests, or aquifer recharge areas. The regional perspective offered by a multi-municipal EAC can be highly beneficial to the participating municipalities as they plan, individually or together, for natural resource protection.

Membership and Terms

Act 148 stipulates that an environmental advisory council may be composed of three to seven members who serve without compensation and are appointed to stag-

gered three-year terms. EACs with three members have been known to function effectively, but there are significant advantages to having a full complement of seven. These advantages include access to a wider range of expertise and the ability to undertake more projects.

Members are appointed by the local governing body. In the case of multi-municipal EACs, each participating municipality appoints an equal number of members to serve on the council. Act 148 states that "whenever possible, one member shall also be a member of the municipal planning board." This cross-representation can be an important factor in the effectiveness of a council.

Beyond this recommendation, members are not required to represent specific groups or to have particular areas of expertise. Such requirements may, however, be included in the ordinance adopted by a municipality creating a council. This allows each municipality to create an EAC that is best able to deal with issues particular to its region. In general, the most important qualifications are interest in environmental issues, interest in local government and planning issues, and willingness to devote time to the council's projects. Nevertheless, it is always helpful to have at least some members with expertise in relevant areas of science and planning.

When new councils are formed, and when vacancies on existing councils occur, the governing body (although not required by law to do so) should advertise the open positions and attempt to fill them with a broadly representative group of individuals. In the event that there are more applicants than positions, the governing body can establish an associate member program. Associate members can provide valuable assistance on council projects, and should be given primary consideration when openings on the council occur.

The EAC Network

Since the enactment of Act 148 in 1973, relatively few communities have created EACs. In response, the Pennsylvania Environmental Council established the EAC Network in 1990 to assist communities in starting EACs, and as a means of support for established councils. The Network's goals are to promote EAC programs in communities across the Commonwealth, to strengthen their role in local environmental decision-making, and to encourage the state to provide them with assistance.

Officers

The chair of a council is selected by the governing body, except in the case of a multi-municipal EAC, where the chair is selected by the council itself. The enabling legislation does not mention the election of other officers, but the general practice in Pennsylvania has been for local ordinances establishing councils to provide for the election of other officers (e.g., vice chair, recording secretary) at the first or second meeting each year. The local ordinance also can spell out the terms and responsibilities of these officers.

Council Budget

Act 148 does not mandate that EACs have designated funding; therefore, environmental advisory councils in Pennsylvania operate on budgets ranging from nothing to thousands of dollars. A governing body may want to consider a minimum budget of $500 to cover the basic operating expenses that will enable a council to function effectively.

Getting Started: Establishing an EAC through Municipal Ordinance

Act 148 does not establish individual environmental advisory councils. Rather, it gives municipalities the authority to establish them by ordinance and provides guidance on their powers and responsibilities. These ordinances must be consistent with Act 148 and should include details on subjects such as officers, budget and recommended projects. The language used in Act 148 is general enough so that an ordinance can be drafted with similar wording. In other cases, the establishment of an EAC can be incorporated into another environmentally based initiative of the municipality. The powers and duties of the EAC are then related to the goals of that initiative.

Although local governing bodies may propose and act on an ordinance establishing an environmental advisory council, they are not mandated to do so. Therefore, it is often up to residents of a community to propose to their elected officials that a council be established.

To find out if there is an EAC in your community, call the municipal offices. If there is no EAC and you

are interested in seeing an environmental advisory council established in your municipality, consider the following suggestions:

- Contact the EAC Network at 1-800-322-9214 for EAC case studies and model ordinances describing the activities and responsibilities of other EACs around the state.
- Before contacting members of your governing body to suggest that they establish an EAC, attend several of their meetings to get a sense of how they work, and to learn their views on local issues.
- Introduce yourself to members of your governing body so you will be familiar to them.
- Talk to friends, neighbors and other acquaintances about an EAC, and make a list of people who are interested in serving on one.
- Talk to your governing body members informally about EACs, explain what they are, suggest projects an EAC might undertake, and ask for their suggestions on steps you can take to promote the idea of establishing a council. It might be helpful to tell them you have identified other residents who are interested in serving on an EAC.
- Emphasize the fact that EAC members are appointed by the governing body and serve in an advisory capacity to that body. Some local officials may be concerned that the establishment of an EAC will create a new layer of bureaucracy when, in fact, EACs are charged only with advising and educating the people who appoint them on environmental issues.
- Present an EAC to your local officials as a source of free research on environmental issues. One of the jobs of an EAC can be to research the environmental impacts of land-use proposals and to report its findings to the governing body to assist local officials in making decisions.

It is likely that the governing body will suggest that you submit a written proposal outlining your ideas for an EAC. Be prepared to do so, and be sure to include a list of projects you think the new council should undertake, keeping in mind the needs of the municipality.

Creating an Effective EAC

To be effective, your EAC will need to establish procedural and organizational guidelines that govern the council's work. Consider the following suggestions:

Organization of the Council:

The Role of Individual Members

The governing body will designate the council chair, but in most cases EAC members designate other officers provided for under the local ordinance (e.g., recording secretary). In addition, it can be helpful to make sure that each member has an assignment (e.g., as a liaison to a municipal board, or as editor of a council newsletter) that fits her or his interests and abilities. Members should report on their assignments at each meeting, with the meetings serving as deadlines for getting work done. As time passes, individual members will develop areas of expertise related to their assigned tasks, a situation that will reap rewards for both the council and the municipal bodies it advises.

Committees

Organization of standing and special committees can enable your council to delve into issues in greater detail. Committees examine issues closely, meet periodically, and report to the full council on a regular basis. It is advantageous to form standing committees that relate to specific municipal functions, such as land use, parks and public open space, and areas of ongoing interest, such as public education. Special committees can be created to look at single issues that arise and do not fall under the purview of a standing committee.

Associate Members

Act 148 places a cap on the number of official members who may sit on an environmental advisory council. To include more people, consider the establishment of an associate members program. Associate members usually don't vote but may participate in all other council activi-

ties and serve on standing and special committees. It may be desirable to have an associate member serve as recording secretary for the council to ensure that all appointed voting members will be able to fully participate in meetings. Associate members can be an important source of expertise, and may be given high priority for appointment to the EAC when vacancies occur.

Effective Meetings

Meetings should be scheduled regularly, usually monthly, in a public place. At the meeting, provide a printed agenda, preferably one that was agreed to at the conclusion of the last meeting and added to by members in the time between meetings. Agendas should always allow time for public comment and new business.

During the meeting, have someone take minutes. These minutes should make note of the members present, subjects considered, decisions made, actions taken, and tasks assigned. Preparing a meeting agenda and providing meeting minutes may seem unnecessarily bureaucratic, but they are important tools in operating an effective council.

Possible EAC Projects

- Develop an Environmental Resource Inventory
- Interact with the Planning Commission on Site Plan and Subdivision Review
- Develop and Maintain an Open Space Index
- Develop an Open Space Plan
- Develop Natural Resource Protection Ordinances
- Coordinate Stream Watch Efforts
- Hold Local Forums on Environmental Issues
- Hold Regional EAC Meetings to Discuss Watershed Issues

Communicating with the Public

Your EAC's communications with the public will help ensure that you are educating local residents on important environmental issues and building public support for policies advocated by the council or your governing body. Communication with the public is often most effective when it is a give-and-take process—the residents of your town will be a source of many important ideas and perspectives on environmental issues. To promote interactive contact with the public and to nurture a sense involvement among community residents, consider the following actions:

- Survey residents to ask what they think are the most important environmental issues facing your municipality. Use the results to help set your council's priorities and to persuade local officials to make changes where there is popular support to do so.
- Seek out information on environmental issues, programs or projects that may affect the environment from community leaders, including representatives of the municipal bodies your EAC advises, and representatives of civic organizations.
- Post a list of environmental advisory council members on public bulletin boards, print it in your local paper or municipal newsletter, and encourage residents to contact them.
- Send meeting minutes and agendas to local media outlets.
- Send press releases about major events and decisions to the same media outlets.

Types of EAC Programs and Projects

In general, an environmental advisory council should develop programs and products to:

- Assist local officials in making policy decisions that relate to resource protection;
- Educate the public on natural resource protection and other environmental issues; and
- Coordinate activities to physically improve the municipality's environment.

Before launching any projects, however, an environmental advisory council should always assess its capabilities and the demands of proposed projects. Setting unrealistic goals or overextending is not a good

practice, particularly when the key players are volunteers. A range of projects can be undertaken and tailored to meet the capabilities of every council.

For all councils, old or new, a principal goal should be to establish a reputation for being able to undertake and complete worthwhile projects. Projects should show that the council has the ability to make a difference. This is necessary both to sustain the interest of your volunteer members and to gain the confidence of the elected officials and appointed boards the council advises. It is essential that an EAC build its reputation so that it will be accepted by all levels of local government and included in "the loop." ■

For more information:

Call the Pennsylvania Environmental Council at 1-800-322-9214 for more information and for samples of work done by EACs around the Commonwealth.

Fundraising for Watershed Protection

Fishing for Dollars

BY MELISA CRAWFORD
Crawford is Program Associate with The Heinz Endowments.

Before writing anything, do your homework! Don't submit a grant proposal to any grantmaker or donor without learning as much as you can about the organization. Thorough planning, organizing and research is critical to successful fundraising.

Beginning the Proposal Planning Process

1. Commit your concept to paper.
2. Describe the project, list strategic partnerships.
3. State goals, objectives and strategies.
4. Construct a timeline.
5. Prepare a budget with project costs such as staff, consultants, materials, travel, equipment and administrative fees. Show funding from other sources when applicable.
6. Include a plan for program evaluation and expected measures and outcomes.
7. Last but not least, make sure all IRS and other necessary paperwork is in order and ready when requested. Remember: foundations by law can only give funding to 501(c)3, tax-exempt organizations.

Narrowing Your Target

First, identify a small number of prospective foundations and organizations to which you will apply. It is more efficient and more effective to send well prepared requests to fewer organizations than to send a generic letter of inquiry to many. While your first proposal may not be funded, a well thought-out program that is within the guidelines of the foundation may leave a positive impression for the next time around.

Remember: foundations always receive more inquiries than they have the resources to fund; the majority of proposals are turned down. In order to increase your odds of success, learn about the goals and strategies of your prospective funders. What areas do they support? Are there any other projects similar to yours? In what way can you complement and enhance the work of these organizations? Why would they be interested in your proposal? Crafting your proposal in a way that shows you are familiar with the philosophy of the potential grantor shows strategic thinking and initiative. This is an important first step in the grant application process.

A river otter reintroduction project on the Allegheny River was made possible when local groups raised the necessary funds.

Once you have determined that you are sending your proposal to an interested party, make sure you are familiar with the application guidelines of the organization. Many grantmakers prefer a letter of inquiry or a face-to-face meeting as the first step. Others want a full proposal with all the required supporting documentation. And some funders have specific forms that start the inquiry process. So again, familiarize yourself with the application procedures—it will save time, energy and ultimately produce more positive results.

The relationship between grantee and grantor is most successful when it is a cultivated relationship of mutual respect and responsibility. It is the grantor's responsibility to review requests with an open mind

and to make fair decisions in a timely fashion. For the prospective grantee, the responsibility is to do the necessary research and present a clear and thoughtfully written proposal.

The Letter of Inquiry

Before setting out to create a full proposal, remember that many funders prefer to receive letters of inquiry first in order to determine the compatibility of your project with their interests. A letter of inquiry describes the main components of the proposal, including the purpose of the program, goals, strategies, primary partnerships and funding sources. The principal objective of this letter is to initiate a dialogue and to encourage the funder to invite you to submit a full proposal.

Some grantmakers supply instructions on what a letter of inquiry or proposal must contain to be considered for funding. In other cases, groups of funders such as Grantmakers for Western Pennsylvania use common grant applications. If instructions aren't available, follow suggested guidelines supplied by resources such as The Foundation Center in New York City (see contact information on page 130).

The Proposal

In their book, *The Foundation Center's Guide to Proposal Writing*, authors Geever and McNeill state, "The proposal does not stand alone." Proposal writing, in other words, is just one step in the grantseeking process. It is the programming or the project itself that ultimately determines whether the organization will be funded. Consequently, grantseekers need to spend the majority of their time fully developing the project concept and then pinpointing the most appropriate potential grantmakers. Once these two steps are complete, the pieces of the proposal writing process should fall more easily into place.

Once you begin writing the formal proposal, remember the following tips:

- Respect the deadline(s) of the organization to which you are applying;
- Keep in mind those who will benefit from the project;
- Use the active rather than the passive voice;
- Avoid using jargon or acronyms without clarification;
- Be concise; keep paragraphs short; employ headings and subheadings. Most organizations prefer around 4-6 pages with limited appendices (unless otherwise directed);
- Traditional typing style is best (e.g. 12 point font, Times Roman, double spaced). Use paperclips and staples so the receiver can easily make copies if needed;
- Number the pages;
- Use quantitative data such as charts and statistics only where appropriate; and
- Keep appendices to a minimum by adding only a limited number of attachments, press releases, news clippings, resumes, etc. The most commonly requested attachments include: a copy of your organization's 501(c)(3) letter from the IRS; a list of your organization's trustees; a copy of your organization's budget and most recent financial audit; and a brochure describing the organization.

The Elements of a Proposal

At a standard length of three or four pages, a proposal typically answers the following questions:

- What are the goals, objectives and action plan?
- What are the distinguishing features of the program?
- How is the program consistent with the funder's goals?
- Why is the proposed program needed?
- Who are the target populations and how will they benefit?
- What monitoring and evaluation methods will you use?
- What are the qualifications of the staff and the organization to undertake this project?
- What is its estimated cost?

Remember: preparing a proposal packet requires critical thinking. Put yourself in the reader's place; keep it

simple. Only include the information you would want to see if you were the grantor. Finally, always address your cover letter to an individual, generally the program director or executive director. Never start out with "Dear Sir" or "To Whom It May Concern." Verify the spelling of names, titles and addresses. It's important to start the reader's experience on a positive note; you want to avoid glaring mistakes up front.

After the Submission

Submitting your proposal is only the beginning of your involvement with the grantmaker. Grant review procedures vary, and the decision-making process can take anywhere from six weeks to six months. During the review process, the funder may request additional information either directly from you or from your references. If you are unclear about the process, don't hesitate to ask.

Unless you are otherwise directed, it is usually best to wait until you are contacted by the grantmakers. Many funders send out a response letter that your proposal or inquiry has been received. This is generally a formality but nonetheless a part of the process. Patience usually works in your favor.

If your hard work results in a grant, write a letter of gratitude acknowledging the funder's support. Generally you want to address the letter to the chairman of the board who made the final grant decision. Find out if the funder has specific forms, procedures and deadlines for reporting the progress of your project. Clarifying your responsibilities as a grantee at the outset will prevent misunderstandings and more serious problems later.

Be aware that, once you are notified a grant has been awarded, there is usually a delay of up to six weeks before a check is issued. It is wise to submit a proposal six to nine months before a project is expected to be implemented—this allows time to apply elsewhere if you are not successful. If your request was denied and you have additional questions, follow up with a phone call.

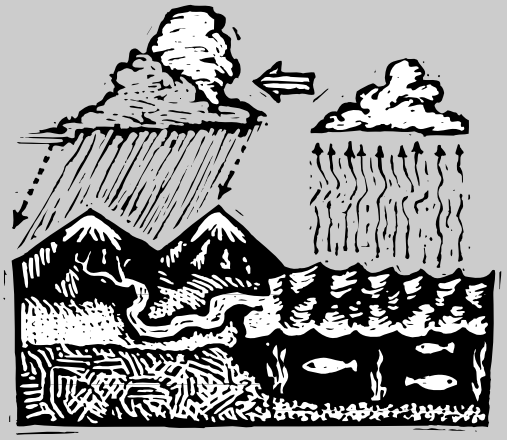
Normally, letters of regret indicate the reason for rejection—but rejection is not necessarily the end of the process. Ask the program staff if they have any suggestions or recommendations, or if they would be interested in considering the proposal at a future date. Put them on your mailing list so they can become better acquainted with your organization. It's never too late to build relationships with prospective funders. And remember: there's always another year! ■

For more information:

- The Foundation Center, New York, NY. Website: www.fdncenter.org.
- Environmental Support Center, Washington DC. Phone: 202-966-9834.
- The Grantsmanship Center, Los Angeles, CA. Phone: 213-482-9860.
- Chardon Press. Website: www.chardonpress.com.
- Non-profit Training Associates & Rose Tree Media Education Foundation, Media, PA. Phone: 610-565-3552.
- River Network Partners. Website: www.rivernetwork.org. Newsletter: *River Fundraising Alert*.
- Institute for Conservation Leadership, Tacoma Park, MD. Newsletter: *The Network*. Phone: 301-270-2900.
- Western Organization of Resource Councils. Publication: *Direct Mail on a Shoestring* by Bruce Ballenger. Phone: 406-252-9672.
- *Grassroots Fundraising Journal*. Phone: 510-704-8714.
- The Conservation Alliance. Website: www.outdoorlink.com.
- The Conservation Coalition. Phone: 603-876-3324.
- Rivers Conservation Program, Pennsylvania Department of Conservation and Natural Resources. Phone: 717-787-2316.
- West Virginia Stream Partners Program. Phone: 800-556-8181.

(Note: public and university libraries may have additional information on fundraising.)

Government Agencies



Government Agencies

Federal and State Agencies

Information compiled by the Allegheny Watershed Network

A number of federal and state agencies have responsibility for various aspects of watershed protection and restoration in Pennsylvania. These agencies are described below. For more information on these and other agencies, check the World Wide Web.

United States Department of Agriculture

U.S. Forest Service

The U.S. Forest Service (USFS) is a federal agency within the U.S. Department of Agriculture that manages public lands in national forests and grasslands. These public lands, known as the National Forest System, are managed for multiple uses and benefits including water, forage, wildlife, wood and recreation. The Forest Service conducts forestry research through a network of experiment stations and the Forest Products Laboratory. It also provides technical and financial assistance to state and private forestry agencies for lands in non-Federal ownership.

Natural Resources Conservation Service

The Natural Resources Conservation Service (NRCS) is the U.S. Department of Agriculture's lead conservation agency. Its mission is to assist people in conserving, improving and sustaining our natural resources and environment. NRCS works in partnership with state and federal agencies, as well as agricultural and environmental groups. The agency works very closely with county conservation districts.

NRCS employees offer technical assistance in a variety of fields, including soil science, soil conservation, agronomy, biology, forestry, engineering, geology, hydrology, cultural resources and economics. While most of the technical assistance provided by NRCS is directed at farmers and ranchers, the agency also provides assistance to rural and urban communities to reduce erosion, conserve and protect water, and solve other resource problems. Financial assistance programs are available, too.

United States Department of Defense

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (USACE or Corps) provides comprehensive engineering, management, and technical support to the Department of Defense, other federal agencies, and state and local governments. Some of the responsibilities of the Corps include: protecting the nation's waterways and wetlands; planning, designing, building and operating projects that provide river and harbor navigation, flood control, water supply, hydroelectric power, environmental restoration, wildlife protection, and recreation; and performing disaster relief and recovery work.

U.S. Environmental Protection Agency

The mission of the U.S. Environmental Protection Agency (USEPA) is to protect human health and the natural environment. The agency is involved in air, water and land issues.

Within the USEPA is the Office of Water, which is responsible for implementing the Clean Water Act, Safe Drinking Water Act, portions of the Coastal Zone Act Reauthorization Amendments of 1990, Resource Conservation and Recovery Act, and several other marine-related statutes. The Office of Water works to prevent pollution and reduce risk for people and ecosystems. It works with other federal and state agencies, organized professional groups, land owners and managers, and the general public. The Office provides guidance, specifies scientific methods and data collection requirements, performs oversight, and facilitates communication among those involved. Departments that make up the Office of Water include: Office of Wetlands, Oceans and Watersheds; Office of Science and Technology; Office of Wastewater Enforcement and Compliance; and Office of Ground Water and Drinking Water.

United States Department of Interior

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) is a bureau within the Department of the Interior that conserves, protects and enhances fish and wildlife and their habitats. The USFWS is responsible for migratory birds, endangered species, freshwater and anadromous fish, wetlands, habitat conservation, environmental contaminants, and the National Wildlife Refuge System. The USFWS consults with government agencies at the state and federal levels about environmental issues—including environmental impact statements and assessments prepared by other agencies—and advises on the potential effects that these other agencies' activities may have on fish, wildlife and habitat. States receive federal funds through the USFWS for wildlife management and education programs. The USFWS also works with private landowners to restore wetlands through its Partners for Wildlife program.

U.S. Geological Survey

The U.S. Geological Survey (USGS) is the country's largest earth science agency. The USGS is responsible for researching the quantity, quality, and location of the nation's water resources. USGS works in cooperation with other federal, state and local agencies, universities, and research centers to collect, interpret and analyze their water data.

One of the projects of the USGS is the National Water Quality Assessment Program (NAWQA). This program assesses historical, current and future water quality conditions in representative river basins and aquifers nationwide.

National Park Service

The National Park Service (NPS) manages areas in the National Park System—including natural areas, historical areas, and recreational areas—for enjoyment and education. The Park Service also provides assistance for river, trail and conservation projects. NPS staff can assist communities in river, trail and greenway planning, in regional assessments and inventories, and in networking with other professionals and citizens groups.

Office of Surface Mining Reclamation and Enforcement

The Office of Surface Mining Reclamation and Enforcement, commonly known as the Office of Surface Mining (OSMRE or OSM), is a bureau of the U.S. Department of the Interior with the responsibility to protect citizens and the environment during coal mining and reclamation, and to reclaim mines abandoned before 1977.

Pennsylvania State Agencies

Department of Community and Economic Development

The Department of Community and Economic Development (DCED) coordinates and administers a number of housing, community and economic development programs for the state and its municipalities. It also gives technical assistance to municipalities on planning and zoning and is responsible for developing and administering a statewide flood plain management program.

Department of Conservation and Natural Resources

The Department of Conservation and Natural Resources (DCNR) is responsible for maintaining, improving and preserving state parks; managing state forest lands; providing information on the state's ecological and geologic resources; and administering grant and technical assistance programs that will benefit rivers conservation, trails and greenways, local recreation, regional heritage conservation, and environmental education programs.

Department of Environmental Protection

The Department of Environmental Protection (DEP) has responsibility for the administration and enforcement of Pennsylvania's environmental laws. It issues permits that are necessary for certain activities and provides services to address environmental issues, such as waste disposal, water quality protection, wetlands protection, air quality and radiation protection, mining, quarrying, community health and recreation, enforcement, and education.

Department of Transportation

The Pennsylvania Department of Transportation (PennDOT) has jurisdiction over the planning and construction of all roads other than township and county roads. Under the National Environmental Policy Act (NEPA), an environmental impact study is required for any road or facility using federal funds. Under state law (Act 120), PennDot must consider the environmental impacts of proposed roads and facilities and avoid taking wetlands, prime agricultural lands, etc., unless no alternatives exist. Public hearings must be held to respond to local environmental and social concerns.

Fish and Boat Commission

The Pennsylvania Fish and Boat Commission (PFBC) sets rules and regulations governing fishing and boating in and on all inland and boundary waters of the Commonwealth. In addition to managing and protecting the state's aquatic resources, the Commission is responsible for all of the state's reptiles and amphibians. Among its activities, the Commission offers a variety of educational programs, produces publications, and directs research, propagation, management and protection of fish, fisheries, habitat, reptiles and amphibians.

As an independent state agency, the Commission is supported by anglers' and boaters' dollars generated through the sale of fishing licenses and boat registrations.

Game Commission

The Pennsylvania Game Commission is responsible for managing all of Pennsylvania's wild birds and mammals. This includes monitoring wildlife populations, enforcing laws and regulations, setting seasons and bag limits, making habitat improvements, providing protection, informing and educating the public, and assessing public satisfaction. The Commission is funded primarily through license revenues, state game land timber sale profits, and a federal excise tax on sporting arms and ammunition. No General Fund appropriations are used to support the Commission.

Other Agencies

Chesapeake Bay Program

The Chesapeake Bay Program is responsible for the restoration and protection of the Chesapeake and the living resources of the Bay. Membership consists of representatives from the U.S. Environmental Protection Agency, Maryland, Virginia, Pennsylvania, the District of Columbia and the Chesapeake Bay Commission.

Delaware Estuary Program

The Delaware Estuary Program was created by a Comprehensive Conservation and Management Plan adopted by Pennsylvania, Delaware and New Jersey. The program implements recommendations and plans that will protect and restore the living resources of the estuary while maintaining the economic vitality of the region.

Delaware River Basin Commission

The Delaware River Basin Commission is responsible for managing the water resources of the Delaware

River Basin through basin-wide planning and management. The commission's duties include establishing water quality standards and planning, designing, funding and operating facilities for water supply and pollution control.

Great Lakes Commission

The Great Lakes Commission is a partnership of eight states in the Great Lakes Watershed that works to guide, protect and advance the common interest of members in regional environmental quality, resource management, transportation and economic development. Input is provided by members, U.S. and Canadian federal agencies, and provincial, regional and tribal groups.

Interstate Commission on the Potomac River Basin

This commission was established through a 1948 Act of Congress to improve and preserve the water quality of the Potomac River. The commission works with member states for cooperation on a full range of watershed issues.

Ohio River Basin Commission

The Ohio River Basin Commission coordinates water-related land resource planning throughout the Ohio River Basin. The commission represents regional interests to Congress and other federal agencies and provides a forum for member states to discuss, study and develop regional policies and positions on interstate issues dealing with water quality and land resources.

Ohio River Valley Water Sanitation Commission

This interstate agency establishes pollution control standards regulating wastewater discharges to the Ohio River. The commission acts through a variety of programs that monitor water quality and identify pollution problems.

Resource Conservation and Development Councils

The Resource Conservation and Development (RC&D) program is a national initiative that helps rural communities improve their economies through the wise use and development of natural resources. Each RC&D area is an independent, nonprofit organization directed by local citizens, funded by a charitable trust, and administered by staff of the U.S. Department of Agriculture's Natural Resource Conservation Service.

Susquehanna River Basin Commission

The Susquehanna River Basin Commission is a federally funded agency that manages the water resources of the Susquehanna River, with a concern for protecting the receiving waters of the Chesapeake Bay.

Municipal Government in Pennsylvania

This information is adapted from The EAC Handbook published by the Pennsylvania Environmental Council (1996).

Local governments in Pennsylvania are deeply involved in a variety of issues affecting the protection of the state's water resources. Understanding the different categories of municipal government, as well as their roles in relation to environmental issues, is critical to achieving success.

Five Categories of Municipal Government

There are five major categories of municipal government in Pennsylvania. Of these, three are different types of local government—boroughs, townships and cities. The fourth category of municipal government in Pennsylvania comprises the counties, and the fifth the home-rule municipalities. This latter category can include members of any of the previous four categories, provided they adopt a home rule charter according to the requirements of the law. Members of all five categories (even counties) are municipalities, and therefore are authorized under the law to establish environmental advisory councils.

In Pennsylvania, there are 2,639 of these municipal, or general purpose, units of government. Of these, 67 are counties. Including school districts and authorities in addition to the municipalities, there are a total of 5,792 government bodies in the Commonwealth.

The five forms of municipal government were established by the Pennsylvania General Assembly. By constitutional and common law, the state has authority over the land and water resources of Pennsylvania. Through the legislature, however, the state has chosen to delegate much of its power to regulate land to the local and county municipalities. As a result, each local government has only the powers specified by the legislation that created its form (e.g., borough or city). In most cases, the boundaries of local governments were established in the early stages of the state's development and were governed by natural barriers (rivers or ridges, for example) and not by state mandate.

Stonycreek

The following is a brief overview of the five categories of municipal government in Pennsylvania.

Boroughs

Boroughs in Pennsylvania represent 38 percent of all general-purpose municipal governments. They range in population from under 1,000 to 36,000 and are governed by the Borough Code. Boroughs have a strong and dominant council—the official governing body—and a "weak" executive, or mayor. Other elected officials, including a tax collector and an assessor, are independent of the council.

Boroughs may be divided into wards, with each ward having one, two or three elected council representatives. Boroughs without wards have three, five or seven council representatives who are elected at large. In either case, the powers of the council are extensive and cover virtually the whole range of municipal functions. A borough manager or secretary is often appointed to carry out the day-to-day activities of the borough government.

Townships

There are two types, or classes, of townships: first class and second class. Townships are governed by the Township of the First Class Code and the Township of the Second Class Code, respectively. Townships of the first class generally serve urban and suburban areas and are more densely populated than townships of the second class, which generally serve more rural areas. Both classes, however, have less government than other classes of municipalities.

All townships are second class except those where first class status has been approved by local voters through referendum. A township of the first class has a population density of at least 300 people per square mile. Its governing body is comprised of five to 15 elected commissioners with staggered, four-year terms. A township of the second class has a governing body of three or five at-large supervisors elected to staggered five- or six-year terms. In both classes of townships, the governing body appoints a variety of officials, including a township secretary, engineer and solicitor. Other appointed positions can include: township manager, police chief, zoning officer, planner, building inspector, recreation director, emergency management coordinator, and sewage enforcement officer.

Third Class Cities

Third class cities operate under a commission form of government, with a mayor and four councilors. The mayor is a member and serves as president of the council. All third class cities are governed by the Third Class City Code. Each councilor is in charge of one of the city's major departments. These officials and the controller and treasurer are elected at large for four-year terms. Appointments of all other city officers and employees, including the city manager, are made by the council.

Home-Rule Municipalities

Philadelphia, Pittsburgh and Scranton—along with 11 other cities, 16 boroughs and 25 townships across the state—have adopted home-rule charters. The charters reflect variations of the mayor-council, council-manager, weak mayor, and commission forms of government. Many home-rule boroughs and townships have adopted the title "municipality" to distinguish themselves from units operating under the borough and township codes.

In a home-rule municipality, the mayor, or executive, has broad appointive and removal powers and control over the administration of the municipality; is responsible for preparing the annual budget and recommending measures for consideration by the council; and can veto legislation. Mayoral vetoes can be overridden by a two-thirds majority vote in the council.

Counties

Counties are governed by the County Code and are funded to provide and coordinate a number of services to the municipalities that are located within their boundaries. Most county funding comes through taxation and bond issues. The state Constitution and state law establish the basic organization of county government, but each county may adapt this format to conform to its particular needs. The chief governing body is a three-member board of elected county commissioners. The 11 other elected officials in a county (including sheriff, district attorney and recorder of deeds) operate independently of the commissioners. All counties have, or share, a planning director and an appointed planning commission.

Nonmunicipal Local, County and Regional Government Units

The following nonmunicipal government units can play a significant role in environmental issues in Pennsylvania municipalities:

Authorities

Unlike boroughs, townships and cities, authorities are not government bodies with general powers. They are created by local municipalities or counties to perform specific services, such as the construction or operation of sewage or water systems. Authorities are authorized to finance these actions through borrowing and issuing bonds. Authority projects can include: public facilities such as school buildings; transportation facilities; marketing and shopping facilities; waterworks; sewage treatment plants; playgrounds; hospitals; and industrial

development projects. Authorities have become increasingly important entities, particularly for organizing and executing joint municipal projects, such as joint water and sewer systems.

County Conservation Districts

County conservation districts are the lead agencies, at the county level, for coordinating local resource conservation efforts. They are staffed by local volunteers as well as by technical and educational professionals who work to create programs that coordinate the conservation efforts of local municipalities and preserve the environmental characteristics unique to each county. County conservation districts were created by the state conservation commission under the County Conservation District Act. Sixty-six of Pennsylvania's 67 counties have conservation districts and the sixty-seventh, Philadelphia County, has a conservation partnership that carries out many of these same responsibilities.

The powers and duties of County Conservation Districts include: aid to farmers, particularly in promoting "best farming practices" in managing soil, nutrient and farmland resources; review of county development plans with regard to management and control of soil erosion, land use, stormwater runoff, farmland preservation and wetlands protection; issuance of permits for erosion and sedimentation control on behalf of the Department of Environmental Protection; assistance to developers through the provision of expertise in soil erosion control, woodlot management, wetlands protection and abandoned mineland reclamation; assistance to educators through environmental education programs; and assistance to engineers, contractors and foresters through seminars and workshops on topics related to local, state and federal laws and regulations.

Planning Agencies

MUNICIPAL PLANNING AGENCIES (planning commissions, planning departments or planning committees) are important components of local government. They are appointed by local governments to advise and make recommendations about land use and development issues.

PLANNING COMMISSIONS. The Pennsylvania Municipalities Planning Code provides for municipalities to designate planning commissions as approving entities if so desired; however, this is rarely done. In most cases, planning commissions are charged only with making recommendations to elected officials; governing bodies then render decisions on development applications.

PLANNING DEPARTMENTS. A municipality may have both a planning commission and a planning department. The roles of a planning department may include providing technical assistance; reviewing plans and making recommendations to the planning commission, zoning hearing board, EAC, and governing body; managing day-to-day code enforcement; developing and updating plans and ordinance; and serving as a repository of community information. In general, counties, cities and large boroughs have planning departments, and less populous municipalities do not.

Powers and Duties of Planning Agencies

Under the Municipal Planning Code, planning agencies have a variety of powers and required duties, including preparation of a comprehensive plan. They may also, at the request of the governing body:

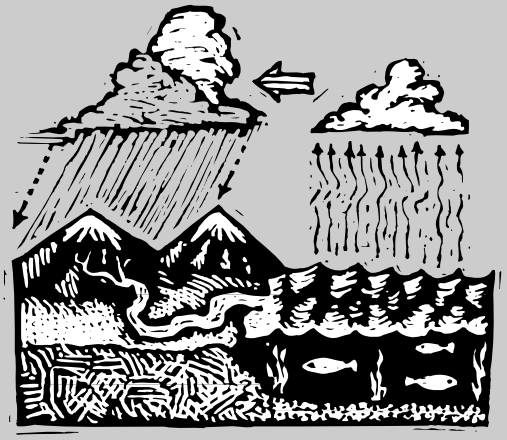
- make recommendations concerning the adoption or amendment of an official map to reflect the provisions and goals of the comprehensive plan;
- prepare or amend zoning ordinances;
- prepare and administer subdivision and land development and planned residential development regulations;
- prepare an environmental study to be presented to the governing body;
- develop recommendations to the governing body for a capital improvements program;
- prepare a water survey, consistent with the State Water Plan and any applicable water resources plan adopted by a river basin commission;
- promote public interest in and understanding of the comprehensive plan and planning in general;
- prepare a study of the feasibility and practicality of using renewable energy sources in specific areas of the municipality; and
- review the zoning ordinance, the subdivision and land development ordinance, the official map, local provisions for planned residential development, and other ordinances governing the development of land.

PLANNING COMMITTEES. If a municipality does not choose to create a planning commission or department, it may form a planning committee made up of elected members of the governing body to carry out the planning responsibilities of the municipality. However, even in very rural municipalities, the responsibilities of elected officials are significant enough that it is advisable to appoint a planning commission or department to carry out these time-intensive duties.

Zoning Hearing Board

Under Article IX of the MPC, any municipality that adopts a zoning ordinance must create a zoning hearing board (ZHB) to hear challenges to the validity of ordinances, appeals of the actions of the zoning officer or municipal engineer, and applications for variances or special exceptions. The powers of the zoning hearing board are enumerated in the MPC. ■

Laws and Regulations Affecting Waterway Protection



Laws and Regulations Affecting Waterway Protection

Statutes and Regulations Affecting Waterways Protection

Navigating the Acts and Codes

BY JOHN J. WALLISER, ESQ.
Walliser is Staff Attorney with the Pennsylvania Environmental Council.

Statutes and regulations relating to the protection of Pennsylvania's water resources are both diverse and intertwined. A single activity affecting a waterway may invoke several different statutes and regulations, whether local, state or federal.

In many cases, both the federal government and the Commonwealth have statutes and agencies that regulate the same threats to the environment. When this happens, many federal statutory regimes allow the states to enforce their own regulations. This situation is often referred to as "primacy"; the state assumes the responsibility of implementing and enforcing environmental regulation, subject to federal approval and oversight.

The following descriptions of selected statutes and regulations are presented only as a basic introduction and are far from complete — a truly comprehensive survey of all relevant statutes and regulations would be larger than this primer itself! It is important to remember that statutes and regulations are notably susceptible to change. Though current at the time of this writing, the explanations that follow may be outdated and inaccurate by the time they are read. For these reasons and more, nothing in this chapter is intended or designed to render any form of legal advice or interpretation. This chapter, in other words, is not a substitute for legal or other professional counsel.

Urban Schuykill River.

Water Quality

Discharges to Water

CLEAN WATER ACT (FEDERAL WATER POLLUTION CONTROL ACT) [33 U.S.C. §§ 1251 TO 1387]; PENNSYLVANIA CLEAN STREAMS LAW [35 P.S. §691.1 ET SEQ.].

The federal Clean Water Act establishes a permit process — the National Pollution Discharge Elimination System (NPDES) — for the discharge of any pollutant from a point source into the waters of the United States. "Pollution" includes additions or alterations to a waterway such as changes in water temperature or dissolved oxygen. A point source is any discernible, confined or discrete conveyance from which pollutants are or may be discharged. The Clean Streams Law gives Pennsylvania primacy to implement

the permit system by providing the Department of Environmental Protection (DEP) with the authority to adopt and enforce water quality standards and regulations.

The quality (concentration) and quantity (load) of pollutants that may be discharged are set by a permit, which also defines monitoring and reporting requirements. The permittee must comply with federal technology-based effluent limitations, determined on an industry-by-industry basis, as well as state water quality standards, which are based on designated protected uses for each waterway in Pennsylvania. These uses define the "water quality goals" of the waterway, such as aquatic life or water supply, as well as the criteria (acceptable levels of different parameters) to protect that use. Therefore, each permit is uniquely dependent on the water quality of the receiving water.

NPDES permits have a fixed term of no more than five years. A separate permit, a Water Quality Management Permit, must be obtained to construct and operate any treatment facility or system relating to the NPDES permit requirements. Public notice and comment requirements are an important part of both permit processes.

Nonpoint source pollution, such as stormwater runoff, does not require a permit under this regime. However, under the Clean Water Act, Pennsylvania is required to protect existing instream uses and the level of water quality necessary to maintain those uses. In addition, several nonpoint sources fall under other regulatory programs, which are addressed later in this chapter.

Another component of the Clean Water Act that is applicable to Pennsylvania is the Great Lakes Initiative, under which the U.S. Environmental Protection Agency (USEPA) establishes specific water quality standards regarding discharges into the waters of the Great Lakes. These standards may be more restrictive than state water quality requirements and apply to all permits for all waterways that drain to the Great Lakes.

The Clean Water Act also contains an "antidegradation policy" for the protection of existing water quality and use. Whether Pennsylvania adequately fulfilled this requirements was the subject of a great deal of debate over the last few years, including: a determination by the USEPA that the state antidegradation program was deficient; a federal lawsuit against USEPA to enforce the Clean Water Act provisions; a 14-month regulatory negotiation; and the eventual move by USEPA, under court order, to impose its own program on the Commonwealth.

The Federal antidegradation regulations require different standards of protection for water quality depending on existing conditions. This is done by dividing waters into three "tiers" based upon the existing uses of the waterbody and how the water quality relates to those uses. In determining what constitutes a "use", the state implementing the program "must take into consideration the use and value of water for public water supplies, protection and propagation of fish, shellfish and wildlife, recreation in and on the water, agricultural, industrial, and other purposes including navigation."

In Tier 1 waters, a state must act to protect existing instream uses (e.g., a cold water fishery) and the water quality necessary to protect those uses. In effect, this means that no permits can be issued that would allow water quality to deteriorate to a level that would impair the existing uses. This protection applies to a wide variety of waters because the regulations require that all rivers and streams be considered fishable and swimmable, even if water quality is severely compromised (e.g., by abandoned mine drainage).

Tier 2 waters are defined as those areas "[w]here the quality of the waters exceed levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water." In other words, Tier 2 waters have a "buffer" of water quality that, if taken away, would not impair the existing uses. The Clean Water Act regulations recognize the importance of this additional water quality and are designed to protect it. That is, unless there is an important economic or social development in the area for which a reduction in water quality is necessary.

Not surprisingly, the final category of waters is known as Tier 3. The regulation states that: "[w]here high quality waters constitute an outstanding National resource, such as waters of National and State parks and wildlife refuges and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected." EPA has taken this to mean that no new or expanded discharges can be made into Tier 3 waters because any additional discharge affects the existing water quality and is a violation of the regulation.

As of early 1999, Pennsylvania DEP was in the final stages of rulemaking for Pennsylvania's antidegradation program.

Sewage

PENNSYLVANIA SEWAGE FACILITIES ACT [35 P.S. §§ 750.1 ET SEQ.]; PENNSYLVANIA CLEAN STREAMS LAW 35 P.S. §691.1 ET SEQ.]; PENNSYLVANIA SEWAGE TREATMENT PLANT AND WATERWORKS OPERATORS' CERTIFICATION ACT [63 P.S. §§ 1001 ET SEQ.].

The Clean Streams Law prohibits the discharge of sewage into state waters without a permit. DEP may order a municipality to perform a study regarding existing and future system and facility needs, and to report these findings to DEP. Further, DEP can require a municipality to construct, repair or modify a sewer system and/or treatment facility where necessary for the prevention of pollution or protection of public health.

However, the key statute is the Sewage Facilities Act, which provides for the development and implementation of sewage waste plans and corresponding regulations. Under the Act, a municipality must develop a comprehensive plan for sewage facilities and services within its boundaries, subject to DEP approval. As part of this process, the municipality must conduct an analysis of stormwater management and wetland protection. In addition, plans must provide for sufficient facilities to prevent the discharge of inadequately treated waste or sewage into state waters. Plans also must assess both current and projected (ten-year) service needs. Individual municipalities may jointly design and submit a single plan together. With limited exceptions, a municipality is required to revise its plan when a new development is proposed. Further, DEP may order a municipality to revise a plan if it is shown to be inadequate for dealing with future needs.

In addition to the planning requirements, the Act gives DEP authority to establish standards for the construction and operation of both individual and community sewage systems and treatment plants. These standards are implemented through permitting, with permits granted only for proposed activities that are in accordance with the municipality's plan. Municipalities or local agencies must employ at least one certified Sewage Enforcement Officer (SEO) to investigate all sewage system permit applications within the municipality for compliance with applicable requirements, including the location and design of the proposed system.

Impacts from Mining and Abandoned Mine Drainage

PENNSYLVANIA CLEAN STREAMS LAW [35 P.S. §691.1 ET SEQ.]; PENNSYLVANIA SURFACE MINING CONSERVATION AND RECLAMATION ACT [52 P.S. §1396.1 ET SEQ.]; NONCOAL SURFACE MINING CONSERVATION AND RECLAMATION ACT [52 P.S. §3301 ET SEQ.]; SURFACE MINING CONTROL AND RECLAMATION ACT OF 1977 (30 U.S.C. 1201 ET SEQ.).

Under the Clean Streams Law, discharges from mining activities are prohibited unless authorized by permit or through regulation. All permit applications must include a determination of the probable hydrological consequences, both on- and off-site, of the proposed operation. DEP may designate an area as "unsuitable for mining" when a certain mining operation could result in the substantial reduction or loss of a water supply's long-range productivity. In addition, mine operators are required to restore the area's "recharge capacity" to approximate pre-mining conditions.

The Surface Mining Conservation and Reclamation Act (SMCRA) requires mine operators to minimize changes to the prevailing hydrologic balance in both the permit and adjacent areas. In addition, the Act establishes water quality standards for bituminous and anthracite coal mining activities. These standards mandate: effluent limitations for acid and other materials such as iron and suspended solids; monitoring requirements; sedimentation control measures; and treatment facilities for discharges. Operators must avoid drainage into ground and surface waters from underground development waste or spoil. Further, underground operations must be conducted in a manner that maintains the existing value and reasonably foreseeable use of perennial streams, such as aquatic life or recreation.

For noncoal mining operations, including surface mining operations that extract an incidental amount of coal, DEP may refuse to issue a permit if the proposed activity will cause water pollution. Further, with strict exceptions, no operation may be conducted within 100 feet of a stream bank. Both coal and noncoal programs must contain bonding measures to ensure that water resources will be restored and protected.

Land Use and Development

Erosion and Sedimentation Control

PENNSYLVANIA CLEAN STREAMS LAW [35 P.S. §691.1 ET SEQ.].

DEP regulations require that any person engaged in earth-moving activities must develop, implement and maintain a plan that contains erosion and sedimentation control measures. The regulations establish minimum design and activity standards that must be met in relation to the unique features and needs of the site both during and after the operation. Municipalities must notify DEP of any permit issuance for earth-disturbing activity that affects more than five acres. With strict limitations, permits from DEP are required only where an earth-disturbing activity affects more than 25 acres. This does not, however, excuse compliance with the regulations on smaller sites.

Landowner Liability

PENNSYLVANIA CLEAN STREAMS LAW [35 P.S. §691.1 ET SEQ.].

Under the Clean Streams Law, DEP may require a landowner or occupier to remedy pollution or the threat of pollution that results from a condition on the land. This liability is imposed regardless of fault. As an alternative, a landowner may be required to allow the agency or another party to enter the property to abate the problem. However, DEP may then assess a civil penalty to retrieve costs.

Storm Water Management

PENNSYLVANIA STORM WATER MANAGEMENT ACT [32 P.S. §680.1 ET SEQ.].

The Storm Water Management Act requires each county, in consultation with the municipalities involved, to prepare and adopt a storm water management plan for each watershed within its boundaries. A watershed is defined by the act as the entire region or area drained by a river or other body of water, whether natural or artificial. An adopted plan must be reviewed every five years and must include an inventory of both existing and potential characteristics and problems of the area. Plans also must include: a survey of existing run-off characteristics, including the impact of soils, slopes, vegetation and existing development; a survey of existing significant obstructions; and analysis, criteria and standards for existing and future development and storm water systems.

DEP, in consultation with the Department of Community and Economic Development (DCED), must review the plan to ensure consistency with municipal floodplain management plans; state programs regulating dams, encroachments and water obstructions; and state and federal flood control programs. Where a watershed extends beyond one county, DEP may require the counties involved to submit a joint plan for the entire watershed. After adoption of a plan, the municipality must adopt corresponding ordinances as necessary to remain in compliance with it. Any person who engages in land development impacting storm water runoff must implement measures to guarantee compliance with the plan.

Though the Act originally contained a two-year deadline for plan development, the timetable has been revised to match the availability of state funds for reimbursement.

Flood Plain Management

PENNSYLVANIA FLOOD PLAIN MANAGEMENT ACT [32 P.S. §679.101 ET SEQ.]; NATIONAL FLOOD INSURANCE PROGRAM [42 U.S.C. §4011 ET SEQ.].

Under the National Flood Insurance Program, the federal government has identified all flood plain areas in the United States. Following the federal standards, the Pennsylvania Flood Plain Management Act establishes an extensive management program wherein municipalities with identified flood plain areas must adopt flood plain management ordinances, codes or regulations. These municipal regulations are reviewed by DCED.

In addition to the management program regulations, DCED has established a list of obstructions that trigger more exacting standards for certain structures or activities located within a flood plain. These restrictions cover obstructions that present special concern to human health or safety, such as hospitals, mobile park homes, and the storage or manufacturing of hazardous materials. A permit from DEP is required for the construction, modification or destruction of any structure located within the federally delineated 100-year flood plain.

Wetlands and Encroachments

CLEAN WATER ACT (FEDERAL WATER POLLUTION CONTROL ACT) [33 U.S.C. §§ 1251 TO 1387]; FEDERAL RIVERS AND HARBORS ACT [33 U.S.C. §§402-403]; PENNSYLVANIA DAM SAFETY AND ENCROACHMENT ACT [32 P.S. §693.1 ET SEQ.].

The Clean Water Act requires a permit for the "discharge of dredged or fill material" into the navigable waters of the United States. Dredged or fill material includes excavated material or any other material used for the purpose of "replacing an aquatic area with dry land or of changing the bottom elevation of a waterbody," such as fills or dams. The definition of "waters of the United States" is broad and includes rivers, streams and wetlands.

The Pennsylvania Dam Safety and Encroachments Act provides DEP and the Environmental Quality Board with the authority to regulate encroachments, obstructions and dams. An encroachment is any structure or activity that alters or diminishes the course or current of any watercourse, floodway or other body of water. DEP has the authority to issue permits for a wide variety of activities and structures, including the filling of wetlands; construction of bridges, dams, docks or roads; dredging or draining of bodies of water; and alteration of streambanks. Certain wetlands have been identified as having "exceptional value" — for example, if the wetland contains habitat for an endangered species. In these cases, DEP will only issue a permit if the application includes plans for strict restrictions and mitigation measures.

Permit applicants must include a broad array of information and analyses, including maps, delineation of wetlands, storm water and floodplain management analyses, and management and mitigation plans. Both the local municipality and the county must be notified of a permit application. Under the Municipalities Planning Code (MPC), local governments are authorized to regulate, permit, prohibit or restrict uses of land, including wetland and riparian zones. Permit evaluation is subject to a joint review process between DEP and the U.S. Army Corps of Engineers through a state programmatic general permit (SPGP) system. When DEP receives an application, it forwards a copy to the Corps for review of Clean Water Act compliance. Certain activities, including those that impact more than five acres, are not eligible for the SPGP process. The Corps may issue a separate permit if a project poses significant environmental impacts.

General permits are available at both the state and federal level for certain structures or categories of activity that are deemed similar in nature and can be adequately regulated by standardized requirements. However, states may reject development under a nationwide general permit in cases where state water quality standards or goals would not be met.

Mitigation is the responsibility of the permittee when wetlands are impacted. Subject to DEP's discretion, this may be accomplished through the replacement of the wetland, typically in an area adjacent to the affected area, or through payment to the state Wetland Replacement Fund.

Another law impacting wetlands is the federal Food Security Act. This law's "swampbuster" provision prohibits farmers receiving subsidies from the U.S. Department of Agriculture, as well as other federal assistance, from dredging, draining, filling or otherwise impacting a wetland. Again, however, mitigation options are available.

Public Water Supply and Allocation

FEDERAL SAFE DRINKING WATER ACT [42 U.S.C. §300F ET SEQ.]; PENNSYLVANIA SAFE DRINKING WATER ACT [35 P.S. §721.1 ET SEQ.]; PENNSYLVANIA CLEAN STREAMS LAW [35 P.S. §691.1 ET SEQ.]; PENNSYLVANIA WATER RIGHTS ACT [32 P.S. 3631 ET SEQ.].

State safe drinking water standards must meet minimum federal requirements for all contaminants regulated under federal law. This is accomplished through the establishment by the state of maximum contaminant levels and the imposition of water treatment requirements. With limited exceptions, these standards apply to any public water system.

DEP maintains a permit system for the construction and operation of a community water supply. The permitting program includes: monitoring and reporting requirements; design, construction and operational standards; emergency procedures; and public notification requirements. Operators also are required to provide notice within 24 hours of any failure to comply with drinking water standards. Under the Clean Streams Law, DEP may adopt and enforce regulations for the protection of public water supplies.

The Pennsylvania Water Rights Act required that

public water supply agencies obtain a permit from DEP before withdrawing from a surface water of the Commonwealth. The Safe Drinking Water Act also authorizes DEP to issue public water supply permits for proposed water systems. The Department must ensure compliance with existing environmental laws and regulations. All other withdrawals of surface or ground water are essentially controlled by the common law (please refer to Chapter 33, Riparian Ownership). However, in the Delaware and Susquehanna River Basins, the River Basin Commissions have designated management authority over their respective water resources.

Other Laws Protecting Water Resources

Environmental Assessment

NATIONAL ENVIRONMENTAL POLICY ACT [42 U.S.C. §§4321 TO 4370(C)].

It is important to note from the start that the National Environmental Policy Act (NEPA) is a procedural, or "action-forcing" statute. The goal of the law is not to impose substantive requirements but to prevent uninformed agency action. The Act, therefore, has two objectives: first, to require agencies to make "informed" and "careful" decisions regarding environmental impacts; and second, to provide the public with information and an opportunity to play an active role in the decision-making process.

The procedural requirements of the Act are triggered by any "major" federal action "significantly" affecting the "human environment." Though somewhat ambiguous, this is a broad definition that affects a wide range of activity. For example, federal financing of a project (such as road construction) would fit within the meaning of "federal action." In addition, the phrase "human environment" was intended to cover a broader range of considerations than the phrase "natural environment," including the indirect effects of land use patterns and growth, aesthetics and public health.

Once triggered, the Act requires an agency to conduct a preliminary study, called an "Environment Assessment," to determine whether the proposed activity could have significant effects on the environment. Based on these findings, the agency determines that an Environmental Impact Statement (EIS) is warranted, or makes a Finding of No Significant Impact (FONSI). If the agency makes a FONSI, this ends the NEPA process, although this decision is appealable. If an EIS is deemed warranted, the agency is responsible for preparing a draft EIS, for which it must solicit comments and allow objections to be filed. The agency then must revise its EIS on the basis of comments received, and publish a final EIS, which can also be challenged. NEPA requirements mandate that the agency provide a "full and fair" discussion of significant environmental impacts, both on- and off-site, and inform decision makers and the public of reasonable alternatives that would avoid or minimize adverse impacts or enhance the quality of the human environment. Again, however, NEPA is procedural in nature and does not substantively require mitigation activities.

Historic Preservation

NATIONAL HISTORIC PRESERVATION ACT [16 U.S.C. §470 ET SEQ.]; PENNSYLVANIA HISTORIC PRESERVATION ACT [37 PA.C.S.A. §§501 TO 906]; PENNSYLVANIA HISTORY CODE [37 PA.C.S.A. §§101 TO 307].

Much like NEPA, the National Historic Preservation Act (NHPA) is an action-forcing statute. NHPA applies to any federal agency having direct or indirect jurisdiction — including the authority to license any undertaking — over federal or federally assisted projects. NHPA's requirements also apply in cases where a federal agency has granted primacy to a state program; however, NHPA's obligations rest solely with the federal agency. To this extent, federal agencies impose informational requirements on permittees to foster compliance with the Act.

Prior to approval of any funds or the issuance of any license, NHPA requires that the federal agency take into account the effect of the proposed undertaking on any district, building, object or structure that is included in or eligible for inclusion in the National Register of Historic Places. The agency must consult with the Pennsylvania Historic Preservation Board. Even if a structure is determined eligible for inclusion, however, a landowner is not required to accept the designation.

The Pennsylvania History Code requires state agencies to consult with the state Historical and Museum

Commission whenever a historical property will be affected. DEP permit applicants must submit an appendix to their application including a geological survey map of the project area and identify, by photograph, any building within that area that is more than 40 years old.

Coastal Management

FEDERAL COASTAL ZONE MANAGEMENT ACT [16 U.S.C. §§1451 TO 1464]; PENNSYLVANIA BLUFF RECESSION AND SETBACK ACT [32 P.S. §5201 ET SEQ.].

The Coastal Zone Management Act protects "coastal zones." Pennsylvania has two coastal areas subject to the Act: Lake Erie and the Delaware Estuary. Authorized under the federal Act, and approved by the Department of Commerce, Pennsylvania has adopted a Coastal Zone Management Plan. The Plan, based on a network of regulatory and nonregulatory policies, requires specific coastal activities to comply with performance and management standards defined in the Plan and other applicable regulations. These standards apply to issues such as bluff recession, dredging, protection of wetlands, fisheries management, and public access and recreation. These standards also apply to the shorelines of major tributaries. The Plan is primarily implemented through an executive order directing administrative departments to act consistently with the goals and polices of the Coastal Zone Management Program, as well as memoranda of understanding between state agencies.

Pennsylvania's Bluff Recession and Setback Act mandates local zoning permits for development within bluff recession hazard areas along Lake Erie. Municipalities must adopt ordinances and regulations for construction and development activities located within those areas identified by DEP as bluff recession hazards. These regulations include minimum setback requirements, which are also established by DEP.

Endangered Species and Habitat Protection

ENDANGERED SPECIES ACT [16 U.S.C. §§1531 ET SEQ.]; PENNSYLVANIA WILD RESOURCES CONSERVATION ACT (30 PA.C.S.A.. §§ 5307 AND 5309); PENNSYLVANIA FISH AND BOAT CODE (30 PA.C.S.A. § 101 ET SEQ.) PENNSYLVANIA GAME AND WILDLIFE CODE (34 PA.C.S.A. § 101 ET SEQ.); PENNSYLVANIA FISH LAW (30 PA.C.S.A. § 101 ET SEQ.).

The Endangered Species Act applies to anyone, including private parties and state and federal agencies. The Act prohibits the "taking" of any species listed as endangered or threatened. Apart from more obvious activities such as hunting or trapping, this standard also includes ecosystem protection — i.e., one cannot engage in an activity that significantly degrades or modifies the habitat of a listed species or that results in the actual killing or injury of a listed species. Injury includes the significant impairment of essential behavioral patterns, such as breeding, feeding or sheltering. The killing or injury does not have to be deliberate.

However, one can apply for an "incidental take permit," which allows a person to "take" a species where the taking is incidental to, and not the purpose of, carrying out an otherwise lawful activity. This may occur, for example, when a proposed land development project has the potential to adversely affect listed species habitat. To acquire an incidental take permit, it must be determined that the taking will not appreciably reduce the likelihood of the survival or recovery of the species. Further, the permittee must develop and implement a Habitat Conservation Plan that includes mitigation efforts.

Threatened or endangered plant species located on private lands are not protected under the federal Act unless they are also protected under a state statute. In Pennsylvania, responsibility for species identification lies with the Game Commission, the Fish and Boat Commission, and the Department of Conservation and Natural Resources. Pennsylvania may list species for state protection in addition to those listed by federal agencies.

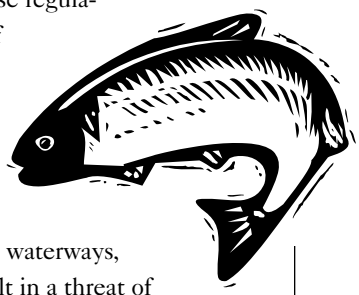
Designation of a listed species may also afford "critical habitat" protection. Critical habitat is defined as those areas within the geographic area currently occupied by a species that, because of the areas' physical or biological features, are essential to the species' conservation. Unlike the designation of species, the designation of critical habitat is subject to an economic impact analysis. Except where failure to designate would result in loss of the species, an area may be excluded from habitat protection if it is determined that the economic costs outweigh the benefit.

The Endangered Species Act provides several opportunities for citizen involvement, from the listing of species to the commencement of citizens' suits to compel protection.

Fish Protection

THE PENNSYLVANIA FISH AND BOAT CODE (THE FISH LAW) [30 PA.C.S.A. §101 ET SEQ.].

The Fish and Boat Code establishes the Fish Commission, which has authority to issue rules and regulations governing the management and protection of fish and fish habitats. These regulations prohibit the emission of garbage or similar refuse, or substances harmful to fish, into the waters of the state. Further, the regulations prohibit the disturbance or misuse of water and waterways, including pollution, that result in a threat of fish kills or streambed injury. The Commission may also designate special refuge areas. ■



The Pennsylvania Municipalities Planning Code

The Power of the MPC

BY: ANNA M. BREINICH, AICP
Breinich is Director of Community Planning with the Pennsylvania Environmental Council
(Modified text from The EAC Handbook published by Pennsylvania Environmental Council (1996)

Local governments have no inherent powers to regulate; they have only those powers that the state legislature has granted them. In Pennsylvania, the principal source of enabling authority for controlling land use and managing growth is the Pennsylvania Municipalities Planning Code (Act 247, as amended). Other laws, such as the Pennsylvania Sewage Facilities Act (Act 537), provide additional authority to municipalities.

About the Pennsylvania Municipalities Planning Code (MPC)

The MPC gives local governments the power to engage in comprehensive development planning and to enact zoning, subdivision/land development, planned residential development and official map ordinances. It authorizes the appointment of planning commissions and allows local governments to prepare capital improvement programs while encouraging them to coordinate development with the availability of infrastructure, such as public water and sewer facilities and necessary transportation systems.

The 1988 revisions to the MPC made by Act 170 added several provisions that improve the ability of municipalities to manage growth and assure a more liveable environment. However, their planning authority is made clearly advisory by virtue of Section 303(c), which was added to indicate that the failure of a municipality to comply with all provisions of its comprehensive plan in the implementation of its land use-related ordinances shall not subject the municipality to challenge or appeal on that basis alone.

Despite this change, comprehensive planning remains critically important because it provides the statement of community development objectives required by the law. This statement can include a goal of controlling "the location, character and timing of future development," as well as goals addressing the preservation of natural resources and the protection of water supply sources. Thus, the comprehensive plan is important as a sound and rational basis for zoning regulations. These regulations are strengthened as a result of the comprehensive plan's consideration of the full spectrum of needs, uses and resources in the municipality.

Municipalities have the power to zone to protect natural resources and farmland, to provide for the trans-

Two very different examples of development.

fer of development rights from areas to be preserved for open uses to areas planned for more intensive development, and to do joint planning and zoning with other municipalities. This zoning power represents the real power of municipalities over land use.

The MPC and Growth Management

Although the present system of land use regulation makes it difficult for even the most progressive municipality to do so, there are ways to plan and zone to achieve maximum natural, historical and cultural resource protection. A careful reading of the MPC, particularly as amended in 1988, indicates that the legislature intended to give local governments in Pennsylvania the power to control the timing, as well as the character and location, of development within their borders. Watershed groups should be aware of these standards for development; they are the essence of a strong municipal growth management/land conservation program.

The MPC and the Protection of Natural Resources

As stated above, the MPC enables municipalities to zone to protect natural resources within their jurisdictions. These provisions authorize a municipality to adopt ordinances protecting farmland, wetlands, aquifers, woodlands, steep slopes and flood plains from development. Before adopting new zoning rules, a municipality must establish a sound and rational basis for zoning protection—in part by developing a local environmental resource inventory.

Key Provisions of the MPC

It is important for watershed groups to be familiar with the following key provisions of the MPC:

The Comprehensive Plan

The comprehensive plan, described in Section 301, consists of maps, charts and text. It must include, but need not be limited to:

- A statement of the municipality's objectives concerning its future development;
- A plan for the character and intensity of land use, as well as a growth phasing plan; and
- A plan for community commerce, facilities and utilities.

In addition, the comprehensive plan must contain a statement about the interrelationships of the various plan components, as well as a statement indicating the relationship of existing and proposed development in the municipality to development in contiguous municipalities. Finally, the plan must contain a discussion of short- and long-range plan implementation strategies. Although plans prepared in the past typically had little to say about implementation, it has become generally recognized that this is the most important element of the comprehensive plan, and should be updated on a regular basis.

In addition to the requirements of Section 301, other plans should be prepared by municipalities. These include an open space and recreation plan (particularly if the municipality intends to require developers to dedicate land for public purposes as a condition for subdivision/land development) and a sewage facilities plan. If a county has an adopted stormwater management plan, municipalities also are responsible for its implementation through adoption of a stormwater management ordinance, or provisions related to stormwater management contained within the Subdivision and Land Development Ordinance.

Subdivision and Land Development

Article V of the MPC authorizes municipalities to adopt regulations governing subdivision and land development. A subdivision and land development ordinance applies anytime a landowner proposes to subdivide a tract of land or develop a tract of land for nonresidential uses.

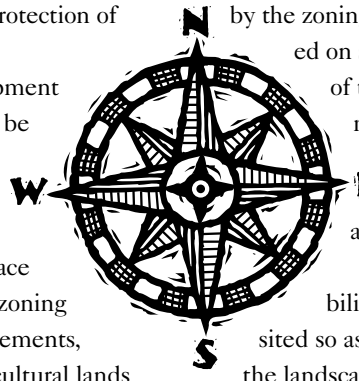
Generally developed as one ordinance, subdivision and land development requirements govern activity at the site or tract level and deal with standards for approval of plats, street design and grading, water and sewer facilities, and dedication of open space. Nearly half of Pennsylvania's municipalities solely rely on subdivision and land development ordinances regulating how a tract or site can be developed, yet have not

adopted zoning ordinances designating where specific uses can be located.

Under the MPC, counties may enact subdivision and land development ordinances for areas of the county that are not governed by a municipal ordinance. A municipality may adopt the county ordinance and designate the county planning agency as the agency for review and approval of plats.

Zoning

The primary way in which municipalities are authorized to manage land use is through the enactment of a zoning ordinance. Specific authority is provided within the MPC for the protection of natural, scenic and historic resources through zoning. Thus, if a municipality has a comprehensive plan identifying natural resources to be protected, it can require performance standards and site design review to ensure the protection of those resources identified in the plan.



Zoning ordinances manage development by determining what kind of uses will be allowed in any given area of the municipality, and imposing requirements relating to density, height, intensity of use, setbacks and open space within a proposed development. The zoning ordinance also establishes other requirements, such as the preservation of prime agricultural lands and the protection of aquifers, streambanks and other natural resource features.

Today it is widely believed that much of the large-lot zoning that municipalities have enacted over the last 30 years has resulted in a "cookie-cutter" approach to development that often does not lead to functional, liveable communities or to protection of connected open space that is important to environmental quality. More creative approaches are being tried by some communities, using the power of zoning, to accomplish quality-of-life and resource protection objectives. Such approaches include mixed-use development with significant open-space requirements, hamlet and village zoning, agricultural zoning, transfer of development rights provisions, performance zoning for natural resource protection, and designation of growth areas.

Official Map

Article IV of the MPC enables counties and municipalities to develop and adopt official maps that show the exact, surveyed locations of existing and proposed public streets, watercourses and public grounds. The official map is an important tool for notifying all landowners of existing and proposed public lands and rights of way. This tool has been little used because of cost, but may be used more in the future because Act 170 allows mapping of all or "only a portion" of a municipality.

Clustering/Open Space Zoning

Open space zoning is a means of preserving configurations of natural features in a community while effecting considerable savings in site development costs. It works by allowing the total number of dwellings permitted by the zoning ordinance for a tract of land to be located on small lots in the most buildable portions of the tract. This "clustering" of development decreases the amount of infrastructure required to support the new buildings while increasing the available open space.

Open space zoning enables more flexibility in site design, allowing structures to be sited so as not to interrupt the traditional rhythm of the landscape, obliterate natural features or obstruct scenic vistas. The remaining land could be used for farming or governed by conservation easements—e.g., for the protection of streambanks or riparian buffers.

Significant cost savings usually are realized with open space zoning, due in part to the use of smaller lots with less frontage; this decreases the length of roads together with public utilities costs. Stormwater runoff is also minimized due to fewer paved surfaces. Last but not least, more natural areas are available for stormwater detention and retention, further lessening the need for manmade stormwater management facilities.

Planned Residential Development (PRD)

Article VII of the MPC provides for Planned Residential Developments (PRDs), which are mixed–use developments combining housing at greater densities with open space and recreation facilities. PRD provisions, generally found in zoning ordinances,

combine elements of zoning and subdivision and land development ordinances into one document. Although originally designed primarily for residential development, Act 170 allows a PRD to include "nonresidential uses deemed to be appropriate for incorporation in the design of planned residential development."

PRDs give builders considerable flexibility within prescribed development standards. As a rule, PRDs allow for greater densities in development in return for the preservation, dedication or construction of agreed-upon open space, recreational or other common public facilities. Through the use of PRDs, both the municipality and developer can have better control over design.

Mandatory Dedication of Land

Section 503(11) provides the standards for mandatory dedication of land within a subdivision for parks or the construction of recreational facilities, or alternative payment of fees. Such standards may not be implemented, however, without the adoption of a municipal open space and recreation plan.

Transfer of Development Rights

Section 619.1, newly enacted in the 1988 amendments to the MPC, creates the right to separate development rights from the land itself through transferable development rights (TDRs), and authorizes municipalities to enact TDR programs allowing the transfer of development rights within a municipality. TDRs enable a community to reduce the intensities of housing and nonresidential development in rural or resource protection areas, encourage more intense development in appropriate areas served by public infrastructure, and provide for a system of compensation for landowners who are restricted from development.

TDR programs also allow for landowners in rural or resource protection areas to sell their development rights to entities wishing to develop in other locations determined by the municipality to be suitable for increased development. The sale of TDRs leaves the rural landowner in possession of title to the land and the right to use the property as farmland, open space or for some related purpose. However, it removes the owner's right to develop the property for other purposes. For the purchaser, the TDR affords the right to develop another parcel more intensely than would otherwise be allowed.

Joint Planning and Zoning

Article VII-A of the MPC was enacted in 1988 to expand and clarify joint municipal planning and zoning, which was authorized (and little used) under prior provisions of the MPC. The new provisions make clear that joint municipal zoning must be based on a joint comprehensive plan adopted by all affected municipalities. Participating municipalities may have joint or separate zoning hearing boards. No municipality may withdraw from or repeal a joint zoning ordinance during the first three years after it is enacted.

Joint planning and zoning, while politically difficult, is a very important tool for achieving a more regionally coherent approach to growth management and watershed protection. Court interpretations of the MPC have required that each municipality in Pennsylvania provide for every use, from industrial to mobile home park, within its boundaries. Municipalities that adopt joint planning and zoning can provide for all uses within the joint area instead of within each municipality and thus can achieve a more rational development plan. They can also protect natural resources at a regional level, a sensible strategy due to the fact that natural resources know no political boundaries.

Site Plan Review Process

The purpose of site plan review is to ensure that a developer meets all the requirements of the community's land-use ordinances, including environmental ordinances that limit the type and amount of development in an area that has been determined to be environmentally sensitive. The developer may be asked to assess the immediate and secondary impacts of the proposal on stormwater runoff, flooding, sewage, environmentally sensitive areas (e.g., wetlands, forest lands, riparian buffers, floodplains, steep slopes), historical and cultural features, and traffic.

The site plan review process is generally a two-step process. A developer has to obtain both preliminary and final approval from a community's official approving body. The preliminary plan, which outlines the long-term results of the development, is subject to

terms or conditions placed on it by the planning commission. Before development can start, the final plan must meet any terms and conditions under which the preliminary plan was approved. The approving body's decision must follow the letter of the subdivision and land development ordinance and/or zoning ordinance within its community. If the plan meets these requirements, approval or conditional approval must be granted.

All site plan reviews must also adhere to certain state regulations and permits as administered by various state agencies. Approval of development plans is contingent on the receipt of proper state permits. All development must be in accordance with the Sewage Facilities, Plan, the Solid Waste Management and Stormwater Management plans. Both the Sewage Facilities and Solid Waste Management plans are developed by local municipalities based on regulations developed by the Pennsylvania Department of Environmental Protection. ■

Riparian Ownership

Who Owns the Water and the Land Around It?

BY CYRIL FOX, ESQ.
Fox is a Professor of Law at the University of Pittsburgh.

Riparian land is land covered, at least in part, by a river, stream, lake, pond or other confined body of water. Every writer on this subject feels obligated to demonstrate an understanding of high school Latin by stating that, technically, land along a lake or pond is not "riparian" land but "littoral" land. This shows we know the difference between *ripa* or "bank" and *litus* or "shore." The truth, of course, is that the rights of a littoral or a riparian owner to reach, use and enjoy the water along the owner's land do not change because of the Latin name for the edge of the water body. Most writers therefore use "riparian" as an all-purpose term to refer to rights in both static bodies of water such as lakes and in flowing waters such as creeks, streams and rivers.

Along a flowing body of water, those owners whose land is upstream of a particular point are referred to as "upper riparian owners." Owners of downstream land are "lower riparian owners." Ownership of riparian land includes rights to use and enjoy the water. A riparian owner's rights are the same whether the water body is a natural or an artificial one. If a riparian owner erects a dam to flood part of the owner's land and if the land of an upstream neighbor is also flooded, that upstream neighbor has the same rights to use the artificial lake as the downstream owner. Whether the upstream owner has the right to use the water over the bed of the downstream owner's land depends on whether the water body is considered navigable or nonnavigable.

The Rights of a Riparian Owner in a River, Stream, or Other Body of Water

Pennsylvania courts have used two somewhat different approaches in defining the rights of riparian owners in the waters that flow over their riparian land. Some older Pennsylvania court decisions talk about a riparian owner's right to receive the "natural flow" of the water from upper riparian owners, and of a duty to pass that natural flow on to lower riparian lands. More recent cases indicate that riparian owners may make any "reasonable use" of the water on their riparian land if no harm is done to other riparian owners along the same stream or in the same watershed. The reasonableness of the use is evaluated, in part, in light of any harm caused to other riparian owners.

Nevertheless, a riparian owner does not own the water that flows over or by the owner's land. When using the water, a riparian owner must respect the rights of other riparian owners to use the water along the watercourse, both above and below the riparian owner's land. If the waterway is a navigable one, the riparian owner must also respect the right of the public to use the water. A riparian owner may, with appropriate government permits, dam the water and delay its passage in order to use the power created by the water's flow. However, the water usually must be released so that the power of the flow may also be enjoyed by lower riparian owners. Likewise, the dam operator has no right to

increase the flow of water over the land of upper riparian owners without their consent. Where the dam is erected by a government agency, the government must compensate the riparian owners for any increased flooding above the ordinary high water line of the river or stream. Similarly, lower riparian owners must be compensated for harm from reduced flow or reduced availability of water below the dam.

Generally speaking, riparian owners have two broad sets of rights regarding the water that makes their land riparian. First, they have the right to get to the water and to use it within the bed of the river or lake; these are the owner's "access and use in place rights." Second, the owner has the right to make certain uses of the water on the owner's riparian land; these are "consumptive use rights." Neither of these rights is absolute, meaning they can in some cases be challenged.

Access and Use in Place Rights

Riparian ownership carries with it the right to get to the water from points along the bank. This includes the right to erect docks or wharves, to swim (often called "bathe" in the older cases) and fish in the water, to boat on its surface, to cut ice when the water is frozen, and to harness the power of the water's flow for uses on the riparian land.

The riparian owner also is entitled to keep others from coming over the land to reach the water without the owner's consent. If the stream, river or lake is navigable, the public has a right to use the river for navigation and other purposes which are described later. In that case, the public may approach the riparian owner's land from the water side without the owner's permission. The public may use the riparian land between the ordinary high and low water lines. And, in times of emergency, such as storms or floods, members of the public may use the riparian owner's land above the high water line to protect life and property; however, they must compensate the owner for any damage done to the land by their use of it.

Consumptive Use Rights

A riparian owner has the right to use the water for a variety of purposes on the owner's riparian land, but only on the riparian land itself. Normally, the owner must return the water to the water body in essentially the amount and condition it was in when diverted. A riparian owner has no right to use the water on lands that are not themselves riparian in character. For example, one may not use water from a stream to irrigate another tract that does not touch the stream. One may not divert water from a stream to a reservoir on nonriparian land, or sell water from a river to owners of nonriparian land to be used on their lands.

A government or private water company that draws its water from a river or lake and distributes it to users on nonriparian lands must get the permission of the lower riparian owners before doing so. If it cannot obtain this permission voluntarily—for example, by purchasing part of the lower riparian owner's rights in the stream—a government agency may acquire the same rights by eminent domain. A private water company may do the same if it is a public utility or otherwise possesses eminent domain powers.

Riparian owners have been permitted to consume all of the water on their riparian land for "domestic purposes" without violating the rights of lower riparian owners. "Domestic purposes" include normal household uses for drinking, bathing, washing and watering livestock. Even large residential institutions may draw so much water from the stream for drinking, washing, bathing and related purposes that little is left for lower riparian owners. Where the use on the riparian land is for other than domestic purposes, courts apply the "reasonable use" doctrine to allocate conflicting claims to the water by different owners. A court generally will allow nondomestic use of the water on the riparian land, even when that use changes the quality of the water or reduces the amount available to other riparian owners, so long as the change does not cause actual harm to the other riparian owners.

No riparian owner can unreasonably increase the amount or speed of the water in a way that causes injury to other riparian owners. In one case, lower riparian owners were able to prevent a public utility from using a stream on their land to carry water away from the utility's plant after it had been used to generate electricity. The water added by the plant would substantially increase the amount of water and the speed of its passage down the stream in all seasons of the year. The court found that this dramatic change in the character of the stream was unreasonable.

The Transfer of Riparian Rights

It is possible for a nonriparian owner to acquire riparian rights from a riparian owner. The law recognizes three ways this can happen: by voluntary transfer (grant), by prescription, and by condemnation or eminent domain.

Access and use in place riparian rights are private property rights and may be transferred voluntarily like any other easement. However, if the right is granted to an individual or corporation without regard to its ownership of other land nearby, the right usually will have a limited life unless it is commercial in nature. For example, a riparian owner who grants an individual the right to fish from the riparian land or the bed of the stream or lake can be assured that the right will end when the individual dies. The individual cannot transfer the right to fish to anyone else without the riparian owner's permission. A similar grant made to a sportsmen's club, on the other hand, can continue long after all original members of the club have died. It may even be transferrable to another club, depending on the riparian owner's intent in the conveyance.

In a few cases, Pennsylvania courts have recognized that continued exercise of riparian rights by a nonriparian owner can establish riparian rights. The nonriparian owner must have exercised these rights without the permission of the riparian owner for a continuous period of at least 21 years. These rights will be limited to the least intrusive of the rights exercised over that time. In other words, if the nonriparian owner has used a neighbor's lake for fishing and boating for at least 21 years, and for swimming only during the last 10 years, the nonriparian owner will be allowed to continue using the lake for boating and fishing purposes, but not for swimming.

There is language in some cases indicating that "personal use only" will not lead to prescriptive rights—in other words, that the rights must have been used for commercial purposes. Under this test, the nonriparian owner who, with his or her family and guests, used the lake for boating and fishing would not acquire any rights by prescription, no matter how long the use continued. But if that same nonriparian owner rented boats to others for boating and fishing, or allowed others to enter the lake in exchange for a fee, he or she could obtain a right to this continued commercial use after 21 years. Again, the court will probably limit the rights acquired to the least intrusive ones possible.

The transfer of riparian rights can also be accomplished by the power of eminent domain. Government agencies and private water companies may use this power to acquire the right to divert water from the stream or lake and sell it to nonriparian land owners. Today, the acquisition of water for these purposes requires a permit from the Pennsylvania Department of Environmental Protection (DEP). Eminent domain powers also can be used in order to construct a dam. Before issuing a permit for construction, the Department must find that the water rights to be acquired are reasonably necessary for the applicant's present and future needs and that the taking of the water will not interfere with navigation, jeopardize public safety, or cause substantial injury to the Commonwealth.

Waterside Boundaries of Riparian Land

The boundary of a riparian owner's land along a river or lake depends on whether the water body is considered a navigable waterway or a nonnavigable one.

Navigable Waterways

Navigable rivers, streams and lakes are public highways. The public has the right to use them for transportation and other riparian purposes without permission from the riparian owners through whose lands these waters flow. A navigable waterway is one that can be used in its ordinary condition to transport people and goods for commercial or trade purposes by customary methods of water travel. It is the suitability of the water body for commercial trade and transportation between communities or regions that makes it navigable, not the fact that someone once traveled over it in a kayak or canoe, or even a steamboat. As the Supreme Court of Pennsylvania observed in Lakeside Park Co. v. Forsmark (1959):

> Navigation and navigability are portentous words. They mean more than the flotation of buoyant vessels in water: if it were otherwise, any tarn [small mountain lake] capable of floating a canoe for which a charge could be made would make the

> water navigable. They mean more than some commercial use to which collected water is put: if this were not so, every spring-fed pool capable of being bottled and sold for drinking water would be navigable. No single factor can control.

The Allegheny River and some of its tributaries were declared to be navigable by acts of the Pennsylvania legislature during the eighteenth and early nineteenth centuries. Tionesta Creek was used to transport logs to the Allegheny. It is therefore a navigable river because it was used to transport goods in commerce. Conneaut Creek and Conneaut Lake are navigable waters because of both an act of the legislature and the incorporation of the Conneaut Lake into the Pennsylvania canal system.

An act of the legislature cannot make a river navigable as a public highway if it is not navigable in fact. However, by declaring a nonnavigable river, or a segment of it, navigable, the Commonwealth acquires title to part of the bed and the right to control certain activities on and along the river. If the river were not in fact navigable, the owners of lands affected by the legislative declaration are entitled to compensation for the loss of any private rights they held as riparian owners along a nonnavigable watercourse.

TITLE TO RIPARIAN LAND ALONG NAVIGABLE WATERS. Ordinarily, a riparian owner's title to land along navigable rivers and lakes extends to the ordinary low water line. The owner's title to the land lying between the ordinary low water line and the ordinary high water line is subject to an easement in favor of the public for navigation and fishing. The bed of the river or lake is owned by the Commonwealth. The riparian owner may not interfere with the public's rights in these areas without permits from both the Commonwealth and the United States Army Corps of Engineers. These two governmental agencies protect the public's ability to enjoy its rights to the water.

OWNERSHIP ISLANDS AND THE BED OF A NAVIGABLE WATERWAY. The Commonwealth owns the bed of all navigable waters between the ordinary low water lines along both banks of a stream or the shore of a lake. The Commonwealth also owns the islands that rise out of the bed and can convey them to private owners in the same way as any other riparian land can be conveyed. The owner of the island will own absolute title to the island, or portion of it, above ordinary high water line and qualified title from there to the ordinary low water line. Islands are conveyed independently of the riparian land opposite them. Even if an island and the land on the bank are owned by one person, that owner has no private rights in the bed of the stream between the ordinary low water lines at the bank and the island. He or she may not fill the bed between the bank and the island without permission from the Commonwealth and the federal government.

The Commonwealth holds the bed of a navigable waterway in trust for the public in order to protect the public's right to use these waters. A 1958 statute provides that the Commonwealth will not grant land patents "for any land or island lying in the beds of navigable rivers," with certain limited exceptions; patents or deeds conveying islands to private owners before this time are valid. As owner, the Commonwealth may permit private parties to use the bed of a navigable river for various purposes, including the dredging of sand and gravel. Licenses for these purposes and related state permits are administered by the DEP. In addition, permission of the U.S. Army Corps of Engineers is required for any activity that may affect navigation.

Nonnavigable Waterways

Any body of water that is not suitable to transport people or goods from place to place within Pennsylvania or to other states is a nonnavigable waterway. For example, a lake that is itself a destination, not a link in a chain of commerce, is nonnavigable. A nonnavigable body of water is owned by the owner or owners of its bed and the public has no right to use it without the owner or owners' permission. Most lakes in western Pennsylvania are not regarded as navigable, even if boats have carried people and goods from point to point along their shores. For example, Sandy Lake in Mercer County was a popular tourist destination early in the twentieth Century. A steamboat that could carry 35 people and tow a barge with 100 dancers went back and forth over the lake for many years. This did not make the lake navigable, however, because the boat's passengers had come to the lake for enjoyment, not to go from one place to another.

TITLE TO RIPARIAN LAND ALONG NONNAVIGABLE WATERS. It is more difficult to describe the ownership rights attributable to land along nonnavigable waters. Where the owner's deed (or often the original patent for the Commonwealth or William Penn's family) describes the land as bordered by a nonnavigable stream, lake or pond, the owner's title ordinarily includes the bed of the water body to the middle of the stream or lake. A riparian owner who owns both sides of the stream owns the bed of the stream. One who owns all the land beneath a lake also owns all riparian rights in the lake. Therefore, although a parcel of land may touch on the lake, if that parcel does not include any part of the bed of the lake, it is not riparian land. Its owner, therefore, has no riparian rights to use or enjoy the lake or the water in it. Where there is more than one owner of the bed of a nonnavigable lake or stream, each owner may prevent the others from using the water over its part of the bed.

Changes in Boundary Locations

Riparian boundaries are generally fixed as the water line or edge for nonnavigable waters and the ordinary high and low water lines in the case of navigable waters. The ordinary high water line is not the line defined by the highest the water has ever been along the stream bank, or even by the highest points from flooding. Rather, it is the level of the water when water regularly flows

Ordinary high and low lines are not constant but change as the course of the stream changes. As the line in question changes with the passage of time, so does the boundary of the riparian land that the stream or lake defines. Change is usually gradual and may not be noticeable from year to year or even over several years. Yet the stream bed and sides do change.

If the change increases the distance to the low water line, the amount of land owned by the riparian owner increases to include this new area. This increase, known as accretion, does not alter the riparian owner's riparian rights, but only increase the amount of land this person owns. If the change results in a decrease in the distance to the low water line, the owner's land area also decreases. This change is known as reliction and, again, does not alter the owner's riparian rights.

A sudden change in the water line, as from a flood, is known as avulsion, and does not change boundary lines. If the water line shifts because of a sudden event to move the stream wholly off the riparian owner's land, that land loses its riparian character. The owner therefore owns to where the water line was before the event took place; ownership does not follow the stream to its new location.

The Effects of Legislation and Improvements to Navigable Water.

In the days before the Allegheny River became a series of canals, with its depth regulated by a system of locks and dams operated by the U.S. Army Corps of Engineers, there were dramatic differences in the ordinary high and low water lines along the riparian land. The ordinary low water line was the height of the water in summer, when the water flow was quite low. The ordinary high water line was the height of the water in the spring, when snowmelt and rains significantly increased the amount of water in the river. During low water, the Allegheny might occupy just one-third as much of the bed as it occupied in the spring. Taking advantage of the situation, riparian owners, particularly mill owners, began to fill the area along their property between the high and low water lines with cinders and other material from their mills, enlarging their lands and diminishing the river channel. After the Pennsylvania Supreme Court held that a riparian owner had no right to fill its land beyond the ordinary high water line, the legislature passed a statute to address permanently the location of these lines along the Allegheny, Monongehela and Ohio Rivers in and around Pittsburgh.

The statute created a commission to investigate, survey and locate the high and low water lines along the rivers. The lines established by the commissioners determined the boundaries between the Commonwealth's absolute ownership (the river bed), the private riparian owner's qualified ownership (the area between the low and high water lines), and the riparian owner's unqualified ownership (landward from the high water line). The commissioners were not empowered to determine boundaries between adjoining riparian owners. Since 1858, various statutes have authorized similar boundary determinations along navigable waters by some municipalities.

The Role of the U.S. Army Corps of Engineers

The U.S. Constitution grants the federal government the power to regulate all navigable waters within the United States. The Constitution creates a public right of navigation, or "navigation servitude," under federal protection similar to that recognized under Pennsylvania common law. It extends to the ordinary high water line of the water body.

The U.S. Army Corps of Engineers exercises the power to protect the public right of navigation under the River and Harbors Act of 1899 and earlier statutes. The Corps is responsible for maintaining the navigability of navigable waters and may fix the high and low waterlines as the boundaries of its jurisdiction. In many locations along the Allegheny River, the Corps has established a "harbor line" along both banks of the river. Any action that may affect navigation—and any construction, filling or other structure, like a dock or wharf, within the harbor line—requires a permit from the Corps. The harbor line determines the area in which a riparian owner may fill lands or erect docks, wharves, and other structures without a permit from the Corps. It is frequently, but not always, the same as the ordinary high water line.

Any conflict between Pennsylvania law and federal law is resolved in favor of the federal government. Thus, where the harbor line is located landward of what had been the ordinary high water line, navigation rights extend to the harbor line. However, if the harbor line is located below the ordinary high water line, the public's rights extend to the high water line. There is no conflict where the federal government has not asserted rights as great as those existing under state law.

Over the years, the Corps erected a series of locks and dams along the Ohio and Allegheny Rivers that have changed the ordinary high and low water lines. The ordinary low water line is now sometimes known as the "pool full line." This line is formed when the surface of the water lies just below the crest of the dam.

Dams and Other Permitted Obstructions

Where the water body is a navigable one, one must obtain a permit from the Corps and the DEP to erect a dam or any other obstruction to navigation. The Corps requires permits under the Rivers and Harbors Act of 1899 and the Clean Water Act. Often, the DEP will follow the Corps' lead when reviewing permits for obstructions, such as dams, docks, bridge piers and other structures. If the activity will require use of the bed of the waterway, a license from the Commonwealth is also required and a fee may be charged for the use of Commonwealth land.

Although the owner of riparian land along a nonnavigable waterway owns the bed of the water way, at least to the middle of the stream or center of the lake, federal and state permits are still required for dams and other actions that can affect the flow of the water. These permits seek to insure the safety of the public from inadequately designed or constructed dams rather than to protect the public right of navigation. A Corps permit under the Clean Water Act may thus be required to build a dam or other structure in a nonnavigable stream, although not for a dock. The DEP regulates dams on nonnavigable waters under the Dam Safety and Encroachments Act. ■

Regulatory Takings

Taking the Fear Out of Takings

BY DAVITT B. WOODWELL, ESQ.
Woodwell is Director of the Western Pennsylvania Office of the Pennsylvania Environmental Council.

Land use decision-making and other governmental regulatory programs limit, to varying extents, what uses landowners can make of their property. Restrictions such as residential zoning and setback requirements, wetlands programs, and emission rules allow citizens and landowners to be secure in knowing the future character and environmental health of their communities. Well designed land use regulations protect property owners from the impacts of inappropriate development and enhance the quality of life in communities. Similarly, environmental laws and regulations protect human health and welfare and ensure the future well being of our surroundings.

But municipalities—and state and federal governments and agencies as well—often shy away from passing and/or enforcing land use regulations because of a fear that they will have to compensate a landowner for a "regulatory taking." This fear is largely unfounded. The courts have long recognized the ability of government to impose restrictions on the use of property in order to promote the health, safety and welfare of the larger community.

The Fifth Amendment to the U.S. Constitution

The Fifth Amendment to the U.S. Constitution states, among other things, that property shall not be taken for public use without just compensation. Article 1, Section 10 of the Pennsylvania Constitution has been interpreted to mirror the Federal provision. The result: when a government entity in the state condemns property for a highway or a school or other public use, it must pay the owner of that property the fair market value.

The more difficult issue involves what happens when a property and its value are affected by a government regulation such as a zoning ordinance or wetland program. Clearly, restricting a property to residential development limits what the owner can do with that property. He or she cannot open an adult bookstore or a steel mill even if these activities would result in a greater financial return. Does this mean the owner must be paid for the difference? The answer under current Supreme Court rulings is probably not. Over the years, the Court has ruled that government can, to a large extent, regulate the use of land and other property in order to protect the public health, safety and welfare without paying for that property.

The Early Cases

A 1922 case, *Pennsylvania Coal* v. *Mahon* (260 U.S. 293 (1922)), marked the first time the Supreme Court found that a regulation could result in a taking of the plaintiff's land for public use, as in cases of eminent domain. The case centered on a statute requiring that coal be left in the ground to avoid subsidence.

The statute was alleged to have "taken" the coal companies' mineral estate obtained by contract with prior owners.

In the *Mahon* case, Justice Oliver Wendell Holmes found that the exercise of the state's police power had gone too far. Nevertheless, Holmes did see the necessity of regulation to protect the public health, safety and welfare. He wrote that: "[t]he general rule at least is, that while property may be regulated to a certain extent, if regulation goes too far it will be recognized as a taking."

Only four years later, the Court had another regulatory takings case before it, this one addressing the general constitutionality of zoning ordinances. The facts of the case—*Euclid* v. *Ambler* (272 U.S. 365 (1926))—were as follows: an owner of 68 acres of land in Euclid, Ohio, objected to the village's recently enacted comprehensive zoning plan, which precluded industrial development on the owner's land. Industry in nearby Cleveland was expanding right through Euclid by way of the land, and the municipality wanted to control development within its boundaries.

The key legal question was whether zoning ordinances were a valid exercise of police power—or whether a local government can, without exceeding its powers, limit the uses that one can make of his or her land. In its ruling, the Supreme Court held that a municipality could indeed impose comprehensive zoning in the exercise of its police powers. However, the Court found that this power is limited by the requirement that the ordinance must "bear a rational relation to the health and safety of the community."

While it approved Euclid's comprehensive zoning plan, the Court could not and would not hold that the ordinance would be constitutional regardless of how and where it is applied. Therefore, it is possible that a zoning ordinance—considered by the Court to be a valid exercise of the police power—still amounts to a taking as applied to a specific piece of property. The landowner in such a case would need to show that the regulation as applied to his or her property was "clearly arbitrary and unreasonable."

Recent Cases: Defining Property

Growth management issues were revisited by the Supreme Court twice in the last few years. In an opinion released in June 1994, the Court reaffirmed "the authority of state and local governments to engage in land use planning." However, the Court also held in *Dolan* v. *Tigard* (1994) that requiring public dedication of land for a greenway and a bikeway could result in a compensable taking. (For more on the *Dolan* case, see below.)

But what are the rules? How can it be determined whether a taking has occurred? Because every piece of land and every situation is different, the Court has stated that each alleged taking must be evaluated on its own merits. The Court also has found that the property in question must be looked at in its entirety.

In *Penn Central* v. *New York City* (438 U.S. 104 (1977)), the plaintiff proposed to erect a 50-story office tower in the air space directly above Grand Central Station, which had been identified as a historic landmark. The City told Penn Central it could not do this, and Penn Central responded by charging that the City's action amounted to a taking. While Penn Central focused on the air space above the terminal as the property in question, the Court considered the entire parcel including the already standing terminal. The Court also considered the fact that the City offered Penn Central development rights on another parcel in the City. Consequently, no taking was found to have occurred.

Another case involving differing notions of property focused the Court's attention once again on coal mining in Pennsylvania. In *Keystone Bituminous Coal Association* v. *DeBenedictis* (480 U.S. 470 (1986)), an anti-subsidence statute required that half the coal under existing structures—or approximately two percent of the total coal in question—be left in the ground. Despite the coal companies, argument that the remain-

ing coal was the "total property," the Court determined that all the coal had to be considered. "In deciding whether a particular governmental action has effected a taking, this Court focuses . . . both on the character of the action and on the nature of the interference with rights in the parcel as a whole," the Court stated.

The Validity of Regulation

Once the property issues are settled, the next step is to address the validity and the impact of the government's actions. In *Nollan* v. *California Coastal Commission* (483 U.S. 825 (1986)), the Supreme Court held that there must be a link between the state interest and the permit condition demanded by the government in order for the regulation to be valid. In Nollan, the California Coastal Commission approved the Nollan family's application for a building permit to replace an old cottage on their beachfront property. However, that approval was conditioned on the Nollans granting the public an easement across their beach.

The Nollans challenged this requirement as a taking of their property without compensation, an argument that prevailed before the Supreme Court. However, the basis for the Court's holding was not that the regulation had denied the Nollans all economically viable use of their land. Rather, it was that the easement was not substantially related to the government interests advanced by the regulation. The Commission defended the requirement for the easement because of what it saw as a loss of public access to the beach view, not physical access to the beach itself.

While the Court agreed that the Nollans' building would reduce the view of the beach, it did not understand how requiring an easement at beach level would improve the view. In the Nollan case, the Court reiterated the requirement that an exercise of the police power that affects property rights must substantially advance a legitimate state interest. Exactly what is meant by "legitimate" is open to changing interpretations by the Court as well as society, but generally has a very broad meaning.

A more recent case that built on the *Nollan* opinion was *Dolan* v. *Tigard* (114 S.Ct. 2309 (1994)). This case resulted from the City of Tigard's determination that in order to obtain a building permit to expand her plumbing and electric supply store along Fanno Creek outside Portland, Oregon, the owner, Mrs. Dolan, had to dedicate land to a public greenway and a public bikeway.

Before sending the case back to the Oregon state courts, the Supreme Court laid out the standards for analyzing land use planning regulations in light of a "takings" claim. The Court did not question "the authority of state and local government to engage in land use planning." Rather, it affirmed that power. The Court also reaffirmed its decision in *Nollan* that, for a regulation to be valid, there must be an "'essential nexus' between the 'legitimate state interest' and the permit condition." That nexus was found to exist in Mrs. Dolan's situation.

The Court also held in the *Dolan* case that if the "essential nexus" test is satisfied, the state then must show that there is "some sort of individualized determination that the required dedication is related both in nature and extent to the impact of the proposed development." Based on the record before it, the Court could not find that this "rough proportionality" requirement had been satisfied in the *Dolan* case. As the Court put it: "[t]he city has never said why a public greenway, as opposed to a private one, was required in the interest of flood control."

On the issue of the bikeway, the Court said the City's statement that the bikeway "could" offset increased traffic pressure from the store's expansion was not definite enough to justify the requirement. "No precise mathematical calculation is required, but the city must make some effort to quantify its findings in support of the dedication," according to the Court.

The Impacts of Regulation

After determining the validity of the regulation, it's important to look at its impacts on the property in question. The key question: Has the regulation deprived the owner of all economic benefit from the property or has it merely limited the uses to which the land can be put?

On June 29, 1992, the Supreme Court issued its much-awaited opinion in the case of *Lucas* v. *South Carolina Coastal Council* (505 U.S. 1003 (1992)). Mr. Lucas, a developer of the Isle of Palms, sued the

defendant following the enactment of the state's Beachfront Management Act in 1988. The Act stated that an increased area of beachfront should be shielded from development in order to protect the state's beaches from erosion. Mr. Lucas, who had paid $950,000 for two single-family residential building lots in his own development in 1986, claimed that the Council's determination meant he could not build on the lots.

The Act, in Mr. Lucas's view, amounted to an unconstitutional "taking" of his property without just compensation because it removed all economic value from his property. The trial court agreed with Mr. Lucas and awarded him $1.2 million in compensation. The South Carolina Supreme Court, however, reversed the trial court, concluding that no taking had occurred because the important public interest objectives of protecting South Carolina's dunes and beach systems, which Mr. Lucas did not dispute, were a valid exercise of state power.

In an opinion written by Justice Antonin Scalia, the Supreme Court's 6-3 decision expanded the takings doctrine somewhat by deciding that a landowner must be compensated when a government regulation denies the owner "all economically beneficial uses" of his land. However, the Court recognized an exception to this rule for restrictions on land that are based on the state's common law and nuisance and property laws. Justice Scalia also recognized the importance of well-formulated and properly implemented land use and environmental statutes, and the possibility that no compensation may be owed where land loses all value because of a regulation enacted due to "changed circumstances or new knowledge." The Court remanded the case to South Carolina for reconsideration in light of its opinion.

The *Lucas* case, which many thought had the possibility of rewriting "takings" law, has left in its wake a process based on a case-by-case determination of the competing interests of the landowner and the public welfare when an environmental regulation is challenged. It is important to remember that this decision affects the analysis in "takings" cases only where loss of all economic value is alleged. Consequently, the decision will have little effect on the vast majority of landowners or the validity and effectiveness of environmental regulations generally.

For the majority of cases where a regulation does not remove all economically viable use from property, the Supreme Court has developed a three-part "test." In the *Penn Central* case focusing on the historic designation of Grand Central Station, the Court assessed the character of the government action and stated that takings "may more readily be found when the interference with property can be characterized as a physical invasion by government, than when interference arises from some public program adjusting the benefits and burdens of economic life to promote the common good."

While requiring consideration of the economic impact on the property owner, the *Penn Central* ruling included an important caveat. Even when over three-quarters of the value of property is affected, this alone does not mandate compensation, the Court concluded. A vital consideration, according to the Court, is the owner's "investment–backed expectations"—i.e., what the owner had in mind when he or she bought the property, the validity of these expectations, and how those expectations have been impacted, if at all, by the regulation.

Because Grand Central Station was turning a profit and the owners still were able to use their land and had transferrable development rights, the Court found that no compensable taking had occurred. Furthermore, the Court reiterated that these questions were "essentially ad hoc, factual inquiries" that could change with each case, meaning that each alleged taking must be analyzed on its own merits because of its individuality.

Pennsylvania Law

The Pennsylvania Supreme Court addressed the issue of constitutional takings in the case of *United Artists* v. *City of Philadelphia* (635 A.2d 612 (Pa. 1993)). The case centered on the historic designation of the Boyd Theater, an art deco moviehouse in Philadelphia. In an earlier decision in 1991, the Pennsylvania Supreme Court found that historic designation of the theater "without the consent of the owner, (is) unjust, unfair and amount(s) to an unconstitutional taking." The 1993 decision reversed the first and held that historic designation of property is a

valid exercise of the state's police power, particularly in light of the Environmental Rights Amendment to the Pennsylvania Constitution, which specifically calls for preservation of historic sites in the Commonwealth. The second part of the 1993 ruling, however, struck down the historic designation of the Boyd Theater because it included the interior of the building. By including the interior, the state had exceeded its power under the applicable ordinance, and the action was therefore invalid.

The *United Artists* case sets forth the test that Pennsylvania courts should apply to questions of regulatory takings claims. Like the test fashioned by the U.S. Supreme Court in *Penn Central*, the Pennsylvania test has three parts to be applied on a case–by–case basis:

1) The interest of the general public, rather than a particular class of persons, must require governmental action;

2) The means must be necessary to achieve that purpose;

3) The means must not be unduly oppressive upon the property holder, considering the economic impact of the regulation, and the extent to which the government physically intrudes on the property.

This opinion is in line with the opinions that have been issued by the United States Supreme Court and undoes the confusion and concern caused by the earlier opinion issued in the *United Artists* case. It even gives reason for optimism in Pennsylvania that protection of historic and aesthetic resources are proper subjects for the exercise of the police power.

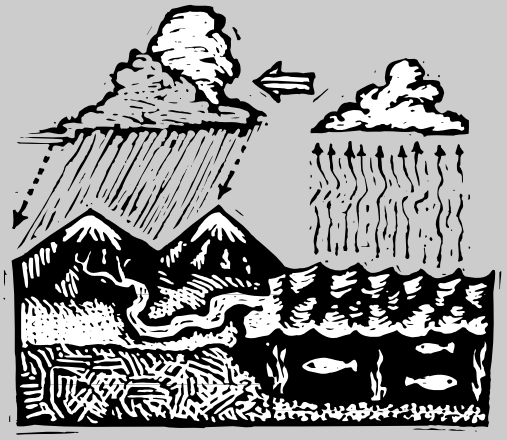
Conclusion

Based on the Supreme Court's line of cases interpreting the takings clause of the Fifth Amendment, it is clear that government can regulate to conserve lands. There are clearly situations where government will have to compensate the landowner for the impact of regulation. However, as the Court has stated, these situations are relatively rare.

Generally, government bodies and agencies are still very much able to take actions for the protection of the public without paying for them so long as there is sufficient justification for the action and the economic impact on the property is not total. Many purported experts on takings have gained their "expertise" through press releases, spin control and scare tactics rather than by carefully adhering to the writings of the Supreme Court. When formulating or enforcing ordinances, municipal officials should seek advice from attorneys and other professionals who truly understand the limits of regulation and the takings clause.

A number of useful guides to understanding takings law and its relationship to land use planning have been printed. These sources can help citizens and municipal officials in understanding both their capabilities and their limits when crafting regulations. ■

Enjoying the Watershed



Enjoying the Watershed

Water-Based Recreation

Angling for a Good Time

BY LEN LICHVAR

Lichvar is Executive Director of the Southern Alleghenies Conservancy and a freelance outdoor writer.

Pennsylvania has witnessed a surge of interest in water-oriented recreation in the last several decades that mirrors the same trend throughout the country. This has placed additional demand on the water resources of the Commonwealth. In some areas, problems of overcrowding have detracted from the overall recreation experience. However, the increased use also has allowed more residents and visitors alike to discover the diversity and the importance of the state's water resources and watersheds, as well as the multiple uses they provide.

Fishing Pennsylvania's Miles and Miles of Streams

When thoughts turn to sports and activities that take place in and around our water resources, the first thing to come to mind is often angling of some form or other. With more than 83,000 miles of rivers and streams in Pennsylvania, fishing opportunities readily abound throughout the state, which is home to several different types of streams and rivers. Most of our waterways are freestone water, which means they rely on precipitation for recharging. Another variety are

French Creek

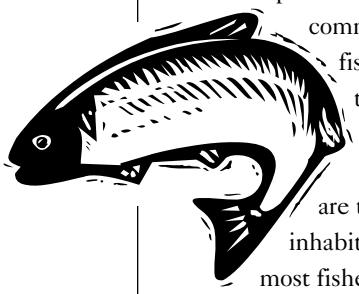
spring creeks that emerge in full flow from underground rivers and maintain their vitality by flowing through limestone-enriched corridors. Pennsylvania also is home to countless headwater streams that act as coldwater resources and that are often born on remote mountain sides or emanate from fertile valleys.

Tracking Trout

The predominant fish found in both freestone and limestone spring creeks are trout; these include brook, brown and rainbow trout. The brook trout, which is actually a char, is the only native trout of Pennsylvania's watersheds. Brown and rainbow trout, although popular angling fare, are imports that have adapted well to the state's cold-flowing rivers and streams. The Pennsylvania Fish and Boat Commission maintains a vigorous stocking program that helps maintain the supply of fish for anglers well after the opening day of trout season in mid-April.

Unfortunately, many trout anglers fade from the water after the last stocking trucks run in late May. Knowledgeable anglers know, however, that large num-

bers of trout survive the early season onslaught and remain in many waterways through the summer and into the autumn and winter as well. Holdover fish supplemented by selected fall stockings by the commission provide a year-round trout fishing experience for anyone willing to take advantage of it.



An often-overlooked resource among many Pennsylvania anglers are the wild or stream-bred trout that inhabit many more miles of water than most fishermen think. There are outstanding opportunities to angle for wild trout in all corners of the state. The Pennsylvania Fish and Boat Commission, in fact, manages many waters primarily for the enhancement of wild trout.

A Variety of Angling Options

Overall, angling opportunities abound in Pennsylvania for bait, lure and fly-fishing enthusiasts. Bait anglers always have found particular success in the early season when water temperature is at its optimum and higher water levels make the presentation of live bait more attractive. Spin or lure fishermen, on the other hand, can locate year-round action with standard bladed spinner offerings. Simply varying the retrieve and color schemes as the seasons change makes this a versatile and effective choice of angling methods. The fly rodder, however, is perhaps the most versatile of the lot since it is possible with today's equipment and techniques to put wet flies or nymphs on the bottom when needed and to change to surface presentations when required, depending on water conditions and the mood of the quarry.

Pennsylvania still has outstanding hatches of aquatic insects that fly anglers enjoy pursuing. The Commonwealth's watersheds are home to a large variety of mayflies, caddisflies, stoneflies and midges, as well as terrestrial insects that provide a plentiful supply of food for the fish and myriad hatch-matching scenarios for the flytier and fly angler. Some of the most famous fly rod anglers in the country currently reside in the state or call Pennsylvania their original home. In addition, such streams as Letort Spring Run, Penns Creek, Spring Creek and others are steeped in fly fishing lore and are known by anglers around the world.

For the Warmwater Angler

As they continue their trek, many freestone and spring-fed waters in Pennsylvania emerge from forested regions, creating opportunities for the sun to increase water temperature. Most of these streams also lose their steep gradient, which slows the water and facilitates the change from a coldwater to a warmwater environment. Just as the characteristics of the water change, so do the inhabitants. Pennsylvania boasts superb warmwater streams and rivers that harbor outstanding populations of smallmouth bass, crappies, rock bass, sunfish and bluegills. Mighty rivers such as the Susquehanna, the lower Delaware and the lower Youghiogheny present some of the finest warmwater angling in the northeast. Unfortunately, for many years the state suffered from overharvest of bass and other

Tips for Pennsylvania Anglers

- Anglers should always pinch down the barbs on their hooks. This makes for faster and quicker penetration by the hook point and produces less damage to the fish, which is especially important if it is to be released.
- Most anglers concentrate on long, flat pools or deep holes when fishing rivers and streams. In order to avoid crowds and heavily fished water, concentrate instead on the riffles and fastwater stretches. Contrary to popular belief, more and larger fish reside in these areas.
- The jig is still the most deadly and versatile lure ever invented, and it is effective for every species of fish. Fish jigs slow when the water is cold and move faster and more erratically in warmer water—and hold on!
- Some of the largest fish in streams and rivers reside close to the slower currents near the banks rather than in the faster water in the center of the stream. Too many anglers stand in the location they should be fishing in.
- The one tool that most fishermen should carry, but seldom do, is hook hone. Keeping hooks sharp is the simplest most important thing an angler can do to increase his or her catch rate.

warmwater species. Despite many miles of water and an excellent food base, larger smallmouth and largemouth bass were difficult to come by. However, in recent years the Pennsylvania Fish and Boat Commission, at the urging of many concerned anglers, has adopted more resource enhancement regulations that are expanding the opportunity for anglers to catch and hopefully return more and larger smallmouth bass and other species.

The Stillwater Story

The state is also dotted with lakes and impoundments that provide stillwater piscatorial pursuits for gamefish such as largemouth bass, pike, muskellunge, panfish, lunker trout and, in some instances, striped bass. The Pennsylvania Fish and Boat Commission manages and operates numerous impoundments throughout the state, and dozens more are managed by the U.S. Army Corps of Engineers or other agencies for flood control or hydroelectric power or as water supplies. Manmade lakes such as Raystown Lake, Pymatuning Lake, the Allegheny Reservoir and Lake Wallenpaupack are all outstanding fish producers. In addition, Pennsylvania is home to at least 76 natural lakes—primarily located in the northeastern and northwestern portions of the state—that also provide a diverse angling experience. Last but not least, countless farm ponds provide hours of leisurely fishing for the expert and novice angler alike. This diverse combination produces an exciting array of opportunities for those who prefer stillwater to moving water.

The watersheds of Pennsylvania provide outstanding angling opportunities for both coldwater and warmwater anglers. Each type of water has its own dedicated core of anglers who already know that some of the finest sport fishing on the North American continent can be found within the watersheds of Penn's Woods. ■

Other Outdoor Pursuits in Pennsylvania

Boating: Recreational boating, canoeing and kayaking are extensively pursued throughout the water courses of the state. Large and powerful watercraft are often found traversing the waters of larger impoundments such as Raystown Lake or the Three Rivers area of Pittsburgh. Water skiing and jet skiing are also popular in these larger bodies of water. However, increasing numbers of outdoor-oriented folks are rediscovering crafts that require less horsepower and more people power.

Canoeing. Canoeing on Pennsylvania's more navigable rivers is a sport that can provide a feeling of being one with the surroundings. The canoe is a conveyance that can provide a view of a watershed that no other method can match. It is also a great way to get to fishing spots that otherwise would be inaccessible.

Kayaking. Kayaking, on the other hand, is for the more adventurous outdoorsperson because it often pits man and woman against the elements of the environment. Pennsylvania boasts some of the finest white water rivers in the nation—such as the Youghiogheny in the west and the Lehigh in the east—providing the type of excitement white water enthusiasts crave. Dozens of other water courses throughout the state provide seasonal high-water kayaking and canoeing opportunities as well.

Tip: Before kayaking or canoeing an unfamiliar piece of water, look up information in a book or on the Internet or talk to someone familiar with the stretch. This extra effort can eliminate many unpleasant surprises or even dangerous encounters.

Birdwatching: Pennsylvania watersheds also provide a great opportunity for the growing number of bird-watching enthusiasts to pursue their pastime. Impoundments and rivers are home to or provide stopover for a wide variety of waterfowl and other bird species. Over a 12-month period in Pennsylvania, it's possible to see a dizzying variety of bird life.

Wing Shooting: Of course, some prefer to view waterfowl over the barrel of their favorite shotgun. Large impoundments such as Pymatuning Lake provide some of the finest wing shooting in the northeast. Also, smaller lakes, beaver ponds, wetlands and rivers provide ample chances for duck and geese hunters to bring down their quarry from the sky. Waterfowling opportunities are actually expanding in the state. Better water quality—especially in western Pennsylvania—has heightened the enthusiasm for the sport. Even some longtime dedicated turkey and upland game hunters are now taking a serious look at the increasing waterfowl hunting opportunities that the Commonwealth's watersheds are providing.

Tip: The greatest error made by the waterfowl hunter is not being able to correctly judge distance. Hunt with experienced hunters before venturing out alone in order to learn when and when not to shoot.

Furtrapping: Although often overlooked and even attacked by well intentioned but misguided activists, Pennsylvania's small but active contingent of fur trappers lay the majority of their traplines through river, stream and wetland areas. Beaver, muskrat and mink are still the prominent targets of the dedicated trapper, who provides an important service by controlling certain species that would otherwise go unchecked and at the same time filling a legitimate demand for fur and its byproducts.

Photographing: Many outdoor enthusiasts prefer to shoot or capture their quarry with a camera. The wildlife and waterfowl that inhabit Pennsylvania's watersheds provide countless photographic opportunities. Perhaps no other natural setting is as photographically appealing than a tumbling brook or waterfall tucked away at the headwaters of a watershed.

Tip: Outdoor photographers should always carry a tripod, which is one of the easiest methods of improving the quality of nature photographs. Numerous manufacturers supply small-sized versions that are ideal for field use.

Hiking and Biking: The rails-to-trails program is providing expanded access to some of the state's best watershed resources. Many of these trails follow streams or rivers for much of their length, providing recreational opportunities in the form of hiking or biking that the entire family can enjoy. Discovering and exploring these low-impact highways that lead into the heart of many watersheds is perhaps the fastest-growing recreational endeavor in the state today.

Credits

Editors:

Janette M. Novak
William H. Woodwell, Jr.

Photographs provided by:

Ellen Alaimo, Pennsylvania Environmental Council
Clyde Hare
Andrew W. Johnson, Pennsylvania Environmental Council
Mike Lambert, Three Rivers Rowing Association
Andrew Loza, Allegheny Land Trust
Susan McAlpine, The Nature Conservancy
Mark McGuigan, Pennsylvania Environmental Council
Douglas Mehan, PPG Industries, Inc.
Janette M. Novak, Pennsylvania Environmental Council
Skutksi & Oltmanns
Joan Schoff, Pennsylvania Environmental Council
John J. Walliser, Pennsylvania Environmental Council
Gates Watson, Pennsylvania Environmental Council
Sue Wiseman, PA CleanWays
Davitt B. Woodwell, Pennsylvania Environmental Council

Hydrologic cycle graphic provided by:

League of Women Voters of Pennsylvania

Stream map of Pennsylvania (back cover) provided by:

Pennsylvania Department of Conservation and Natural Resources,
Bureau of Topographic and Geologic Services

Funding provided by:

Vira I. Heinz Endowments
Pennsylvania Department of Environmental Protection

Design:

Emily Dyer, Skutski & Oltmanns

Major River Basins in Pennsylvania