Sinkholes serve as natural catchments where surface water enters the subsurface to recharge karst aquifers. Dumping trash in sinkholes leads to contamination of groundwater systems. Improper management practices result in polluting caves and water.

Over the decades, many landowners used caves and sinkholes as places to dispose of trash and sometimes even hazardous materials. Debris commonly found in sinkhole dumpsites can range from common household waste, old appliances and junk cars, to pesticide containers and dead animal carcasses. Debris from dumping frequently obstructs cave entrances that are found in sinkholes. As water flows through such an accumulation of waste, contaminants and pathogens wash into the cave environment and ultimately into drinking water supplies. Sinkhole cleanout projects are a practical way to protect caves and improve the quality of groundwater in karst aquifers.

Some sinkholes tend to channel unfiltered pollutants into the subsurface more readily than others do. Sinkholes with cave entrances or ones receiving flow from active or intermittent streams are particularly vulnerable to contamination. These more sensitive sinkholes should receive a higher priority when planning and targeting cleanouts. Especially valuable are projects resulting in restoration and protection of habitat for stygobitic and troglobitic fauna in cave and karst systems. (See stygobites, page 36.) Sinkhole cleanout projects can significantly help efforts to preserve biological diversity in karst regions.

Landowner Involvement
Landowner involvement is the most important element in organizing a sinkhole cleanout. It is critical for the landowner to fully agree with project plans and grant legal permission before performing any work. Funding for sinkhole cleanouts usually depends on landowner participation.

Unless you or your organization is willing to absorb all the costs, the landowner will be a major player in cleaning up any sinkhole dump. Landowners can apply for funding through federal and state environmental cost share programs to pay for sinkhole cleanouts. Under some cost share programs, donated volunteer labor can apply toward required landowner contributions. Depending upon the specific details of a sinkhole cleanout project, and what cost share funding program is used, the required landowner contribution might range from 0 to 50 percent.

Government Assistance
Government programs at various levels can fund sinkhole cleanout projects. Federal programs such as the Environmental Quality Incentives Program (EQIP) and the Conservation Reserve Enhancement Program (CREP) may fund a cleanout if the sinkhole receives an active stream. Sinkholes with large drainage areas and significant intermittent stream flows into the groundwater may also qualify for funding under CREP. The
The US Fish and Wildlife Service funds and manages sinkhole and cave cleanout projects involving federally listed species with the Partners for Wildlife Program under the US Department of the Interior. The US Fish and Wildlife Service funds and manages sinkhole and cave cleanout projects involving federally listed species with the Partners for Wildlife Program under the US Department of the Interior. In addition to paying for implementation of particular conservation practices, some programs provide an annual rental payment to landowners who continue to maintain conservation practices as specified under a contractual agreement. Cost share rental payments are usually contingent on the sinkhole being fenced off after the cleanout.

### State Assistance

Some states sponsor cost share and tax credit programs to assist landowners with conservation practices such as sinkhole cleanouts. On July 1, 2002, the Virginia Agricultural Best Management Practices (BMPs) Cost Share Program, administered by the Virginia Department of Conservation and Recreation, adopted a Sinkhole Protection BMP. The Virginia Sinkhole Protection BMP (WQ–11) can pay up to 75 percent of the cost for a sinkhole cleanout with a maximum contribution by the state of $2,500. Landowners in Virginia and elsewhere can also apply for financial assistance for conservation efforts through their local Soil and Water Conservation Office. Other agencies assisting landowners are the USDA Farm Service Agency and Natural Resources Conservation Service.

### Cave Conservancies

In addition to government programs, private organizations sometimes fund sinkhole cleanout projects. Cave conservancies such as the Cave Conservancy of the Virginias, the West Virginia Cave Conservancy, the Michigan Karst Conservancy, and the Indiana Karst Conservancy have all supported sinkhole cleanouts. The Nature Conservancy of Tennessee and the Canaan Valley Institute are also involved with sinkhole cleanout work.

Much can be accomplished through cooperation between private organizations and government agencies. The Virginia Karst Program, administered under the Virginia Department of Conservation and Recreation Division of Natural Heritage, has coordinated many successful sinkhole cleanout projects using funds provided through outside sources, including the Cave Conservancy of the Virginias.

### Cleanout Costs

The cost of sinkhole cleanouts can range from a few hundred to many thousands of dollars. Most sinkhole projects involve coordination with excavation contractors who use heavy machinery such as backhoes, track hoes, and front-end loaders to perform the actual cleanout work. A sanitation service or similar waste hauler usually provides transportation of the removed materials to a nearby landfill.

Proper disposal of the debris removed from sinkhole dumpsites usually requires segregation of recyclable materials and the payment of landfill tipping fees. Some localities and regional public service authorities are willing to encourage sinkhole cleanout projects by waiving landfill tipping fees and may even provide heavy equipment if asked.

### Contractors

Choice of a contractor should hinge on a company’s equipment capabilities and experience as well as cost. A cheap, but unreliable contractor will cost a project far more in the long run than paying an experienced operator to do the job. Written contracts are advisable to prevent misunderstandings and to help ensure successful completion of sinkhole cleanout projects. Any contract should specify payment only for work actually performed. Be

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<th>Federal Farm Bill provides funding for the CREP and EQIP programs through the US Department of Agriculture.</th>
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<td>The US Fish and Wildlife Service funds and manages sinkhole and cave cleanout projects involving federally listed species with the Partners for Wildlife Program under the US Department of the Interior. In addition to paying for implementation of particular conservation practices, some programs provide an annual rental payment to landowners who continue to maintain conservation practices as specified under a contractual agreement. Cost share rental payments are usually contingent on the sinkhole being fenced off after the cleanout.</td>
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In addition to government programs, private organizations sometimes fund sinkhole cleanout projects.
sure contractors can certify they are adequately insured—at least a half million dollars in general business liability and automobile liability coverage is usually required for contractors performing work on small government-funded projects. Employers are usually required to have workers compensation insurance as well as employer’s liability insurance. Check state and local laws.

**Erosion and Sedimentation Control**

Implementation of proper erosion and sedimentation control practices is critical for every sinkhole project. Proper conservation practices will help protect the sinkhole, caves, and groundwater from further damage. Stormwater and sediment can pass directly into the karst aquifer from unstable slopes that lack appropriate vegetative ground cover. Sinkholes should have a vegetated buffer or filter strip around their perimeter to provide some filtration of water flowing into the subsurface. Plantings should include native species. Avoid the use of invasive species.

Choose products such as erosion control matting with an eye toward minimizing adverse impacts to wildlife—the plastic netting used in some erosion control materials can trap small animals. Professional natural resource conservationists such as those working for the Natural Resources Conservation Service, US Fish and Wildlife Service, and local Soil and Water Conservation Districts can usually recommend appropriate ground
cover plantings and advise what erosion control practices are appropriate for a given site.

**Sinkhole Protection**
Fence building is an important part of sinkhole protection. Semi-skilled volunteer laborers can contribute significantly to sinkhole cleanout projects during fence construction. Most cost share programs require livestock exclusion from treated areas. Livestock ought to be fenced from any sinkholes that contain cave entrances or receive active or intermittent streams. Farm animals should be excluded from streams in karst regions whenever possible. Allowing livestock direct access to streams and sinkholes can result in higher levels of nitrates and pathogens in surface streams and groundwater. The same cost share programs used for sinkhole cleanouts will sometimes pay to develop alternate water sources for cattle and will fund livestock exclusion practices.

**Monitoring Sinkholes**
It is important to continue to check sinkholes after cleanouts are completed. Watch for indications of slope instability and erosion problems. Monitor the growth and stability of ground cover plantings. Place signs at the sinkhole to help discourage further dumping. Correct any problems as quickly as possible to put a stop to any resumption of dumping and to prevent associated environmental impacts.

**Sinkhole News Stories**
Sinkhole cleanout projects are newsworthy. People who understand the direct connections between sinkhole dumps and their drinking water supply are less likely to put waste in sinkholes in the first place. Tell news correspondents the important details about the project and the reason for the cleanout. Always give credit to the organizations involved in the project. Provide a prepared written news release to reduce the chances for tainted articles that contain misquoted statements and out-of-context casual remarks. A good news story, however, can be an invaluable tool for educating the public about the importance of protecting caves and groundwater quality in karst regions. (See public relations and press relations, page 284.)

Sinkhole cleanouts can help promote cave and karst protection. For media coverage and community collaboration, choose a sinkhole project that demonstrates karst contamination, groundwater pollution, and impacts to cave resources. Partnerships between conservation groups and government agencies can provide significant resources for performing sinkhole cleanouts.

To better promote conservation projects, place a strong emphasis on groundwater protection and cave habitat enhancement issues. Educating the public about the reasons for sinkhole cleanouts and the resulting benefits to water quality can create a larger group of stakeholders who will work to support cave and karst protection goals.

**Additional Reading**

