

United States Geological Survey

Programs in West Virginia



The USGS provides maps, reports, and information to help others meet their needs to manage, develop, and protect America's water, energy, mineral, and land resources. We help find natural resources needed to build tomorrow, and supply scientific understanding needed to help minimize or mitigate the effects of natural hazards and environmental damage caused by human activities. The results of our efforts touch the daily lives of almost every American.

Coal-Resource Assessments

Coal accounts for one-third of the total energy used and over one-half of the electricity generated in the United States. Coal from Appalachian Basin fields in West Virginia is a major resource for the Nation. Assessment of potential coal development needs to recognize both physical constraints and societal restrictions on mining. Since 1988, the U.S. Geological Survey (USGS) and the West Virginia Geological and Economic Survey (WVGES) have cooperated to identify these restrictions as part of a national effort to analyze the relation between mining restrictions and potential coal availability.

New technologies to use coal will require resources of specific and known quality. The economics of coal utilization depend on mining and transportation costs. Coal quality affects those costs, especially with respect to waste disposal. For example, high concentrations of sulfur in coal beds and associated rocks may produce acid drainage after mining or acid rain after combustion but may be beneficial in a synthetic fuel process. The USGS, in cooperation with State and Federal agencies, is developing cost-effective strategies to mitigate potential acidity problems and to clean up existing contamination.

Since 1975, the USGS, in cooperation with the WVGES, has evaluated and correlated data from drill holes, mines, and outcrops by using the National Coal Resources Data System. The USGS regularly provides the WVGES with paleontological and mineralogical analyses of key strata to identify coal beds better. The location and quality of coal resources throughout the State will be identified in the National Coal Assessment. Similar projects are ongoing with 22

States, representing 98 percent of U.S. coal production.

Effects of Resource Extraction

Coal mining and other forms of resource extraction, including logging or drilling for oil and gas, affect West Virginians in many ways. The USGS has completed numerous studies of the economic, hydrologic, and water-quality effects of resource extraction throughout the State, often in cooperation with the WVGES. The fracturing and subsidence of rock layers that result from underground mining increase the infiltration of precipitation and streamflow and also increase the volume of water in subsurface storage (fig. 1). These changes tend to reduce flood peaks and increase base flow in streams. More than 70 communities in West Virginia use active or abandoned coal mines as sources of public water supply.

Index of Subjects

- Coal-Resource Assessments
- Effects of Resource Extraction
- Water-Quality Assessments
- Ground-Water Studies
- New River Gorge Studies
- Streamflow Monitoring
- Ohio River Studies
- Canaan Valley Studies
- Rural Sanitation
- Mineral Assessments
- National Mapping Program
- Earth Observation Data
- Cooperative Programs

Water in mined areas generally has high concentrations of dissolved solids because of increased contact between the water and subsurface minerals. Where the sulfur content of the rocks is high enough, as is more common in the northern part of the State, the water becomes acidic and may contain undesirable concentrations of metals. The West Virginia Division of Environmental Protection (WVDEP) reports that acid mine drainage has affected at least 484 streams totalling 2,852 stream miles. A recent

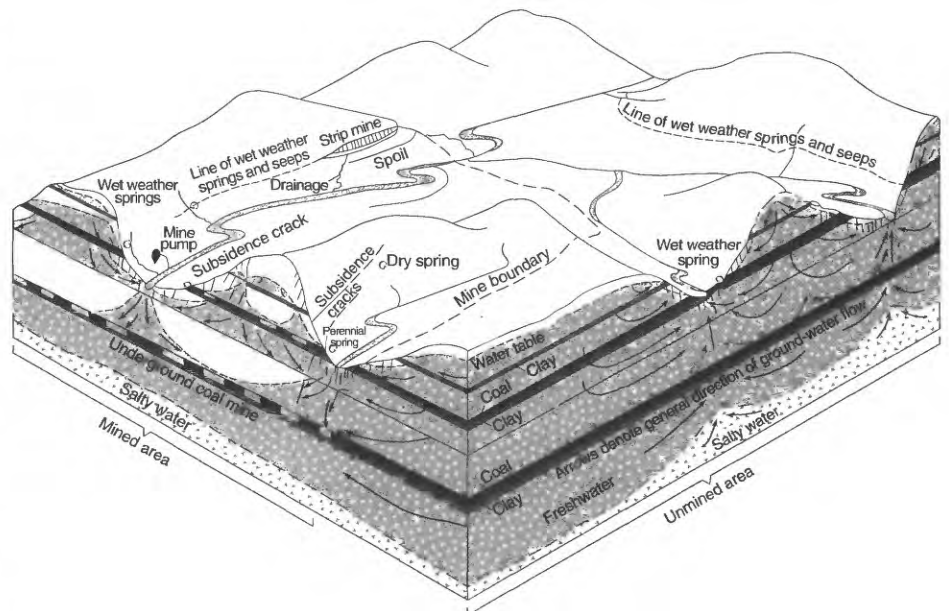


Figure 1. Typical hydrology in mined and unmined areas.

USGS assessment of potential mineral deposits included a map showing the distribution of acid stream water. In some rivers, acid drainage kills all living creatures; in others, fish are able to live for a few weeks or months but are unable to reproduce. Expanding suburbs in the Deckers Creek Basin near Morgantown are affected by the area's history of acid-mine drainage. USGS sampling in the Basin during 1993–94 helped identify the most heavily affected areas and allowed the U.S. Soil Conservation Service to set priorities for restoration.

Land-surface disturbance related to resource extraction can increase erosion, cause elevated concentrations of suspended sediment in streams, and lead to deposition of sediment in reservoirs and navigable rivers. Highway construction can produce large amounts of suspended sediment from small areas, but sediment yield can be even larger in these basins affected only by mining and logging, according to USGS studies in cooperation with the West Virginia Department of Highways and the West Virginia Division of Natural Resources. Like many other hydrologic processes, suspended-sediment transport is most important under extreme conditions, which makes monitoring, analysis, and interpretation difficult. For example, during more than 4 years of study in one basin, 30 percent of the total suspended-sediment movement occurred during just four storms.

Water-Quality Assessments

Management of the State's water resources needs to be based on a clear understanding of their suitability for each possible use. An extensive data base of water-quality information for West Virginia (fig. 2) has been developed through resource assessments of individual basins, studies of local problems, a series of federally funded coal hydrology studies between 1978 and 1981, and long-term monitoring at several stream-gaging stations. The data base, however, is incomplete in the number of chemical and biological characteristics measured and in the limited range of time and location that has been sampled.

The USGS National Water-Quality Assessment (NAWQA) Program has

long-term goals to describe the status and trends in the quality of a large, representative part of the Nation's surface- and ground-water resources and to identify the natural and human factors that affect their quality. About two-thirds of the State is included in three NAWQA Program study areas (fig. 3). Between 1992 and 1996, the Potomac River Basin will be intensively assessed; planning began in 1994 for assessments in the Allegheny–Monongahela and the Kanawha–New River Basins. The assessments combine a comprehensive review of available data, wide-ranging collection of new data, and regional analysis. These assessments provide the background within which local water-quality problems can be understood and managed; they also identify the occurrence and areal distribution of potential issues of concern. During the 1990's, the Program will focus on pesticides; nutrients such as nitrate and phosphate; volatile organic compounds; and aquatic ecology. The three study units have local liaison committees that involve more than 100 individuals and organizations with water-quality interests and responsibilities.

Ground-Water Studies

Ground water is used throughout West Virginia for public, domestic, and industrial supplies. About 90 percent of the rural population depends on ground water for domestic use. The USGS has conducted more than 100 hydrologic studies in the State to provide comprehensive information to public agencies.

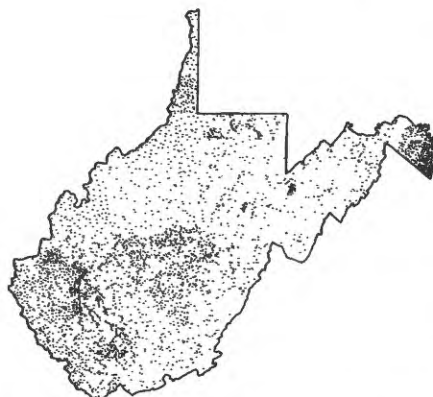


Figure 2. Water-quality data-collection sites in West Virginia.



Figure 3. NAWQA study units in West Virginia.

A recent study in Jefferson County, which is in the rapidly developing eastern panhandle of the State, is typical of resource evaluations by the USGS. The study findings included descriptions of the occurrence of ground water in each geologic formation in the County, including the range in depth to water and well yield. The distribution of sinkholes was mapped, and their hydrologic significance was described. The rate of ground-water flow along and across the geologic bedding was measured with tracer dyes. The amount of ground water available for use and the present rate of use were determined. Water-quality samples were analyzed for 62 wells and 8 springs for comparison with water-quality standards and to detect changes from conditions during a study 15 years earlier. Samples from seven sites were analyzed seasonally for 1 year. Most of the samples showed contamination by fecal bacteria, and about one-quarter had excessive levels of nitrate. About one-third of the sites, mostly near orchards, showed contamination by one or two of four pesticides that have not been used for more than 5 years; none of the concentrations exceeded health standards.

A statewide review of dissolved fluoride in ground water drew on analyses of samples from 1,889 wells and springs collected incidentally for other studies during more than 40 years. Results of the USGS analysis showed that more than 90 percent of the sites have less than the optimum fluoride concentration (1 milligram per liter) and that the few sites with excessive concentrations generally are scattered in the northwestern part of the State.

New River Gorge Studies

The New River Gorge National River was established by Congress in 1978 to preserve a 53-mile-long reach of the river as a free-flowing stream for public enjoyment and benefit. The National River combines scenic wilderness, fishing, and whitewater rafting. Water-resources information is essential to wise management of the area. Whitewater boating is best when flow in the river is between 3,000 and 15,000 cubic feet per second. The flow is affected by operation of Bluestone Dam on the New River and unregulated flow from the Greenbrier River. A study by the USGS, in cooperation with the National Park Service (NPS), found that rapid increases in flow advance through the gorge about twice as fast at high flow as at low flow. Whitewater users can plan their trips by calling the USGS gaging station on the New River at Thurmond, [(304) 465-0493]. A series of beeps reports the river stage, which can be converted to flow.

The USGS computed flood elevations for 2-, 25- and 100-year floods on the New River and five tributaries within the National River boundary. The NPS uses the results to design facilities near the rivers to withstand periodic flooding and to locate other facilities outside flood-hazard areas. The USGS studied the movement of a hypothetical spill of a soluble contaminant into the New River. A major railroad parallels the river and several major highways cross it in this reach. The study results indicate that a spill could be mitigated in predictable ways by regulating discharge from Bluestone Dam.

Streamflow Monitoring

Stream-discharge data are needed to forecast floods, to operate reservoirs, to prove that regulatory requirements have been met, to manage navigable waterways, to plan whitewater recreation, and to supplement water-quality monitoring. The USGS currently (1995) collects records of stream stage or discharge at about 90 sites in West Virginia, including 73 sites where satellite communication links automatically relay the data to central computers. At 65 of the stream sites, telephone links also permit more

frequent data access when needed. Rain-fall data are relayed by satellite from 40 stream sites and 24 other sites. The data are used by the National Weather Service to forecast floods and by the U.S. Army Corps of Engineers reservoir operators to control floods, to supplement streamflow during droughts, and to maintain whitewater for seasonal recreation on some rivers. Operators of hydroelectric powerplants use USGS data to confirm compliance with minimum-flow requirements set by the Federal Energy Regulatory Commission. The WVDEP collects water-quality data at many of the sites and uses the USGS discharge record to supplement the data they collect.

Understanding floods and droughts is essential to planning for structures near rivers. This understanding develops from statistical analysis of streamflow data available in the accumulated USGS data base. Discharge records at least 10 years long are available for 126 sites; they average 40 years, and the longest record is 115 years. Records less than 10 years long are available for an additional 105 sites. In a recent USGS study, in cooperation with the WVDEP, a method was developed to estimate low-flow characteristics for any stream in the State. This information can be used to determine the reliability of flows at a proposed public water-supply intake and estimate how much wastewater could be discharged to a stream without damage to other water users.

Ohio River Studies

New hydroelectric generators are planned for several navigation dams on the Ohio, the Monongahela, and the Allegheny Rivers. Flows through generators would enter the downstream river with less turbulence and air contact than do previous flows through gates. This change could reduce reaeration, which is the movement of oxygen from the air into the water. Loss of reaeration potential could reduce the wasteload-assimilation capacity of the rivers and affect waste-discharge permit limits.

The USGS, in cooperation with the City of New Martinsville, is monitoring dissolved oxygen in two navigational pools on the Ohio River. The data show

that discharge variations and algal growth dynamics in the pools may be as important as the characteristics of the dams in controlling dissolved oxygen. Continuation of the work is expected to lead to new methods for measuring the reaeration potential of gated navigational structures and to provide the data necessary to construct a management model of water quality and river discharge.

USGS biologists, oceanographers, and geologists are using underwater videography and sidescan sonar to characterize the river bottom near the 35 islands of the 365-mile-long Ohio River Islands National Wildlife Refuge. The work, in cooperation with the U.S. Fish and Wildlife Service and the West Virginia Division of Natural Resources, will provide a broad assessment of aquatic habitat resources for freshwater mussels and other species. Mussels are indicators of the health of the whole river. The project supports resource management based on ecosystems rather than single species.

Canaan Valley Studies

At an average altitude of 3,200 feet, the Canaan Valley is the highest valley of its size east of the Rocky Mountains. Its forests and wetlands support many plants and animals that are unusual or rare in West Virginia and the Eastern United States. The Canaan Valley's natural beauty, diverse ecology, and many recreational opportunities are enjoyed by seasonal and permanent residents and by more than 1.5 million annual visitors. The Canaan Valley National Wildlife Refuge was established in 1994. The USGS has studied the water resources of the Canaan Valley since 1990 and has begun detailed geologic mapping in cooperation with the WVDEP, the West Virginia Division of Tourism and Parks, and the WVGES. The USGS recently developed a water-quality model for the upper Blackwater River, which drains the valley, to represent the effects of physical, chemical, and biological processes on dissolved-oxygen concentrations. The model is useful to the WVDEP for analyzing the waste-assimilation capacity of the river as part of its regulation of wastewater discharges.

Rural Sanitation

Inadequate public water supply and sewage treatment in many rural areas of West Virginia are major factors that hamper economic development. In November 1994, West Virginia voters approved a \$300 million bond issue to fund improvements in water and sewage systems. More than one-half of West Virginia's population lives in rural areas, commonly in steep-sided narrow valleys adjacent to small streams. The limited available flat land combined with dispersed population has made development of community water supplies and sewer services difficult. Efforts to attract new industries to these areas are hampered by the lack of available water and sewer capacity. Information from USGS water-resource appraisals of several river basins and counties provide county leaders an overview of local water resources useful for developing plans for new community sanitation facilities.

Mineral Assessments

In 1994, the USGS completed an assessment of the State's potential for metallic and industrial minerals, which was published in a folio of 11 maps. Four areas that have a high potential for new mineral discoveries were identified. Deposits of zinc, copper, lead, uranium, and barite might occur in the areas. An unusual rock type (carbonatite or kimberlite) is the probable source of higher-than-normal amounts of thorium, titanium, and rare-earth elements found near Clarksburg and for elevated levels of flu-

orine found in well water. The maps link rock, sediment, and water chemistry with geological and geophysical data to move beyond previous studies of single media. Valuable information has resulted from additional USGS analysis of data collected by the U.S. Department of Energy about 1980 during a search for uranium deposits. The assessment, which was done in cooperation with the WVGES, provides a basis for more detailed studies and exploration. Other basic and applied research on the natural and human-induced environmental effects associated with geologic sources is carried out by the USGS Center for Environmental Geochemistry and Geophysics.

National Mapping Program

Among the most popular and versatile products of the USGS are its 1:24,000-scale topographic maps (1 inch on the map represents 2,000 feet on the ground). These maps depict basic natural and cultural features of the landscape, such as lakes and streams, highways and railroads, boundaries, and geographic names. Contour lines are used to depict the elevation and shape of terrain. West Virginia is covered by 493 maps at this scale, which is useful for civil engineering, land-use planning, natural-resource monitoring, and other technical applications. These maps have long been favorites with the general public for outdoor uses, including hiking, camping, exploring, and back-country fishing expeditions. Metric topographic maps at 1:100,000 scale cover the entire State in

28 sheets and are available on paper and as computer data sets for geographic information systems.

Earth Observation Data

Through its Earth Resources Observation Systems Data Center near Sioux Falls, South Dakota, the USGS distributes a variety of aerial photographs and satellite image data products that cover West Virginia. Mapping photographs of some sites go back about 40 years. Satellite images dating from 1972 can be used to study changes in regional landscapes.

Cooperative Programs

The USGS cooperates with about 20 local, State, and Federal agencies in West Virginia each year. Cooperative activities include water-resources-data collection, interpretive water-availability and water-quality studies, mineral-resource assessments, and mapping. Activities with local and State agencies typically match USGS and non-Federal funds equally. In addition to the agencies already mentioned, the USGS has cooperated in recent years with the Berkeley and Marshall County Commissions; the West Virginia Division of Environmental Protection Offices of Abandoned Mine Lands, Waste Management, and Water Resources; the Federal Emergency Management Agency; and the West Virginia Water Resources Research Institute, which conducts a program of research, education, and information and technology transfer.

For more information contact any of the following:

For water information

District Chief
11 Dunbar Street
Charleston, West Virginia 25301
(304) 347-5130

New River at Thurmond water level
[Count each of 4 sets of beeps. Each set is one digit in the stage value nn.nn feet]
(304) 465-0493

For map information

Chief, Mapping Applications Center
567 National Center
Reston, Virginia 22092
(703) 648-6002

For geologic information

Assistant Chief Geologist
953 National Center
Reston, Virginia 22092
(703) 648-6660

National Earthquake Information Center
Denver Federal Center, Mail Stop 967
Denver, Colorado 80225
(303) 273-8500

Center for Environmental Chemistry
and Geophysics
Denver Federal Center, Mail Stop 973
Denver, Colorado 80225
(303) 236-3301

Additional earth science information

can be found by accessing the USGS "Home Page" on the World Wide Web at "<http://www.usgs.gov>".

For more information on all USGS reports and products (including maps, images, and computerized data), call 1-800-USA-MAPS.