

United States Geological Survey

Programs in Indiana



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.

Information Needs

To make wise management decisions for the people of Indiana, policymakers require accurate and objective geologic, topographic, and hydrologic information. Through cooperative work with local, State, and other Federal agencies, the U.S. Geological Survey (USGS) fulfills the need for this unbiased information.

The USGS is a primary source of earthquake information, mineral data, satellite imagery, and high-quality maps and maintains readily-accessible data bases on surface and ground water and water quality.

In Indiana, the USGS has participated in studies that address issues that include determining ground-water availability for public supplies, agriculture, and industry; locations and quality of mineral resources; flood risk for decisions associated with land use; the effect of water shortages and drought; the sources and amounts of sediments flowing in Indiana rivers and streams; the rates that selected lakes are being filled by sediments; the amounts of pesticides and other chemicals that are reaching water supplies; the extent of ground-water-flow systems and the effects of those systems on pollutant migration and Indiana water supplies.

National Water-Quality Assessment Program

In 1991, the USGS began a study of the White River Basin in Indiana as part of the National Water-Quality Assessment (NAWQA) Program (fig. 1). The goal of the study is to determine water-quality conditions and trends in the surface and ground water of the 11,349-square-mile basin and to understand the factors that affect water quality. In particular, a wide variety of pesticides used in agriculture and urban areas are being monitored in

surface and ground water to determine concentrations and the frequency and duration of their occurrence. Nitrogen and phosphorous also are being studied to determine if the major sources of these nutrients are agricultural, or discharges from sewage-treatment plants, or combined-sewer overflows. The NAWQA Program will produce a wealth of water-quality information that will be useful to policymakers and water managers at the local, State, and national levels.

In addition to the NAWQA Program, water-quality investigations are conducted throughout Indiana. Statewide, water-quality data are collected for nearly 120 surface-water and 120 ground-water sites.

National Mapping Program

Among the most popular and versatile products of the USGS are its topographic maps at the scale of 1:24,000 (one 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



Figure 1. The White River basin study area for NAWQA program.

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the elevation and shape of terrain. Indiana is covered by 710 maps at this scale, which is useful for 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 fishing trips.

Digital map products that are used by computer-based geographic information systems have been developed by the USGS for Indiana at a scale of 1:100,000. These digital files are available by computer and are used by local, State, and private entities in resource assessments, technical investigations, and planning.

Indiana Ground-Water Atlas

In Indiana, about 200 billion gallons of ground water is withdrawn each year for drinking water, energy production, industrial, commercial, and agricultural uses. The need for a comprehensive publication detailing information on water-bearing units in the state was addressed in a cooperative effort by the USGS, the Indiana Department of Environmental Management (IDEM), and the Indiana Depart-

ment of Natural Resources (IDNR), Division of Water.

Ground-Water Models

The disposal of refuse and treated waste is an issue that confronts citizens of Indiana and the Nation. The USGS cooperated with the Indianapolis Department of Public Works (DPW) to investigate ground-water flows at landfills in Marion County. In this study, geologic, hydrologic, and water-quality data were collected. Ground-water-flow models were calibrated to determine the amount of water flowing through the landfills and if the leachate was reaching shallow aquifers and nearby streams.

The USGS and the DPW also cooperated in another study that focused on the ground-water flow and water quality beneath the sewage-sludge lagoons.

Communities require adequate supplies of clean water to provide for the needs of their citizens and to contribute in a positive way to the economies of the State and the Nation. The USGS has conducted extensive studies pertaining to ground-water availability throughout the State, as well as studies that define regional ground-water flow systems. An example is the USGS study to determine the ground-water flow system near the city of Elkhart by use of a ground-water-flow model. Results of the study which was conducted as a cooperative effort by the city of Elkhart and the USGS, were useful to water-resources decision makers in developing the water resources of the area.

Recently, a ground-water model was developed jointly with the IDNR for a heavily irrigated area in Newton and Jasper Counties. Results of the model indicated the significance of a clay-confining unit to the replenishment of an important bedrock aquifer. This information was useful in the development of regional water-management policies.

Southern Shore of Lake Michigan

Local government in Indiana is confronted by many problems that also are of concern at the national level. The USGS conducts scientific investigations that

address these challenging issues. In northwestern Indiana on the southern shore of Lake Michigan is a complex area of dunes, beaches, and wetlands. This area is adjacent to a highly industrialized zone recognized by the International Joint Commission and the U.S. Environmental Protection Agency as one of the principal areas of concern in the Great Lakes Basin. So that future planning can be based on a sound understanding of the physical and chemical processes that occur in this important region, the USGS and the National Park Service cooperated in a study that focused on the hydrogeology and hydrochemistry of these dunes and wetlands.

The USGS and IDEM cooperated on a number of other studies in the industrial lakeshore area to address contamination issues and define the complex interaction between ground and surface water. In addition, ground-water-level and quality data have been collected in northwestern Indiana in cooperation with the U.S. Environmental Protection Agency to evaluate those interactions in areas of extensive industrial and waste-disposal activity.

Core samples are being collected and analyzed to investigate the wetlands of the States that border the Great Lakes. A better understanding of the changes that resulted from natural conditions and human activities will assist resource managers in selecting optimum management practices. This work is being conducted in cooperation with numerous local, State, and Federal agencies. USGS studies along southern Lake Michigan determined that lake levels previously have varied by as much as 3 meters. This is more than the maximum variation of 1.6 meters that spanned the 1964 low level and the 1985–87 high level.

Collection of Continuous Hydrologic Data

In response to the water-information needs of individuals and agencies that are required to make important economic, environmental, and regulatory decisions, the USGS has been developing a long-term base of water-resources data in Indiana since the early part of the 20th century. In 1993, continuous-record data

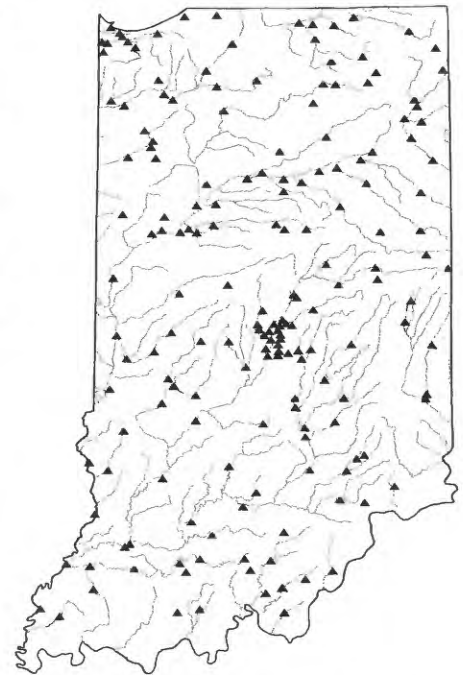


Figure 2. Locations of streamflow and water-quality gaging stations in Indiana in 1993.

were collected at 178 streamflow-gaging stations, 5 stage-only stations, 80 lakes, and 94 ground-water observation wells (fig. 2). The IDNR, Division of Water, is the principal State agency cooperating in USGS data-collection programs. Currently, more than 80 percent of the continuous hydrologic data-collection activity is maintained through efforts cooperatively funded by the IDNR and the USGS. Other cooperators in the data program include the U.S. Army Corps of Engineers, the IDEM, the Indiana Department of Transportation, and the Indianapolis Department of Public Works.

Lost River Investigation

The Lost River is one of the most fascinating hydrologic systems in the State. Above the Orangeville Rise, the river drains 163 square miles of scenic, rolling hills. Appropriately named, the Lost River is characterized by sinkholes and streambed swallow holes into which most of the headwaters "disappear" near the central part of the watershed. The water that leaves the surface through these natural openings travels underground through fractures and joints of the limestone. Most of the water returns to the surface at the Orangeville Rise. The remaining water

resurfaces at Twin Caves, Hamer Cave, Rise of Lost River, and other springs.

The Lost River Basin has been the subject of numerous studies for many decades. In a cooperative effort, the USGS and the U.S. Army Corps of Engineers, conducted a scientific investigation in 1993 and 1994. The purpose of the study was to define the ground-water drainage boundaries of the Lost River Basin better and to improve the understanding of the hydrogeology near the town of Orleans, a community subject to frequent flooding. By injecting nontoxic fluorescent dyes into the ground-water system at selected locations throughout the basin and observing their resurgence, drainage boundaries were delineated, and the direction of underground flows were determined. In addition, hydrologic factors that contribute to flooding at Orleans were determined, including the inhibition of stormwater infiltration into the subsurface. This information can be useful for future flood-control designs.

Environmental and Industrial Uses of Mineral Resources

Economic growth and development in Indiana depends on continued availability of industrial minerals for use in construction, industry, manufacturing, and the maintenance and upgrading of the State's infrastructure.

Indiana is one of the Nation's leading producers of masonry cement from limestone. Limestone and dolomite are the leading mineral commodities produced in the State. These rocks contain resources of high-calcium limestone and high-magnesium dolomite. In raw and unrefined form, these products have many environmental uses, particularly in cleaning stack emissions of coal-fired power stations. In addition, they are vital to medicine, agriculture, residential consumption, and high-technology processes.

The USGS is beginning an assessment of undiscovered limestone and dolomite resources in Indiana and other States. These materials will continue to have great effect on industrial growth and urban development, and in the establishment of new markets for Indiana products.

Oil and Gas Resources

Part of Indiana is underlain by the petroleum-producing Illinois Basin. The USGS has conducted research in a technique known as "mass balance" distribution. Because the production history is well documented in this basin, a measurement can be made comparing the amount of petroleum that has been produced with the potential total amount of petroleum contained in source rocks. This information helps in estimating how much more petroleum can be produced, on the basis of determinations of expulsion efficiencies of the source rock. Providing this type of information is part of the ongoing USGS National Petroleum Assessment. The USGS works closely with State agencies in acquiring the data necessary to make these calculations.

Coal Mining

The Nation depends on coal as a major source of energy. Coal usage accounts for one-third of the total energy and over one-half of the electricity generated in the United States. The use of coal is expected to increase during the next century to offset dependence on foreign oil and to sustain environmentally sound economic growth. Coal mining has an important role in the economy of southern Indiana.

The effects of coal mining on stormflows and water quality have been studied in cooperative efforts between the USGS and the IDNR, Division of Water. The results of these studies have assisted resource managers in identifying and instituting responsible mining practices.

As part of the cooperative geological mapping program, the USGS has partially funded and otherwise assisted the Indiana Geological Survey in the search for minable low-sulfur coal resources. The USGS also supports the Indiana mapping program with the identification of coal beds and associated horizons by means of analyses of their microfossil content.

A key issue of interest to future users of coal is the quality of coal that will be mined in the next 20 years. In a joint effort, the USGS and the Indiana Geological Survey are compiling information on coal quality of various major producing coal beds. These products allow planners

and industry to identify areas that can sustain production and coal of specific quality for specific applications, including clean combustion and synfuel production.

State Cooperatives in Coal-Resources Data

Resource managers, scientists, industry, and other Government agencies require standardized, current information on the location, quantity, and quality of coal resources. A joint venture between the USGS and State Geological Surveys was initiated in 1975 to develop the National Coal Resources Data System (NCRDS). Currently, cooperative projects are ongoing with 22 States representing 98 percent of current U.S. coal production.

A cooperative project between the USGS and the Indiana Geological Survey was initiated in 1982 to collect, evaluate, and correlate drillhole, mine, and outcrop data; encode and enter geologic and geochemical data into the NCRDS; and access the NCRDS data bases and software to generate new maps, reports, and resource assessments. Continued data collection and support of the NCRDS data bases provide baseline information that can be accessed for annual State resource updates and to meet data needs as they arise.

Earthquake Hazards

In the past decade, there has been increasing awareness that the seismic hazard in the Eastern United States could be greater than the historic earthquake record suggests. This region has experienced at least 40 felt earthquakes since 1875. Recent discoveries have shown evidence of at least seven strong prehistoric earthquakes. An earthquake of magnitude about 7.5 struck about 6,000 years ago in the Wabash River Valley, near the Indiana-Illinois border. Numerous other prehistoric earthquakes of magnitude 6 to 7 have struck southern Indiana and Illinois. Geologic evidence of these earthquakes, in the form of liquefaction-induced intrusions of sand and gravel in river sediments, has been discovered at more than a hundred widespread sites in the Wabash River Valley and along the river's tributaries. These intrusions permit the use of geologic, archaeological, and engineer-

ing techniques to determine when the earthquakes occurred, as well as their epicenters and approximate magnitudes.

This work has been carried out in cooperation with the Indiana Geological Survey and with archeologists from Indiana University.

Geologic Information Centers

The National Earthquake Information Center (NEIC), located in Golden, Colorado, collects, processes, and distributes information from more than 20,000 seismic events each year. This information is distributed in the form of alerts, bulletins, and routine catalogs to emergency management officials at the Federal and State level, operators of critical facilities, news media, the general public, and the earthquake-research community. These catalogs of recent and historical earthquake information are used in earthquake-hazard assessments. In order to better fulfill its mission, the NEIC has developed and is deploying the U.S. National Seismograph Network (USNSN), which, when completed, will consist of approximately 60 seismograph stations nationwide. The USNSN monitors nationwide seismicity, provides early notification of seismic events to national-level emergency service personnel, maintains an archive of high-quality digital data on national seis-

micity, and provides public information on earthquakes.

The Center for Environmental Geochemistry and Geophysics (CEGG) focuses on environmental geoscience research and information exchange. CEGG coordinates and supports basic and applied research on the natural and human-induced environmental effects associated with geologic sources—especially those related to mineral and energy resources and their development. Some examples of currently supported investigations include: environmental geochemistry of historic mining and smelting activities, behavior and transport of toxic elements in natural systems, and use of naturally occurring minerals as scavengers for toxic metals.

Earth Observation Data

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

Cooperative Programs

The USGS cooperates with numerous local, State, and Federal agencies. Cooperative activities include water-resources data collection, interpretive water-availability and water-quality studies, mineral-resource assessments, and mapping. When local and State agencies are involved, activities typically are funded on a matching-funds basis. In addition to agencies already mentioned, the USGS conducts cooperative studies with the Town of Carmel, the Cities of Indianapolis, Muncie, and Seymour; the Saint Joseph River Basin Commission; the Indiana Department of Highways; the U.S. Department of Defense; and others. The USGS provides support to the Indiana Water Resources Research Center at Purdue University, which conducts a program of research, education, and information and technology transfer. The USGS also provides support to the Water Resources Research Institute, which conducts a program of research, education, and information and technology transfer.

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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.