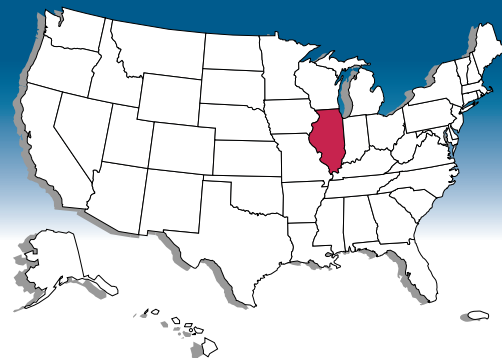




U.S. Geological Survey Programs in Illinois

U.S. Department of the Interior ■ U.S. Geological Survey



The safety, health, and economic well being of Illinois' citizens are important to the U.S. Geological Survey (USGS). The USGS is involved in the study of water, mineral, and biological resources throughout the State. Through cooperative programs with many Federal, State, and local agencies, the USGS is at work every day in the State of Illinois studying coastal erosion, assessing water quality, and determining the risk from earthquakes, landslides, and other natural hazards. Through national programs, citizens of Illinois also have access to the thousands of map, book, and aerial photographic products of the USGS. Information follows on acquiring these products and accessing various traditional and electronic sources of products and services.

Coastal Erosion of Lake Michigan

During this century, water levels in Lake Michigan have risen successively higher. The highest water levels ever recorded were from 1985 to 1987. Periodic intense storm waves, as well as high water levels, cause damage to the Illinois shoreline. This was especially true in 1986 when storm waves and high lake levels caused extensive damage to Chicago Lakefront businesses, parks, and condominiums. The potential savings of millions of dollars in beach replenishment and maintenance costs was the goal of studies by the Illinois Department of Natural Resources-Illinois State Geological Survey (ISGS), several Illinois universities, the U.S. Army Corps of Engineers (USACE), and the National Oceanic and Atmospheric Administration.

The USGS cooperated in studies to determine why and where the structures that support the shoreline are failing and why and where the sand, which normally protects the shoreline and maintains the beaches, is being depleted. A major finding is that prehistoric lake-level fluctuations were at least twice as great as those observed historically.

The USGS study of the Chicago shoreline protection structures serves as a basis for

planning extensive reconstruction. Understanding sand movement by mapping lake-bottom physiography and sediment distribution by using sidescan sonar imagery and seismic reflection geophysical techniques (fig. 1). Together, these data provide the basis for preparing lake-bottom maps of physiography and sediment distribution and can enable planners to save millions of dollars in beach replenishment and maintenance costs.

Urbanization and Flooding

Rapid urbanization of drainage areas has often led to unanticipated high peak flows and increased frequency of flooding within or downstream from the drainage areas. Computer models that represent the characteristics and responses of watershed runoff in response to rainfall are used to apply storm data to the planning, design, and management of roads, bridges, culverts, and dams. Solutions developed by water-resource planners for mitigating anticipated storm runoff can then be included in zoning restrictions and construction plans for future development in areas that are undergoing rapid ur-

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banization. Rainfall and streamflow data are being collected in suburban counties of Metropolitan Chicago that are undergoing rapid development. These data are used to calibrate models of rainfall and stream runoff to a variety of watershed conditions. Concurrently, a real-time rainfall data network is being installed in a large watershed in Du Page County. The information provided by the modeling study and the network will be used to optimize the management of reservoir operations to mitigate the severity of flooding. Cooperators on these studies are the Du Page County Department of Environmental Concerns, the Lake County Stormwater Management Commission, and the Illinois Department of Natural Resources-Office of Water Resources.

Coal Availability and Quality

The availability of environmentally acceptable and reliable energy resources is an important issue for Federal, State and local planners and industries that utilize coal. Coal usage currently accounts for one-third of the total energy used and more than one-half of the electricity generated in the United States. Illinois has the largest resource of bituminous coal in the United States. A cooperative program between the USGS and the ISGS was initiated in 1992 to study 7.5-minute

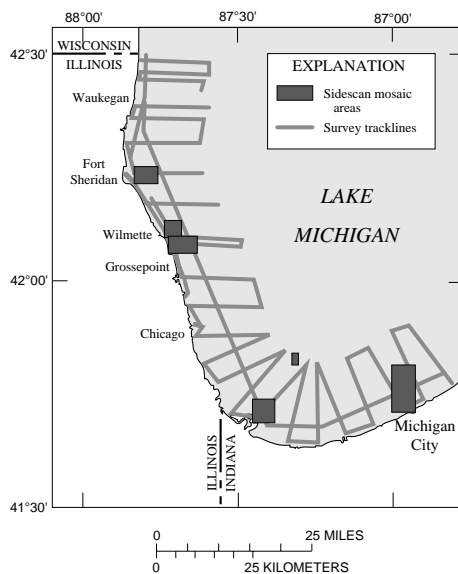


Figure 1. Southern Lake Michigan showing areas surveyed by using sidescan sonar imagery and seismic reflection track lines.

quadrangle topographic maps of representative coal areas under development in the State to identify current major constraints to the development of coal resources and to estimate the amount of remaining coal resources that may be available for development. As part of the coal assessment activities in the Illinois Basin, the USGS is working with the ISGS to update data bases for Illinois coals, and then to integrate these data bases with those from other Illinois Basin States (Kentucky and Indiana).

Coal production in the Illinois Basin has declined over the last 2 to 3 years. This is because the electric utilities have switched from high-sulfur coals from the Illinois Basin to low-sulfur coals from Western States. The ISGS and USGS are cooperating in studies to develop models to increase understanding of the geochemical processes that affect distributions, variability, and modes of occurrences for sulfur and potentially hazardous trace elements in coal.

Oil and Gas Resources

Illinois has a long history of exploration for and production of oil and gas. Most of the State has been explored thoroughly for oil and gas, yet there are areas that are underexplored because the oil and gas resources are at great depths in the Illinois Basin. A technique known as the mass-balance method has been developed to estimate the undiscovered amount of oil and gas that the Basin could produce and how much has actually been produced. As part of the National Oil and Gas Assessment, the USGS worked with the ISGS to define oil and gas activities in the State.

Water Quality of the Illinois River Basin

Protecting the quality of the Nation's ground- and surface-water resources is a priority concern. The impact of degraded water quality may have short- or long-term effects on public health or economic success. Project scientists in the USGS National Water-Quality Assessment (NAWQA) Program are collecting water-quality data in the lower Illinois River Basin and have completed a study of the upper Illinois River Basin (fig. 2). The identification of the trends in water quality is a major thrust of the NAWQA Program. Objectives of the lower Illinois River Basin study are to provide a description of present water-quality conditions; to develop conceptual models that relate observed conditions to sources and



Figure 2. National Water-Quality Assessment (NAWQA) Program study units.

causes; to track long-term trends in water quality; and to improve the understanding of the relation between causative factors and water quality. The NAWQA Program studies in Illinois have established liaison committees with representatives from Federal, State, and local agencies, such as the USACE, the Biological Resources Division (BRD; formerly the National Biological Service), and the Metropolitan Water Reclamation District of Greater Chicago to identify the important topics for study.

Earthquake Hazards

In the past decade, there has been increasing awareness that the seismic hazard in the Midwest may be greater than the historical earthquake record would suggest. Recent discoveries have shown evidence of possibly eight or more strong earthquakes (likely magnitudes between 6.0 and 7.5). At least 155 magnitude 2.5 or larger earthquakes have struck Illinois since 1875. Numerous prehistoric earthquakes of magnitude 6 to 7 have struck southern Indiana and Illinois; some may have been larger. Geologic evidence for these earthquakes in the form of sand-and-gravel intrusions in river sediments has been discovered at more than 200 sites in the Wabash River Valley and along its tributaries in Illinois. This information is the result of USGS studies done in cooperation with the Illinois Department of Natural Resources—Illinois State Museum and the ISGS, the Indiana Geological Survey, and Indiana University.

Hazardous Waste

Contamination of surface water and ground water by hazardous wastes is of major concern throughout Illinois. Studies to characterize several Superfund sites and

urban areas in northern Illinois are being conducted by the USGS in cooperation with the U.S. Environmental Protection Agency (USEPA), Region V. The USGS is contributing technical expertise, such as borehole logging, aquifer-test analysis, and water-quality sampling and analysis, to aid in understanding the geologic and hydrologic characteristics of the study areas. Results of these studies improve understanding of the concentration and distribution of soil and ground-water contamination needed for site remediation and protection of ground-water supplies.

The USGS also is contributing technical expertise to studies at hazardous-waste sites at several U.S. Department of Defense installations. For example, the USGS is conducting a study of soil and ground-water contamination at Fort Sheridan north of Chicago. Many of the military installations in Illinois have been closed or are being closed under the auspices of the Base Closure and Realignment Act, as part of the closure procedures, and the problems of environmental contamination have to be addressed.

Diversion of Water From Lake Michigan

Since 1900, Illinois has diverted water from Lake Michigan down the Chicago Sanitary and Ship Canal (CSSC; the Chicago River and associated waterways) to the Des Plaines River and then to the Illinois River. This was done to protect the quality of water in Lake Michigan by carrying sanitary wastewater away from the Lake and allowing barge traffic on the Illinois River between the Mississippi River and Chicago. The most recent U.S. Supreme Court decision (1967 and modified December 1, 1980) that regulates the diversion of water from Lake Michigan limits diversion by the State to a 40-year average of 3,200 cubic feet per second. The USACE is responsible for accounting for the water diverted, and the State is responsible for allocation of the water diverted.

Determining the diversion by Illinois is a complicated and time-consuming process. The USACE has determined that Illinois has diverted flows in excess of the 3,200-cubic-feet-per-second limit from the 1983 to 1993 water years. Improved accounting of the various components of the water diversion is a goal of the diversion accounting program of the USACE. An acoustic velocity meter (AVM) for measuring flows on the CSSC at Romeoville is a key part of the Lake Michigan diversion accounting procedure. The USGS is responsible for the operation and

maintenance of the AVM by agreement with the USACE.

The USGS also is cooperating with the USACE, the Illinois Department of Natural Resources—Office of Water Resources, and the Metropolitan Water Reclamation District of Greater Chicago to refine various components of the Lake Michigan diversion accounting. The USGS also is applying advanced techniques and technology, such as Acoustic Doppler current profilers and AVM's, to measure flows in the CSSC and leakage through the lakefront diversion-control structures. Recent measurements made by the USGS indicate that actual leakage through the lakefront diversion-control structures is much greater than previous estimates.

Sedimentation Studies and Monitoring Network

Sedimentation in river basins throughout Illinois has resulted in reduced depths of navigation pools and backwater lakes. Fish and migratory bird populations are being adversely affected by a loss of food and habitat as a result of increased sediment loads in the water and sediment deposits in the aquatic habitats. The USGS is studying sedimentation on the Mississippi, the Illinois, the Kankakee, and the Cache Rivers and other streams to measure sediment loads. Measures of sediment concentrations and loads are being made by the USGS in the pool above Lock & Dam 13 on the Mississippi River and in the pool above La Grange Lock & Dam on the Illinois River to determine sediment budgets and transport. The sedimentation studies are being conducted in cooperation with the BRD, the USACE, as well as State and local agencies. The USGS maintains a network of 21 sediment-monitoring stations throughout the State in support of the sedimentation studies and for basic data collection.

Collection of Water Information

Surface- and ground-water and water-quality information are needed for a variety of activities. These include the surveillance, planning, design, hazard warning, operation, and management in water-related activities, such as water supply, hydroelectric power generation, flood-control, irrigation, bridge and culvert design, wildlife management, pollution abatement, flood-plain management, and water-resources development. The USGS, in cooperation with more than 20 Federal, State, and local agencies, collects

streamflow (fig. 3), ground-water level, and water-quality data throughout the State.

Of the streamflow-gaging stations in Illinois, 146 (about 94 percent of all stations) are equipped with satellite or telephone telemetry. Through a network of satellite or telephone telemetry, streamflow data in Illinois are provided to the National Weather Service, the USACE, and various other Federal, State, and local agencies to manage flood-control structures and reservoirs, to plan for flood mitigation, to forecast streamflow, and many other activities. The public can find much of this information by accessing the USGS home page computer on the World Wide Web at the USGS District Office In Urbana at URL:

<http://www.dilurb.er.usgs.gov/>

Landslide Hazards

According to a 1985 inventory of landslides in Illinois, at least \$8 million in damages have been documented since 1928. The USGS and the ISGS continue to compile landslide information. The compiled data show that most landslides in the State have been induced by construction activities and that most occur along the Illinois and the Mississippi Rivers. In spring 1995, heavy rain caused many damaging slides, in which one person died. An inventory map of locations of severe landslide problems is useful to developers, businesses, and local governmental agencies responsible for developing mitigation strategies. Analyses of eight land-



Figure 3. Surface-water data-collection sites.

slides within the New Madrid Seismic Zone indicated that the landslides were stable, but failure is possible during an earthquake of the magnitude experienced in 1812 (probably the strongest historic earthquake in the conterminous United States).

Geologic Mapping

The USGS has had an on-going cooperative geologic mapping program with the ISGS for the last 10 years to produce large-scale (1 inch equals 2,000 feet) geologic maps on the 7.5-minute quadrangle base. Priorities for selection of areas to be mapped are set by the Illinois Geological Mapping Advisory Committee, which consists of representatives from State and county governments, universities, industry, professional associations, and others concerned with geologic mapping. Geologic mapping is used in the identification of mineral resources and delineation of glacial deposits for determining sand and gravel resources and in the identification and protection of aquifers susceptible to contamination. These programs also include structural studies in selected parts of southern Illinois to assess the age, character, and extent of faulting in areas within or near the New Madrid Seismic Zone to help determine the earthquake-hazard potential.

Topographic Mapping

The USGS, in cooperation with Federal, State, and county governmental agencies in Illinois, prepares printed topographic maps and computerized geographic and cartographic data. The resulting products serve many geographic information systems (GIS) applications in addressing natural resource, conservation, waste disposal, emergency, hazard, and other environmental and societal issues that confront the State's citizens. Current USGS mapping work, much of it conducted in funding partnerships with various agencies in Illinois, includes production of 1:100,000-scale topographic maps and several types of computer-readable cartographic data, which include ground-elevation and contour files, on-screen images of topographic maps and aerial photographs, digital elevation models, and map-revision data. A new set of aerial photographs also is being acquired across the State through a cooperative effort.

State agencies currently participating with the USGS in the joint production of digital map data include the Illinois Department of Natural Resources—Office of Water Resources and the ISGS, the Illinois Depart-

ment of Transportation, and Lake County. Federal mapping partners with the USGS in Illinois include the Natural Resources Conservation Service (NRCS); the U.S. Forest Service (USFS); the USEPA; and the US-ACE.

The Illinois Mapping Advisory Committee (IMAC) serves as the primary statewide topographic mapping coordination body in Illinois. Representatives of the IMAC are from Federal, State, and county governmental agencies; universities; and the private sector. IMAC meetings, which are held twice a year, feature presentations and demonstrations on mapping and GIS issues and information exchange.

Earth Science Information

The USGS Earth Science Information Centers (ESIC) provide information about the USGS, its programs, products, and technological developments to the public. The Earth Science Information Center in Champaign was established under a cooperative agreement among the USGS, the ISGS, and the University of Illinois and is part of a nationwide network of such centers to provide public access to earth science information. The University of Illinois in Chicago also is a State ESIC affiliate. As part of the national ESIC network, these offices provide information on such earth science topics as cartography, geography, digital data, remote sensing, geology, geophysics, geochemistry, hydrology, geohydrology, aerial photography, and land use. The ESIC office at the ISGS in Champaign also has USGS map products available for purchase. Each ESIC is supported by the USGS with reference materials, technical assistance, training and outreach activities, and access to USGS data bases.

Coastal Wetlands

Coastal wetlands of Lake Michigan are beneficial to the quality of water and protect the shoreline communities in Illinois. Many physical, climatic, and human processes have been interacting to cause the deterioration of these wetlands since the last glaciation in Illinois (from 25,000–13,500 years ago). Histories of wetlands along the Illinois coast are included in mapping being done by the USGS using GIS for Lake Michigan. Monitoring changes in the wetlands through time will provide a tool for land-use planners, political jurisdictions dealing with conflicting best-management practices, and scientists who are trying to understand geological limits on biodiversity. The ability to

estimate the effect of natural processes and human activities on coastal wetlands has required close cooperation with the ISGS, Morton Arboretum, Northeastern Illinois University, the Chicago Department of Engineering and Public Works, the Field Museum of Natural History, as well as with the BRD, and the National Wetlands Inventory of the U.S. Fish and Wildlife Service.

Digital Soil Surveys

The Southern 7 GIS Project is a multi-agency project sponsored by the U.S. Department of Agriculture to prepare digital soil surveys in the seven southernmost counties of Illinois. Digital orthophotoquads (DOQ's) are being produced for the area as part of the USGS DOQ program, with costs shared by the USGS, NRCS, the USFS, and the State of Illinois. DOQ's are used as a base map for the digital soil surveys and as a source for other information used in a GIS, such as tree-stand data for the USFS, locations of homes and streets for a 911 emergency telephone system, and other applications.

Sharing Spatial Data

The National Spatial Data Infrastructure Comprehensive Cooperative Agreement Program was established by the Federal Geographic Data Committee through the USGS to help form geographic and cartographic data-sharing partnerships with the non-Federal sector. This Program provides funding to State and local government agencies, academia, and the private sector to encourage resource-sharing projects through the use of technology, networking, and interagency coordination.

The Illinois GIS 2002 Project is designed to develop an accurate and continually updated GIS of base map and parcel data for Adams County. The Project, which involves Federal, State, and county agencies; public utilities; and private firms, will address data-standardization issues and promote efficient collection and sharing of geographic and cartographic data among multiple users. The Champaign County Network effort, which includes more than 70 participating agencies, is directed toward providing computer network access to community-relevant geographic and cartographic data from local, regional, State, and national sources. The effort is intended to demonstrate the development of a prototype local information system.

For More Information

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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**

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

U.S. Geological Survey
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