A SUMMARY OF WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN IOWA, FISCAL YEAR 1994

Compiled by ROBERT C. BUCHMILLER

U.S. GEOLOGICAL SURVEY
Open-File Report 94-88

Prepared in cooperation with the
STATE OF IOWA and other agencies

Iowa City, Iowa
1994

U.S. DEPARTMENT OF THE INTERIOR

BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY

GORDON P. EATON, Director

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U.S. Geological Survey
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Iowa City, IA 52244-1230

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Box 25286, MS 517
Denver Federal Center
Denver, Colorado 80225

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CONVERSION FACTORS, ABBREVIATIONS, AND VERTICAL DATUM

Multiply	*By*	*To obtain*
	Length	
inch (in.)	25.4	millimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
	Area	
acre	4,047	square meter
acre	0.4047	hectare
square mile (mi^2)	2.590	square kilometer
	Flow	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second
	Volume	
million gallon per day (Mgal/d)	0.04381	cubic meter per second
	Mass	
ton, short	0.9072	megagram
ton per acre (ton/acre)	0.0002241	megagram per square meter

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929--a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

The use of firm or trade names in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

MESSAGE FROM THE IOWA DISTRICT CHIEF

The collection of hydrologic data and the investigation and assessment of the quantity, quality, and use of surface- and ground-water resources are major components of the mission of the Water Resources Division, U.S. Geological Survey. To accomplish this mission, the Iowa District, U.S. Geological Survey, is organized into a District Office and three Field Headquarters offices. These offices are geographically located to provide access and response to hydrologic events and to maintain a liaison with cooperating State and Federal agencies. The Iowa District technical staff is organized into three major organizational units: (1) the Hydrologic Surveillance Section, which maintains the systematic hydrologic data programs for the State; (2) the Hydrologic Studies Section, which investigates and assesses the quantity, quality, and use of the State's water resources; and (3) the National Water-Quality Assessment Program Unit, which plans and implements a new Federal program designed to describe the Nation's water-quality conditions and their changes with time.

The Hydrologic Surveillance Section maintains a network of hydrologic data-collection sites and compiles hydrologic data collected from these sites for public distribution. These hydrologic data include records of: (1) stage and discharge of principal rivers and tributaries; (2) chemistry and suspended-sediment concentration of selected rivers; (3) water levels in and quality of principal aquifers; (4) precipitation chemistry; and (5) surface- and ground-water use. Data from this network are compiled and entered in the Survey's National Water Information System data base, located in Reston, Virginia, and are published annually in the report series "Water Resources Data--Iowa."

The Iowa District Hydrologic Surveillance Section performed a critical role during the 1993 flooding on the upper Mississippi River Basin. River-discharge measurements were obtained on a daily basis at key gaging stations in the upper Mississippi River Basin, and data from these measurements were sent immediately to flood forecasters, river managers, and flood-relief agencies. Emergency maintenance and repairs were performed at gaging stations in the flooded area to document conditions and provide data users with continual river-stage and discharge information. Water-quality and suspended-sediment samples were collected at selected gaging stations in the flooded region. Iowa District personnel assisted in compiling information included in the U.S. Geological Survey Circular 1120 series, which describes and analyzes many aspects of the flooding in the upper Mississippi River Basin during 1993.

The investigation and assessment of the surface- and ground-water resources of Iowa is accomplished through a series of diversified projects conducted by the Hydrologic Studies Section. Each project has a project chief who is responsible for managing the investigative aspects of the project, maintaining a project budget, and providing public access to the findings of the project.

New projects planned for the Iowa District during fiscal year 1994 include studies of:

* 1993 flood-inundation maps,

* Effects of 1993 floods on flood-frequency estimates,

* Evaluation of the water-supply potential of the Cedar River alluvium,

* Reconnaissance assessment of 1993 flooding on ground-water contamination.

The effects of land-use practices on water resources and the effects of chemical fertilizers and pesticides on surface- and ground-water quality are a growing public concern in Iowa. The Iowa District is presently conducting several State and Federally supported projects relating the effects of agricultural chemical use on the water resources of the State. An important part of the effort is an interagency research project presently being conducted at the Iowa Management System Evaluation Area (MSEA). The Iowa MSEA is a collaborative effort by the U.S. Department of Agriculture, the U.S. Geological Survey, the U.S. Environmental Protection Agency, the Iowa Department of Natural Resources, the University of Iowa Hygienic Laboratory, and Iowa State University. As part of this cooperative program, the Iowa MSEA project will quantify the levels of nitrates and pesticides and their movement in soils according to climate, crops, and various management practices.

In FY1991, Congress authorized the U.S. Geological Survey to proceed with full implementation of the National Water-Quality Assessment (NAWQA) Program. The objectives of the NAWQA program are to:

* Provide a nationally consistent description of current water-quality conditions for a large part of the Nation's water resources,

* Define long-term trends (or lack of trends) in water quality, and

* Identify, describe, and explain, as possible, the major factors that affect observed water-quality conditions and trends.

During 1994, the National Water-Quality Assessment Program Unit will initiate the Eastern Iowa Basins study unit, which is one of 60 study units in the NAWQA program. During 1994-95, the Iowa NAWQA section will establish a workplan and compile and analyze hydrologic data previously collected in the study area. During 1996-99, the NAWQA section will conduct an intensive period of data collection and analysis. Findings from this intensive data analysis will be released in a series of reports in support of the overall program objectives. The NAWQA study activities and staff will provide significant new technical resources to the Iowa District program.

Utilizing the energy and interests of the Iowa District staff, the Iowa District can continue to assist cooperating State, Federal, and local agencies by providing accurate and timely hydrologic information. I look forward to continuing partnerships that will provide the basis for the beneficial use and management of Iowa's water resources.

N.B. Melcher

District Chief

Iowa City, Iowa

A SUMMARY OF WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN IOWA, FISCAL YEAR 1994

Compiled by
Robert C. Buchmiller

ABSTRACT

Water-resources programs and activities of the U.S. Geological Survey in Iowa consist principally of hydrologic data collection and investigative studies that address water-resource issues. The work is supported by direct Federal funding, by transfer of funds from other Federal agencies, and by joint-funding agreements with State or local agencies.

The Iowa District of the Geological Survey's Water Resources Division conducts its hydrologic work through a District Office in Iowa City and Field Headquarters in Iowa City, Council Bluffs, and Fort Dodge. The projects currently being conducted, as summarized in this report, are operated under the general categories of data collection and investigative studies.

This report describes: (1) the organization of the Iowa District; (2) the hydrologic data-collection programs; and (3) the local, statewide, regional, or national hydrologic investigations conducted by the U.S. Geological Survey in Iowa during fiscal year 1994. The report also lists reports published or released by the Iowa District since 1984.

ORIGIN AND MISSION OF THE U.S. GEOLOGICAL SURVEY

The U.S. Geological Survey (USGS) was established by an act of Congress on March 3, 1879, to provide a permanent Federal agency to conduct the systematic and scientific "classification of the public lands and examination of the geological structure, mineral resources, and products of national domain." An integral part of that original mission includes publishing and disseminating the Earth-science information needed to understand, to plan the use of, and to manage the Nation's energy, land, mineral, and water resources.

Since 1879, the research and fact-finding role of the USGS has grown and been modified to meet the changing needs of the Nation it serves. As part of that evolution, the USGS has become the Federal Government's largest Earth-science research agency, the Nation's largest civilian mapmaking agency, the primary source of data on the Nation's surface- and ground-water resources, and the employer of the largest number of professional Earth scientists. Today's programs serve a diversity of needs and users. Programs include:

* Conducting detailed assessments of the energy and mineral potential of the Nation's land and offshore areas.

* Investigating and issuing warnings of earthquakes, volcanic eruptions, landslides, and other geologic and hydrologic hazards.

* Conducting research on the geologic structure of the Nation.

* Studying the geologic features, structure, processes, and history of the other planets of our solar system.

* Conducting topographic surveys of the Nation and preparing topographic and thematic maps and related cartographic products.

* Developing and producing digital cartographic data bases and products.

* Collecting data on a routine basis to determine the quantity, quality, and use of surface and ground water.

* Conducting water-resource appraisals to describe the consequences of alternative plans for developing land and water resources.

* Conducting research in hydraulics and hydrology, and coordinating all Federal water-data acquisition.

* Using remotely sensed data to develop new cartographic, geologic, and hydrologic research techniques for natural-resources planning and management.

* Providing Earth-science information through an extensive publications program and a network of public-access points.

Along with its continuing commitment to meet the growing and changing Earth-science needs of the Nation, the USGS remains dedicated to its original mission to collect, analyze, interpret, publish, and disseminate information about the natural resources of the Nation--providing "Earth science in the public service."

MISSION OF THE WATER RESOURCES DIVISION

The mission of the Water Resources Division is to provide the hydrologic information and understanding needed for the optimum utilization and management of the Nation's water resources for the overall benefit of the people of the United States.

This is accomplished, in large part, through cooperation with other Federal and non-Federal agencies by:

* Collecting, on a systematic basis, data needed for the continuing determination and evaluation of the quantity, quality, and use of the Nation's water resources.

* Conducting analytical and interpretive water-resources appraisals describing the occurrence, availability, and the physical, chemical, and biological characteristics of surface and ground water.

* Conducting basic and problem-oriented research in hydraulics, hydrology, and related fields of science to improve the scientific basis for investigations and measurement techniques and to understand hydrologic systems to predict their response to stress, either natural or human induced.

* Disseminating water data and the results of investigations and research through reports, maps, computerized information services, and other forms of public release.

* Coordinating the activities of Federal agencies in the acquisition of water data for streams, lakes, reservoirs, estuaries, and ground water.

* Providing scientific and technical assistance in hydrologic fields to other Federal, State, and local agencies, to licensees of the Federal Energy Regulatory Commission, and to international agencies on behalf of the Department of State.

IOWA DISTRICT ORGANIZATION

The Iowa District of the USGS, Water Resources Division, consists of three operating sections (the Hydrologic Surveillance Section, the Hydrologic Studies Section, and the National Water-Quality Assessment Program Unit) and two support sections (the Administrative Services Section and the Computer Services Section) located in three offices. Personnel are based at the District Office and Field Headquarters in Iowa City and at Field Headquarters offices in Council Bluffs and Fort Dodge (fig. 1). The District operates with guidance and support from the Office of Midwest Programs in Lawrence, Kansas, the Central Region Office in Denver, Colorado, and the National Headquarters in Reston, Virginia.

Operating Sections

The Hydrologic Surveillance Section designs, constructs, operates, and maintains hydrologic-data networks in the State. It also manages the compilation and analysis of hydrologic data, reviews and processes data for publication, prepares water-resources data for the annual water-data report, and provides quality assurance in the collection and processing of hydrologic data.

The Hydrologic Studies Section plans, conducts, and reports on multidiscipline water-resources projects. These investigations involve general geohydrology, ground-water hydraulics, and mathematical modeling of aquifer systems; hydraulic effects of manmade structures; magnitude and frequency of floods and droughts; assessment of surface-water availability and water use; and assessment or projection of the effects of natural forces or human activities on the quality of water in hydrologic systems.

The National Water-Quality Assessment Program Unit plans, conducts, and reports on hydrologic data collection and analysis for study areas within the District that are part of this Federal program. The program is designed to describe the status and trends in the quality of the Nation's ground- and surface-water resources and to provide an understanding of the natural and human factors that affect the quality of these resources.

Support Sections

The Administrative Services Section provides administrative support for the District in the form of programming, budgeting, accounting, management of personnel, property inventory, travel records, vehicle management, and related services. The Computer Services Section is responsible for day-to-day operation of the District's computer and peripheral equipment, programming support to the staff, and recommendations for hardware and software that can enhance computer capability.

Office Addresses

Inquiries regarding projects described in this report, ground-water data, and water-quality data may be directed to the District Office listed below. Requests for streamflow data can be directed to the District Office or the Field Headquarters office nearest the area of concern (fig. 2).

Iowa District Office

N.B. Melcher, District Chief
U.S. Geological Survey
Water Resources Division
269 Federal Building
P.O. Box 1230
Iowa City, Iowa 52244-1230
Telephone (319) 337-4191

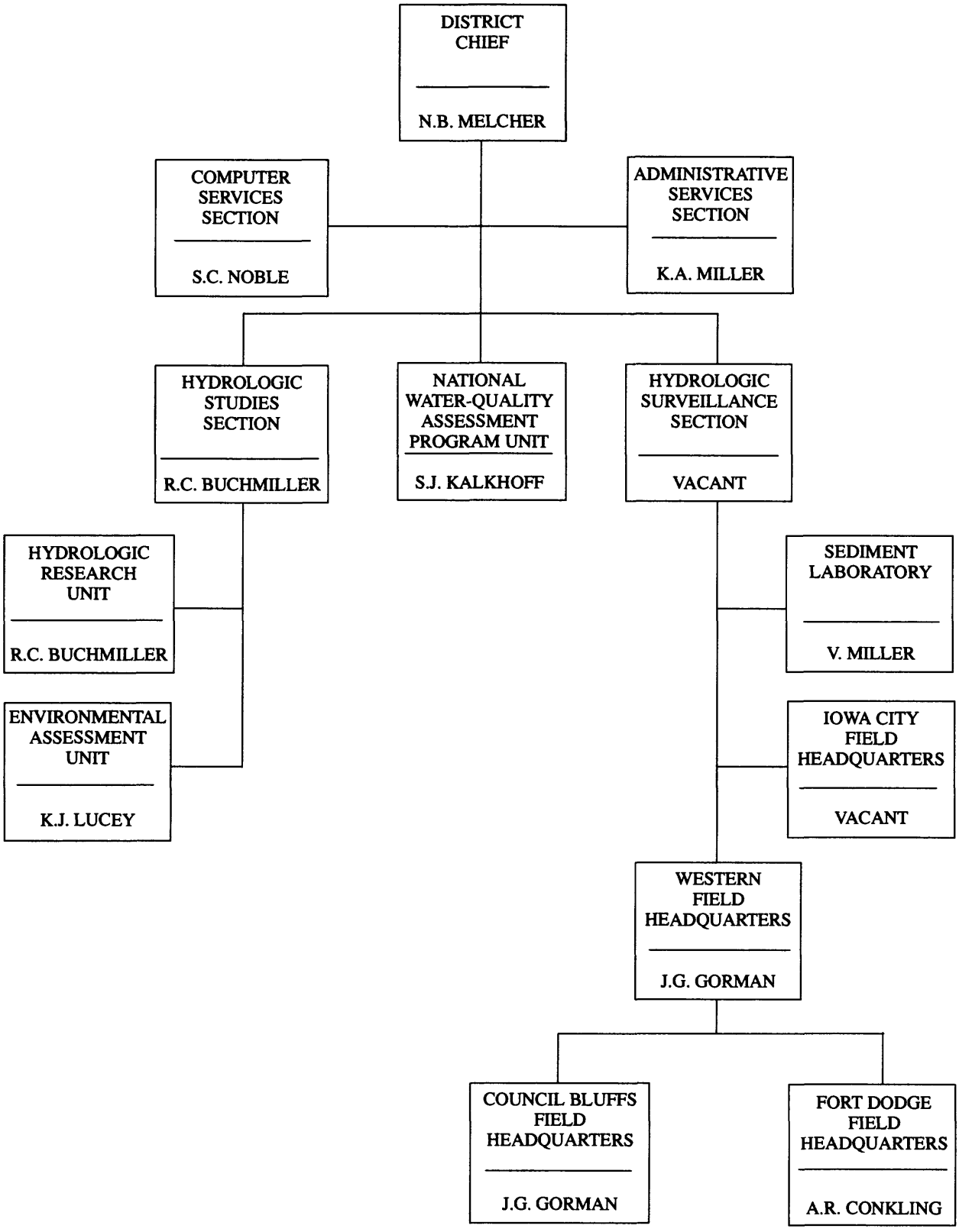


Figure 1. Iowa District organization.

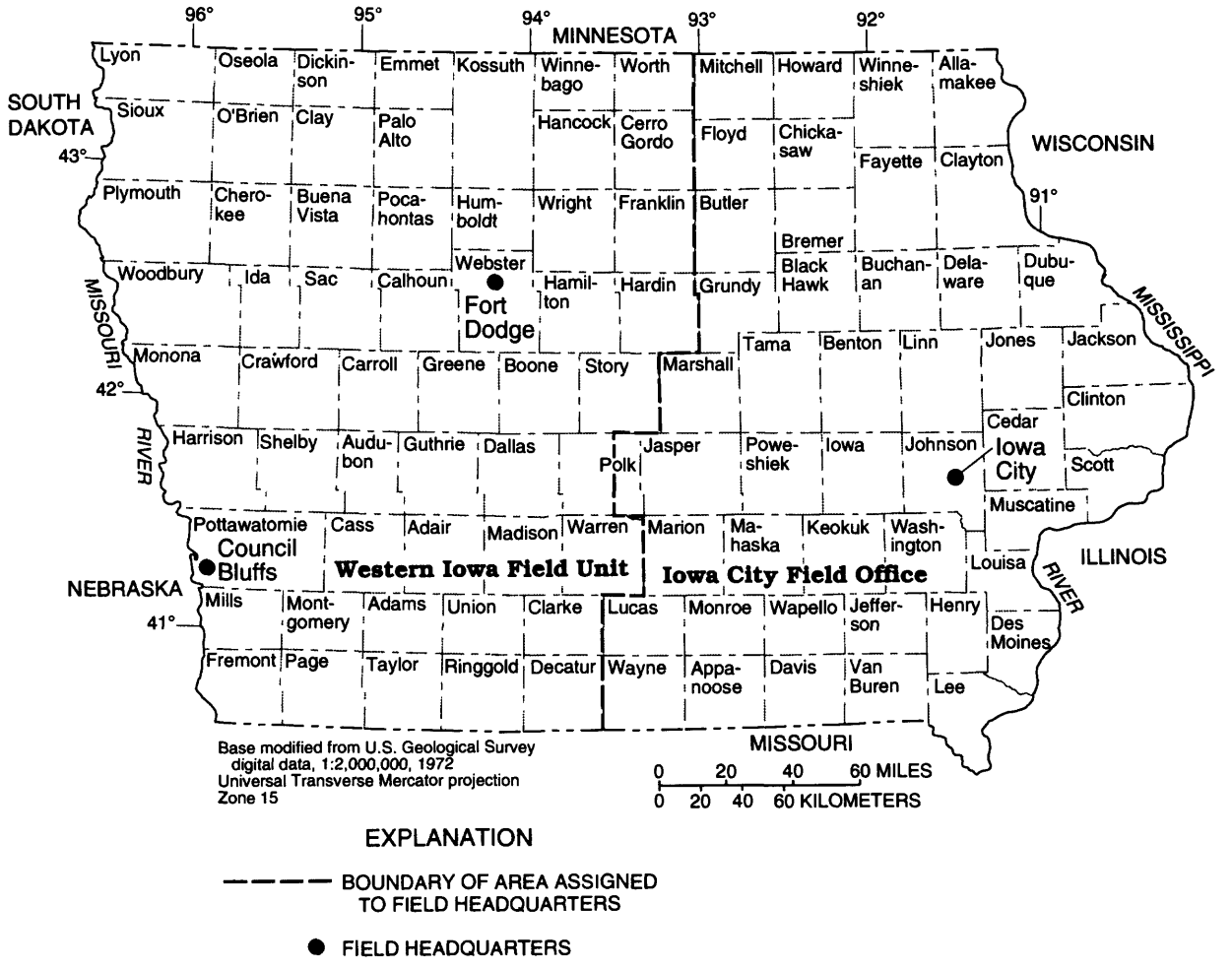


Figure 2. Location of Water Resources Division offices and areas assigned to Field Headquarters in Iowa.

Iowa City Field Headquarters

Vacant, Hydrologist
U.S. Geological Survey
Water Resources Division
269 Federal Building
P.O. Box 1230
Iowa City, Iowa 52244-1230
Telephone (319) 337-4191

Council Bluffs Field Headquarters

J.G. Gorman, Supervisory Hydrologic Technician
U.S. Geological Survey
Water Resources Division
250 Federal Building
P.O. Box 917
Council Bluffs, Iowa 51502
Telephone (712) 323-8024

Fort Dodge Field Headquarters

A.R. Conkling, Lead Hydrologic Technician
U.S. Geological Survey
Water Resources Division
456 Federal Building
P.O. Box 693
Fort Dodge, Iowa 50501
Telephone (515) 576-4571

Types of Funding

The data-collection efforts and hydrologic investigations in the Iowa District are supported by services and joint funding provided by State and local agencies (table 1) matched with Federal funds up to a 50-50 cost sharing (cooperative program); by funds transferred from other Federal agencies (OFA program); and by funds appropriated directly to the USGS (Federal program). In fiscal year 1994, the financial support for these programs in Iowa was $3,385,069, which was distributed as shown in figure 3.

SOURCES OF GEOLOGICAL SURVEY PUBLICATIONS AND INFORMATION

Publications of the USGS are available from various sources. Specific locations for obtaining different types of reports follow.

Books

Current reports are listed in a pamphlet, "New Publications of the U.S. Geological Survey." Subscription to the pamphlet, which is issued monthly, is free upon request to:

U.S. Geological Survey
582 National Center
Reston, VA 22092

Professional Papers, Bulletins, Water-Supply Papers, Techniques of Water-Resources Investigations, Circulars, and publications of general interest (such as leaflets, pamphlets, booklets) are available by mail from:

U.S. Geological Survey
Branch of Distribution
Federal Center
Box 25286
Denver, CO 80225

Records of streamflow, quality of water, and ground-water levels have been published for many years as USGS Water-Supply Papers. Beginning with water year 1965, however, the data were released in a new publications series, USGS Water-Data Reports. This series combines for each State: streamflow data, water-quality data for surface water, and ground-water-level data from the basic network of observation wells. In Iowa, precipitation-quality data and ground-water-quality data for project IA047 also are published. For Iowa, an example title is, "Water Resources Data, Iowa, Water Year 1992," U.S. Geological Survey Water-Data Report IA-92-1. Additional information on these publications can be obtained from the District Chief at the address shown earlier in this report.

Open-File Reports and Water-Resources Investigations Reports are available for inspection at the District Office of the USGS in Iowa City. Most reports in these series can be purchased in microfiche and paper-copy forms from:

U.S. Geological Survey
Earth-Science Information Center
Open-File Reports Section
Box 25286, MS 517
Denver Federal Center
Denver, CO 80225

Table 1. *Agencies supporting water-resources investigations in Iowa during fiscal year 1994*

Local Agencies

City of Ames
City of Cedar Rapids
City of Charles City
City of Clear Lake
City of Clinton
City of Davenport
City of Denison
City of Des Moines
City of Des Moines Water Works
City of Fort Dodge
City of Iowa City
City of Marshalltown
City of Milford
City of Muscatine
    Muscatine Power and Water
City of Sioux City
City of Waterloo
City of Waterloo Sewage Treatment Plant
City of West Des Moines

State Agencies

Iowa Department of Transportation
    Highway Division
        Highway Research Advisory Board
Iowa Department of Natural Resources
    Environmental Protection Division
    Fish and Wildlife Division
    Geological Survey Bureau
Iowa State University
    Department of Agricultural Engineering and Biosystems Engineering
    Iowa State Water Resources Research Institute
The University of Iowa
    Department of Preventive Medicine and Environmental Health
    Hygienic Laboratory
    Institute of Hydraulic Research

Federal Agencies

U.S. Department of Agriculture
    Agricultural Research Service
U.S. Department of Defense
    U.S. Army Corps of Engineers
        Kansas City District
        Omaha District
        Rock Island District
        St. Paul District
U.S. Department of Interior
    U.S. Geological Survey
        Water Resources Division (Federal program)
U.S. Environmental Protection Agency

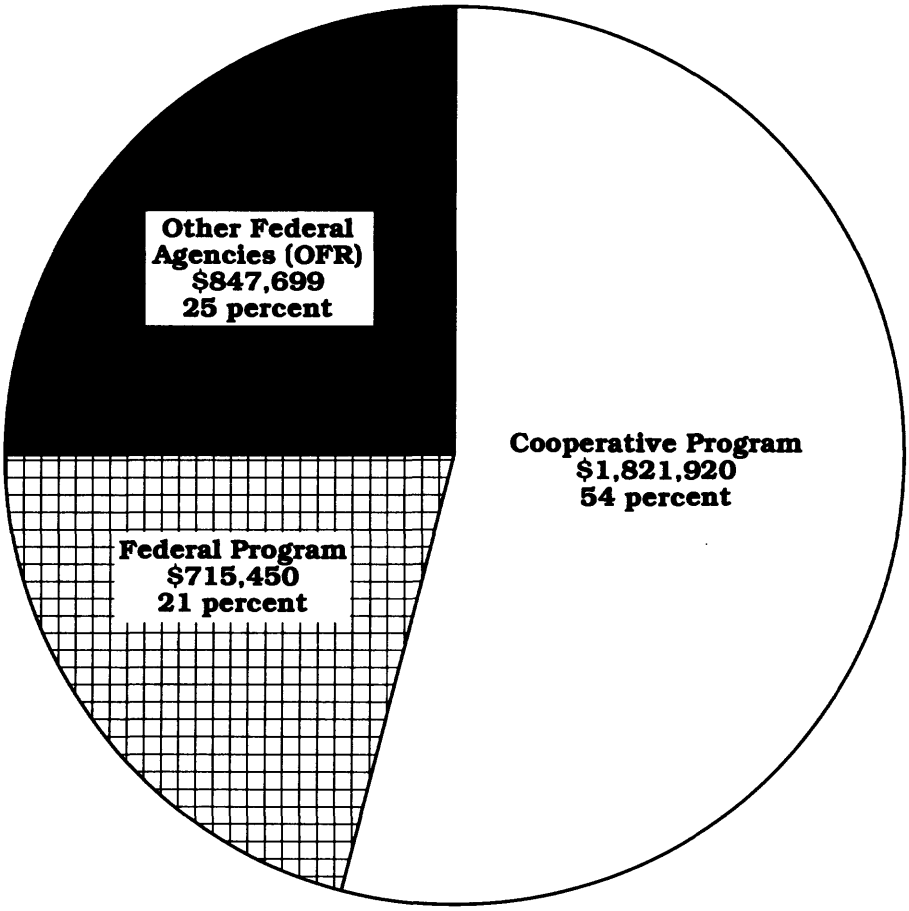


Figure 3. Distribution of funding of the U.S. Geological Survey in Iowa, fiscal year 1994.

Maps

Miscellaneous Investigations Maps, Hydrologic Investigations Atlases, Hydrologic Unit Maps, topographic maps, and other maps pertaining to Iowa (as well as maps of other areas in the United States, Guam, Puerto Rico, Samoa, and The Virgin Islands) are available for sale from:

U.S. Geological Survey
Map Distribution
Federal Center
Box 25286
Denver, CO 80225

Flood-prone-area maps of selected areas are available for nominal cost from:

Flood Map Distribution Center
6930 (A-F) San Tomas Road
Baltimore, MD 21227-6227
Telephone: (800) 358-9616

More detailed maps, prepared as part of flood-insurance studies, are available for inspection at local city or county engineer offices in communities that participate in the National Flood Insurance Program.

General Information

The Earth Science Information Center (ESIC) provides general information about the programs of the USGS and its reports and maps. ESIC answers inquiries made in person, by mail, or by telephone and refers requests for specific technical information to the appropriate people. Direct inquiries for Iowa to:

Earth Science Information Center (ESIC)
U.S. Geological Survey
Box 25046, Building 25, Room 1813
Federal Center
Denver, CO 80225-0046
Telephone: (303) 236-5829

Requests for miscellaneous water information and information on programs in other States may be referred to:

Water Resources Division
U.S. Geological Survey
440 National Center
12201 Sunrise Valley Drive
Reston, VA 22092

The National Center of the USGS maintains a library with an extensive Earth-sciences collection. Local libraries may obtain books, periodicals, and maps through interlibrary loan by writing to:

U.S. Geological Survey Library
950 National Center
Room 4-A-100
12201 Sunrise Valley Drive
Reston, VA 22092

In addition to the data collected within the State, the Iowa District has access to water data collected nationwide. The National Water Data Exchange (NAWDEX) of the USGS provides information on location and type of data pertaining to water and related subjects from more than 400 organizations. The National Water Data Storage and Retrieval System (WATSTORE) serves as a central repository of water data collected by the USGS, including large volumes of data on the quantity and quality of both surface and ground water.

General information pertaining to Iowa's water resources, water programs of the USGS, availability of water data, and reports describing water resources can be obtained from the District Chief at the address shown earlier in this report. Additional information on other USGS programs, both within and outside the State, can be obtained from the following sources:

Water: Regional Hydrologist, Central Region
U.S. Geological Survey
Mail Stop 406, Box 25046
Federal Center
Denver, CO 80225
Telephone: (303) 236-5920

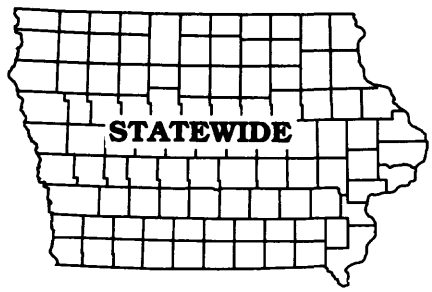
Geology: Assistant Chief Geologist, Central Region
U.S. Geological Survey
Mail Stop 911, Box 25046
Federal Center
Denver, CO 80225
Telephone: (303) 236-5438

National maps: Chief, National Cartographic Information Center
U.S. Geological Survey
National Mapping Division
Mid-Continent Mapping Center NCIC
1400 Independence Road
Rolla, MO 65401
Telephone: (314) 341-0852

Finally, the reader interested in obtaining information on the varied material that the USGS produces and distributes is referred to USGS Circular 900, "Guide to obtaining USGS information." That guide covers a wide variety of specialties such as geology, hydrology, cartography, geography, and remote sensing, as well as information on land use and energy, mineral, and water resources.

HYDROLOGIC DATA-COLLECTION NETWORKS AND PROGRAMS

SURFACE-WATER STATIONS (IA 00-001)



PERIOD OF PROJECT: Continuous since 1902

PROJECT CHIEF: R.E. Southard

STUDY AREA: Statewide

COOPERATING AGENCIES: Iowa Department of Natural Resources (Environmental Protection Division, Geological Survey Bureau), U.S. Army Corps of Engineers, the University of Iowa (Institute of Hydraulic Research and Department of Preventive Medicine and Environmental Health), Iowa Department of Transportation (Highway Division, Highway Research Advisory Board), Iowa State University (Department of Agricultural Resources Research Institute), City of Cedar Rapids, City of Davenport, City of Des Moines, City of Fort Dodge, Union Electric Company, Des Moines Water Works, Waterloo Sewage Treatment Plant, The University of Iowa, West Central Iowa Rural Water Association, City of Charles City, City of Clear Lake, City of Denison, City of Iowa City, City of Marshalltown, City of Sioux City, and City of Waterloo

NEED FOR STUDY: Streamflow supplies water for many uses, including domestic, commercial, and industrial uses; irrigation of crops; dilution and transport for removal of wastes; hydroelectric-power generation; commercial transport; and recreation. Streamflow records are used to develop reliable surface-water supplies because they provide information on the availability and variability of streamflow. Excessive streamflow, or flooding, can cause extensive damage and hardship. Records of floods obtained at streamflow-gaging stations serve as the basis for the design of bridges, culverts, dams, and flood-warning systems. Streamflow records are used in the planning and design of surface-water related projects and in the management or operation of such projects after they have been completed.

OBJECTIVES: To collect surface-water data sufficient to satisfy the needs for current uses, such as: (1) assessment of water resources; (2) operation of reservoirs or industries; (3) forecasting; (4) pollution control and disposal of wastes; (5) discharge data to accompany water-quality measurements; (6) contract and legal requirements; and (7) research or special studies. To collect the data necessary for analytical studies to define, for any location, the statistical properties and trends in discharge or elevation of streams, lakes, and reservoirs.

PROGRESS: Surface-water data were collected, compiled, and published through the 1992 water year. The data network presently (1994) consists of 117 streamflow-gaging stations and stage stations for 10 lakes or reservoirs. During the 1993 water year, record flooding occurred in the Cedar, Des Moines, Iowa, Little Sioux, Nishnabotna, and Skunk River Basins. Documentation of this flooding is being compiled in the USGS Circular 1120 series. A complete list of active stations is given in table 2, locations are shown in figure 4, and a list of discontinued surface-water gaging stations is given in table 3.

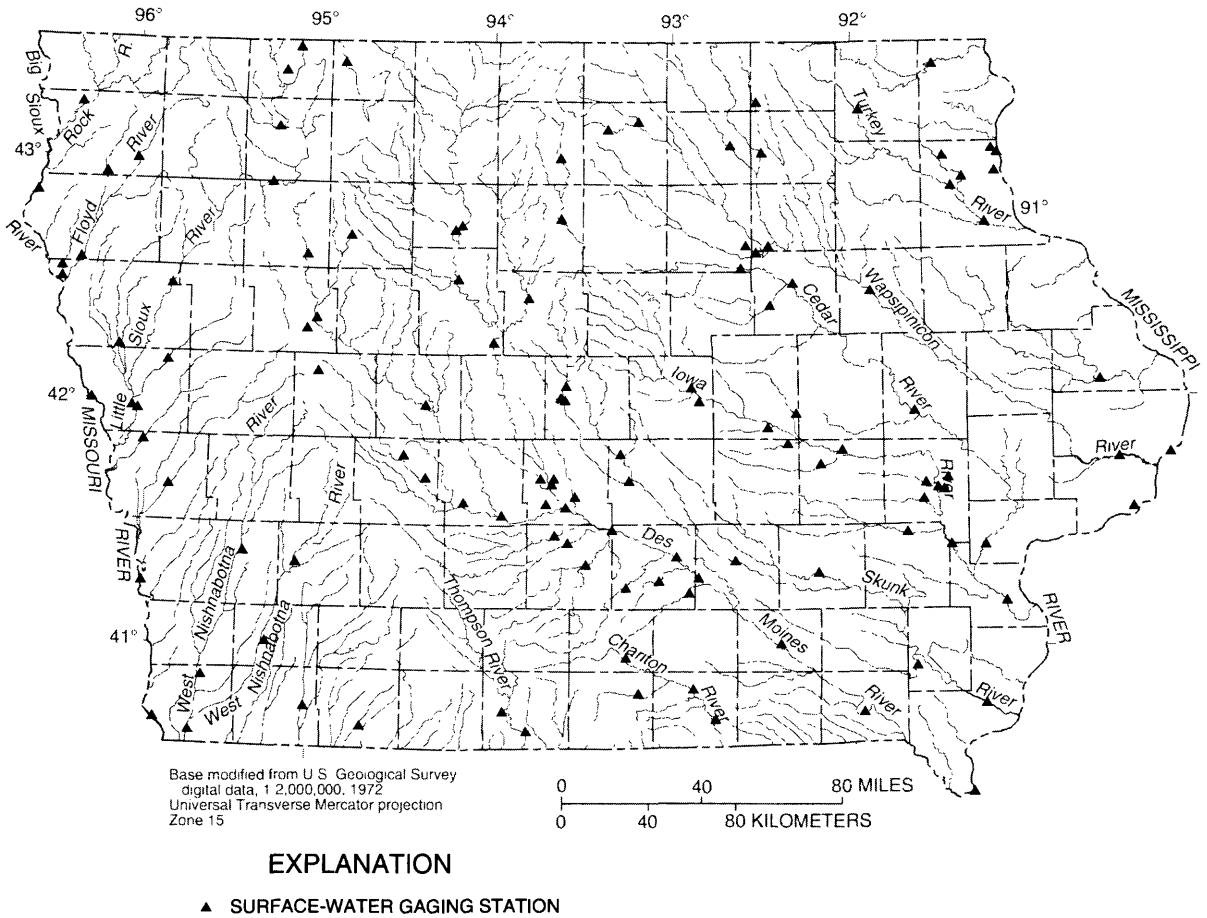


Figure 4. Location of continuous-record surface-water gaging stations.

Table 2. *Daily discharge and surface-water-quality stations operated by the Iowa District during fiscal year 1994*

[Letter after station name designates type of data collected: (c), chemical; (d), discharge; (e), elevation; (m), microbiological; (t), water temperature; (s), sediment; Abbreviation: mi^2, square miles]

Station number (downstream order)	Station name	Drainage area (mi^2)	Period of record
05388250	Upper Iowa River near Dorchester (d)	770	1936-93
05389400	Bloody Run Creek near Marquette (d,t,s)	34.1	1992-93
05389500	Mississippi River at McGregor (d,t,s)	67,500	1936-93
05411400	Sny Magill Creek near Clayton (d,t,s)	27.6	1992-93
05411950	Big Spring near Elkader (d,c,t)	103	1938, 1982-83, 1988, 1990-93
05412060	Silver Creek near Luana (d)	4.39	1986-93
05412100	Roberts Creek above Saint Olaf (d)	70.7	1957-77, 1986-93
05412500	Turkey River at Garber (d)	1,545	1913-16, 1919-27, 1929-30, 1933-93
05418500	Maquoketa River near Maquoketa (d)	1,553	1913-93
05420500	Mississippi River at Clinton (d)	85,600	1873-1993
05420560	Wapsipinicon River near Elma (d)	95.2	1959-93
05421000	Wapsipinicon River at Independence (d)	1,048	1933-93
05422000	Wapsipinicon River near De Witt (d)	2,330	1934-93
05422470	Crow Creek at Bettendorf (d)	17.8	1978-93
05449000	East Branch Iowa River near Klemme (d)	133	1948-76, 1977-93
05449500	Iowa River near Rowan (d)	429	1941-76, 1977-93
05451500	Iowa River at Marshalltown (d,t,s)	1,564	1902-03, 1915-27, 1933-93
05451700	Timber Creek near Marshalltown (d)	118	1950-93
05451900	Richland Creek near Haven (d)	56.1	1950-93
05452000	Salt Creek near Elberon (d)	201	1946-93
05452200	Walnut Creek near Hartwick (d)	70.9	1950-93
05453000	Big Bear Creek at Ladora (d)	189	1946-93
05453100	Iowa River at Marengo (d)	2,794	1957-93
05453510	Coralville Lake near Coralville (e)	3,115	1959-93
05453520	Iowa River below Coralville Dam near Coralville (d)	3,115	1993
05454000	Rapid Creek near Iowa City (d)	25.3	1938-93
05454300	Clear Creek near Coralville (d)	98.1	1953-93
05454500	Iowa River at Iowa City (d)	3,271	1903-93
05455010	South Branch Ralston Creek at Iowa City (d)	2.94	1964-93
05455100	Old Mans Creek near Iowa City (d)	201	1951-77, 1985-93
05455500	English River at Kalona (d)	573	1940-93
05455700	Iowa River near Lone Tree (d)	4,293	1957-93
05457700	Cedar River at Charles City (d)	1,054	1965-93
05458000	Little Cedar River near Ionia (d)	306	1955-93
05458500	Cedar River at Janesville (d)	1,661	1905-06, 1915-27, 1933-42, 1946-93
05458900	West Fork Cedar River at Finchford (d)	846	1946-93
05459500	Winnebago River at Mason City (d)	526	1933-93
05460000	Clear Lake at Clear Lake (e)	22.6	1933-93
05462000	Shell Rock River at Shell Rock (d)	1,746	1953-93
05463000	Beaver Creek at New Hartford (d)	347	1946-93

Table 2. *Daily discharge and surface-water-quality stations operated by the Iowa District during fiscal year 1994*--Continued

Station number (downstream order)	Station name	Drainage area (mi^2)	Period of record
05463050	Cedar River at Cedar Falls (c)	4,734	1976-79, 1984-85, 1987-93
05463500	Black Hawk Creek at Hudson (d)	303	1952-93
05464000	Cedar River at Waterloo (d)	5,146	1941-93
05464500	Cedar River at Cedar Rapids (d)	6,510	1903-93
05465000	Cedar River near Conesville (d)	7,785	1939-93
05465500	Iowa River at Wapello (d,c,m,t,s)	12,499	1915-93
05470000	South Skunk River near Ames (d)	315	1920-27, 1933-93
05470500	Squaw Creek at Ames (d)	204	1919-27,.1965-93
05471000	South Skunk River below Squaw Creek near Ames (d)	556	1953-79, 1992-93
05471050	South Skunk River at Colfax (d,t)	803	1986-93
05471200	Indian Creek near Mingo (d)	276	1958-75, 1986-93
05471500	South Skunk River near Oskaloosa (d)	1,635	1946-93
05472500	North Skunk River near Sigourney (d)	730	1946-93
05473400	Cedar Creek near Oakland Mills (d)	530	1957-77, 1977-93
05474000	Skunk River at Augusta (d,c,m,t,s)	4,303	1913-93
05474500	Mississippi River at Keokuk (d)	119,000	1878-1993
05476500	Des Moines River at Estherville (d)	1,372	1952-93
05476750	Des Moines River at Humboldt (d)	2,256	1964-93
05479000	East Fork Des Moines River at Dakota City (d)	1,308	1945-93
05480500	Des Moines River at Fort Dodge (d)	4,190	1905-06, 1914-27, 1947-93
05481000	Boone River near Webster City (d)	844	1940-93
05481300	Des Moines River near Stratford (d)	5,452	1920-93
05481630	Saylorville Lake near Saylorville (e)	5,823	1977-93
05481650	Des Moines River near Saylorville (d,t,s)	5,841	1962-93
05481950	Beaver Creek near Grimes (d)	358	1960-93
05482135	North Raccoon River near Newell (d)	233	1983-93
05482300	North Raccoon River near Sac City (d)	700	1958-93
05482315	Black Hawk Lake at Lake View (e)	23.3	1970-75, 1978-93
05482500	North Raccoon River near Jefferson (d)	1,619	1940-93
05483343	Hazelbrush Creek near Maple River (d,c,t,s)	9.22	1991-93
05483450	Middle Raccoon River near Bayard (d)	375	1979-93
05483470	Lake Panorama at Panora (e)	433	1979-93
05483600	Middle Raccoon River at Panora (d)	440	1958-93
05484000	South Raccoon River at Redfield (d)	994	1940-93
05484500	Raccoon River at Van Meter (d,c,m,t)	3,441	1915-93
05484800	Walnut Creek at Des Moines (d)	78.4	1972-93
05485500	Des Moines River below Raccoon River at Des Moines (d)	9,879	1940-93
05485640	Fourmile Creek at Des Moines (d)	92.7	1972-93
05486000	North River near Norwalk (d)	349	1940-93
05486490	Middle River near Indianola (d)	503	1940-93
05487500	South River near Ackworth (d)	460	1940-93
05487500	Des Moines River near Runnells (d)	11,655	1986-93
05487980	White Breast Creek near Dallas (d)	342	1963-93
05488100	Lake Red Rock near Pella (e)	12,323	1963-93
05488110	Des Moines River near Pella (d)	12,323	1993

Table 2. *Daily discharge and surface-water-quality stations operated by the Iowa District during fiscal year 1994*--Continued

Station number (downstream order)	Station name	Drainage area (mi^2)	Period of record
05488200	English Creek near Knoxville (d)	90.1	1985-93
05488500	Des Moines River near Tracy (d)	12,479	1920-93
05489000	Cedar Creek near Bussey (d)	374	1948-93
05489500	Des Moines River at Ottumwa (d)	13,374	1917-93
05490500	Des Moines River at Keosauqua (d)	14,038	1903-06, 1910-93
06483500	Rock River near Rock Valley (d)	1,592	1948-93
06485500	Big Sioux River at Akron (d)	8,424	1929-93
06486000	Missouri River at Sioux City (d,s)	314,600	1898-1993
06600000	Perry Creek at 38th Street, Sioux City (d)	65.1	1946-69, 1981-93
06600100	Floyd River at Alton (d)	268	1956-93
06600300	West Branch Floyd River near Struble (d)	180	1956-93
06600500	Floyd River at James (d)	886	1935-93
06601200	Missouri River at Decatur, Nebraska (d)	316,200	1988-93
06602020	West Fork ditch at Hornick (d)	403	1939-69, 1974-93
06602400	Monona-Harrison ditch near Turin (d)	900	1939-93
06604000	Spirit Lake near Orleans (e)	75.6	1933-75, 1990-93
06604200	West Okoboji Lake at Lakeside Laboratory near Milford (e)	125	1933-93
06605000	Ocheyedan River near Spencer (d)	426	1978-93
06605850	Little Sioux River at Linn Grove (d)	1,548	1973-93
06606600	Little Sioux River at Correctionville (d)	2,500	1918-25, 1929-32, 1936-93
06607200	Maple River at Mapleton (d)	669	1942-93
06607500	Little Sioux River near Turin (d)	3,526	1959-93
06608500	Soldier River at Pisgah (d)	407	1940-93
06609500	Boyer River at Logan (d)	871	1918-25, 1938-93
06610000	Missouri River at Omaha, Nebraska (d,s)	322,800	1928-93
06807000	Missouri River at Nebraska City, Nebraska (d,s)	410,000	1929-93
06807410	West Nishnabotna River at Hancock (d)	609	1960-93
06808500	West Nishnabotna River at Randolph (d)	1,326	1948-93
06809210	East Nishnabotna River near Atlantic (d)	436	1961-93
06809500	East Nishnabotna River at Red Oak (d)	894	1918-25, 1936-93
06810000	Nishnabotna River above Hamburg (d)	2,806	1922-23, 1929-93
06813500	Missouri River at Rulo, Nebraska (d)	414,900	1950-93
06817000	Nodaway River at Clarinda (d)	762	1918-25, 1936-93
06819185	East Fork One Hundred and Two River near Bedford (d)	85.4	1984-93
06897950	Elk Creek near Decatur City (c,d,s,t)	52.5	1968-93
06898000	Thompson River at Davis City (d)	701	1918-25, 1941-93
06903400	Chariton River near Chariton (d)	182	1966-93
06903677	Corydon Lake at spillway at Corydon (e,c,m,t)	2.5	1991-93
06903700	South Fork Chariton River near Promise City (d)	168	1968-93
06903880	Rathbun Lake near Rathbun (e)	549	1970-93
06903900	Chariton River near Rathbun (d)	549	1957-93
06904010	Chariton River near Moulton (d)	740	1979-93

Table 3. *Discontinued surface-water gaging stations in Iowa*

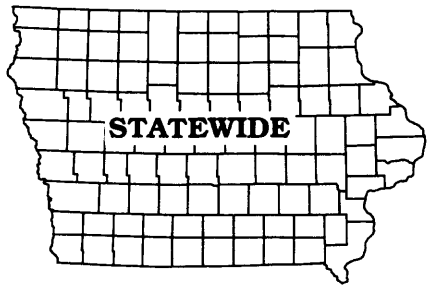
[Abbreviation: mi^2, square miles]

Station number (downstream order)	Station name	Drainage area (mi^2)	Period of record
05387500	Upper Iowa River at Decorah	511	1952-83
05388000	Upper Iowa River near Decorah	568	1913-14, 1919-27, 1933-51
05388500	Paint Creek at Waterville	42.8	1952-73
05389000	Yellow River at Ion	221	1934-51
05411500	Mississippi River at Clayton	9,200	1930-36
05411600	Turkey River at Spillville	177	1957-73, 1978-91
05412000	Turkey River at Elkader	891	1932-42
05412070	Unnamed Creek near Luana	1.15	1986-92
05414500	Little Maquoketa River near Durango	130	1934-82
05417000	Maquoketa River near Manchester	305	1933-73
05417500	Maquoketa River near Delhi	347	1933-40
05417700	Bear Creek near Monmouth	61.3	1957-76
05418000	Maquoketa River above North Fork Maquoketa River near Maquoketa	938	1913-14
05418450	North Fork Maguoketa River at Fulton	516	1977-91
05421500	Wapsipinicon River at Stone City	1,324	1903-14
05422420	Crow Creek at Eldridge	2.20	1977-82
05422450	Crow Creek at Mt. Joy	6.90	1977-82
05448150	Pine Creek at Muscatine	38.9	1975-82
05448285	Eagle Lake inlet near Britt	3.83	1975-80
05448290	Eagle Lake outlet near Britt	11.3	1975-80
05448500	West Branch (West Fork) Iowa River near Klemme	112	1948-58
05450000	Iowa River near Iowa Falls	665	1911-14
05450500	Upper Pine Lake at Eldora	14.9	1936-70
05451000	Lower Pine Lake at Eldora	15.9	1936-70
05452500	Iowa River near Belle Plaine	2,455	1939-59
05453500	Lake Macbride near Solon	27.0	1936-71
05455000	Ralston Creek at Iowa City	3.01	1924-87
05457500	Cedar River at Mitchell	826	1933-42
05459000	Shell Rock River near Northwood	300	1945-86
05460500	Shell Rock River at Marble Rock (Greene)	1,318	1933-53
05461000	Shell Rock River at Greene	1,357	1933-42
05461500	Shell Rock River near Clarksville	1,626	1915-27, 1932-34
05464130	Fourmile Creek near Lincoln	13.78	1962-67, 1969-74
05464133	Half Mile Creek near Gladbrook	1.33	1962-67, 1969-74
05464137	Fourmile Creek near Traer	19.51	1962-74, 1975-80
05464640	Prairie Creek at Fairfax	178	1966-82
05472000	Lake Keomah near Oskaloosa	3.06	1936-71
05473000	Skunk River at Coppock	2,916	1913-44
05473500	Big Creek near Mount Pleasant	106	1955-79
05478000	East Fork Des Moines River near Burt	462	1971-74
05478500	East Fork Des Moines River near Hardy	1,268	1940-54
05479500	Des Moines River near Fort Dodge	3,753	1911-13
05480000	Lizard Creek near Clare	257	1940-82
05481500	Des Moines River near Boone	5,511	1920-68
05482000	Des Moines River at Des Moines	6,245	1905-06, 1915-61

Table 3. *Discontinued surface-water gaging stations in Iowa*--Continued

Station number (downstream order)	Station name	Drainage area (mi^2)	Period of record
05482140	Storm Lake at Storm Lake	28.3	1970-75
05482170	Big Cedar Creek near Varina	80.0	1960-91
05483000	East Fork Hardin Creek near Churdan	24.0	1953-91
05483500	Springbrook Lake near Guthrie Center	5.18	1936-71
05485000	Raccoon River at Des Moines	3,590	1902-03
05487000	Lake Ahquabi near Indianola	4.93	1936-71
05488000	White Breast Creek near Knoxville	380	1945-62
05489190	Muchakinock Creek near Eddyville	70.2	1975-79
05490000	Lake Wapello near Drakesville	7.75	1936-71
05491000	Sugar Creek near Keokuk	105	1922-31, 1958-73
05494300	Fox River at Bloomfield	87.7	1957-73
05494500	Fox River at Cantril	161	1940-51
06483270	Rock River at Rock Rapids	788	1959-74
06484000	Dry Creek at Hawarden	48.4	1948-69
06602000	West Fork ditch at Holly Springs	399	1939-69
06603920	Loon Creek near Orleans	31	1971-74
06604100	Spirit Lake outlet at Orleans	75.6	1971-74
06604400	Milford Creek at Milford	146	1971-74
06605100	Little Sioux River at Spencer	990	1936-42
06605600	Little Sioux River at Gillett Grove	1,334	1958-73
06606700	Little Sioux River near Kennebeck	2,738	1939-69
06607000	Odebolt Creek near Arthur	39.3	1957-75
06607300	Maple River at Turin	725	1939-41
06607510	Little Sioux River near Blencoe (Turin)	4,470	1939-42
06609200	Steer Creek near Magnolia	9.26	1963-69
06609590	Thompson Creek near Woodbine	6.97	1963-69
06609600	Willow Creek near Logan	129	1972-75
06610500	Indian Creek at Council Bluffs	7.99	1954-76
06610520	Mosquito Creek near Earling	32.0	1965-79
06806000	Waubonsie Creek near Bartlett	30.4	1946-69
06807320	West Nishnabotna River at Harlan	316	1977-82
06807500	West Nishnabotna River at (near) White Cloud	967	1918-24
06808000	Mule Creek near Malvern	10.6	1954-69
06808200	Spring Valley Creek near Tabor	7.6	1955-64
06809000	Davids Creek near Hamlin	26.0	1952-73
06812000	Tarkio river at Blanchard	200	1934-40
06811840	Tarkio River at Stanton	49.3	1958-91
06816500	West Nodaway River at Villisca	342	1918-25
06818750	Platte River near Diagonal	217	1969-91
06898400	Weldon River near Leon	104	1959-91
06903500	Honey Creek near Russell	13.2	1952-62
06904000	Chariton River near Centerville	708	1938-59

GROUND-WATER STATIONS (IA 00-002)



PERIOD OF PROJECT: Continuous since 1939

PROJECT CHIEF: B.K. Nations

STUDY AREA: Statewide

COOPERATING AGENCIES: Iowa Department of Natural Resources (Geological Survey Bureau)

NEED FOR STUDY: A long-term regional ground-water data base is needed to evaluate the effects of natural and human-induced stresses on the principal ground-water systems in Iowa. Information from the long-term data base will provide baseline information for short-term aquifer studies, as well as documenting long-term trends in Iowa's ground-water supply. Information from the short-term and long-term data bases will be used to assess the ground-water resource, project future conditions of supply, address contamination concerns, and provide the information necessary to effectively manage the resource.

OBJECTIVES: The primary objectives of the Iowa ground-water-level monitoring network are to: (1) collect data documenting the change in ground-water storage through time in the principal aquifers; (2) provide both the long-term and short-term data necessary to assess and project the response of hydrologic systems to natural climatic variations and human-induced stresses; (3) quantify the hydrologic characteristics of aquifers, including transmissivity, hydraulic conductivity, and specific capacity; and (4) provide historical baseline data for aquifer studies.

PROGRESS: The current ground-water-level monitoring network in Iowa consists of 236 wells (fig. 5) completed in the principal bedrock and surficial aquifers that supply ground water to numerous users throughout the State. Historic hydrologic and geologic information continues to be updated in the computer data bases. Network data are collected, compiled, and published in the annual USGS "Water-Resources Data, Iowa" report. A report that describes the network, "The Ground-Water-Level Monitoring Network in Iowa," was published in 1992 (Lambert, 1992).

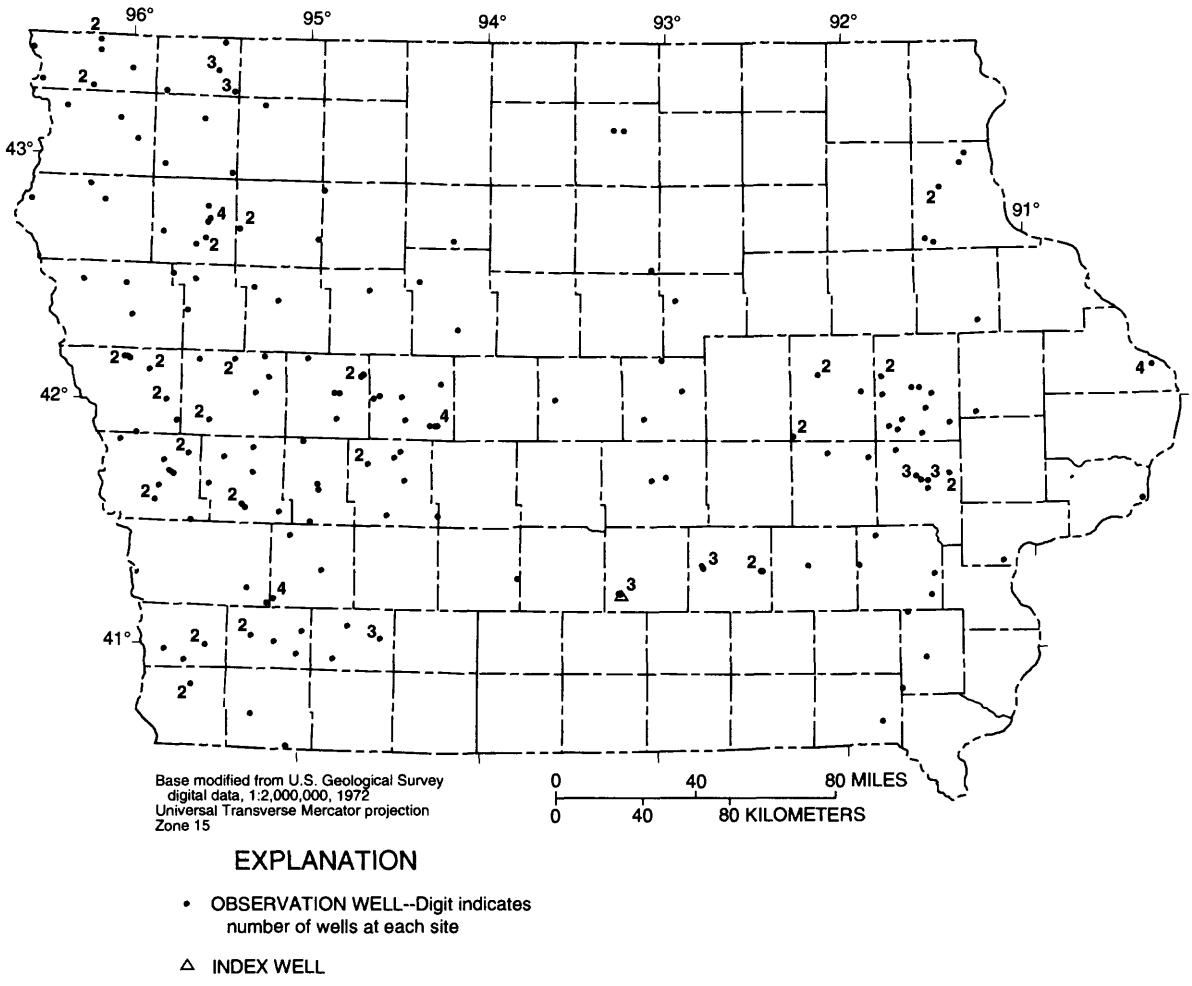
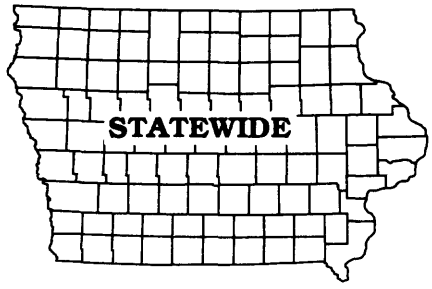


Figure 5. Location of observation wells.

WATER-QUALITY STATIONS (IA 00-003)



PERIOD OF PROJECT: Continuous since 1906

PROJECT CHIEF: D.A. Sneck-Fahrer

STUDY AREA: Statewide

COOPERATING AGENCIES: U.S. Geological Survey (Federal program)

NEED FOR STUDY: Water-resource planning and water-quality assessment require a nationwide data base with standardized information for planning and assessment of water resources. Furthermore, the chemical and physical quality of the rivers and streams need to be monitored and defined to effectively manage the resource.

OBJECTIVES: To provide a national data base for water-quality information for Federal planning and action programs and to provide data for Federal management of interstate waters.

PROGRESS: Water-quality data were collected, compiled, and published in the annual data report, "Water Resources Data, Iowa, Water Year 1992," for five National Stream-Quality Accounting Network (NASQAN) stations and one National Hydrologic Bench-Mark station. The NASQAN station, Nishnabotna River above Hamburg (06810000), was discontinued in water year 1994 (table 4). Measurements of specific conductance and water temperature were obtained during discharge measurements at most surface-water gaging stations and published in the annual report. Station locations are shown in figure 6, and a list of discontinued surface-water-quality stations is given in table 4. Sampling for herbicides and nitrate in the outflow from five reservoirs in Iowa began in March 1992 and continued until September 1993. This sampling was part of a program to study the occurrence, temporal distribution, and persistence of herbicides in the outflow of 76 reservoirs in the Midwest. Additional water-quality sampling was performed during 1993 on Rathbun Lake as part of an assessment of water-quality conditions in U.S. Army Corps of Engineers reservoirs and on the Mississippi River at Clinton, Iowa, as part of the USGS response to the floods that occurred in the Midwest.

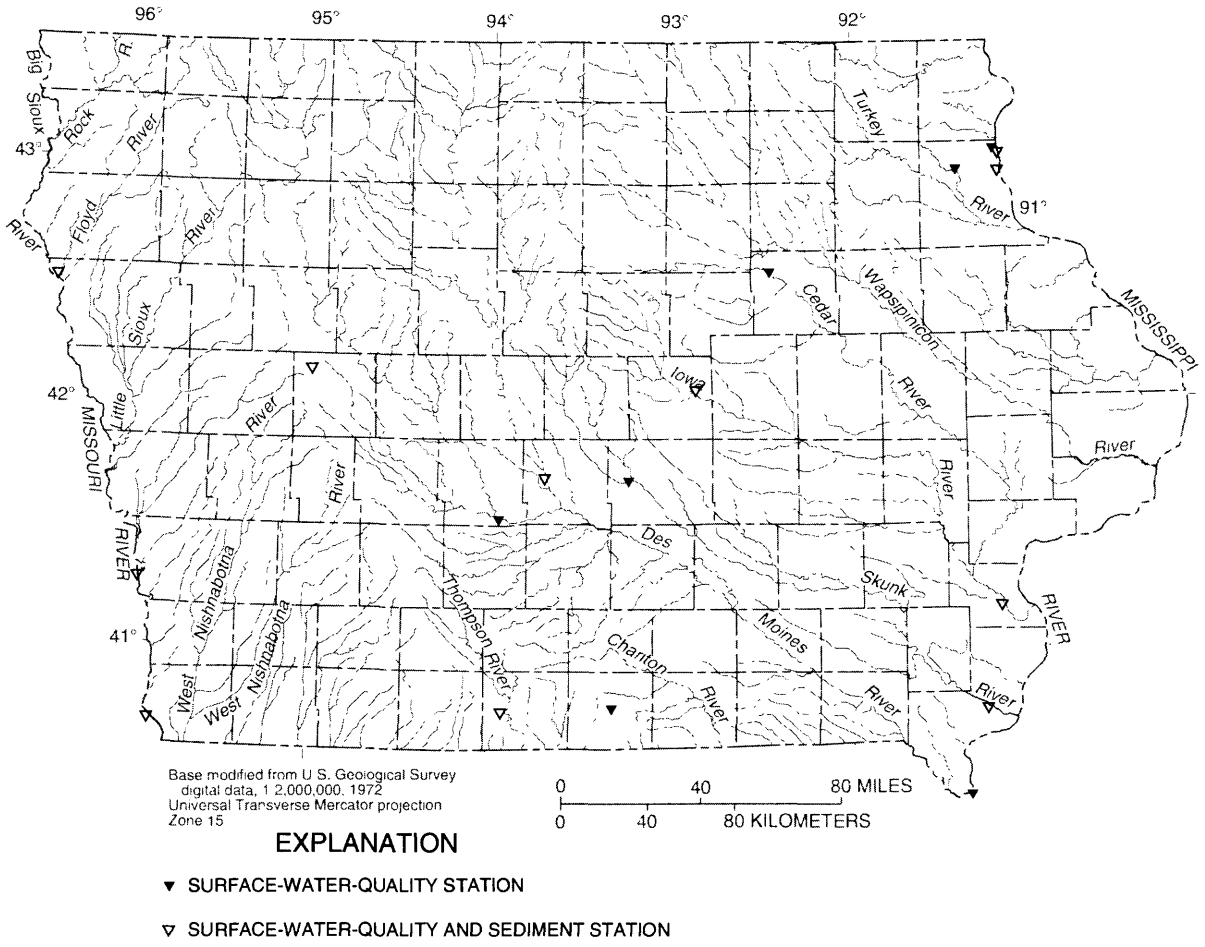


Figure 6. Location of surface-water-quality stations.

Table 4. *Discontinued surface-water-quality stations in Iowa*

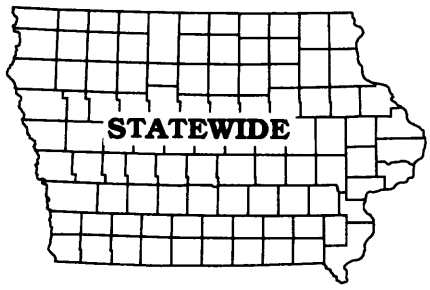
[Letter after station name designates type of data collected: (c), chemical; (m), microbiological; (s), sediment; (t), temperature; (*), periodic data are available for that constituent subsequent to the period of daily record; Abbreviation: mi^2, square miles]

Station number (downstream order)	Station name	Drainage area (mi^2)	Period of record
05387500	Upper Iowa River at Decorah (s,t)	511	1963-83
05388250	Upper Iowa River near Dorchester (s,t)	770	1975-81
05388500	Paint Creek at Waterville (t)	42.8	1952-56
	(s)		1952-57
05412070	Unnamed Creek near Luana (c)	1.15	1986-92
05412500	Turkey River at Garber (s*,t)	1,545	1957-62
05414700	Mississippi River at Dubuque (c)	1,600	1969-73
05418500	Maquoketa River near Maquoketa (c,s,t)	1,553	1978-82
05420500	Mississippi River at Clinton (c)	85,600	1973-87
05421000	Wapsipinicon River at Independence (c*)	1,048	1968-70
	(s*,t*)		1967-70
05422470	Crow Creek at Bettendorf (c,s,t)	17.8	1978-82

Table 4. *Discontinued surface-water-quality stations in Iowa*--Continued

Station number (downstream order)	Station name	Drainage area (mi^2)	Period of record
05449500	Iowa River near Rowan (s*,t*)	429	1957-62
05454500	Iowa River at Iowa City (c,s,t)	3,271	1952-87
05455000	Ralston Creek at Iowa City (c,s,t)	3.01	1906-07, 1944-88
05464020	Cedar River near Gilbertville (c)	5,234	1971, 1975-81
05464130	Fourmile Creek near Lincoln (c,s,t)	13.78	1969-74
05464133	Half Mile Creek near Gladbrook (c,s,t)	1.33	1969-74
05464137	Fourmile Creek near Traer (c,s,t)	19.51	1969-74
05464450	Cedar River near Palo (c)	6,380	1975-79
05464500	Cedar River at Cedar Rapids (c*)	6,640	1906-07, 1944-54
	(t*)		1944-54
	(s)		1943-54
05464760	Cedar River near Bertram (c)	6,955	1975-81
05469720	Mississippi River at Burlington (c)	4,000	1969-73
05471050	South Skunk River at Colfax (s)	803	1985-93
05474500	Mississippi River at Keokuk (c)	119,000	1974-87
05480500	Des Moines River at Fort Dodge (c)	4,190	1972-73
05482000	Des Moines River at Des Moines (c)	6,245	1954-55
	(s,t)		1954-61
05483000	East Fork Hardin Creek near Churdan (s*,t*)	24.0	1952-57
05483450	Middle Fork Raccoon River near Bayard (c,s,t)	375	1979-85
05483600	Middle Fork Raccoon River at Panora (c,s,t)	440	1979-85
05485000	Raccoon River at Des Moines (c,t)	3,590	1945-47
05485500	Des Moines River below Raccoon River at Des Moines (c*)	9,770	1944-45
	(s,t*)		1944-47
05485520	Des Moines River below Des Moines (c)	9,901	1971, 1975-81
05486490	Middle River near Indianola (s,t*)	503	1962-67
05487980	White Breast Creek near Dallas (c)	342	1968-73
	(s,t)		1967-73
06485950	Big Sioux River at Sioux City (c)	9,410	1969-73
06486000	Missouri River at Sioux City (c)	314,600	1972-86
06600500	Floyd River at James (s,t)	882	1968-73
06600520	Floyd River at Sioux City (c)	921	1969-73
06601200	Missouri River at Decatur, Nebraska (c)	316,160	1974-81
06606600	Little Sioux River at Correctionville (c*)	2,500	1954-55
	(t*)		1951-62
	(s)		1950-62
06606700	Little Sioux River near Kennebec (t)	2,738	1950-55
	(s)		1950-57
06607513	Little Sioux River at River Sioux (c)	3,600	1969-73
06608505	Soldier River near Mondamin (c)	440	1970-73
06609200	Steer Creek near Magnolia (s,t)	9.26	1963-69
06609590	Thompson Creek near Woodbine (s,t)	6.97	1963-69
06609600	Willow Creek near Logan (c,t)	129	1972-75
	(s)		1971-75
06610000	Missouri River at Omaha, Nebraska (c)	322,800	1969-86
06808000	Mule Creek near Malvern (t)	10.6	1958-69
	(s)		1954-69
06809000	Davids Creek near Hamlin (t*)	26.0	1952-53, 1965-68
06809500	East Nishnabotna River at Red Oak (s,t)	894	1962-73
06810000	Nishnabotna River above Hamburg (c,m,s,t)	2,806	1979-93
06817000	Nodaway River at Clarinda (c,s,t)	762	1976-93
06818750	Platte River near Diagonal (c)	217	1969-73
06898000	Thompson River at Davis City (c)	701	1967-73
	(s,t)		1968-73
06898400	Weldon River near Leon (c)	104	1968-73
06903400	Chariton River near Chariton (s,t)	182	1969-73
06903500	Honey Creek near Russell (s)	13.2	1952-62
06903900	Chariton River near Rathbun (s*,t*)	551	1962-69

SEDIMENT STATIONS
(IA 00-004)



PERIOD OF PROJECT: Continuous since 1943

PROJECT CHIEF: Vacant

STUDY AREA: Statewide

COOPERATING AGENCIES: U.S. Geological Survey (Federal program), U.S. Army Corps of Engineers, Iowa Department of Natural Resources (Geological Survey Bureau), and the University of Iowa (Department of Preventive Medicine)

NEED FOR STUDY: Water-resource planning and water-quality assessment requires a nationwide data base of standardized information. Sediment concentrations and discharges in rivers and streams need to be monitored and defined to achieve this goal.

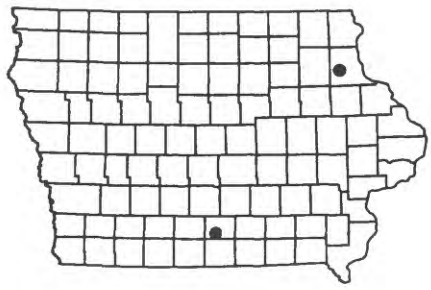
OBJECTIVES: To provide a national sediment data base for use in Federal programs and Federal management of interstate waters. The State also needs spatial and temporal averages and trends of sediment concentration, sediment discharge, and particle size of sediment being transported in the rivers and streams for planning and action programs.

PROGRESS: Data were collected (fig. 7), compiled, and published in the annual data report "Water Resources Data, Iowa, Water Year 1992." The network consists of the following stations and cooperators. Two daily sediment stations are operated in cooperation with the Iowa Department of Natural Resources (Skunk River at Augusta and Iowa River at Marshalltown). Two daily stations are operated in cooperation with the U.S. Army Corps of Engineers, Rock Island District, and one daily sediment station is operated in cooperation with the U.S. Army Corps of Engineers, St. Paul District. A program studying the biweekly concentration of sediment at three sites on the Missouri River is operated in cooperation with the U.S. Army Corps of Engineers, Omaha District. A daily sediment station is operated in cooperation with the University of Iowa and the Agricultural Research Service.

Laboratory analyses of sediment samples collected by the U.S. Army Corps of Engineers (Rock Island District) and by USGS Districts in Alaska, Arizona, Colorado, Indiana, Minnesota, Montana, Nebraska, North Dakota, South Dakota, Tennessee, Wisconsin, and Wyoming are performed in the Iowa District sediment laboratory. The laboratory performs the following analyses for suspended sediment: (1) concentration, (2) concentration and determination of material finer than sand, and (3) dissolved solids. Particle-size analyses for suspended sediment, bed material, and bed-load material that are sand are determined by sieve or visual accumulation tube, and particle size of material finer than sand by pipet, Sedigraph, or air elutriation.

Figure 7. Sediment sample being collected from Iowa River at Marengo.

IOWA PRECIPITATION MONITORING FOR THE NATIONAL TRENDS NETWORK (IA 84-005)



PERIOD OF PROJECT: Continuous since 1984

PROJECT CHIEF: D.A. Sneck-Fahrer

STUDY AREA: Clayton and Lucas Counties

COOPERATING AGENCIES: U.S. Geological Survey (Federal program)

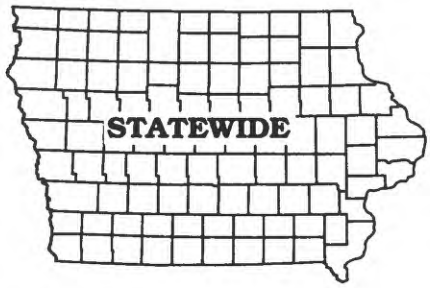
NEED FOR STUDY: The amount of substances dispersed into the atmosphere and deposited by precipitation, aerosols, and gases is expected to continue to increase throughout North America. Thus, there is an increasing need for careful, coordinated measurement on a national scale of the amounts, nature, and effects of these substances. To establish long-term trends in composition and flux, it is necessary that these measurements be made for a period of at least 10 years. These measurements will be used to assess the link between environmental effects and atmospheric deposition and will provide the information necessary for the responsible management of agricultural, forest, and aquatic ecosystems of the United States.

OBJECTIVES: The Iowa precipitation-monitoring sites are part of the National Atmospheric Deposition Program/National Trends Network (NADP/NTN) program, which provides a regional-to-national overview of chemical composition of atmospheric deposition in the United States. This program includes scientific research in atmospheric deposition, monitoring, and assessment activities. Information from this overview is being used to discover and characterize environmentally important geographical and temporal trends in the chemical climate of North America. In addition, information from this national program is being used to assess the effects of atmospheric deposition on: (1) the productivity of agricultural and forest lands; (2) the health of domestic animals, wildlife, and fish; (3) the chemistry of surface and ground water; and (4) visibility and materials.

PROGRESS: Wet-deposition samples are collected weekly at the two Iowa National Trends Network sites (fig. 8). Onsite determinations of specific conductance and pH and the chemical analyses of the precipitation are published in the annual USGS "Water-Resources Data, Iowa" report, as well as in the National Atmospheric Deposition Program/National Trends Network "Annual Data Summary of Precipitation Chemistry in the United States."

Figure 8. National Trends Network precipitation-monitoring site at Big Spring Fish Hatchery, Clayton County, Iowa.

FLOOD INFORMATION AT SELECTED BRIDGE AND CULVERT SITES (IA 66-006)



PERIOD OF PROJECT: Continuous since 1966

PROJECT CHIEF: Vacant

STUDY AREA: Statewide

COOPERATING AGENCY: Iowa Department of Transportation (Highway Division, Highway Research Advisory Board)

NEED FOR STUDY: Systematic flood information is needed for the proper hydraulic design of new bridges, culverts, and other flow structures (especially on small drainage basins of less than 100 mi^2) and for the evaluation of existing structures. There also is a need to analyze the hydrology and hydraulics of proposed sites with little available data and to document outstanding floods at ungaged sites on an event basis. Because of the large number of small basins in the State, relatively few will have specific flood data available. Therefore, flood discharges are estimated from numerical models that are calibrated using data collected for these sites. To define and calibrate these models for basins in Iowa, flood data must be available from basins with a variety of characteristics, such as drainage area, topography, soil type, shape, and land use.

OBJECTIVES: For small drainage basins with less than 100 mi^2 of drainage area: (1) obtain basin characteristics and systematic flood data for a network of representative basins in the State, and (2) document flood discharges for ungaged basins on an event basis.

PROGRESS: Data were collected at 104 bridge and culvert sites throughout Iowa in 1993 (fig. 9). This consisted of annual maximum discharge data at each site and numerous discharge measurements at selected sites. Record flooding occurred throughout the State during 1993. On July 9, 1993, intense rain over Carroll County caused record flooding on the Brushy Fork Creek. The U.S. Highway 71 bridge crossing northeast of Templeton was destroyed along with the crest-stage gage at this site. Data for the calculation of an indirect discharge computation have been collected at the site. The indirect discharge computation and verification of numerous peaks at other crest-stage gage sites are in progress. Annual maximum discharge data are compiled and published in the annual USGS "Water Resources Data, Iowa" report series.

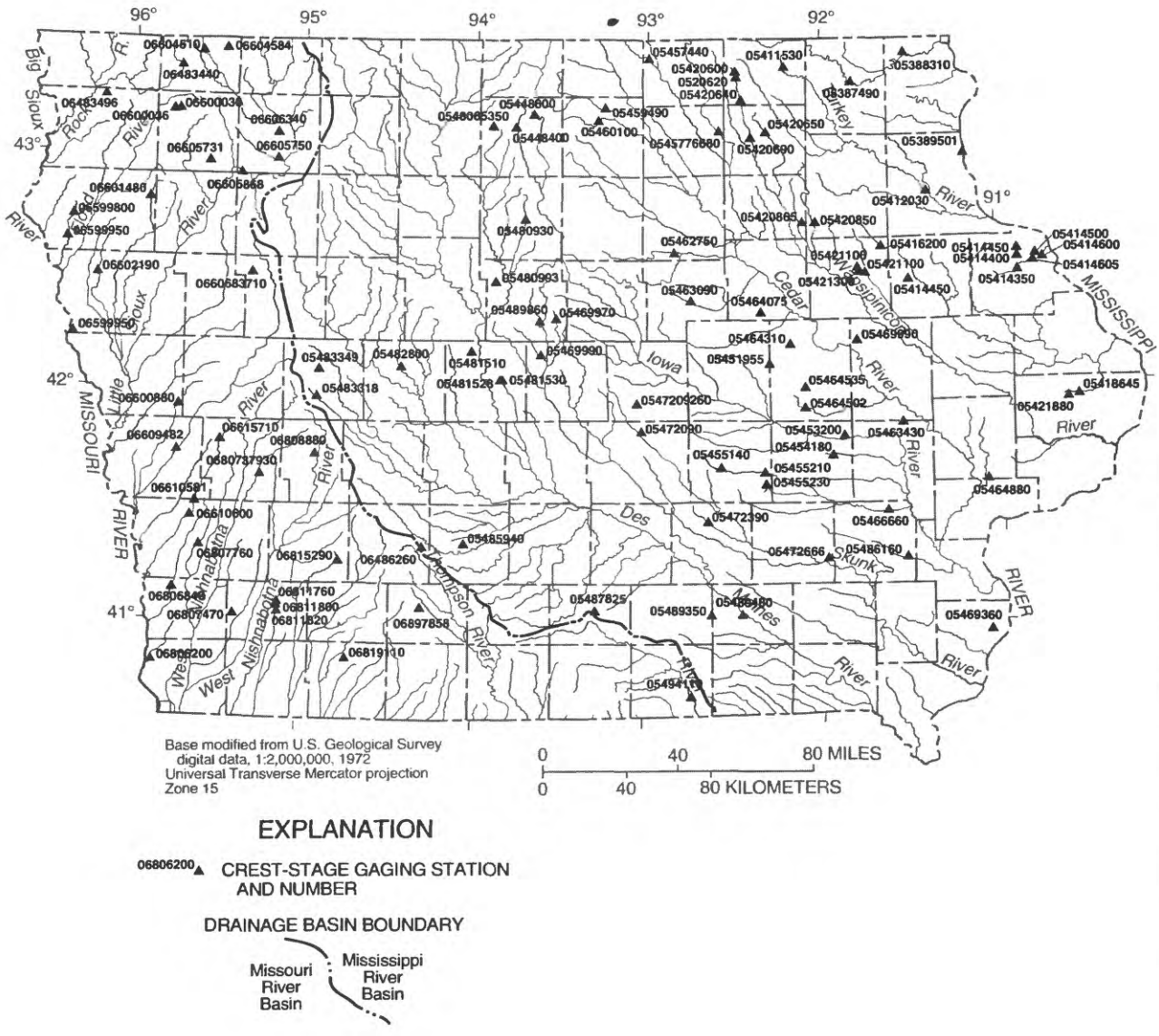


Figure 9. Location of crest-stage gaging stations.

WATER USE
(IA 00-007)

PERIOD OF PROJECT: Continuous since 1980

PROJECT CHIEF: E.E. Fischer

STUDY AREA: Statewide

COOPERATING AGENCIES: Iowa Department of Natural Resources

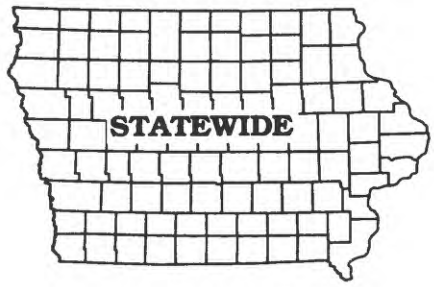
NEED FOR STUDY: In 1977, the Congress of the United States directed the USGS to establish a National Water-Use Information Program to complement the Survey's data on the Nation's water resources. This program, which became a part of the USGS Federal-State cooperative program, was designed to be the source for accurate, consistent, timely, and accessible water-use information.

OBJECTIVES: The objective of the Iowa water-use program is to collect and compile reliable site-specific and aggregated water-use information for the State according to guidelines established for the National Water-Use Information Program. Data are collected annually, and the data base updated to maintain current information on the State's water use.

PROGRESS: The Iowa District has transferred the water-use data base from the Distributed Information System I (Prime computer) to the Distributed Information System II (Unix workstations). Reports of withdrawal by permitted water users are being entered in the data base.

AREAL HYDROLOGIC INVESTIGATIONS

FLOOD PROFILES OF IOWA STREAMS (IA 58-011)



PERIOD OF PROJECT: Continuous since 1957

PROJECT CHIEF: R.F. Einhellig

STUDY AREA: Statewide

COOPERATING AGENCY: Iowa Department of Transportation (Highway Division, Highway Research Advisory Board)

NEED FOR STUDY: Flood-peak and water-surface profile information is needed for the economical and safe location and design of bridges and other structures on or over streams and the adjacent flood plains. Defining the limits of flood inundation and establishing encroachment limits on flood plains are related problems needing this information. Data for major floods are needed to compute flood-peak discharges and calibrate water-surface profile models at ungaged sites along streams.

OBJECTIVES: Define the water-surface profiles and corresponding discharges along streams in basins with at least 100 mi^2 of drainage area for at least one recorded flood and the expected flood(s) of one or more selected recurrence intervals, usually the 25- and 50-year recurrence intervals. Evaluate the flood characteristics and hydraulics at existing and proposed flow structures on basins of all sizes when requested.

PROGRESS: The Raccoon River report was published as USGS Open-File Report 92-94, "Floods of 1986 and 1990 in the Raccoon River Basin, West-Central Iowa" (Baebenroth and Schaap, 1992). Level lines were measured using sea-level datum from bench marks to establish temporary marks on bridges along Clear Creek for the report on the June 17, 1990, flood; along Perry Creek in Woodbury County for the report on the May 19, 1990, flood; along the Turkey and Volga Rivers and along Roberts and Otter Creeks for the report on the June 6, 1991, floods, and at selected bridge sites along Squaw Creek and South Skunk River for the report on the June 17, 1990, and July 9, 1993, floods. Low-water and low-bridge chord and bridge-deck elevations were surveyed using temporary bench marks along Clear Creek. Low-water elevations were surveyed along the Turkey and Volga Rivers and along Roberts and Otter Creeks in northeast Iowa and along Squaw Creek and South Skunk River in the Ames area. As a result of significant floods, high-water marks were surveyed using temporary bench marks at the following locations: along the Chariton River, South Fork Chariton River, Weldon River, Thompson River, and along Elk Creek in south-central Iowa for the floods of September 15-16, 1992; along Squaw Creek and South Skunk River in the Ames area for the flood of 1993; along the Raccoon, North Raccoon, Middle Raccoon, and South Raccoon Rivers, and along Brushy Fork Creek for the flood in the Raccoon River Basin of July 9-10, 1993; and at the Interstate 80 bridge crossing Clear Creek near Coralville for the flood of July 6, 1993, in the Clear Creek Basin. The report "Flood of June 17, 1990, in the Clear Creek Basin, East-Central Iowa" has been prepared and currently is being reviewed. The following is a chronological listing of flood-profile reports for Iowa prepared by the USGS.

Chronological Flood-Profile References

Schwob, H.H., **1963**, Cedar River Basin floods: Ames, Iowa Department of Transportation, Iowa Highway Research Board Bulletin 27, 59 p.

Schwob, H.H., and Meyers, R.E., **1965**, The Mississippi River flood in Iowa: Iowa City, U.S. Geological Survey open-file report, 39 p.

Schwob, H.H., **1966**, Little Sioux River Basin floods: Iowa City, U.S. Geological Survey open-file report, 60 p.

_____**1967**, Floods on Otter Creek in Linn County, Iowa: Iowa City, U.S. Geological Survey open-file report, 22 p.

_____**1968a**, Floods of June 7, 1967, in the Wapsinonoc Creek Basin, Iowa: Iowa City, U.S. Geological Survey open-file report, 21 p.

_____**1968b**, Flood profile study, Squaw Creek, Linn County, Iowa: Iowa City, U.S. Geological Survey open-file report, 13 p.

_____**1970a**, Floods in the upper Des Moines River Basin, Iowa: Iowa City, U.S. Geological Survey open-file report, 49 p.

_____**1970b**, Flood profile study, Morgan Creek, Linn County, Iowa: Iowa City, U.S. Geological Survey open-file report, 16 p.

_____**1970c**, Flood of March 3, 1970, on Old Mans Creek, Johnson County, Iowa: Iowa City, U.S. Geological Survey open-file report, 9 p.

_____**1970d**, Flood profile study, Hoosier Creek, Linn County, Iowa: Iowa City, U.S. Geological Survey open-file report, 18 p.

_____**1971**, Floods in the Wapsipinicon River Basin, Iowa: Iowa City, U.S. Geological Survey open-file report, 52 p.

Heinitz, A.J., **1973a**, Floods in the Iowa River Basin upstream from Coralville Lake, Iowa: Iowa City, U.S. Geological Survey open-file report, 75 p.

_____**1973b**, Floods of August 2, 1972, in the Little Maquoketa River Basin, Dubuque County, Iowa: Iowa City, U.S. Geological Survey open-file report, 28 p.

_____**1973c**, Floods in the Rock River Basin, Iowa: Iowa City, U.S. Geological Survey open-file report, 74 p.

Lara, O.G., and Heinitz, A.J., **1976**, Flood of June 27, 1975, in city of Ames, Iowa: U.S. Geological Survey Open-File Report 76-728, 56 p.

Heinitz, A.J., **1977**, Floods in the Big Creek Basin, Linn County, Iowa: U.S. Geological Survey Open-File Report 77-209, 35 p.

Heinitz, A.J., and Wiitala, S.W., **1978**, Floods in the Skunk River Basin, Iowa: U.S. Geological Survey Open-File Report 79-272, 80 p.

Heinitz, A.J., **1979**, Supplement to floods in the upper Des Moines River Basin, Iowa: U.S. Geological Survey Open-File Report 79-1486, 6 p.

_____**1980**, Floods in the Raccoon River Basin, Iowa: U.S. Geological Survey Open-File Report 80-162, 110 p.

Heinitz, A.J., and Riddle, D.E., **1981**, Floods in the English River Basin, Iowa: U.S. Geological Survey Open-File Report 81-67, 61 p.

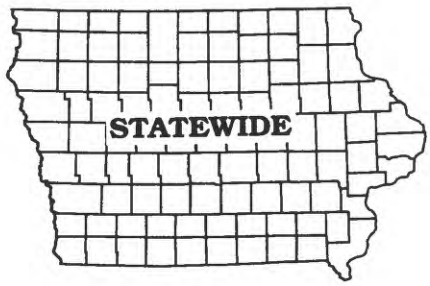
Heinitz, A.J., **1985**, Floods in south-central Iowa: U.S. Geological Survey Open-File Report 85-100, 95 p.

_____**1986**, Floods in the Floyd River Basin, Iowa: U.S. Geological Survey Open-File Report 86-476, 61 p.

Eash, D.A., and Heinitz, A.J., **1991**, Floods in the Nishnabotna River Basin, Iowa: U.S. Geological Survey Open-File Report 91-171, 118 p.

Baebenroth, R.W., and Schaap, B.D., **1992**, Floods of 1986 and 1990 in the Raccoon River Basin, west-central Iowa: U.S. Geological Survey Open-File Report 92-94, 144 p.

IOWA GROUND-WATER-QUALITY MONITORING PROGRAM (IA 83-047)



PERIOD OF PROJECT: Continuous since 1982

PROJECT CHIEF: D.A. Sneck-Fahrer

STUDY AREA: Statewide

COOPERATING AGENCY: Iowa Department of Natural Resources (Geological Survey Bureau) and the University of Iowa Hygienic Laboratory

NEED FOR STUDY: Ground-water quality is one of the most critical resource concerns in the State of Iowa. A ground-water-quality monitoring program is needed to provide data to aid State and local management and regulatory agencies to effectively evaluate the ground-water resources of the State.

OBJECTIVES: The primary purpose of the ground-water-quality monitoring program is to provide consistent and representative ground-water-quality data that describe the chemical quality of ground-water resources in the State. Initially, the primary objective was to specifically describe the baseline ground-water quality of the major aquifers in the State that are stressed by intensive use, contamination, or deteriorating quality. After 10 years of data collection, this phase of the program has been completed. Since 1992, the objectives have been: (1) to determine possible trends in ground-water quality throughout a 10-year period and (2) to correlate the analytical results with primary contributing factors, including location, land use, regional ground-water flow, and precipitation.

PROGRESS: Ninety wells (fig. 10) completed in the principal aquifers of the State have been selected for sampling to determine possible trends in ground-water quality. Wells completed in surficial and bedrock aquifers are sampled on 1- or 2-year schedules, respectively. All wells are sampled for major ions, nutrients, and common herbicides. Additionally, shallow wells (less than 300 ft deep) are sampled for selected priority pollutants, and deep wells (more than 300 ft deep) are sampled for radionuclides. Radon concentrations are determined in 45 randomly selected wells. Network data are compiled and published in the annual USGS "Water Resources Data, Iowa" report.

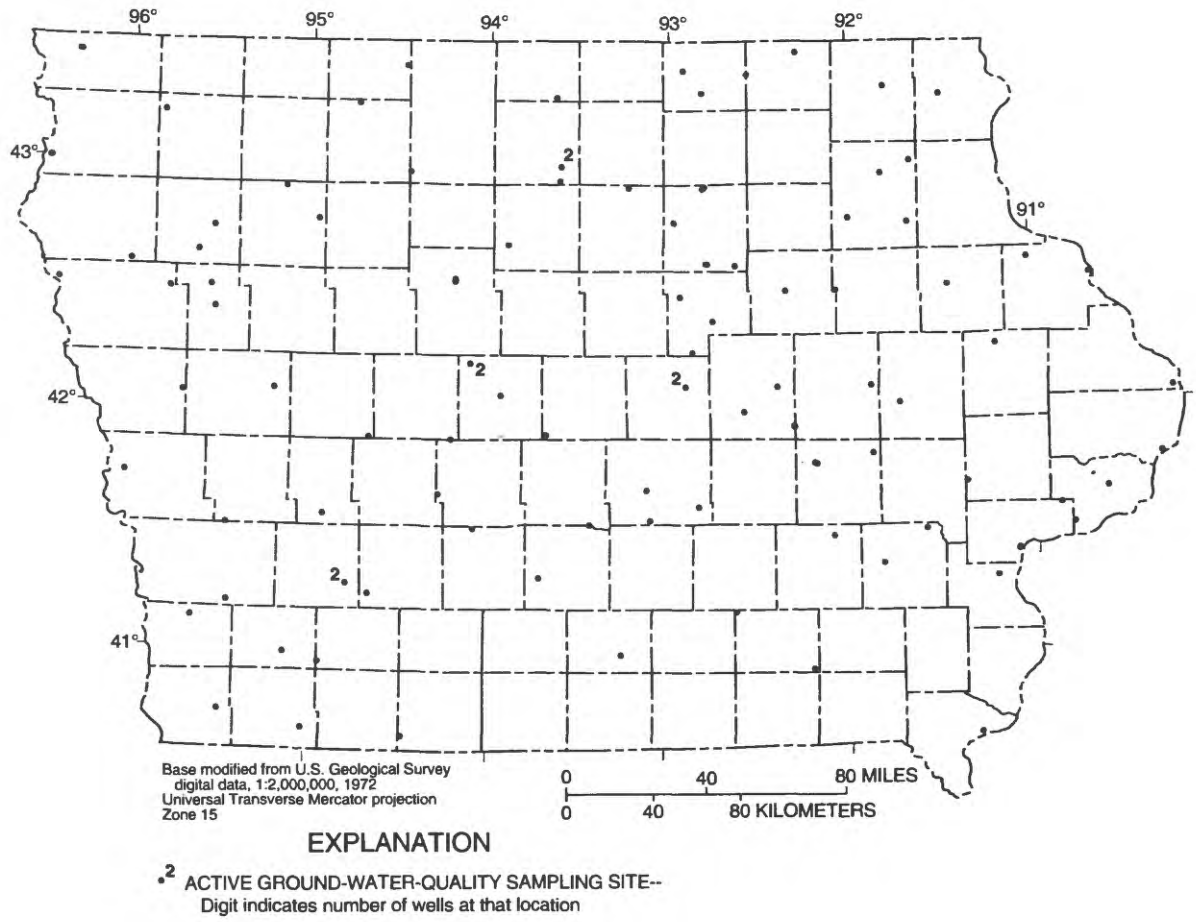
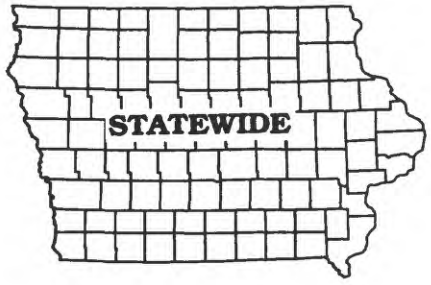


Figure 10. Location of ground-water-quality sampling sites.

EVALUATION OF FACTORS AFFECTING THE OCCURRENCE OF AGRICULTURAL CHEMICALS IN WATER RESOURCES OF THE CENTRAL MIDWEST (IA 87-057)



PERIOD OF PROJECT: 1987-95

PROJECT CHIEF: D.W. Kolpin

STUDY AREA: Illinois, Indiana, and Iowa; parts of Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin

COOPERATING AGENCY: U.S. Geological Survey (Federal program)

NEED FOR STUDY: Agricultural chemical contamination of ground water and surface water poses a major threat in much of the United States. A comprehensive evaluation of the available information is needed to identify the extent to which water resources have been affected by agricultural chemicals and what measures are necessary to mitigate the problems related to contamination.

OBJECTIVES: In collaboration with the U.S. Department of Agriculture and the U.S. Environmental Protection Agency (EPA), the overall goal of this project is to develop an understanding of factors that affect the occurrence of agricultural chemicals in water resources and to develop strategies to improve and protect water resources. To meet this objective, the USGS is identifying the spatial and temporal occurrence of herbicides and nitrate in water resources of the Midwest through reconnaissance sampling (fig. 11) and evaluation of chemical constituents of aquifers, streams, and precipitation throughout the 12-state area. The project also is providing geographic-information-system support for studies being conducted by other USGS offices.

PROGRESS: Hydrogeologic, land-use, and water-quality data collected during 1991 for the Midcontinental Ground-Water Reconnaissance were published as USGS Open-File Report 93-114. Interpretations from this data were published as USGS Water-Supply Paper 2413 and also in a scientific journal. About one-third of the ground-water network was resampled during July and August of 1992. The main objective of the 1992 sampling was to determine if the spatial patterns in occurrence change with an increased number of pesticide compounds analyzed (13 in 1991 to 60 in 1992) using lower reporting limits. Selected results from the 1991 and 1992 study were published in USGS Open-File Report 93-418. Currently, about 110 wells from the ground-water network have been selected for sampling to determine if there has been an immediate effect on ground-water quality from the record flooding that occurred in the Midwest during the summer of 1993. Also, a study to determine the effects of land use, topographic features, and the generalized flow system on agricultural chemical contamination of near-surface aquifers is in progress.

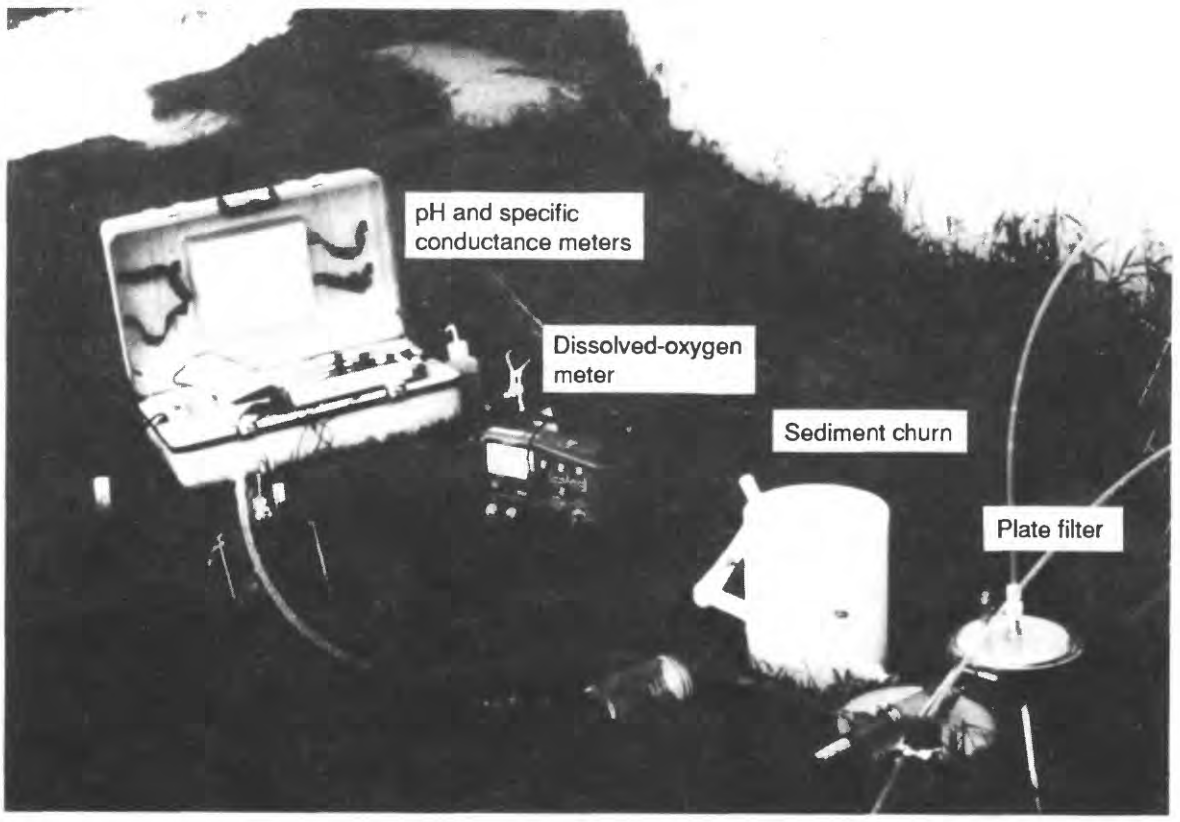
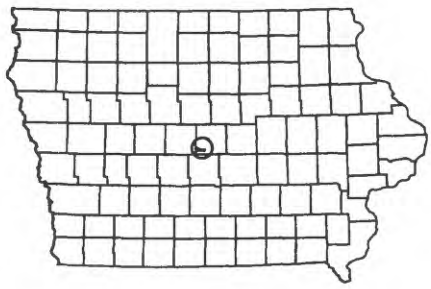


Figure 11. Water-quality equipment used during collection of ground-water samples for nitrate and pesticide analysis.

WATER-FLOW PROCESSES AND RELATED AGRICULTURAL CHEMICAL LOADINGS IN THE WALNUT CREEK WATERSHED NEAR AMES, IOWA (IA 91-067)



PERIOD OF PROJECT: 1991-93

PROJECT CHIEF: P.J. Soenksen

STUDY AREA: Boone and Story Counties

COOPERATING AGENCY: U.S. Geological Survey (Federal program)

NEED FOR STUDY: The processes governing how agricultural chemicals are transported from points of application to surface- and ground-water resources must be understood in order to minimize contamination of those resources. Agricultural chemicals, such as nitrate, alachlor, atrazine, metolachlor, and metribuzin, are soluble in water to varying degrees, and their transport is thought to be related to the major water-flow processes. Understanding how such factors as physical basin characteristics, land use, agricultural management systems, and meteorological factors affect water-flow processes should increase understanding of agricultural chemical transport.

OBJECTIVES: The Iowa District is working with the U.S. Department of Agriculture, Agricultural Research Service (ARS), and the Agricultural Experiment Station (AES) of Iowa State University on the Iowa Management System Evaluation Area (MSEA) project. The following objectives relate to the Iowa District's effort on the Walnut Creek watershed and are secondary objectives of the Iowa MSEA: (1) define ground-water flow paths and estimate movement in the saturated zone for selected basins; (2) evaluate the ability of the Precipitation-Runoff Modeling System to simulate, at various scales, the major flow processes (water and sediment) and compare with simulations of other models being used; and (3) relate the loadings of agricultural chemicals and sediment in streamflow and tile flow to the major flow processes.

PROGRESS: Data have been collected from a network of 105 observation wells and 5 surface-water gaging stations. Ground-water-level measurements and samples were collected monthly. Surface-water discharge was monitored continuously, and water-quality and sediment samples were collected at least weekly during base flow and more frequently during stormflow. Samples were analyzed by ARS for nitrate as nitrogen and the herbicides atrazine and metolachlor. Sediment samples were analyzed for suspended load by the USGS.

Water-table maps were developed from ground-water-level data for selected field and small basin study areas. Flow patterns indicate that the main tile lines function as ground-water sinks and that the upper, oxidized glacial materials are the most hydrologically active. Surface-water discharge records were computed for water years 1991-92.

Chemical-concentration curves were developed and used to compute instantaneous values of chemical discharge for each station through September 1992. Cumulative chemical loads and yields were computed for selected stations (fig. 12), including an ARS tile-flow station. The combined chemical data show that (1) nitrate moves during both stormflow and base flow, whereas the herbicides move primarily during stormflow; (2) herbicide concentrations and loads increase and decrease rapidly during stormflow and are largest during stormflow shortly after chemical application; (3) nitrate concentrations generally are above 10 milligrams per liter except when diluted during periods of stormflow; and (4) tile flow was the major source of nitrate and herbicides during 1992 when stormflow did not occur for about 2 months after chemical application. To date, a USGS Water Fact Sheet has been published (Soenksen and others, 1992), three poster papers have been presented at conferences, and one paper is in press.

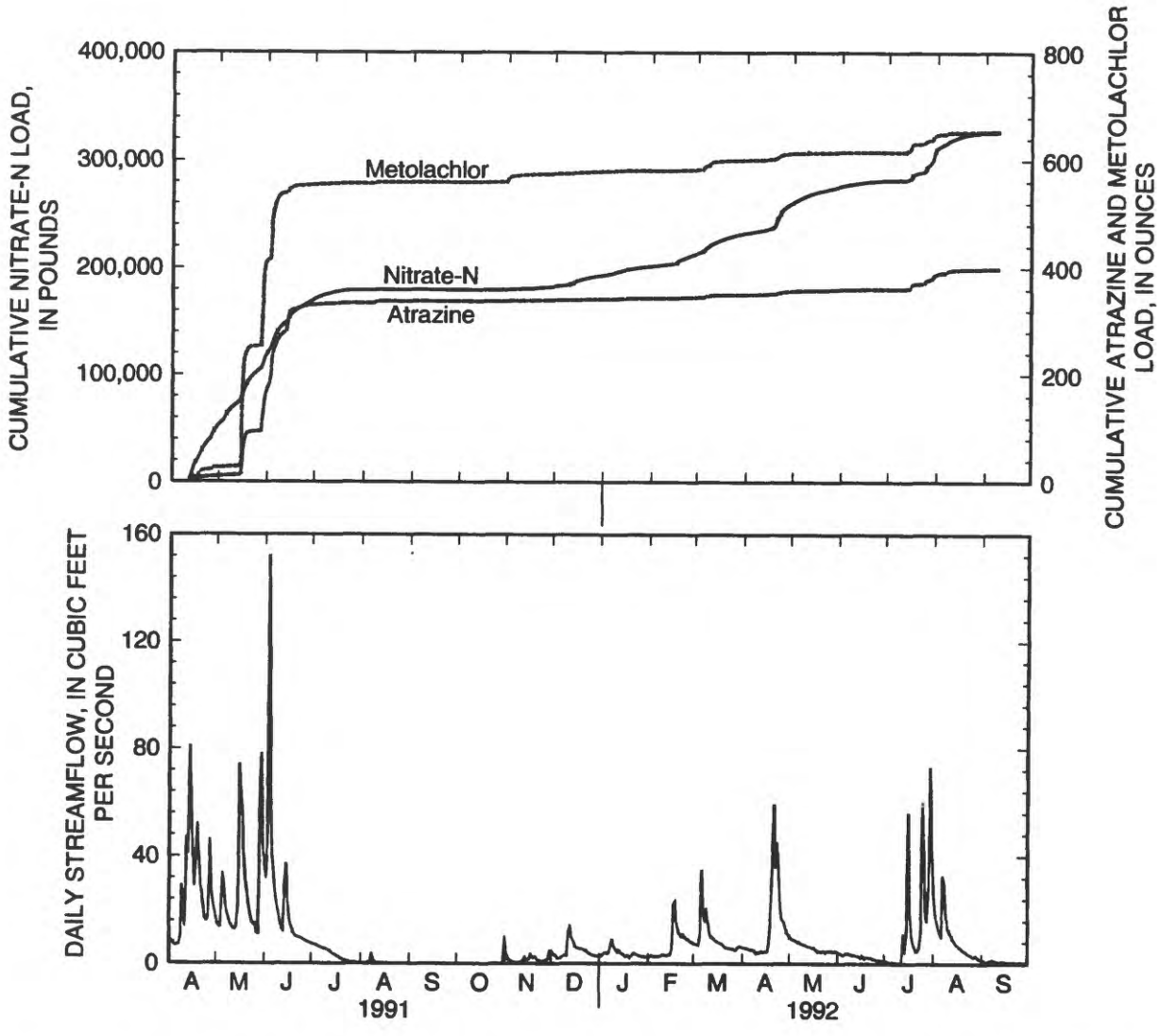
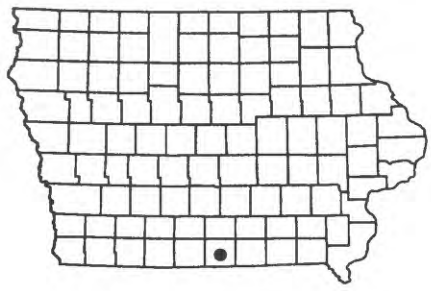


Figure 12. Cumulative loads of nitrate as nitrogen, atrazine, and metolachlor and daily streamflow at Walnut Creek at Kelley gaging station.

AGRICULTURAL CHEMICALS IN A WATER-SUPPLY RESERVOIR IN SOUTH-CENTRAL IOWA (IA 91-068)



PERIOD OF PROJECT: 1991-94

PROJECT CHIEF: Vacant

STUDY AREA: Wayne County

COOPERATING AGENCY: Iowa Department of Natural Resources (Geological Survey Bureau)

NEED FOR STUDY: Previous analyses of water from the Corydon Reservoir, used as a source for municipal water supply, indicate that, at times, agricultural chemical concentrations exceed U.S. Environmental Protection Agency Maximum Contaminant Levels for drinking water. To reduce agricultural chemical runoff, several State and Federal agencies (U.S. Environmental Protection Agency; U.S. Department of Agriculture's Soil Conservation Service; Iowa State University Cooperative Extension Service; Iowa Department of Agriculture and Land Stewardship; and the City of Corydon) have provided funding and personnel to assist landowners in the Corydon Reservoir watershed to modify their agricultural practices and to implement conservation practices. This is intended to reduce the input of nitrate, herbicides, and sediment into the reservoir. There is a need to monitor the water quality of the Corydon Reservoir to assess the affect of these conservation practices.

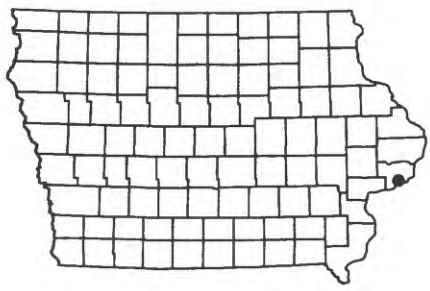
OBJECTIVES: To monitor the effect of changing land-management practices on the quality of water in the Corydon Reservoir, Wayne County, Iowa.

PROGRESS: The quality of water in Corydon Reservoir has been monitored monthly since the beginning of the project. Specific-conductance, pH, water-temperature, and dissolved-oxygen profiles are determined at three sites in the reservoir. Samples for the analyses of nutrients, selected herbicides, total solids, bacteria, and chlorophyll have been collected monthly (fig. 13). The lake level is recorded continually to document inflow to the reservoir. Preliminary results suggest that the concentration of several herbicides commonly used in the watershed are related to the amount and timing of spring and summer rains. Atrazine and cyanazine concentrations peak in late spring and early summer soon after application. The greatest concentrations occurred after intense rains in May and June and were followed by below normal rainfall in July to September 1991. The herbicides were washed into the reservoir during the rainy period and were stored in the reservoir during the dry period. Although remaining below 3.0 milligrams per liter, nitrate concentrations followed a similar seasonal trend. A limited number of samples were collected to determine if the herbicides were stored in the bottom sediment.

In a related study, bottom samples were collected from 15 water-supply lakes to determine the levels of the common herbicides. The results showed that atrazine was present in sediment from eight lakes, cyanazine in two lakes, and alachlor in one lake. Atrazine concentrations in bottom sediment were significantly related to the atrazine concentrations in the overlying water. The results of the first year's data collection have been published as USGS Water-Resources Investigations Report 93-4099 (Kalkhoff, 1993a).

Figure 13. Winter sampling of reservoir water quality.

DETERMINATION OF STORMWATER RUNOFF QUALITY IN DAVENPORT, IOWA (IA 91-070)



PERIOD OF PROJECT: 1991-94

PROJECT CHIEF: R.F. Einhellig

STUDY AREA: Scott County

COOPERATING AGENCY: City of Davenport

NEED FOR STUDY: Cumulative constituent loads associated with urban runoff can have substantial effects on the water quality of receiving streams. If the source of possible contaminants can be determined, management controls can be implemented. The quantity and quality of stormwater runoff will be characterized for five major land uses: (1) residential, (2) commercial, (3) industrial, (4) agricultural, and (5) urban open space. Annual contaminant loads for 12 constituents for each land-use type will be determined. The data collected will satisfy the requirements of the U.S. Environmental Protection Agency's National Pollution Discharge Elimination System (NPDES) permit application for discharges from municipal stormwater systems.

OBJECTIVES: The objective of the study is to characterize the quantity and the quality of stormwater in streams and channels draining five areas of specific land uses. The data will be used to determine mean concentrations and annual loads of selected constituents in stormwater discharges for the City of Davenport.

PROGRESS: Stormwater sample collection was completed in 1992 (fig. 14). Annual loads for 12 constituents were calculated using USGS national regression equations and using site-specific data with U.S. Environmental Protection Agency methods. Information was provided to the City of Davenport to support the NPDES permit application for municipal stormwater discharges.

Figure 14. New gaging-station construction on Duck Creek near Davenport, Iowa.

INVESTIGATION OF SCOUR SUSCEPTIBILITY AT BRIDGES IN IOWA (IA 92-071)

PERIOD OF PROJECT: 1992-94

PROJECT CHIEF: E.E. Fischer

STUDY AREA: Statewide

COOPERATING AGENCY: Iowa Department of Transportation (Highway Division, Highway Research Advisory Board)

NEED FOR STUDY: The Federal Highway Administration has requested that the Iowa Department of Transportation (IDOT) and the State's counties and cities assess the scour-related integrity of bridges in Iowa because of several scour-related bridge failures in other parts of the country. In 1990, the IDOT initiated a bridge-scour evaluation of more than 2,000 bridges over water in the State's primary highway system. Transportation officials in Iowa's counties and cities also have begun to evaluate more than 21,000 bridges in the secondary highway system. To assist them in their scour review, IDOT has requested the USGS provide an assessment of regional scour susceptibility for bridges in Iowa.

OBJECTIVES: The objective of the Iowa bridge-scour-susceptibility project is to provide regional information and understanding of scour at bridge sites throughout the State. Working in cooperation with the IDOT, the USGS will assess scour susceptibility at about 100 bridge sites throughout the State by onsite inspection, select between 8 and 15 sites to collect data for more detailed evaluations of scour susceptibility, and make scour analyses. The USGS also will attempt to collect measurements of scour during several high flows.

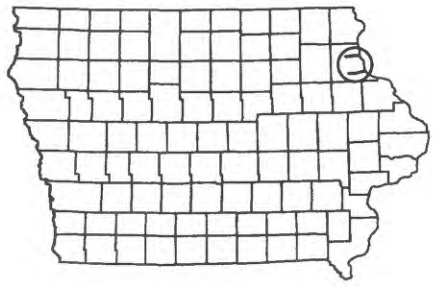
PROGRESS: The scour susceptibility of 130 bridges was assessed during water year 1992 using a form developed for the purpose. The form listed factors to measure relating to the geomorphology of the river with respect to the bridge. The factors included extent of channel constriction at the bridge, proximity of river meander impact points, bank conditions, and extent of debris blockage. A potential-scour index then was computed for each bridge using the data. During water year 1993, 10 sites were selected, and work began on more detailed evaluations of scour susceptibility.

Bridge-scour measurements were made during flooding in the State, both during and after the floods in south-central Iowa in September 1992 and during the floods of 1993. Significant scour occurred at several sites. Abutment piling was exposed at a State Highway bridge in southern Iowa during the flood of September 1992 (fig. 15). This scour was the subject of a paper presented at the American Society of

Civil Engineers Hydraulics Conference in July 1993 (Fisher, 1993). The streambed of the Iowa River scoured below the footings of another State Highway bridge in southeastern Iowa during 1993. The bridge did not fail because the footings were supported by piling. Each bridge was closed to traffic during the floods.

Figure 15. Abutment scour at the State Highway 2 bridge over the Weldon River, Decatur County, Iowa.

EFFECT OF LAND-USE CHANGES ON STREAM SEDIMENT IN THE SNY MAGILL WATERSHED, CLAYTON COUNTY, IOWA (IA 92-072)



PERIOD OF PROJECT: 1992-96

PROJECT CHIEF: Vacant

STUDY AREA: Clayton County

COOPERATING AGENCY: Iowa Department of Natural Resources (Geological Survey Bureau)

NEED FOR STUDY: Stream sediment continues to be a major problem in rivers and streams throughout the corn- and soybean-growing region of the Midcontinent United States. Measurements of the sediment yield of Mississippi River tributaries in Iowa indicate that sediment losses are between 500 ton/acre in north-central Iowa to 1,500 ton/acre in east-central Iowa. Sediment yield from tilled agricultural land has been shown to be 20 times greater than pastured land and hundreds of times greater than forested land. Increases in stream sediment can cause the loss of productive topsoil, channel instability, altered stream biology, and can limit the recreational and aesthetic value of the stream's environment. Public and Congressional concern for the contamination of ground- and surface-water supplies has prompted the agricultural community to re-evaluate present farming methods. The U.S. Department of Agriculture has been charged with developing and implementing best-management practices intended to lessen the environmental effects of present agricultural land-use practices. These management practices will be implemented on the local level through a series of farm-demonstration projects located in selected hydrologic units. To determine the effectiveness of best-management practices, stream-sediment changes need to be monitored.

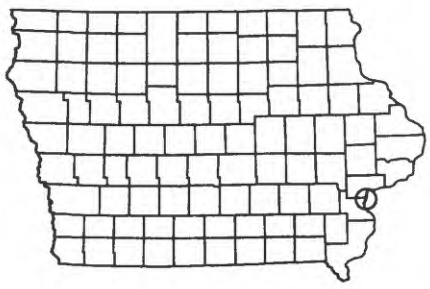
OBJECTIVES: The principle objective of the project is to determine the effectiveness of land-use practices implemented in the Sny Magill watershed to reduce stream-sediment yield. Specific project objectives include: (1) evaluation of the stream-sediment yield from a basin where present agricultural practices are continued; (2) evaluation of the effectiveness of riparian buffer strips (fig. 16) in reducing stream-sediment yield; and (3) evaluation of the effects of best-management practices and sediment controls in reducing stream-sediment yield.

PROGRESS: The collection of stream-discharge and suspended-sediment concentration data from paired basins is being conducted to determine the effects of conservation practices designed to reduce soil erosion on stream-water quality. Conservation practices are being applied in the Sny Magill Creek watershed. Land use will remain

unchanged in the Bloody Run watershed. The total suspended-sediment discharge from Sny Magill watershed in water year 1992 was about 1,900 tons of which 61 percent was discharged in one day (April 20, 1993). During 1992, the total suspended-sediment discharge from Bloody Run was about 2,700 tons of which 1,250 tons were discharged in April. The maximum daily discharge was about 920 tons on April 20.

Figure 16. Livestock grazing along the riparian zone of Sny Magill Creek, Clayton County, Iowa.

QUANTITATIVE ASSESSMENT OF THE HYDROGEOLOGY OF MUSCATINE ISLAND, IOWA (IA 92-073)



PERIOD OF PROJECT: 1992-94

PROJECT CHIEF: K.J. Lucey

STUDY AREA: Muscatine and Louisa Counties

COOPERATING AGENCY: City of Muscatine (Muscatine Power and Water)

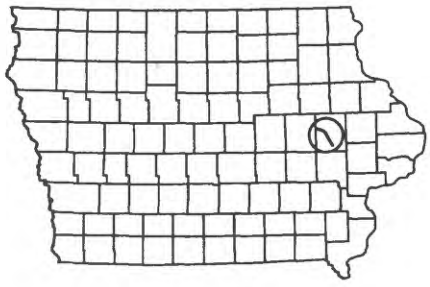
NEED FOR STUDY: The area of the study is a substantial alluvial sand and gravel deposit along the Mississippi River south of Muscatine, Iowa, and known as the Muscatine Island alluvial aquifer. The aquifer covers about 50 mi^2 and varies in thickness from 40 to 180 ft. Ground-water withdrawals have increased considerably since the last hydrogeologic study was completed by the USGS in 1977. Withdrawals for municipal, industrial, and irrigation use have increased, and there has been a gradual deterioration in water quality. There is a need for a redefinition of the sources of water recharging the aquifer and documentation of changes in water quality that have occurred in response to increased water withdrawals.

OBJECTIVES: Specific objectives of the study are to: (1) evaluate the source of water recharging the aquifer in response to current pumping rate; (2) document current seasonal water levels (fig. 17), water use, and the areal variation in water quality; and (3) determine the quality of water recharging the aquifer under current pumping conditions.

PROGRESS: A data-collection network of more than 80 observation wells was established to provide information on geology, water levels, and water quality. Water-quality samples are collected every 3 months from 20 wells, the Mississippi River, and Muscatine Slough. Samples are analyzed for major ions and nutrients. Determinations of selected trace metals are performed twice per year. A preliminary steady-state ground-water flow model has been constructed to describe the hydrology of the aquifer.

Figure 17. High water-table conditions July 12, 1993, along Mississippi River flood plain in Muscatine and Louisa Counties, Iowa.

ASSESSMENT OF GROUND-WATER FLOW AND QUALITY: CEDAR RIVER ALLUVIUM, CEDAR RAPIDS, IOWA (IA ⁉2-074)



PERIOD OF PROJECT: 1992-96

PROJECT CHIEF: P.J. Squillace

STUDY AREA: Linn County

COOPERATING AGENCY: City of Cedar Rapids (Water Department)

NEED FOR STUDY: Cedar Rapids, Iowa, obtains its municipal water supply from shallow wells (less than 100 ft deep) completed in alluvial deposits of the Cedar River. Municipal water withdrawals averaged about 23 Mgal/d during 1990. During summers of below normal rainfall and greater than normal temperatures, withdrawals increased to greater than 40 Mgal/d. The number of wells used by Cedar Rapids has increased since 1964 due to an increase in water demand. The withdrawal network has expanded by progressively developing areas of alluvium in an upstream direction. The City currently is able to meet its demand for water although during times of drought the system is stressed and changes in water quality have been observed. The water managers have recognized a need to determine the maximum safe yield of the alluvial aquifer, to identify threats to the quality of water in the alluvial aquifer, and to plan for additional withdrawals to meet projected water demands and economic growth.

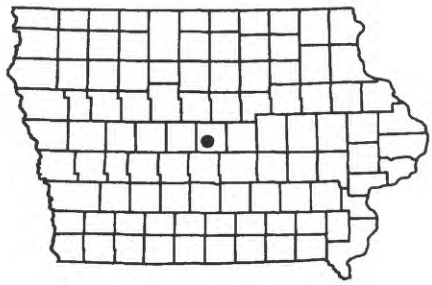
OBJECTIVES: The objectives of the project are to: (1) determine the source of water to the alluvial aquifer in the area of the present Cedar Rapids well field; (2) determine the predevelopment and postdevelopment recharge to the aquifer upstream of the present well field as far as Palo, Iowa; and (3) characterize the water quality of the alluvial aquifer and its recharge sources.

PROGRESS: An observation-well network consisting of 45 small-diameter wells and several 4-in. diameter wells was established to provide information on geology, water levels, and water quality. Marine and land-refraction seismic geophysical tests (fig. 18) were done to determine the depth to bedrock in areas where there is little available borehole information. Water-quality samples are collected every 3 months from the Cedar River, the municipal wells, and selected observation wells to determine the spatial and temporal variability in water quality. Continuous monitoring of in-situ river and aquifer physiochemical water-quality constituents, such as specific conductance and temperature, near pumping wells is being conducted to determine if the quality of water withdrawn from municipal wells becomes similar to the river water quality with pumping. Additional sampling of municipal wells during high river-stage conditions is being conducted to determine if surface-water borne particulates are

present in water pumped from the aquifer. Hydrogeologic maps of the alluvial aquifer have been prepared to determine the areal extent of alluvial aquifer material. A conceptual ground-water flow model of the well-field areas has been constructed and will be expanded to simulate flow in the aquifer.

Figure 18. Land-refraction seismic equipment being set up for data collection, Linn County, Iowa.

PRELIMINARY ASSESSMENT OF GROUND-WATER FLOW AND QUALITY: SOUTH SKUNK RIVER ALLUVIUM NEAR AMES, IOWA (IA 92-075)



PERIOD OF PROJECT: 1992-95

PROJECT CHIEF: P.J. Squillace

STUDY AREA: Story County

COOPERATING AGENCY: U.S. Department of Agriculture (Agricultural Research Service)

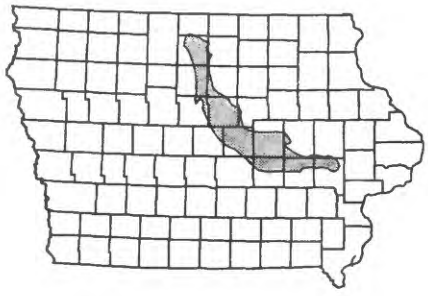
NEED FOR STUDY: A significant amount of research has been conducted to determine the fate and transport of agricultural chemicals to surface-water systems and within the soil and unsaturated zone. Present research activities by various of agencies will continue to increase the information available for these hydrologic systems. However, fundamental questions remain unanswered about the fate and transport of agricultural chemicals in ground-water aquifers. Research to determine the processes that govern the transport of agricultural chemicals in alluvial aquifers has been proposed by the Agricultural Research Service and the USGS for the South Skunk River alluvium. There is a need to have a detailed understanding of the movement of water in Midwestern alluvial aquifers so that when the processes that affect the fate of the chemicals are known, the agricultural chemical occurrence, distribution, and transport can be projected.

OBJECTIVES: An in-depth understanding of the hydrology of the study area is needed before the results of subsequent water-quality research can be evaluated. The assessment of the hydrology has been divided into four main tasks: (1) drilling and construction of observation wells and sample-collection points; (2) determination of site geology and geometry; (3) determination of site hydrology, and (4) determination of background water-quality information.

PROGRESS: A preliminary evaluation of the South Skunk River alluvial aquifer was begun by installing observation wells at six sites in the alluvium near the confluence of Walnut Creek with the South Skunk River (fig. 19). The observation wells, at various depths at each site, were sampled for chemical analyses, and water levels were measured during 1992-93. Preliminary results indicate that nitrate in water exceeds the U.S. Environmental Protection Agency's drinking-water regulation of 10 milligrams per liter at approximately 20 to 25 ft below land surface at some locations. Water from other locations and depths do not exceed the regulation. Few herbicides were detected in ground-water samples.

Figure 19. Dry Walnut Creek streambed as it crosses the South Skunk River flood plain during low-flow conditions.

CHANNEL AND FLOOD-PLAIN AGGRADATION IN THE IOWA RIVER BASIN, IOWA (IA 93-076)



PERIOD OF PROJECT: 1992-95

PROJECT CHIEF: D.A. Eash

STUDY AREA: Iowa River, Central Iowa

COOPERATING AGENCY: Iowa Department of Transportation (Highway Division, Highway Research Advisory Board)

NEED FOR STUDY: Knowledge of sediment-deposition processes and rates of stream aggradation for Iowa streams is needed by planners and engineers to design bridges, culverts, and other water-related structures. In the past, these structures have been designed using historic flood data or derived flood information, and design-flood profile elevations are computed for the present-day channel conveyance. The design of these structures does not consider channel aggradation and the conveyance changes that occur at some bridges and culverts. The reduction in the bridge or culvert conveyance from channel and flood-plain aggradation can affect the flow capacity, the backwater design, and the integrity of the structure. The Iowa Department of Transportation has indicated that channel aggradation in the Iowa River Basin may be affecting the conveyance of bridges over the Iowa River in Marshall County. An increase in floodwater elevations caused by channel and flood-plain aggradation also can affect the design of road-grade elevations for roads located on flood plains. Knowledge of aggradation rates is needed by engineers in the design of road-grade elevations and to diminish potential life-threatening situations posed from road overflows during floods.

OBJECTIVES: The principal objective of the project is to identify locations along the Iowa River upstream from Coralville Lake where channel and flood-plain aggradation are occurring and to quantify the rates of aggradation. In addition to the Iowa River Basin study, conduct comparative quantifications to determine rates of stream aggradation for two Skunk River Basin sites. A second objective of the project is to assess the feasibility of using the methods for evaluating aggradation rates on a regional or statewide basis. The third objective is to improve understanding of the effects of land-use changes and geomorphic processes affecting channel aggradation.

PROGRESS: During March 1993, 10 clay pads were installed at three bridge sites along the Iowa River in Marshall and Tama Counties. The pads were installed prior to overbank flooding to measure short-term flood-plain aggradation rates. During October 1993, 9 of the 10 pads were located after river stages returned to within bank, and sediment-deposition measurements for 1993 were collected. A dendrogeomorphic method

was used to measure long-term flood-plain aggradation rates at 10 selected bridge sites along the Iowa River and at 2 bridge sites in the Skunk River Basin. The dendrogeomorphic method measures the depth of sediment deposition above the original root collar of a tree, and the age of the tree is determined from a core of the tree (fig. 20). An average long-term aggradation rate then is calculated from these two measurements. During October and November 1993, the dendrogeomorphic method was used to determine aggradation rates at 257 trees located along the flood plain near these 12 bridge sites. Another method, which examines stage-discharge relations over the period of record at streamflow-gaging stations, has been used to determine aggradation rates at 4 of the 10 Iowa River sites and at the 2 sites in the Skunk River Basin. Preliminary results from both the dendrogeomorphic and stage-discharge methods appear to corroborate each other and indicate that aggradation is occurring along the Iowa River and in the Skunk River Basin at varying rates that range from moderate to significant. A method that compares historical and current bridge-opening cross sections of the stream channel and flood plain also is being examined for the 12 bridge sites. Historical cross sections for five of the six streamflow-gaging stations have been completed using archived discharge-measurement notes. Bridge plans obtained from the Iowa Department of Transportation will be used to determine historical cross sections at the other six ungaged bridge sites. Cross-sectional surveys currently are being made at these 12 bridge sites for comparison to the historical cross sections. Channel gradients for the Iowa River have been measured from 1:24,000-scale topographic maps. Channel-gradient and aggradation-rate correlations will be examined for the Iowa River sites. Channelization plans obtained from the Marshall County Engineers Office and 1:24,000-scale topographic maps have been used to measure both pre- and post-channelization river lengths and gradients for a reach of the Iowa River that was channelized between 1918-20.

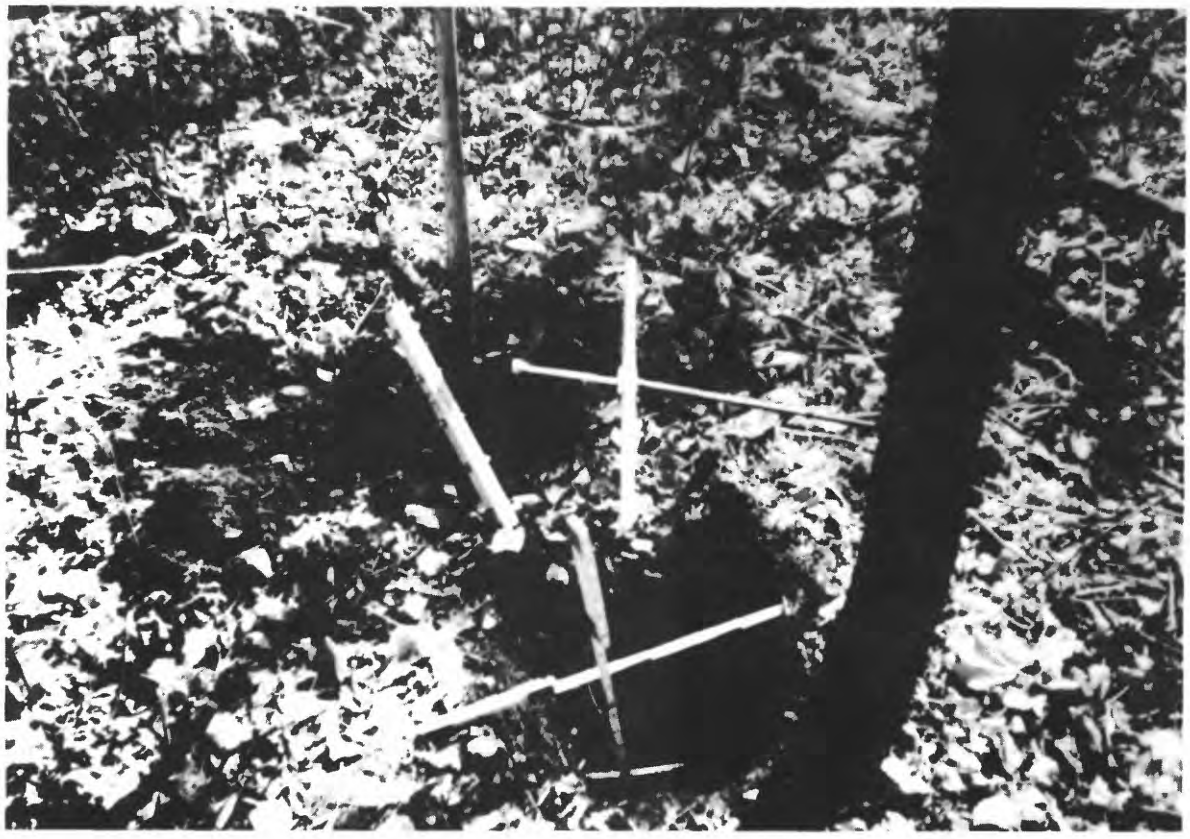


Figure 20. Tree coring and depth-to-root measurements for determining flood-plain aggradation rates.

INVESTIGATION OF IRON AND MANGANESE CONCENTRATIONS IN THE ALLUVIAL AQUIFER, MAIN WELL FIELD, MUSCATINE, IOWA (IA 93-077)

PERIOD OF PROJECT: 1993-95

PROJECT CHIEF: D.J. Schnoebelen

STUDY AREA: Muscatine County

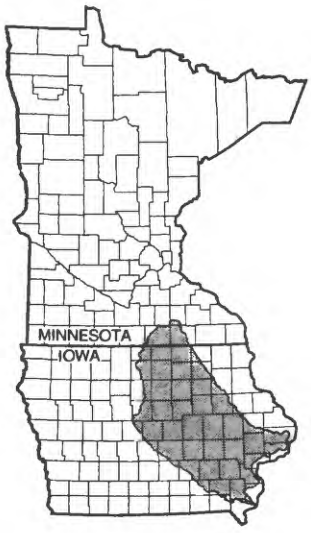
COOPERATING AGENCY: City of Muscatine (Muscatine Power and Water)

NEED FOR STUDY: The City of Muscatine, Iowa, obtains its water supply from several well fields completed in an alluvial aquifer adjacent to the Mississippi River. Muscatine Power and Water's (MPW) Main Well Field has been producing from the alluvial aquifer since the early 1900's. Historically, the aquifer has supplied large quantities of readily available water of excellent quality. Samples collected during the spring of 1992 indicated that water quality from one of the production wells had changed substantially. Iron concentrations increased from 420 to 4,000 micrograms per liter, with a corresponding increase in alkalinity and a decrease in pH. Additional sampling of nearby wells in the spring of 1993 also showed an increase in metal concentrations. The cause of these water-quality changes needs to be determined to assess the potential threat to other supply wells in the well field.

OBJECTIVES: The objectives of the study are to: (1) determine the areal extent of the zone of large metal concentrations in the Main Well Field, (2) investigate the occurrence of dissolved organic matter and gas in the ground water, (3) identify the possible chemical processes causing the large metal concentrations in the aquifer, and (4) investigate seasonal variations in the chemistry of the ground water in the Main Well Field.

PROGRESS: Six observation wells have been installed upgradient of the Main Well Field. Water-quality samples have been collected from production wells and observation wells and analyzed for major ions, dissolved organic carbon, selected trace metals, and nutrients. Results from these samples will be used to determine the potential geochemical processes occurring in the aquifer. Selected wells also have been sampled for dissolved-gas analysis. A shallow soil-gas survey for carbon dioxide has been conducted to determine if there are larger than background concentrations of carbon dioxide present in the study area. Data will be analyzed, and an interpretative report prepared.

NATIONAL WATER QUALITY ASSESSMENT PROGRAM: EASTERN IOWA BASINS (IA 94-078)



PERIOD OF PROJECT: Continuous since 1994

PROJECT CHIEF: S.J. Kalkhoff

STUDY AREA: Eastern Iowa

COOPERATING AGENCY: U.S. Geological Survey (Federal program)

NEED FOR STUDY: Water as a resource has become increasingly important due to increased use and demand. Thus, there is a need to define the current condition of this resource and to document changing conditions due to natural and human factors.

OBJECTIVES: To describe the status and trends in surface- and ground-water quality of the Iowa, Cedar, Wapsipinicon, and Skunk River watersheds. Study the primary natural and human factors that affect the quality of water in the study area.

PROGRESS: Work on the Eastern Iowa Basins study unit began in 1994. The study-unit boundary has been reviewed and modified to include the Cedar, Iowa, Skunk, and Wapsipinicon River watersheds (fig. 21). A literature review of the available water-quality information collected in these watersheds has begun. Geographic-information-system data coverages have been compiled for the watershed boundaries, political boundaries, stream network, cities and towns, and soil associations. Planning for the formation of a liaison committee has begun. The members of the committee will be scientists and water-management personnel from Federal, State, local agencies and academia.

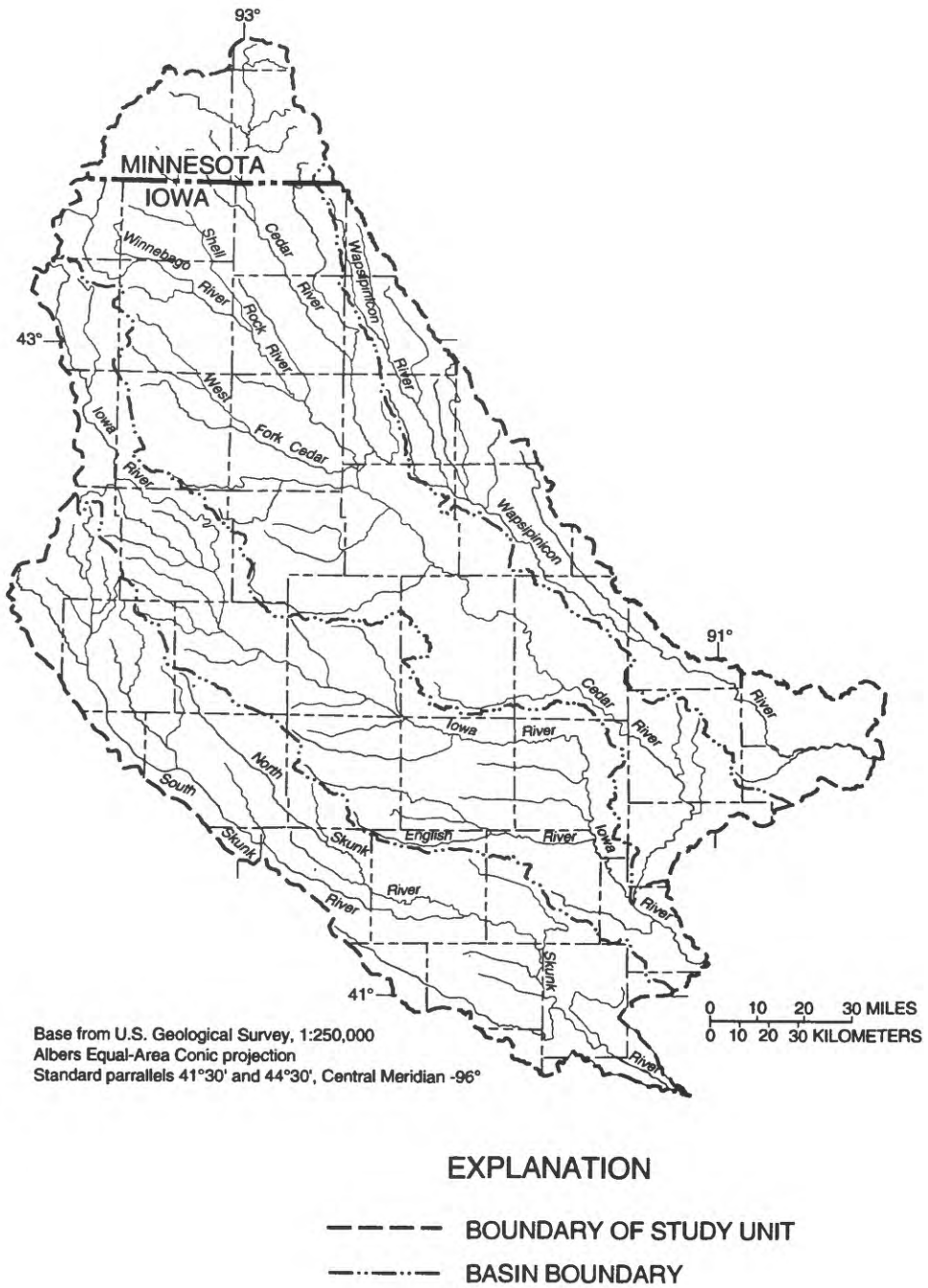
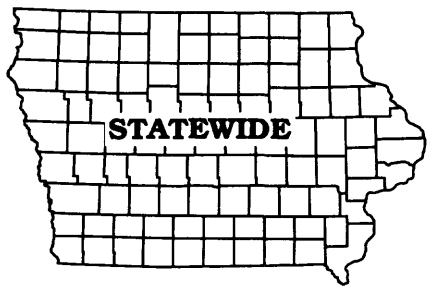


Figure 21. Areal extent of the Eastern Iowa Basins study unit for the National Water-Quality Assessment Program.

TECHNICAL ASSISTANCE FOR RESOURCE CONSERVATION AND RECOVERY ACT ACTIVITIES (IA 94-079)



PERIOD OF PROJECT: 1994-95

PROJECT CHIEF: J.P. Caldwell

STUDY AREA: Statewide

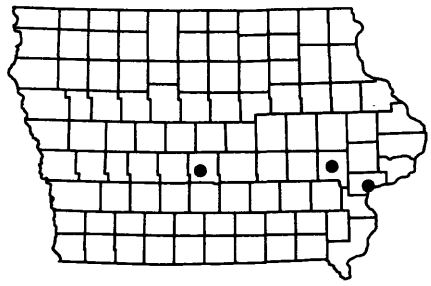
COOPERATING AGENCY: U.S. Environmental Protection Agency--Region VII

NEED FOR STUDY: The U.S. Environmental Protection Agency (USEPA) is charged with administering the provisions of the Federal Resource Conservation and Recovery Act (RCRA) within the State of Iowa. Through RCRA, the USEPA regulates the storage and disposal of solid and hazardous waste at facilities in every State, typically by overseeing State programs that administer the program. In Iowa, the State has returned primacy to USEPA for the RCRA program, and the USEPA has a need for additional technical assistance to gather, analyze, and review environmental data and assess environmental conditions at selected RCRA sites.

OBJECTIVES: To provide technical assistance to the USEPA--Region VII in: (1) data collection and areal investigation of water quality and environmental conditions; (2) technical assistance in reviewing reports and assessing the water quality and environmental conditions at selected RCRA sites; (3) training and technology transfer with USEPA staff; and (4) research.

PROGRESS: This program began in October of 1993 after establishing an interagency agreement that defined the scope of work. Activities will consist of site visits to collect data and technically review the collection of environmental data, to review reports on environmental data compiled and submitted to the USEPA, and to prepare written reports describing the environmental conditions at selected RCRA sites.

MAPPING OF FLOOD-INUNDATED URBAN AREAS IN IOWA, JUNE-AUGUST 1993 (IA 93-703)



PERIOD OF PROJECT: 1993-95

PROJECT CHIEF: B.D. Schaap

STUDY AREA: Davenport, Des Moines, Iowa City

COOPERATING AGENCY: U.S. Geological Survey (Federal program)

NEED FOR STUDY: Flooding in and around Davenport, Des Moines, and Iowa City during the summer of 1993 caused extensive property damage and stress on governmental services. A record of the extent of the flooding will provide planners with the information needed to develop strategies for dealing with future flooding and for decisions regarding future flood-plain development.

OBJECTIVES: A flood-inundation map will be prepared for each of the three affected urban areas. The primary source of information will be U.S. Army Corps of Engineers aerial photographs. Additional data from the Corps of Engineers, the Iowa Department of Transportation, the USGS, other local and State agencies, and eyewitness accounts will be used to map areas obscured or not covered by the aerial photographs.

PROGRESS: Available data collected by government agencies have been compiled. In areas where additional information is needed, the extent of the flooding has been determined by site visits, and work has begun to determine the flood-peak elevations from high-water marks. Arrangements have been made to convert map data into geographic-information-system coverages.

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