A SUMMARY OF WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN IOWA, FISCAL YEAR 1992

Compiled by Richard A. Karsten

U.S. GEOLOGICAL SURVEY

Open-File Report 92-154

Iowa City, Iowa
1992

U.S. DEPARTMENT OF THE INTERIOR

MANUEL LUJAN, JR., Secretary

U.S. GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information write to:

District Chief
U.S. Geological Survey
Rm. 269, Federal Building
400 South Clinton Street
Iowa City, Iowa 52244

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Box 25425
Denver, Colorado 80225

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CONVERSION FACTORS, ABBREVIATIONS, AND VERTICAL DATUM

Multiply	*By*	*To obtain*
	Length	
inch (in.)	25.40	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
	Mass	
ton per acre (ton/acre)	0.0002241	megagram per square meter
	Temperature	
degree Fahrenheit (°F)	(1)	degree Celsius (°C)

[1] °C = 5/9 (°F-32).

°F = 9/5 (°C) + 32.

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 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 is organized into a district office and two field offices. These offices are geographically located in the State to provide access and response to hydrologic events and to maintain liaison with cooperating State and Federal agencies. The Iowa District technical staff is organized into two major sections: (1) the Hydrologic Surveillance Section, which maintains the systematic hydrologic data programs for the State and (2) the Hydrologic Studies Section, which investigates and assesses the quantity, quality, and use of the State's water resources.

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) levels 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 has made substantial progress in developing a real-time hydrologic data base. Surface- and ground-water data at selected sites are transmitted to the Iowa District central hydrologic data base at regular intervals using satellite or ground data-relay systems. This information is accessible to scientists or water managers to assess current hydrologic conditions.

The investigation and assessment of the surface- and ground-water resources of Iowa is accomplished through a series of diversified projects by the Hydrologic Studies Section. Each project is managed by a designated 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 1992-93 include studies of:

- The Effects of Land-Use Changes on Stream Sediment in the Sny Magill Watershed
- Herbicide Degradation Processes in Small Streams
- Pier Scour Susceptibility at Bridges in Iowa
- Channel Aggradation and Degradation on Selected Main-Stem Rivers in Iowa.

The effects of land-use practices on water resources and the effects of chemical fertilizers and pesticides on surface- and ground-water quality is 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 project will quantify the levels of nitrates and pesticides and their movement in soils according to climate, crops, and varying management practices. Research teams are assessing the impact of Iowa's current farming systems. These solutions will be arrived at through: (1) extensive monitoring of surface and ground water; (2) comparison of farming systems on water quality; and (3) evaluation of new and improved farming systems for their environmental and economic impact. Assessing the impact of these contaminants on surface- and ground-water supplies and analyzing the processes of chemical transport through the hydrologic systems represents both a challenge and an opportunity for the Iowa District for the 1990's.

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.

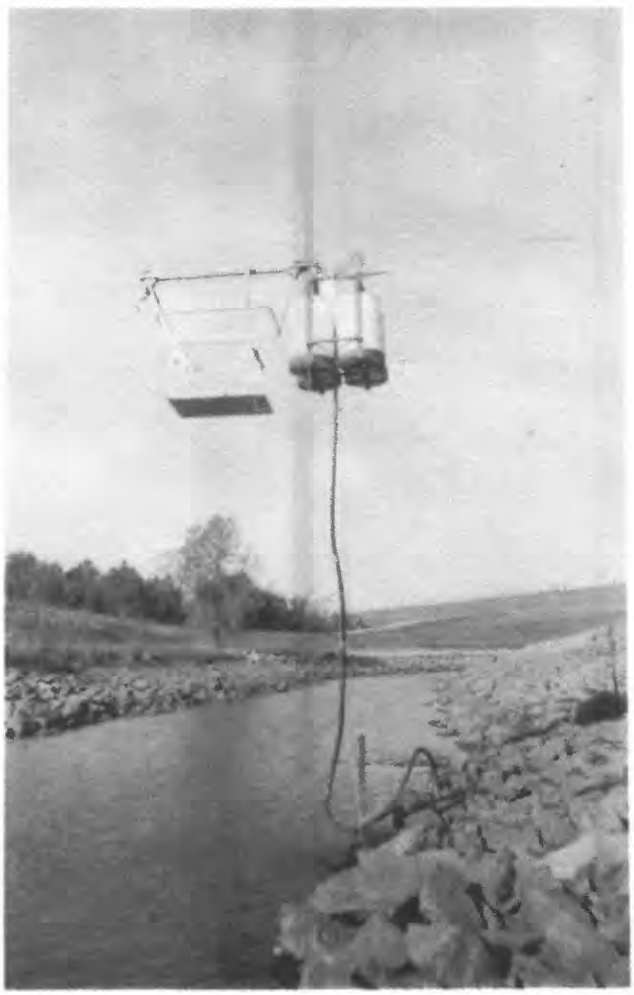
N.B. Melcher
District Chief
Iowa City, Iowa

SELECTED FIELD ACTIVITIES OF THE IOWA DISTRICT

U.S. Geological Survey personnel collecting ground-water samples from the alluvium along the Cedar River in Linn County.

U.S. Geological Survey personnel conducting a slug test in the alluvium along the Cedar River in Linn County.

The gaging station on Sny Magill Creek near Clayton in Clayton County.



A cableway deadload tester on the Chariton River below the Rathbun Reservoir in Appanoose County.

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 AND PROGRAM 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 releases.
- 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.

A SUMMARY OF WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN IOWA, FISCAL YEAR 1992

Compiled by
Richard A. Karsten

ABSTRACT

Water-resources activities of the U.S. Geological Survey in Iowa consist of collecting hydrologic data and conducting interpretive studies. Hydrologic investigations in Iowa are made through three basic types of projects: (1) hydrologic data-collection programs; (2) local or areal studies; and (3) statewide or regional investigations. These projects are funded through cooperative joint-funding agreements with Federal, State, and local agencies and direct Federal funds. The data and the results of the interpretive studies are published or released by either the U.S. Geological Survey or by cooperating agencies. This report describes: (1) the hydrologic data-collection programs; (2) the local or areal hydrologic investigations; and (3) statewide or regional studies conducted by the U.S. Geological Survey in Iowa during fiscal year 1992 and provides a list of selected water-resources references for Iowa.

IOWA DISTRICT ORGANIZATION

The Iowa District of the U.S. Geological Survey, Water Resources Division, consists of two operating sections (the Hydrologic Surveillance Section and the Hydrologic Studies Section), two support units (the Administrative Services Section and the Computer Services Section), and three field offices (fig. 1). Personnel are based at the District Office in Iowa City and at field headquarters in Council Bluffs, Fort Dodge, and Iowa City (fig. 2). The District operates with guidance from the Office of Midwest Programs in Lawrence, Kansas, the Central Regional Office in Denver, Colorado, and the National Headquarters in Reston, Virginia.

Inquires 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 should be directed to the District Office or the field headquarters nearest the area of concern (fig. 2).

Iowa District Office

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

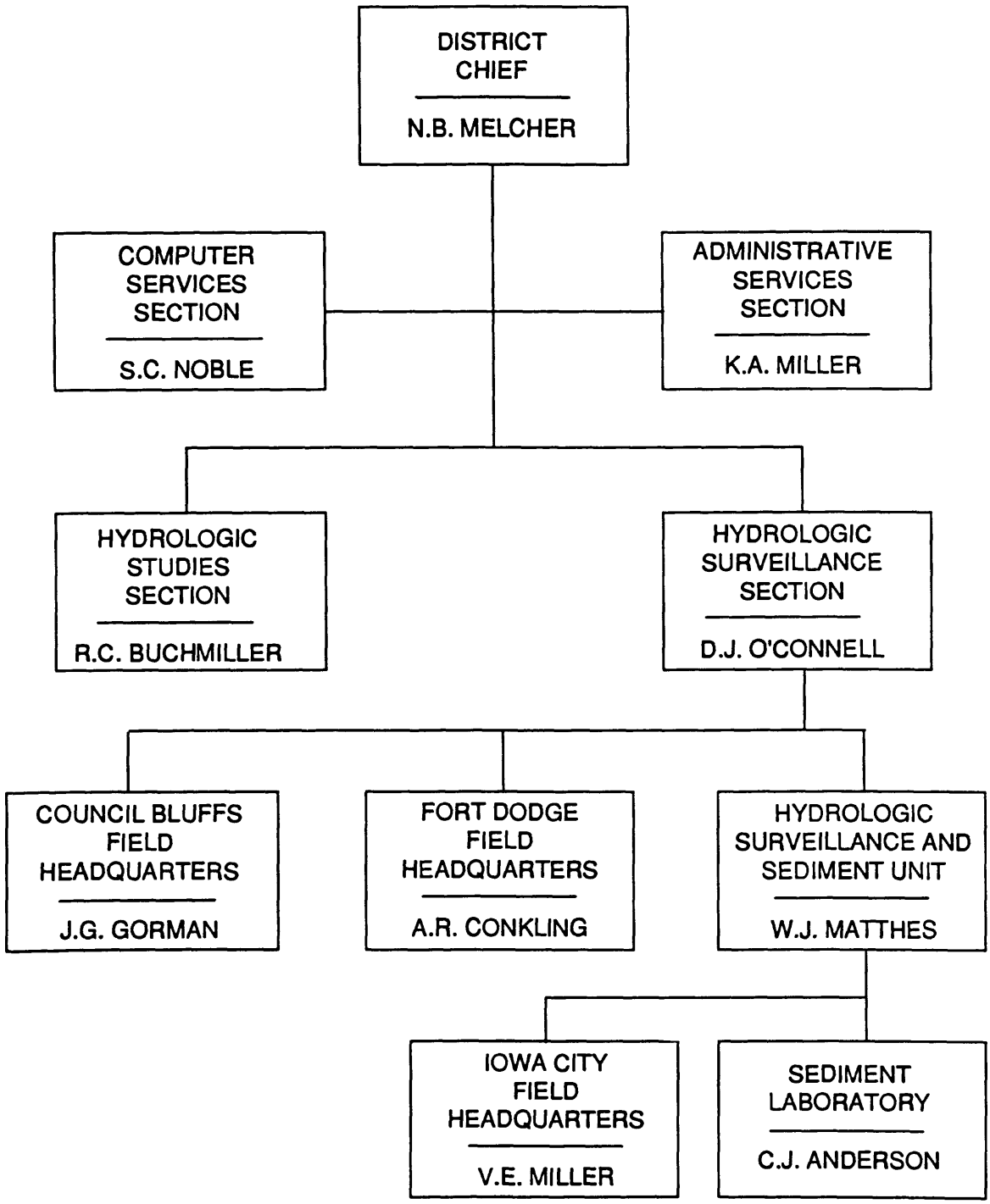


Figure 1. Iowa District organization.

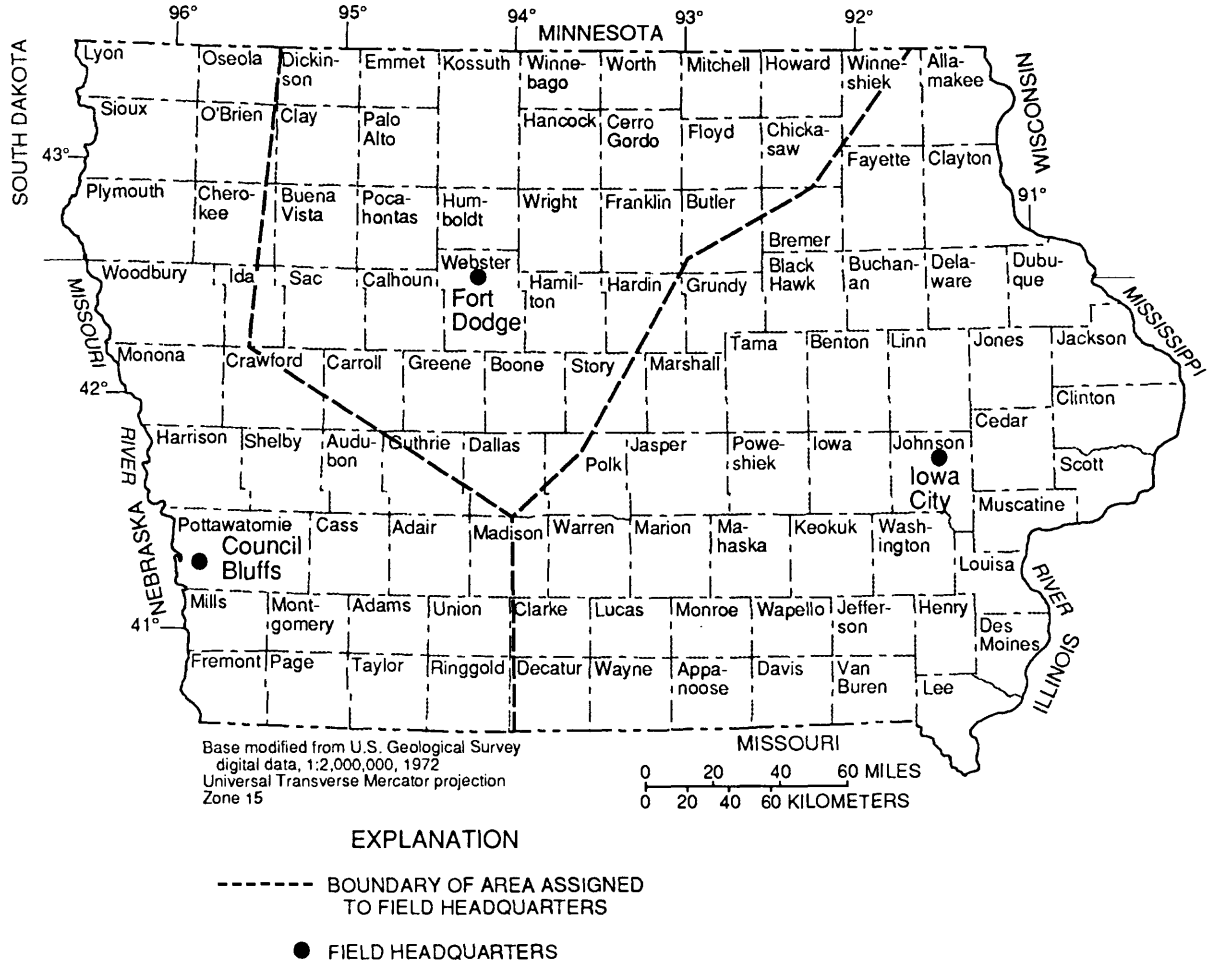


Figure 2. Location of Water Resources Division offices and areas assigned to field headquarters in Iowa.

Field Headquarters

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

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

V.E. Miller
Lead Hydrologic Technician
Water Resources Division
U.S. Geological Survey
269 Federal Building
P.O. Box 1240
Iowa City, Iowa 52244
Telephone: (319) 337-4191

TYPES OF FUNDING

The hydrologic investigations and data-collection efforts in the Iowa District are supported by services and joint funding provided by State and local agencies (table 1) on a 50-50 basis with Federal monies (cooperative program); by funds transferred from other Federal agencies (OFA), such as the U.S. Army Corps of Engineers (OFA program); and by funds appropriated directly to the U.S. Geological Survey (Federal program). In fiscal year 1991, the financial support for these programs in Iowa was $3,513,816, which was distributed as shown in figure 3.

WHERE TO OBTAIN U.S. GEOLOGICAL SURVEY PUBLICATIONS

Current publications are described in a monthly pamphlet, "New Publications of the Geological Survey," which may be obtained from:

U.S. Geological Survey
Books and Open-File Reports
Federal Center, Building 810
Box 25425
Denver, Colorado 80225

Professional Papers, Bulletins, Water-Supply Papers, Techniques of Water-Resources Investigations, Circulars, Earthquake Bulletins, and popular leaflets, pamphlets, and booklets may be purchased from the above address. Additional information is given in "Guide to Obtaining Information from the U.S. Geological Survey, 1989," U.S. Geological Survey Circular 900, which is available at no cost from the above address. Reports and maps of flood-prone areas for Iowa are available for inspection at the Iowa District Office. Other map information is available from:

U.S. Geological Survey
Map Distribution
Federal Center, Building 810
Box 25286
Denver, Colorado 80225

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

Water Resources Division
U.S. Geological Survey
Mail Stop 440
12201 Sunrise Valley Drive
Reston, Virginia 22092

Table 1. *Agencies supporting water-resources investigations in Iowa during fiscal year 1992*

STATE AGENCIES:

Iowa Department of Natural Resources
Iowa Department of Transportation
  Highway Division
  Highway Research Board
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

LOCAL AGENCIES:

Carroll County Auditor
Carroll County Soil and Water Conservation District
City of Ames
City of Cedar Rapids
City of Charles City
City of Clear Lake
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 Sioux City
City of Waterloo
City of Waterloo Sewage Treatment Plant
Union Electric Company, Keokuk
West Central Iowa Rural Water Association, Manning

FEDERAL AGENCIES:

U.S. Department of Agriculture
U.S. Department of the Army
  U.S. Army Corps of Engineers
    Kansas City District
    Omaha District
    Rock Island District
    St. Paul District
U.S. Department of Defense
  Air Force Center for Environmental Excellence
U.S. Department of the Interior
  U.S. Geological Survey
    Water Resources Division (Federal Program)
U.S. Environmental Protection Agency

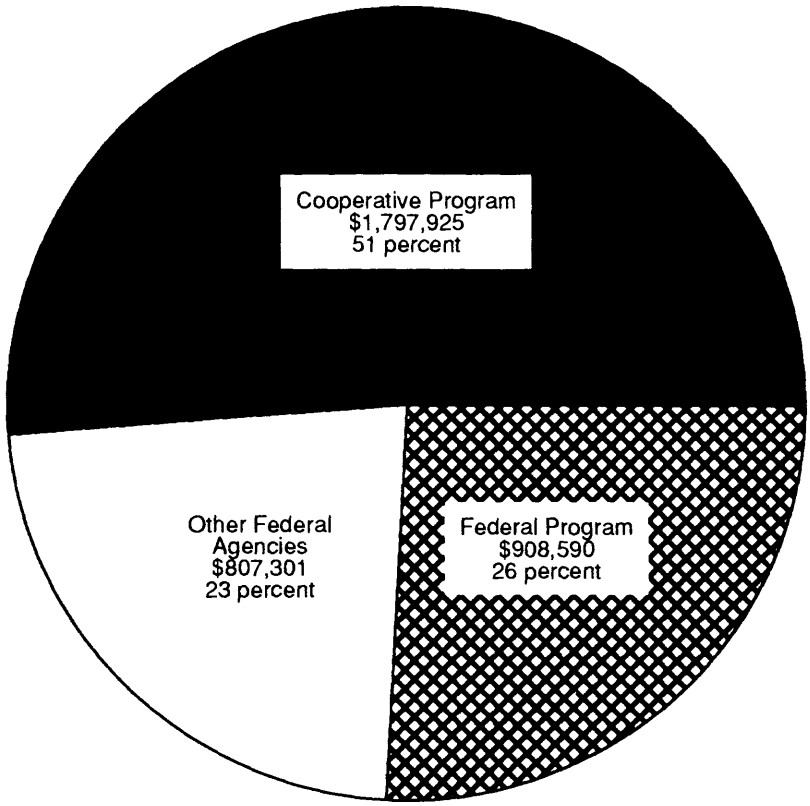


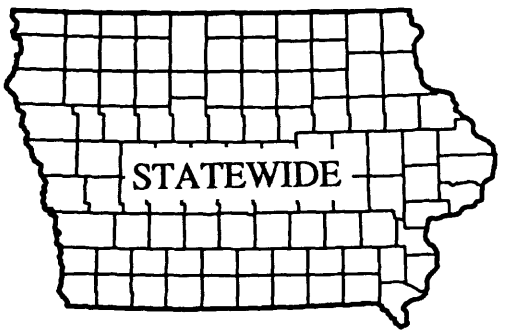
Figure 3. Distribution of funding of the U.S. Geological Survey in Iowa, fiscal year 1991.

The U.S. Geological Survey's National Center maintains a library with an extensive Earth-sciences collection. Local libraries may obtain books, periodicals, and maps through the interlibrary loan system by writing to:

U.S. Geological Survey Library
12201 Sunrise Valley Drive
Reston, Virginia 22092

HYDROLOGIC DATA-COLLECTION NETWORKS AND PROGRAMS

SURFACE-WATER STATIONS (IA 00-001)



PERIOD OF PROJECT: Continuous since 1902

PROJECT CHIEF: D.J. O'Connell

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 Engineering and Biosystems Engineering and the Iowa State Water 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; energy for hydroelectric-power generation; transport channels for commerce; and a medium for recreation. Records of streamflow are the basic data used in developing reliable surface-water supplies because the records provide information on the availability of streamflow and its variability in time and space. Streamflow, when it occurs in excess, can create a hazard--floods 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-control reservoirs, and for flood-plain delineation and flood-warning systems. Streamflow records are used in the planning and design of surface-water related projects, and they are used in the management or operation of such projects after the projects 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. The annual data report, "Water Resources Data-Iowa, Water Year 1990" was completed during 1991. The data network consists of 119 daily streamflow-gaging stations, 5 lakes and stream-stage stations, and 4 reservoir-contents stations. Data for floods in Iowa were compiled and will be published in the Survey's "Summary of Floods in the United States During 1991." Data for 86 of the streamflow-gaging stations are transmitted to the Iowa District's central computer using a real-time telemetry network. A complete list of active stations is given in table 2, locations are shown in figure 4, and a list of discontinued gaging stations is given in table 3.

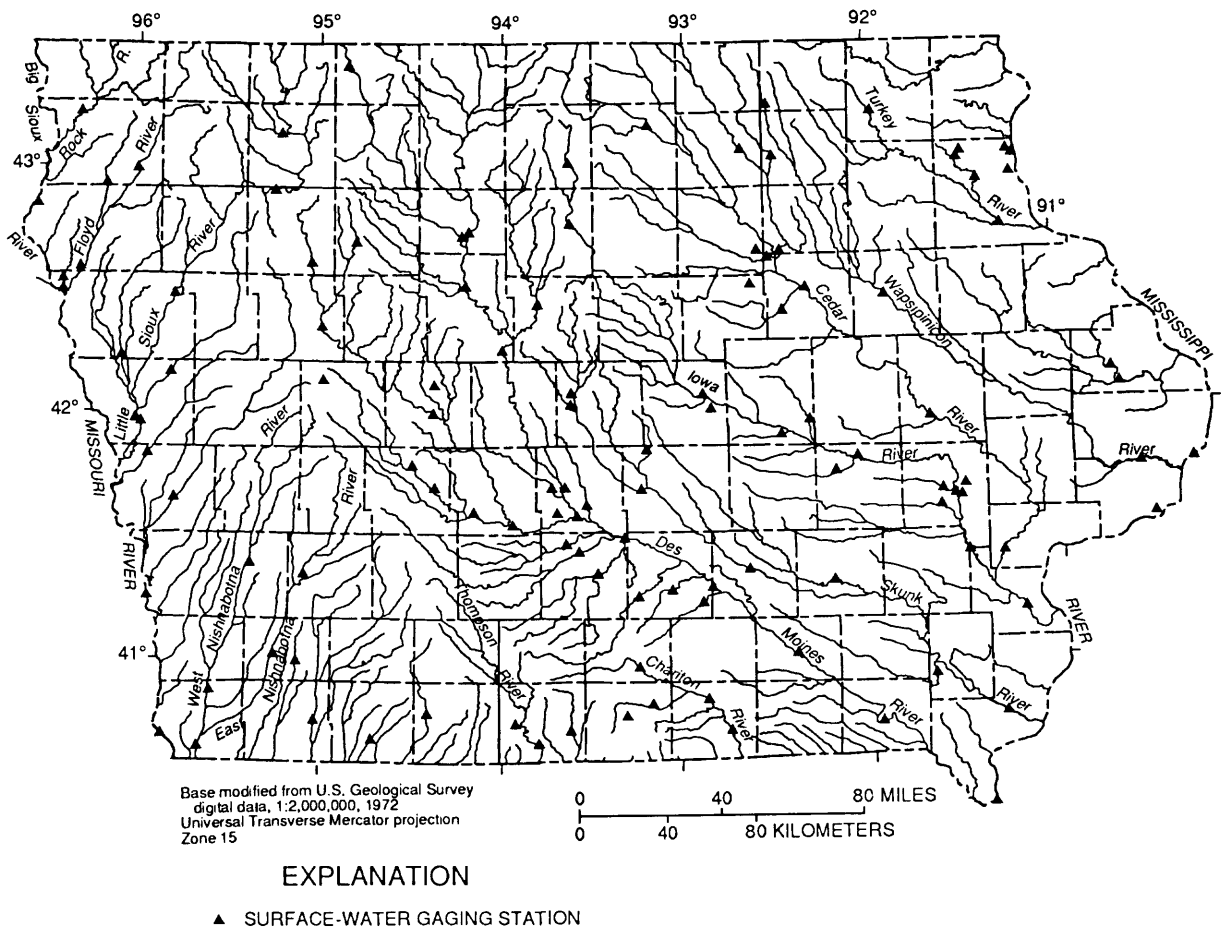


Figure 4. Location of continuous-record surface-water gaging stations.

Table 2. *Daily discharge and surface-water-quality stations operated by the Iowa District during fiscal year 1992*

[Letter after station name designates type of data: (d) discharge,(c) chemical, (m) microbiological, (t) water temperature, (s) sediment]

Station name	Station number	Drainage area (square miles)	Period of record
Upper Iowa River near Dorchester (d)	05388250	770	1936-92
Bloody Run Creek near Marquette (dts)	05389400	1992	
Mississippi River at McGregor (dts)	05389500	67,500	1936-92
Sny Magill Creek near Clayton (dts)	05411400	27.6	1992
Turkey River at Spillville (d)	05411600	177	1956-70, 1977-92
Silver Creek near Luana (d)	05412060	4.39	1986-92
Unnamed Creek near Luana (d)	05412070	1.15	1886-92
Roberts Creek above Saint Olaf (d)	05412100	70.7	1957-77, 1986-92
Turkey River at Garber (d)	05412500	1,545	1913-16, 1919-27, 1929-30, 1932-92
North Fork Maquoketa River at Fulton (d)	05418450	516	1977-92
Maquoketa River near Maquoketa (d)	05418500	1,553	1913-92
Mississippi River at Clinton (d)	05420500	85,600	1873-1992
Wapsipinicon River near Elma (d)	05420560	95.2	1958-92
Wapsipinicon River at Independence (d)	05421000	1,048	1933-92
Wapsipinicon River near De Witt (d)	05422000	2,330	1934-92
Crow Creek at Bettendorf (d)	05422470	17.8	1977-92
East Branch Iowa River near Klemme (d)	05449000	133	1948-76, 1977-92
Iowa River near Rowan (d)	05449500	429	1940-76, 1977-92
Iowa River at Marshalltown (dts)	05451500	1,564	1902-03, 1914-27, 1932-92
Timber Creek near Marshalltown (d)	05451700	118	1949-92
Richland Creek near Haven (d)	05451900	56.1	1949-92
Salt Creek near Elberon (d)	05452000	201	1945-92
Walnut Creek near Hartwick (d)	05452200	70.9	1949-92
Big Bear Creek at Ladora (d)	05453000	189	1945-92
Iowa River at Iowa City (d)	05454500	3,271	1903-92
Iowa River at Marengo (d)	05453100	2,794	1956-92
Coralville Lake near Coralville	05453510	3,115	1958-92
Rapid Creek near Iowa City (d)	05454000	23.5	1937-92
Clear Creek near Coralville (d)	05454300	98.1	1952-92
South Branch Ralston Creek at Iowa City (d)	05455010	2.94	1963-92
Old Mans Creek near Iowa City (d)	05455100	201	1950-77, 1984-92
English River at Kalona (d)	05455500	573	1939-92
Iowa River near Lone Tree (d)	05455700	4,293	1956-92
Cedar River at Charles City (d)	05457700	1,054	1964-92
Little Cedar River near Ionia (d)	05458000	306	1954-92
Cedar River at Janesville (d)	05458500	1,661	1904-06, 1914-27, 1932-42, 1945-92
West Fork Cedar River at Finchford (d)	05458900	846	1945-92
Winnebago River at Mason City (d)	05459500	526	1932-92
Clear Lake at Clear Lake	05460000	22.6	1933-92
Shell Rock River at Shell Rock (d)	05462000	1,746	1953-92
Beaver Creek at New Hartford (d)	05463000	347	1945-92
Cedar River at Cedar Falls (c)	05463050	4,734	1975-79, 1984-85, 1986-92
Black Hawk Creek at Hudson (d)	05463500	303	1952-92

Table 2. *Daily discharge and surface-water-quality stations operated by the Iowa District during fiscal year 1992*--Continued

Station name	Station number	Drainage area (square miles)	Period of record
Cedar River at Waterloo (d)	05464000	5,146	1940-92
Cedar River at Cedar Rapids (d)	05464500	6,510	1902-92
Cedar River near Conesville (d)	05465000	7,785	1939-92
Iowa River at Wapello (dcmts)	05465500	12,499	1914-92
South Skunk River (head of Skunk River) near Ames (d)	05470000	315	1920-27, 1932-92
Squaw Creek at Ames (d)	05470500	204	1919-27, 1965-92
South Skunk below Squaw Creek near Ames (d)	05471000	556	1952-79, 1992
South Skunk River at Colfax (d)	05471050	803	1985-92
Indian Creek near Mingo (d)	05471200	276	1958-75, 1985-92
South Skunk River near Oskaloosa (d)	05471500	1,635	1945-92
North Skunk River near Sigourney (d)	05472500	730	1945-92
Cedar Creek near Oakland Mills (d)	05473400	530	1957-77, 1977-92
Skunk River at Augusta (dcmts)	05474000	4,303	1913-14, 1914-92
Mississippi River at Keokuk (d)	05474500	119,000	1878-1992
Des Moines River at Estherville (d)	05476500	1,372	1951-92
Des Moines River at Humboldt (d)	05476750	2,256	1964-92
East Fork Des Moines River at Dakota City (d)	05479000	1,308	1940-92
Des Moines River at Fort Dodge (d)	05480500	4,190	1905-06, 1913-27, 1946-92
Boone River near Webster City (d)	05481000	844	1940-92
Des Moines River near Stratford (d)	05481300	5,452	1920-92
Saylorville Lake near Saylorville	05481630	5,823	1977-92
Des Moines River near Saylorville (dts)	05481650	5,841	1961-92
Beaver Creek near Grimes (d)	05481950	358	1960-92
North Raccoon River near Newell (d)	05482135	233	1982-92
Big Cedar Creek near Varina (d)	05482170	80	1959-92
North Raccoon River near Sac City (d)	05482300	700	1958-92
Black Hawk Lake at Lake View	05482315	23.3	1970-75, 1978-92
North Raccoon River near Jefferson (d)	05482500	1,619	1940-92
East Fork Hardin Creek near Churdan (d)	05483000	24	1952-92
Hazelbrush Creek near Maple River (dts)	05483343	9.22	1991-92
Middle Raccoon River near Bayard (d)	05483450	375	1979-92
Lake Panorama at Panora	05483470	433	1979-92
Middle Raccoon River at Panora (d)	05483600	440	1958-92
South Raccoon River at Redfield (d)	05484000	994	1940-92
Raccoon River at Van Meter (dc)	05484500	3,441	1915-92
Walnut Creek at Des Moines (d)	05484800	78.4	1971-92
Des Moines River below Raccoon River at Des Moines (d)	05485500	9,879	1940-92
Fourmile Creek at Des Moines (d)	05485640	92.7	1971-92
North River near Norwalk (d)	05486000	349	1940-92
Middle River near Indianola (d)	05486590	503	1940-92
South River near Ackworth (d)	05487470	460	1940-92
Des Moines River near Runnells(d)	05487500	11,655	1985-92
White Breast Creek near Dallas (d)	05487980	342	1962-92
Lake Red Rock near Pella	05488100	12,323	1963-92
English Creek near Knoxville (d)	05488200	90.1	1985-92
Des Moines River near Tracy (d)	05488500	12,479	1920-92
Cedar Creek near Bussey (d)	05489000	374	1947-92
Des Moines River at Ottumwa (d)	05489500	13,374	1917-92

Table 2. *Daily discharge and surface-water-quality stations operated by the Iowa District during fiscal year 1992*--Continued

Station name	Station number	Drainage area (square miles)	Period of record
Des Moines River at Keosauqua (d)	05490500	14,038	1903-06, 1910-92
Rock River near Rock Valley (d)	06483500	1,592	1948-92
Big Sioux River at Akron (d)	06485500	8,424	1928-92
Missouri River at Sioux City (ds)	06486000	314,600	1897-1992
Perry Creek at 38th Street, Sioux City (d)	06600000	65.1	1945-69, 1981-92
Floyd River at Alton (d)	06600100	268	1955-92
West Branch Floyd River near Struble (d)	06600300	180	1955-92
Floyd River at James (d)	06600500	886	1934-92
Missouri River at Decatur, Nebraska (d)	06601200	316,200	1987-92
West Fork ditch (head of Monana-Harrison ditch) at Hornick (d)	06602020	403	1939-69, 1974-92
Monona-Harrison ditch near Turin (d)	06602400	900	1939-92
Spirit Lake near Orleans	06604000	75.6	1933-75, 1990-92
West Okoboji Lake at Lakeside Laboratory near Milford	06604200	125	1933-92
Ocheyedan River near Spencer (d)	06605000	426	1977-92
Little Sioux River at Linn Grove (d)	06605850	1,548	1972-92
Little Sioux River at Correctionville (d)	06606600	2,500	1918-25, 1928-32, 1936-92
Maple River at Mapleton (d)	06607200	669	1941-92
Little Sioux River near Turin (d)	06607500	3,526	1958-92
Soldier River at Pisgah (d)	06608500	407	1940-92
Boyer River at Logan (d)	06609500	871	1918-25, 1937-92
Missouri River at Omaha, Nebraska (ds)	06610000	322,800	1928-92
Missouri River at Nebraska City, Nebraska (ds)	06807000	410,000	1929-92
West Nishnabotna River at Hancock (d)	06807410	609	1959-92
West Nishnabotna River at Randolph (d)	06808500	1,326	1948-92
East Nishnabotna River near Atlantic (d)	06809210	436	1960-92
East Nishnabotna River at Red Oak (d)	06809500	894	1918-25, 1936-92
Nishnabotna River above Hamburg (dcmts)	06810000	2,806	1922-23, 1928-92
Tarkio River at Stanton (d)	06811840	49.3	1957-92
Missouri River at Rulo, Nebraska (d)	06813500	414,900	1949-92
Nodaway River at Clarinda (dcts)	06817000	762	1918-25, 1936-92
Platte River near Diagonal (d)	06818750	217	1968-92
East Fork One Hundred and Two River near Bedford (d)	06819185	85.4	1983-92
Elk Creek near Decatur City (dcmts)	06897950	52.5	1967-92
Thompson River at Davis City (d)	06898000	701	1918-25, 1941-92
Weldon River near Leon (d)	06898400	104	1958-92
Chariton River near Chariton (d)	06903400	182	1965-92
Corydon Lake at spillway at Corydon (dc)	06903677	2.5	1991-92
South Fork Chariton River near Promise City (d)	06903700	168	1967-92
Rathbun Lake near Rathbun	06903880	549	1969-92
Chariton River near Rathbun (d)	06903900	549	1956-92
Chariton River near Moulton (d)	06904010	740	1979-92

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

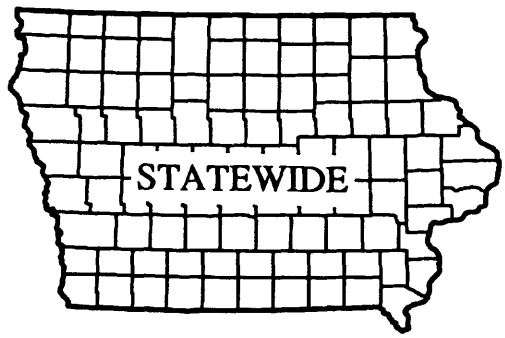
[The following surface-water gaging stations have been discontinued in Iowa. Continuous daily streamflow records were collected and published for the period of record shown for each station]

Station name	Station number	Drainage area (square miles)	Period of record
Upper Iowa River at Decorah	05387500	511	1952-83
Upper Iowa River near Decorah	05388000	568	1913-14, 1919-27, 1933-51
Paint Creek at Waterville	05388500	42.8	1952-73
Yellow River at Ion	05389000	221	1934-51
Mississippi River at Clayton	05411500	9,200	1930-36
Turkey River at Elkader	05412000	891	1932-42
Little Maquoketa River near Durango	05414500	130	1934-82
Maquoketa River near Manchester	05417000	305	1933-73
Maquoketa River near Delhi	05417500	347	1933-40
Bear Creek near Monmouth	05417700	61.3	1957-76
Maquoketa River above North Fork Maquoketa River near Maquoketa	05418000	938	1913-14
Wapsipinicon River at Stone City	05421500	1,324	1903-14
Crow Creek at Eldridge	05422420	2.20	1977-82
Creek at Mt. Joy	05422450	6.90	1977-82
Pine Creek at Muscatine	05448150	38.9	1975-82
Eagle Lake inlet near Britt	05448285	3.83	1975-80
Eagle Lake outlet near Britt	05448290	11.3	1975-80
West Branch (West Fork) Iowa River near Klemme	05448500	112	1948-58
Iowa River near Iowa Falls	05450000	665	1911-14
Upper Pine Lake at Eldora	05450500	14.9	1936-70
Lower Pine Lake at Eldora	05451000	15.9	1936-70
Iowa River near Belle Plaine	05452500	2,455	1939-59
Lake Macbride near Solon	05453500	27.0	1936-71
Ralston Creek at Iowa City	05455000	3.01	1924-87
Cedar River at Mitchell	05457500	826	1933-42
Shell Rock River near Northwood	05459000	300	1945-86
Shell Rock River at Marble Rock (Greene)	05460500	1,318	1933-53
Shell Rock River at Greene	05461000	1,357	1933-42
Shell Rock River near Clarksville	05461500	1,626	1915-27, 1932-34
Fourmile Creek near Lincoln	05464130	13.78	1962-67, 1969-74
Half Mile Creek near Gladbrook	05464133	1.33	1962-67, 1969-74
Fourmile Creek near Traer	05464137	19.51	1962-74, 1975-80
Prairie Creek at Fairfax	05464640	178	1966-82
South Skunk River below Squaw Creek near Ames	05471000	556	1952-79
Lake Keomah near Oskaloosa	05472000	3.06	1936-71
Skunk River at Coppock	05473000	2,916	1913-44
Big Creek near Mount Pleasant	05473500	106	1955-79
East Fork Des Moines River near Burt	05478000	462	1971-74
East Fork Des Moines River near Hardy	05478500	1,268	1940-54
Des Moines River near Fort Dodge	05479500	3,753	1911-13

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

Station name	Station number	Drainage area (square miles)	Period of record
Lizard Creek near Clare	05480000	257	1940-82
Des Moines River near Boone	05481500	5,511	1920-68
Des Moines River at Des Moines	05482000	6,245	1905-06, 1915-61
Storm Lake at Storm Lake	05482140	28.3	1970-75.
Springbrook Lake near Guthrie Center	05483500	5.18	1936-71
Raccoon River at Des Moines	05485000	3,590	1902-03
Lake Ahquabi near Indianola	05487000	4.93	1936-71
White Breast Creek near Knoxville	05488000	380	1945-62
Muchakinock Creek near Eddyville	05489190	70.2	1975-79
Lake Wapello near Drakesville	05490000	7.75	1936-71
Sugar Creek near Keokuk	05491000	105	1922-31, 1958-73
Fox River at Bloomfield	05494300	87.7	1957-73
Fox River at Cantril	05494500	161	1940-51
Rock River at Rock Rapids	06483270	788	1959-74
Dry Creek at Hawarden	06484000	48.4	1948-69
West Fork ditch at Holly Springs	06602000	399	1939-69
Loon Creek near Orleans	06603920	31	1971-74
Spirit Lake outlet at Orleans	06604100	75.6	1971-74
Milford Creek at Milford	06604400	146	1971-74
Little Sioux River at Spencer	06605100	990	1936-42
Little Sioux River at Gillett Grove	06605600	1,334	1958-73
Little Sioux River near Kennebeck	06606700	2,738	1939-69
Odebolt Creek near Arthur	06607000	39.3	1957-75
Maple River at Turin	06607300	725	1939-41
Little Sioux River near Blencoe (Turin)	06607510	4,470	1939-42
Steer Creek near Magnolia	06609200	9.26	1963-69
Thompson Creek near Woodbine	06609590	6.97	1963-69
Willow Creek near Logan	06609600	129	1972-75
Indian Creek at Council Bluffs	06610500	7.99	1954-76
Mosquito Creek near Earling	06610520	32.0	1965-79
Waubonsie Creek near Bartlett	06806000	30.4	1946-69
West Nishnabotna River at Harlan	06807320	316	1977-82
West Nishnabotna River at (near) White Cloud	06807500	967	1918-24
Mule Creek near Malvern	06808000	10.6	1954-69
Spring Valley Creek near Tabor	06808200	7.6	1955-64
Davids Creek near Hamlin	06809000	26.0	1952-73
Tarkio River at Blanchard	06812000	200	1934-40
West Nodaway River at Villisca	06816500	342	1918-25
Honey Creek near Russell	06903500	13.2	1952-62
Chariton River near Centerville	06904000	708	1938-59

GROUND-WATER STATIONS
(IA 00-002)



PERIOD OF PROJECT: Continuous since 1939

PROJECT CHIEF: R.B. Lambert

STUDY AREA: Statewide

COOPERATING AGENCY: 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 predict 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 ground-water-level monitoring network (fig. 5) has been redesigned and expanded to improve the areal distribution and aquifer coverage across Iowa. The current (1991) monitoring network has 202 observation wells. Three data components of the monitoring-network have been established to address the primary objectives of the project. These three data networks are: (1) hydrologic; (2) water-management; and (3) baseline data. The hydrologic network is designed to document the change in storage and define the areal extent of an aquifer. The water-management network provides information needed to assess and predict the effects of natural stresses and human activities on aquifer recharge and discharge. The baseline network collects information that documents long-term changes in climate and the effects of topography and geology on the climatic response. Historical water levels for the observation wells have been updated in the Survey's WATer data STOrage and REtrieval System (WATSTORE). Quality-assurance techniques have been implemented to ensure the integrity of the data. The annual data report, "Water Resources Data--Iowa, Water Year 1990" was published in May 1991 and included data for 185 observation wells. Monitoring data for the 1991 water year will be compiled and published in the annual data report. An open-file report "The Ground-Water-Level Monitoring Network in Iowa" is in preparation.

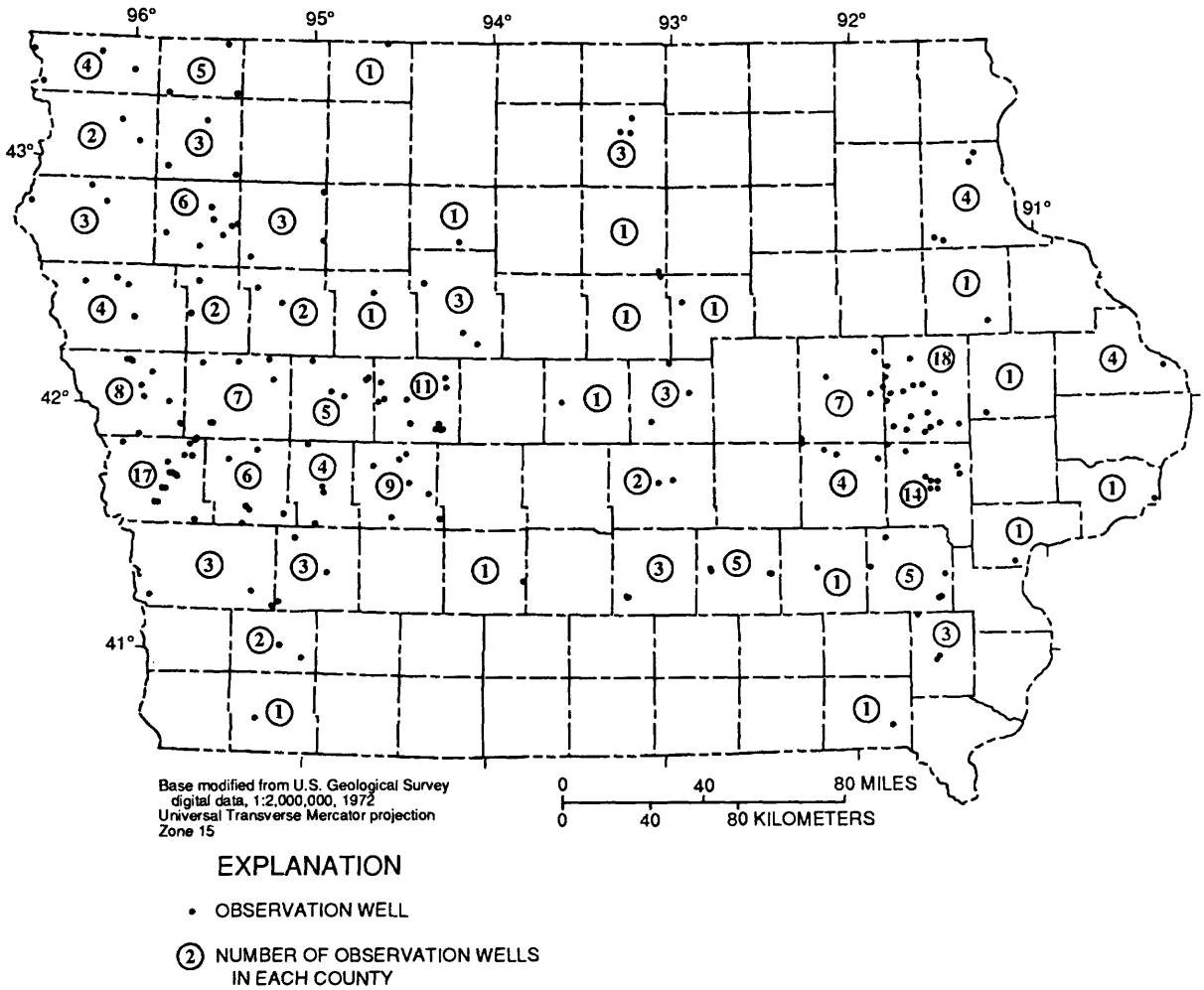
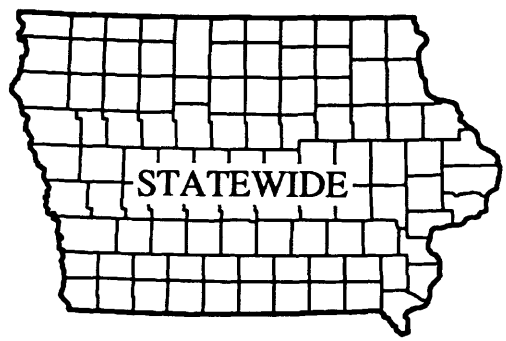


Figure 5. Location of observation wells.

WATER-QUALITY STATIONS
(IA 00-003)



PERIOD OF PROJECT: Continuous since 1906

PROJECT CHIEF: D.J. O'Connell

STUDY AREA: Statewide

COOPERATING AGENCY: 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 must be monitored and defined.

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 processed for publication in the annual data report for five National Stream-Quality Accounting Network (NASQAN) stations and one National Hydrologic Bench-Mark Station. Measurements of water temperature and specific conductance were obtained during discharge measurements at most surface-water gaging stations and published in the annual report. The annual data report, "Water Resources Data--Iowa, Water Year 1990" was delivered in May 1991. Station locations are shown in figure 6, and a list of discontinued surface-water-quality stations is given in table 4. Sampling for verification of herbicides in nine streams in Iowa, as part of the Regional Program Verification Sampling for Herbicides in Upper Midwest Streams, was completed in 1990. Results of this study were published in the ASCE Irrigation and Drainage Proceedings 1991 as an article entitled "Geographic and Seasonal Distribution of Herbicides in Streams of the Midwestern United States" (Goolsby and others, 1991b). Sampling for herbicides in the Mississippi River near Clinton (fig. 6) began in April 1991 and will continue through the spring runoff season of 1992. This sampling is part of a program to study of the occurrence, distribution, and transport of agricultural chemicals in the Mississippi, Missouri, and Ohio River basins.

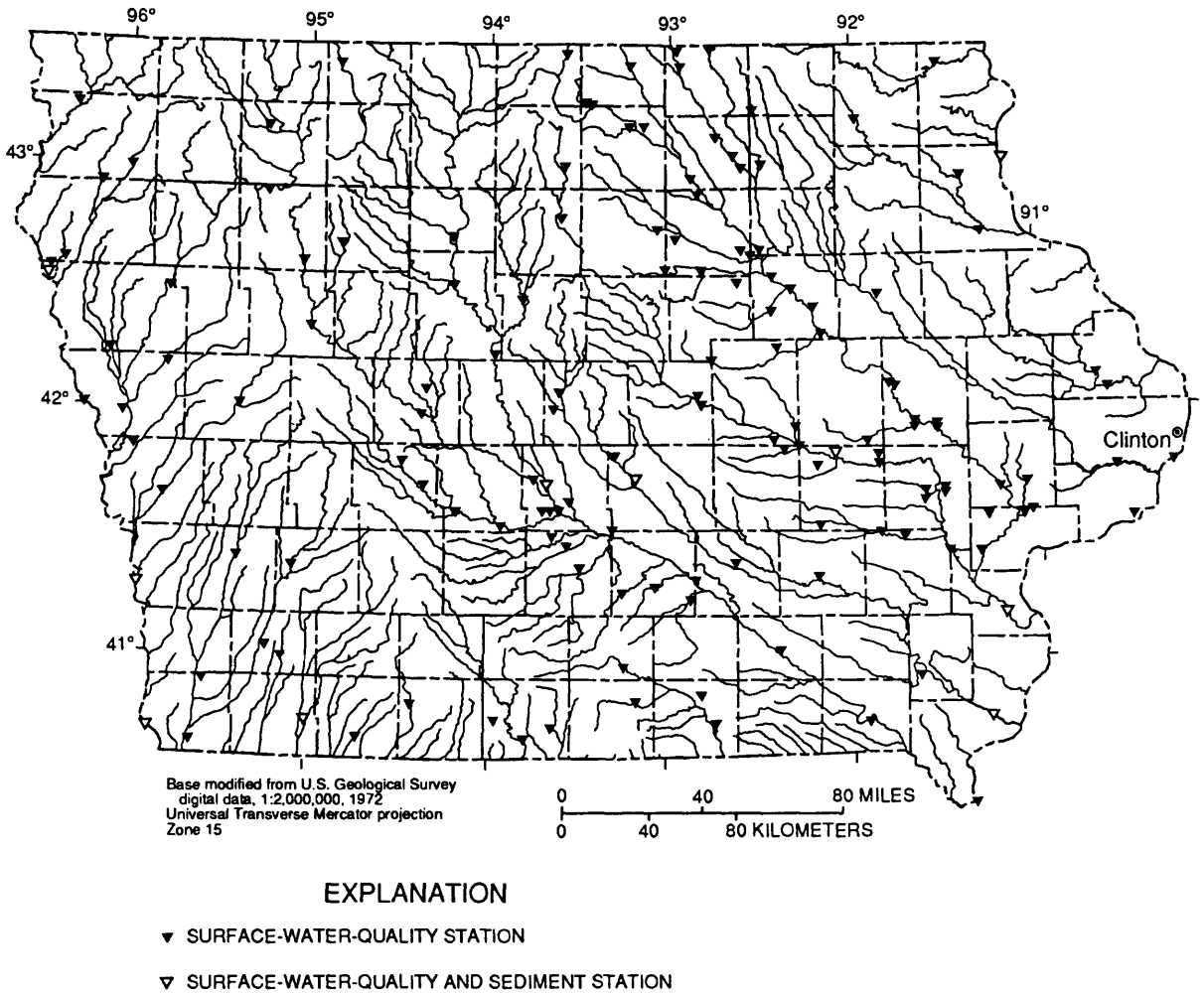


Figure 6. Location of surface-water-quality stations.

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

[The following surface-water-quality stations have been discontinued in Iowa. Continuous daily records of water temperature or sediment and monthly or periodic samples of chemical quality were collected and published for the period of record shown for each station. An asterisk (*) in the type of record column indicates that periodic data are available for that water-quality constituent subsequent to the period of daily record]

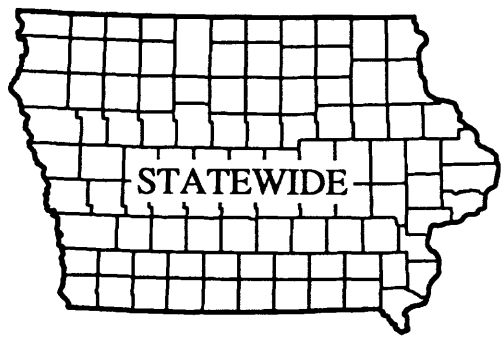
Station name	Station number	Drainage area (square miles)	Type of record[1]	Period of record
Upper Iowa River at Decorah, Iowa	05387500	511	Sed., Temp.	1963-1983
Upper Iowa River near Dorchester, Iowa	05388250	770	Sed., Temp.	1975-81
Paint Creek at Waterville, Iowa	05388500	42.8	Temp.	1952-56
			Sed.	1952-57
Turkey River at Garber, Iowa	05412500	1,545	Temp., Sed.*	1957-62
Mississippi River at Dubuque, Iowa	05414700	1,600	Chem.	1969-73
Maquoketa River near Maquoketa, Iowa	05418500	1,553	Chem., Temp., Sed.	1978-82
Mississippi River at Clinton, Iowa	05420500	85,600	Chem.	1973-87
Wapsipinicon River at Independence, Iowa	05421000	1,048	Chem.*	1968-70
			Temp.*, Sed.*	1967-70
Crow Creek at Bettendorf, Iowa	05422470	17.8	Chem., Temp., Sed.	1978-82
Iowa River near Rowan, Iowa	05449500	429	Temp.*, Sed.*	1957-62

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

Station name	Station number	Drainage area (square miles)	Type of record[1]	Period of record
Cedar River near Gilbertville, Iowa	05464020	5,234	Chem.	1971, 1975-81
Iowa River at Iowa City, Iowa	05454500	3,271	Chem., Temp., Sed.	1952-1987
Ralston Creek at Iowa City, Iowa	05455000	3.01	Chem., Temp., Sed.	1906-1907, 1944-88
Fourmile Creek near Lincoln, Iowa	05464130	13.78	Chem., Temp., Sed.	1969-74
Half Mile Creek near Gladbrook, Iowa	05464133	1.33	Chem., Temp., Sed.	1969-74
Fourmile Creek near Traer, Iowa	05464137	19.51	Chem., Temp., Sed.	1969-74
Cedar River near Palo, Iowa	05464450	6,380	Chem.	1975-79
Cedar River at Cedar Rapids, Iowa	05464500	6,640	Chem.*	1906-07, 1944-54
			Temp.*	1944-54
			Sed.	1943-54
Cedar River near Bertram, Iowa	05464760	6,955	Chem.	1975-81
Mississippi River at Burlington, Iowa	05469720	4,000	Chem.	1969-73
Mississippi River at Keokuk, Iowa	05474500	119,000	Chem.	1974-87
Des Moines River at Fort Dodge, Iowa	05480500	4,190	Chem.	1972-73
Des Moines River at Des Moines, Iowa	05482000	6,245	Chem.	1954-55
			Temp., Sed.	1954-61
E. Fork Hardin Creek near Churdan, Iowa	05483000	24.0	Temp.*, Sed.*	1952-57
M. Fork Raccoon River near Bayard, Iowa	05483450	375	Chem., Temp., Sed.	1979-85
M. Fork Raccoon River at Panora, Iowa	05483600	440	Chem., Temp., Sed.	1979-85
Raccoon River at Des Moines, Iowa	05485000	3,590	Chem., Temp.	1945-47
Des Moines River below Raccoon River at Des Moines, Iowa	05485500	9,770	Chem.*	1944-45
			Temp.*, Sed.	1944-47
Des Moines River below Des Moines, Iowa	05485520	9,901	Chem.	1971, 1975-81
Middle River near Indianola, Iowa	05486490	503	Temp.*, Sed.	1962-67
White Breast Creek near Dallas, Iowa	05487980	342	Chem.	1968-73
			Temp., Sed.	1967-73
Big Sioux River at Sioux City, Iowa	06485950	9,410	Chem.	1969-73
Missouri River at Sioux City, Iowa	06486000	314,600	Chem.	1972-86
Floyd River at James, Iowa	06600500	882	Temp., Sed.	1968-73
Floyd River at Sioux City, Iowa	06600520	921	Chem.	1969-73
Missouri River at Decatur, Nebr.	06601200	316,160	Chem.	1974-81
Little Sioux River at Correctionville, Iowa	06606600	2,500	Chem.*	1954-55
			Temp.*	1951-62
			Sed.	1950-62
Little Sioux River near Kennebec, Iowa	06606700	2,738	Temp.	1950-55
			Sed.	1950-57
Little Sioux River at River Sioux, Iowa	06607513	3,600	Chem.	1969-73
Soldier River near Mondamin, Iowa	06608505	440	Chem.	1970-73
Steer Creek near Magnolia, Iowa	06609200	9.26	Temp., Sed.	1963-69
Thompson Creek near Woodbine, Iowa	06609590	6.97	Temp., Sed.	1963-69
Willow Creek near Logan, Iowa	06609600	129	Chem., Temp.	1972-75
			Sed.	1971-75
Missouri River at Omaha, Nebr.	06610000	322,800	Chem.	1969-86
Mule Creek near Malvern, Iowa	06808000	10.6	Temp.	1958-69
			Sed.	1954-69
Davids Creek near Hamlin, Iowa	06809000	26.0	Temp.*	1952-53, 1965-68
East Nishnabotna River at Red Oak, Iowa	06809500	894	Temp., Sed.	1962-73
Platte River near Diagonal, Iowa	06818750	217	Chem.	1969-73
Thompson River at Davis City, Iowa	06898000	701	Chem.	1967-73
			Temp., Sed.	1968-73
Weldon River near Leon, Iowa	06898400	104	Chem.	1968-73
Chariton River near Chariton, Iowa	06903400	182	Temp., Sed.	1969-73
Honey Creek near Russell, Iowa	06903500	13.2	Sed.	1952-62
Chariton River near Rathbun, Iowa	06903900	551	Temp*, Sed.*	1962-69

[1] Type of record: Chem., chemical quality; Temp., water temperature; Sed., sediment.

SEDIMENT STATIONS
(IA 00-004)



PERIOD OF PROJECT: Continuous since 1943

PROJECT CHIEF: D.J. O'Connell

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).

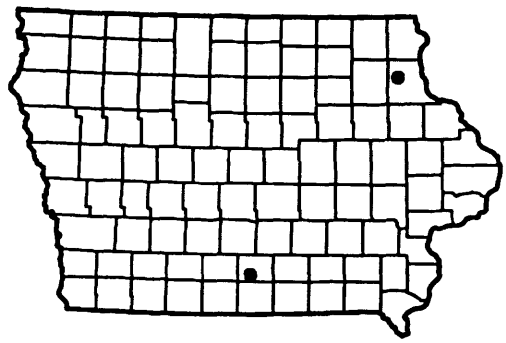
NEED FOR STUDY: Water-resource planning and water-quality assessment requires a nationwide base of standardized information. Sediment concentrations and discharges in rivers and streams need to be monitored and defined to achieve this goal.

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, compiled, and processed for publication on schedule. The annual data report, "Water Resources Data--Iowa, Water Year 1990" was delivered in May 1991. The network consist of five daily sediment stations operated in cooperation with the Iowa Department of Natural Resources (Geological Survey Bureau) [IDNR (GSB)]. Two daily stations were operated in cooperation with the U.S. Army Corps of Engineers, Rock Island District, and one daily sediment station with the U.S. Army Corps of Engineers, St. Paul District. A program operated cooperatively with the U.S. Army Corps of Engineers, Omaha District, studied the larger than 0.062-millimeter material in the river cross section and the point velocities at three sites on the Missouri River. A daily sediment station was added to the network during 1991 that is operated cooperatively with the University of Iowa (Department of Preventive Medicine) and the Agricultural Research Service. Two daily sediment stations were added during 1992 in cooperation with the IDNR (GSB) to study the effect of land-use practices on the stream's sediment yield.

Laboratory analyses of sediment samples collected by the U.S. Army Corps of Engineers (Rock Island District) and by U.S. Geological Survey Districts in Alaska, Arizona, Colorado, Illinois, Indiana, Kentucky, Minnesota, Missouri, Montana, Nebraska, Nevada, 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.

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



PERIOD OF PROJECT: Continuous since 1984

PROJECT CHIEF: R.B. Lambert

STUDY AREA: Clayton and Lucas Counties

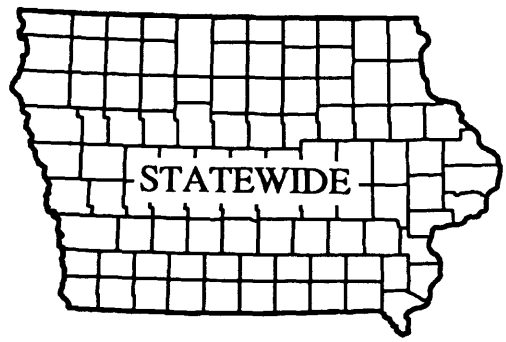
COOPERATING AGENCY: U.S. Geological Survey (Federal program).

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 carried out 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 the agricultural, forest, and aquatic ecosystems of the United States.

OBJECTIVES: The Iowa precipitation-monitoring stations are part of the National Atmospheric Deposition Program/National Trends Network (NADP/NTN) program to provide 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: Precipitation samples are collected at 200 sites across the United States. Wet-deposition samples are collected weekly on a continuing basis at the Big Spring Fish Hatchery in Clayton County, and at the McNay Agricultural Research Farm in Lucas County (see index map). Severe flooding in the Turkey River basin in northeast Iowa destroyed the Big Spring Fish Hatchery sampler in August 1990 and again in June 1991. After the June 1991 flood, equipment at that site was again replaced, and the station returned to operation in July 1991. Information collected from the Iowa stations is published annually in a series of data reports. Values of pH and specific conductance and the chemical composition of the precipitation from both stations were published in the "Water Resources Data--Iowa, Water Year 1990" and the U.S. Geological Survey's "NADP/NTN Annual Data Summary--Precipitation Chemistry in the United States for 1989." The results of sample analyses for water year 1991 will be published in "Water Resources Data--Iowa, Water Year 1991."

WATER USE
(IA 00-007)



PERIOD OF PROJECT: Continuous since 1980

PROJECT CHIEF: E.E. Fischer

STUDY AREA: Statewide

COOPERATING AGENCY: Iowa Department of Natural Resources

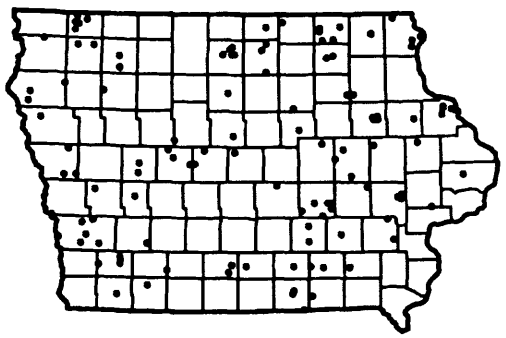
NEED FOR STUDY: In 1977, the Congress of the United States directed the U.S. Geological Survey to establish a National Water-Use Information Program to complement the Survey's data on the Nation's water resources. This program, which became a part of the U.S. Geological Survey's Federal-State cooperative 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 in accordance with guidelines established for the National Water-Use Information Program. Data are to be collected annually and the data base updated to maintain current information on the State's water use.

PROGRESS: The Iowa part of the 1990 national water-use data-collection effort was completed during fiscal year 1991. Much of the data were supplied by water-user reports to the Iowa Department of Natural Resources. The remainder of the data were collected by contacting individual water users (municipal, commercial, and industrial) and by using documented estimation procedures. The data were sent to the National Water-Use Information Program office. The data that were collected include the amount of water each user withdrew during 1990, whether the withdrawal was ground water or surface water, and the location of each withdrawal point. Estimates of water use on farms (other than irrigation, which is covered by the State's water-permit system) were made from data supplied by the Iowa Department of Agriculture and Land Stewardship. Estimates of domestic water use were provided by the billing departments of municipalities representing more than one-half of the State's population.

AREAL HYDROLOGIC INVESTIGATIONS

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



PERIOD OF PROJECT: Continuous since 1966

PROJECT CHIEF: D.A. Eash

STUDY AREA: Statewide

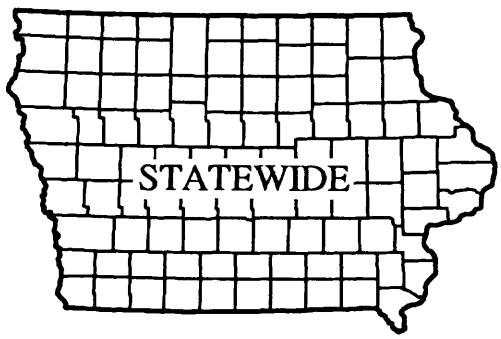
COOPERATING AGENCY: Iowa Department of Transportation (Highway Division, Highway Research Advisory Board).

NEED FOR STUDY: Systematic flood information is needed for the proper hydraulic design of new bridges, culverts, and other flow structures (especially in 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 ever 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 peak discharges on ungaged basins on an event basis.

PROGRESS: Operation of the small-basin, crest-stage gage (CSG) network was continued. Annual peak-flood data from the network were compiled and published in the U.S. Geological Survey Water-Data Report IA-90-1 (O'Connell and others, 1990). Data were collected from 120 CSG sites throughout the State (see index map). During water year 1990, 22 CSG sites were discontinued, and 17 new sites were added to the network. Maximum gage heights were recorded at the 17 sites with peak discharges determined at 7 of the sites. Maximum gage heights were recorded, and peak discharges were determined at 46 sites. Maximum gage heights were recorded at 18 sites, and peak discharges will be published when ratings for the sites are defined. At 11 sites, a peak above the base did not occur. Two sites were affected by ice during the time of the maximum gage height, and no discharge could be determined. Three indirect discharge computations and field work for five indirect discharge measurements and culvert ratings were completed in 1990. Six indirect discharge measurements started in water year 1990 were finalized and submitted for review in water year 1991. Field work for a bridge study on the Cedar River at Cedar Falls was completed. Site selection and installation of new CSG sites continued.

FLOOD PROFILES OF IOWA STREAMS (IA 58-011)



PERIOD OF PROJECT: Continuous since 1957

PROJECT CHIEF: P.J. Soenksen

STUDY AREA: Statewide

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

NEED FOR STUDY: Information is needed on flood peaks and profiles 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. Basic data on 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 on a request basis.

PROGRESS: Low-water and low-bridge chord and bridge-deck elevations were determined using temporary bench marks along the East and West Nishnabotna Rivers. The Nishnabotna report was published as U.S. Geological Survey Open-File Report 91-171, "Floods in the Nishnabotna River Basin, Iowa" (Eash and Heintz, 1991). As a result of significant floods, high-water marks, low-bridge chord elevations, and bridge-deck elevations were surveyed using temporary bench marks along Clear Creek in Johnson County (flood of June 17, 1990), Perry Creek in Woodbury County (flood of May 19, 1990), along Squaw Creek and the Skunk River near and in Ames in Story County (flood of June 17, 1990), and in the Turkey River basin in northeast Iowa (flood of June 6, 1991). Level lines were measured using sea level datum from bench marks to establish temporary marks on bridges along Willow Creek, Mosquito Creek, and the South Raccoon River for the Raccoon River report using third-order accuracy. The report for the Raccoon River basin, "Floods of 1986 and 1990 in the Raccoon River Basin, Iowa" is in preparation. Elevations of high-water marks were obtained at three bridge sites in the Waterloo-Cedar Falls area in Black Hawk County for site-specific documentation of backwater and flood conditions for the flood of July 30, 1990, along the Cedar River. The following is a chronological listing of flood-profile reports for Iowa prepared by the U.S. Geological Survey.

CHRONOLOGICAL FLOOD-PROFILE REFERENCES

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

Schwob, H.H., and Meyers, R.E., 1965, The 1965 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.

_____1968, Flood of June 7, 1967, in the Wapsinonoc Creek basin, Iowa: Iowa City, U.S. Geological Survey Open-File Report, 21 p.

_____1968, 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, Flood 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.

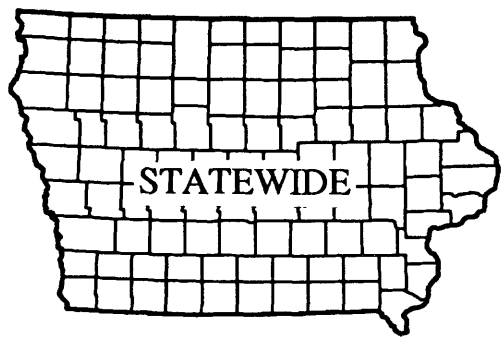
Heinitz, A.J., and Riddle, D.E., 1981, Floods in the English River basin, Iowa: U.S. Geological Survey Open-File Report 81-67, 61 p.

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.

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 AGENCIES: Iowa Department of Natural Resources (Geological Survey Bureau) and the University of Iowa Hygenic 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 the ground-water resources in the State. The two major objectives of this program are: (1) to specifically describe the baseline ground-water quality of the major aquifers in the State and to provide ground-water-quality data for areas of the State or aquifers in the State that are stressed by intensive use, contamination, or deteriorating quality; and (2) to establish a subnetwork within the program to monitor long-term ground-water-quality trends.

PROGRESS: Approximately 2,000 municipal wells are included in the ground-water-quality monitoring inventory of potential sampling sites, 200 of which are selected annually. The location of sampling sites for 1990 and 1991 is shown in figure 7. The current sampling strategy, which was initiated in 1990, combines a random selection from the inventory of wells, weighted by aquifer vulnerability, with a fixed subnetwork of 50 wells. This selection process provides a more statistically sound basis for the assessment of the overall quality of ground water throughout the State and for the analysis of long-term water-quality trends.

During 1991 sampling, personal contact with municipal-well superintendents resulted in updating and confirmation of 40 percent of the ground-water-quality monitoring inventory. Additionally, land use within a 2-mi radius surrounding each well was assessed. All samples were collected according to standard U.S. Geological Survey

procedures and chemically analyzed by the University of Iowa Hygenic Laboratory for constituents in the following categories: (1) major ions, (2) nutrients, (3) common herbicides, (4) selected priority contaminants, and (5) radiochemical materials. Analytical and land-use data from 1991 currently are being compiled and will be used in conjunction with data from previous years for subsequent statistical analysis to explore the spatial and temporal aspects of water quality in Iowa.

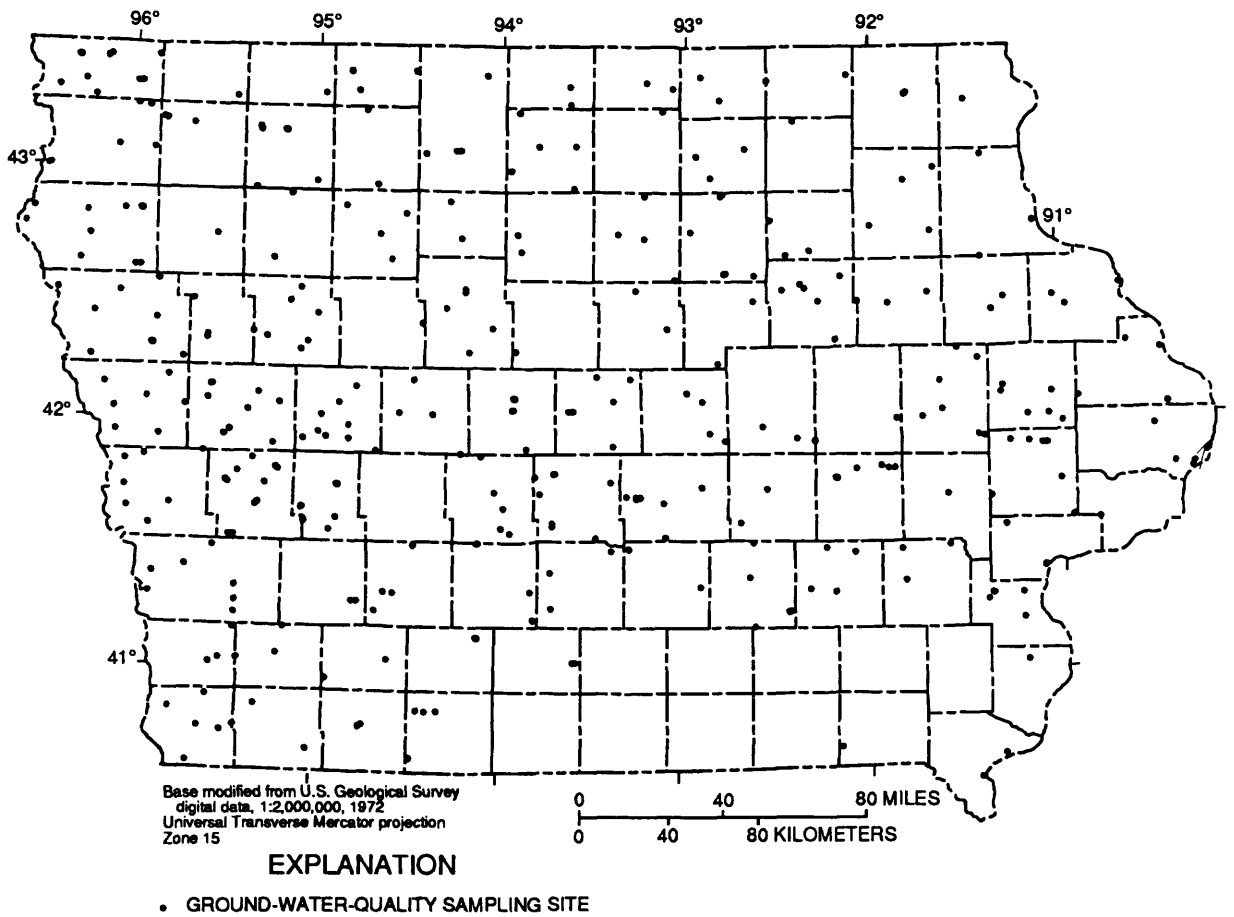
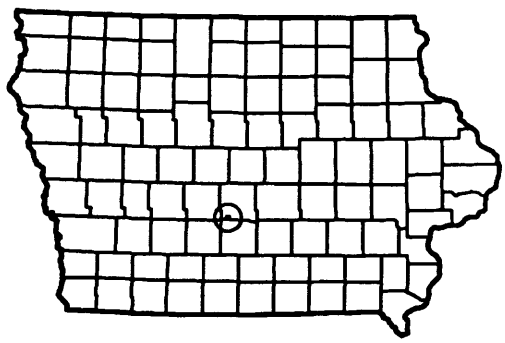


Figure 7. Location of ground-water-quality sampling sites.

DES MOINES AIR NATIONAL GUARD BASE, INSTALLATION RESTORATION PROGRAM (IA 84-050)



PERIOD OF PROJECT: 1984-92

PROJECT CHIEF: R.C. Buchmiller

STUDY AREA: Polk County

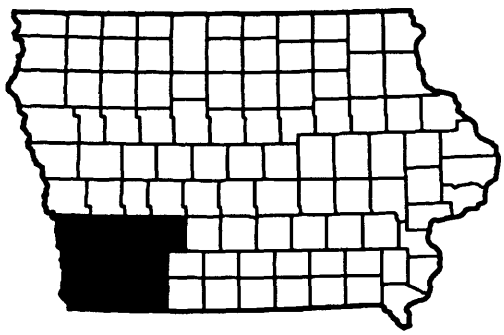
COOPERATING AGENCY: U.S. Department of Defense (Air Force Center for Environmental Excellence).

NEED FOR STUDY: Disposal of chemicals at sites on the Iowa Air National Guard Base, Des Moines, may pose a hazard to ground and surface water in the study area.

OBJECTIVES: To identify and evaluate potential problems caused by past handling or disposal of toxic or hazardous materials at the U.S. Air Force facility.

PROGRESS: Four sites where disposal of wastes or leakage of stored materials occurred were studied. A total of 24 observation wells were drilled and completed at the four sites. Water levels were measured in the wells to obtain information on ground-water flow direction and gradient at each site. Hydraulic tests were performed on each well to characterize the hydraulic properties of soils at each site. Twelve wells were sampled for selected water-quality constituents and properties during 1984 to determine if disposal of wastes or leakage of stored materials had affected ground water adjacent to the sites. On the basis of results from this sampling, an additional 12 wells were installed, and all 24 wells were sampled twice during 1987 to confirm the presence of selected water-quality constituents and properties. In addition to the sampling of the observation wells, a soil-gas survey was performed during 1987 to attempt to map the areal extent of suspected ground-water contamination plumes. Onsite work has been completed, and the data have been presented to the U.S. Air Force for their approval. Plans for fiscal year 1992 include publishing the final report and the proper abandonment of monitoring wells at the sites selected for no further action.

SOUTHWEST IOWA GROUND-WATER APPRAISAL (IA 85-053)



PERIOD OF PROJECT: 1985-90

PROJECT CHIEF: R.C. Buchmiller

STUDY AREA: Adair, Adams, Cass, Fremont, Mills, Montgomery, Page, Pottawattamie, and Taylor Counties

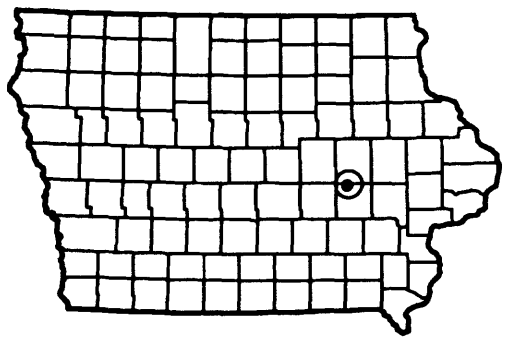
COOPERATING AGENCY: Iowa Department of Natural Resources (Geological Survey Bureau).

NEED FOR STUDY: Southwest Iowa is an agricultural area with limited sources of ground water. Possible ground-water sources with adequate quality and quantity of water are the alluvial, buried channel, and Dakota aquifers. Other aquifers exist but are of a discontinuous nature or contain water of undesirable quality.

OBJECTIVES: To determine the availability, quantity, and quality of ground water from the alluvial, glacial-drift, and Dakota aquifers in southwest Iowa. Specific objectives are to: (1) determine the location, areal extent, and use of these aquifers; (2) evaluate the occurrence, movement, and storage of ground water, including the relation between streams and near-surface aquifers; (3) estimate the potential yields to wells tapping the aquifers; (4) describe the chemical quality of the surface and ground water; and (5) report the annual municipal water withdrawals and estimate other categories of water use from the aquifers.

PROGRESS: A study of the shallow ground-water resources in a nine-county area of southwest Iowa was begun in 1985. Historical records and test-well drilling were used to obtain data for specific aquifers in areas where little or no ground-water information was available. Observation wells were constructed to monitor water-level changes and to obtain samples of ground water for chemical analysis. Surface-water samples were collected at several sites to compare with analytical results from adjacent alluvial aquifers. Municipal water-use information was obtained from local water suppliers. Data were collected for five types of unconsolidated aquifers and one bedrock aquifer; alluvial, loess, inter-till sand-and-gravel, basal sand-and-gravel, buried-channel, and the Dakota aquifers, respectively. Data collection for this project has been completed. A report authored by personnel of the U.S. Geological Survey and Iowa Department of Natural Resources (Geological Survey Bureau) was published (Hansen and others, 1992). An additional report that revises the bedrock topography of the area on the basis of data compiled during this project is in preparation.

AN ACCOUNTING OF PESTICIDES IN SOIL AND GROUND WATER AT SELECTED SITES IN THE IOWA RIVER BASIN (IA 85-055)



PERIOD OF PROJECT: 1985-88

PROJECT CHIEF: S.J. Kalkhoff

STUDY AREA: Iowa County

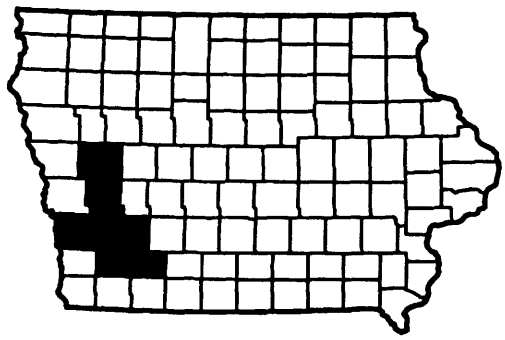
COOPERATING AGENCY: The University of Iowa Hygienic Laboratory.

NEED FOR STUDY: Ground-water-quality monitoring programs have detected pesticides, particularly the herbicides alachlor, atrazine, and cyanazine, in a substantial number of wells in shallow ground-water supplies throughout Iowa. Increasing concern about the undesirable leaching of agricultural chemicals from fields to underlying aquifers has led to a need for detailed study of the movement of these chemicals.

OBJECTIVES: The purpose of this study is to evaluate the movement and distribution of selected pesticides in the field. The investigation focuses on the leaching of herbicides and nitrate to shallow ground water. Specific objectives are to determine the distribution of selected herbicides in the soil-unsaturated zone-aquifer profile and to interpret the movement, leaching rates, and physical-chemical characteristics of herbicide movement from the soil to shallow ground water.

PROGRESS: Seven wells and four lysimeters were completed at various depths at a site in the Iowa River alluvial aquifer near Marengo, Iowa. Water levels were measured in each well to determine the vertical gradient of water movement at the site. The wells and lysimeters were sampled monthly for 2 years. Sampling was completed in the fall of 1987. Water samples were analyzed for nitrate and selected herbicides. Results and interpretations of data collected during the study are being prepared for publication in a technical journal.

SIDE-LOOKING AIRBORNE RADAR AS A RECONNAISSANCE TOOL FOR THE DELINEATION OF LINEAMENTS IN WESTERN IOWA (IA 86-056)



PERIOD OF PROJECT: 1986-92

PROJECT CHIEF: J.P. Caldwell

STUDY AREA: Adams, Cass, Crawford, Montgomery, Pottawattamie, and Shelby Counties

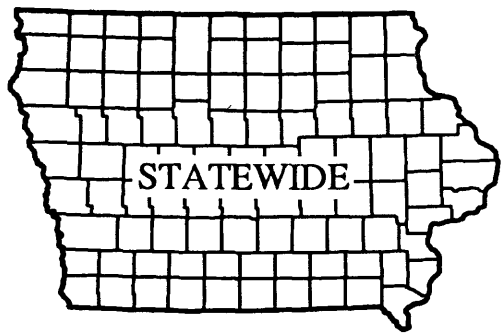
COOPERATING AGENCY: U.S. Geological Survey (Federal program).

NEED FOR STUDY: The character and distribution of surface lithologic units have a major effect on the movement of surface and shallow ground water. Much of the ground-water availability or flow from carbonate bedrock in Iowa is related to secondary permeability associated with structural features such as fractures, joints, and faults. The surface expression of bedrock structural features that have been mantled by glacial drift often is undetectable using routine field-reconnaissance methods. Mapping these bedrock features would aid in the protection, conservation, and utilization of these shallow aquifers. Side-looking airborne-radar (SLAR) imagery may provide a means of detecting fracture zones (lineaments) on a regional scale.

OBJECTIVES: Evaluate the usefulness of SLAR imagery for hydrologic and geologic reconnaissance in Iowa. SLAR imagery will be analyzed to detect subtle topographic expression, differences in texture and composition of surficial materials and vegetation, and drainage patterns that may follow the surface projection of bedrock-fracture zones. Regional maps showing the distribution of interpreted lineament systems will be evaluated according to known land-use patterns, cultural features, geology, and hydrology to select sites for detailed characterization studies. Bedrock-fracture zones may provide pathways for the migration of bedrock-sourced radiochemicals (radon). Streams will be sampled during base-flow conditions in the vicinity of these lineaments to determine if increased levels of radon are present.

PROGRESS: Preliminary maps showing the distribution of lineament systems in the Omaha quadrangle (1° by 2°) were prepared utilizing SLAR imagery. Seven sites were selected for ground-water radon sampling on the basis of their close proximity to lineament intersections. Three of the sites were abandoned after onsite investigation showed them to be either inaccessible or that their streambed sediments were too fine grained to allow ground-water sampling with available field equipment. A total of 12 ground-water samples were obtained from the four remaining sites. One sample at each site was collected where the stream crossed the mapped lineament intersection. Samples also were collected upstream and downstream from the primary sampling site to obtain background radon levels. The ground-water samples were analyzed onsite using a portable alpha scintillometer. Preliminary results show increased radon levels at three of the sites.

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



PERIOD OF PROJECT: 1987-93

PROJECT CHIEF: M.R. Burkart

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 also of 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 ultimate 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 goal, two objectives being pursued by the U.S. Geological Survey are being coordinated within this project: (1) identify the spatial and temporal occurrence of herbicides and nitrate in water resources of the Midwest, and (2) evaluate the effect on water quality of prevailing and modified farming systems. The first objective is being approached through reconnaissance sampling and evaluation of chemical constituents of aquifers, streams, and precipitation throughout the 12-state area (fig. 8). Stream and atmospheric sampling is being coordinated through another U.S. Geological Survey project in Denver, Colorado. The project described here is conducting the ground-water reconnaissance and providing geographic-information-system support for the stream-sampling activity. The second objective is being met through collaborative efforts at five Management System Evaluation Areas (MSEA) in Iowa, Minnesota, Missouri, Nebraska, and Ohio. Water-quality research is being conducted through U.S. Geological Survey projects in the five states, and this research is being coordinated through this project.

PROGRESS: Progress on the first objective includes drafting and publishing a work plan for the ground-water reconnaissance. Samples were collected at 300 wells in shallow unconsolidated and bedrock aquifers in late winter 1991 and during July-August 1991. Among the reports in progress are the following topics: "Herbicides in Surface Waters of the Midwestern United States," "Effects of the Spring Flush," "Historical Occurrence of

Nitrate in Ground Water of the MidContinent," and "Occurrence of Herbicides and Nitrate in Shallow Aquifers of the MidContinent." Several reports describing the MSEA plans and preliminary interpretation of regional data have been published. MSEA activities are fully in place. The EPA plans to initiate agro-ecosystem research at one or more MSEA sites in fiscal year 1992. A strategy is being developed to project the potential benefits of implementing MSEA research results to large segments of the MidContinent.

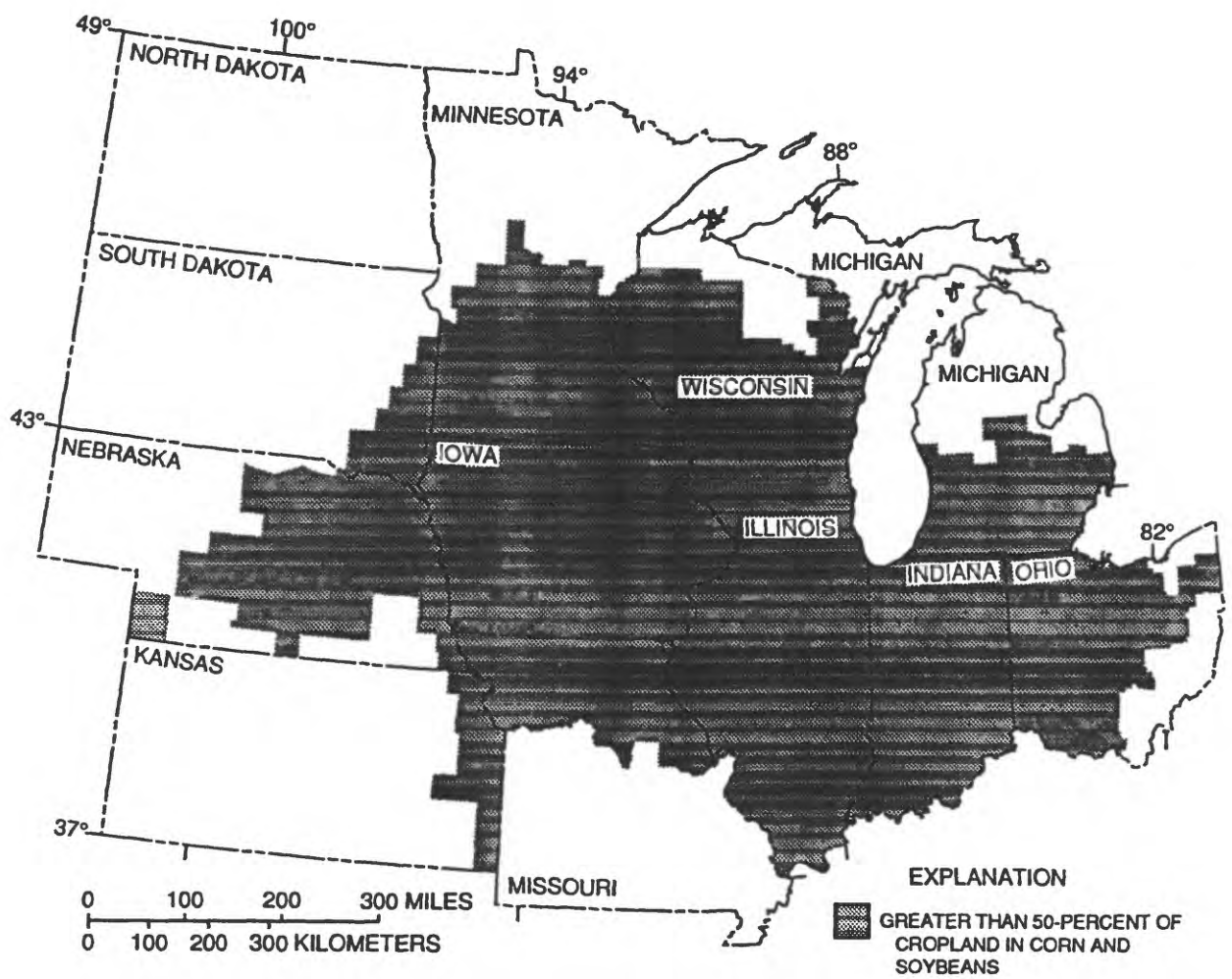
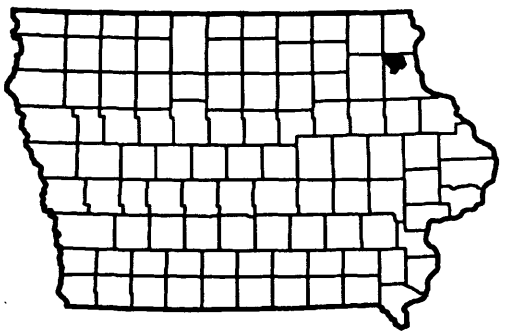


Figure 8. Area of focus for interagency research into the occurrence of agricultural chemicals in the water resources of the central Midwest.

HYDROLOGIC ANALYSIS OF WATER QUALITY AND THE FLOW SYSTEM IN THE BIG SPRING BASIN, CLAYTON COUNTY, IOWA (IA 87-058)



PERIOD OF PROJECT: 1987-92

PROJECT CHIEF: S.J. Kalkhoff

STUDY AREA: Clayton County

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

NEED FOR STUDY: Northeast Iowa is an agricultural region in an area of karst topography. Previous studies have shown that agricultural chemicals (nitrate and herbicides) have contaminated the Galena aquifer of Ordovician age, which is the source of most domestic water supplies. The contaminant source is generally known; however, knowledge of the flow path of ground water and the chemical processes affecting contamination is limited. Also, the effects of modified agricultural practices on the contaminant levels in surface and ground water need to be monitored.

OBJECTIVES: To further characterize the water quality in the Big Spring Basin and to define several aspects of the hydrologic flow system. Specific objectives include: (1) define ground-water recharge and discharge rates; (2) characterize the quality of small streams that drain into sinkholes; (3) identify the amount and quality of water lost from streams due to seepage; (4) monitor quality and sediment load of water leaving the basin through Big Spring and Roberts Creek; and (5) define geochemical processes that affect surface-water quality.

PROGRESS: The ground-water recharge and discharge rates have been partially defined by measuring stream discharge at about 40 sites in the basin to calculate the amount of water that infiltrates to the aquifer through stream seepage. Ground-water discharge is measured continuously at Big Spring. The quality and quantity of water in Unnamed Creek is monitored to characterize the water flowing directly into sinkholes. Specific conductance, water temperature, and pH are monitored continuously at both the surface-water discharge point, Roberts Creek above Saint Olaf, and at the ground-water discharge point, Big Spring (fig. 9). Sediment samples are collected at these sites to calculate the sediment load discharged from the basin. Monthly and intermittent samples for the analyses of nutrients and selected herbicides are collected to document changing water quality. A study was conducted in the Deer Creek watershed, a small headwater watershed, to determine how agricultural chemicals are transported to the stream after application. Another study investigated the process of instream herbicide degradation. Data collected during this study have been published in annual U.S. Geological Survey Open-File Reports (Kalkhoff, 1989a; Kalkhoff and Kuzniar, 1991). A report on "Time of Travel and Dispersion in a Selected Reach of Roberts Creek, Clayton County, Iowa" as part of the instream degradation study was published as U.S. Geological Survey

Water-Resources Investigations Report 91-4145 (Kolpin and Kalkhoff, 1992). Results of the degradation study also are being prepared for publication as a journal article. Results of the study in the Deer Creek watershed are being prepared for publication in a U.S. Geological Survey Water-Resources Investigations Report.

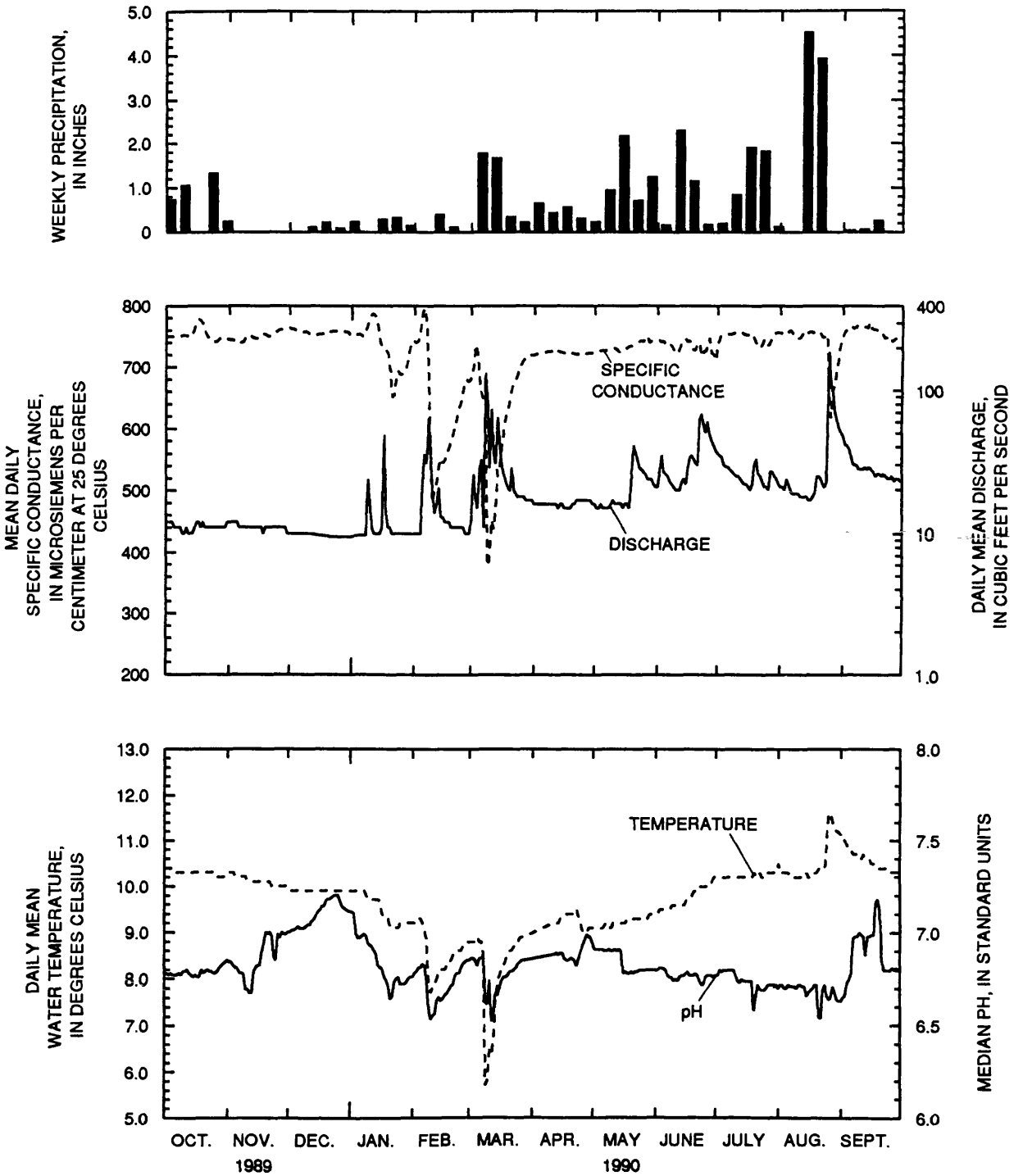
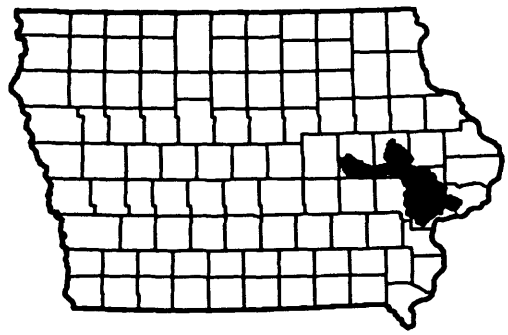


Figure 9. Weekly precipitation, mean daily specific conductance, daily mean discharge, daily mean water temperature, and median pH at Big Spring, Clayton County, Iowa, water year 1990.

MOVEMENT OF NONPOINT-SOURCE AGRICULTURAL CHEMICALS BY THE INTERACTION OF GROUND WATER AND SURFACE WATER IN AN ALLUVIAL AQUIFER (IA 88-061)



PERIOD OF PROJECT: 1988-92

PROJECT CHIEF: P.J. Squillace

STUDY AREA: All or parts of Benton, Cedar, Johnson, Jones, Linn, Muscatine, and Scott Counties, Iowa.

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

NEED FOR STUDY: Herbicides have been detected in rivers for a number of years during runoff and base-flow conditions. The presence of herbicides in rivers during base-flow conditions may indicate a ground-water source. Research is needed to determine how the surface-water quality affects the water quality of the alluvial aquifers and how the water quality of the ground water leaving the alluvial aquifer affects the water quality of the streams.

OBJECTIVE: The objective of this research project is to examine the significance of the exchange of nonpoint sources of contaminants between ground water and surface water by focusing on two questions: (1) to what extent does the water quality of a river affect the water quality of the alluvial aquifer as a result of changes in river stage? and (2) what is the contribution of nonpoint sources of agricultural contaminants to the river by alluvial aquifers during base-flow conditions?

PROGRESS: Three seepage investigations were conducted along the main stem of the Cedar River to determine where agricultural chemicals enter the river during base-flow conditions. The seepage investigations were conducted when the river was in base flow and there was no overland flow into the river. Forty-one wells were installed at a site in the alluvium along the Cedar River, and the water from the wells was sampled 15 times for water-quality properties and constituents. These wells were sampled to determine how agricultural chemicals move in and out of the alluvial aquifer with bank storage. The alluvial-aquifer material was analyzed for organic-carbon content, mineralogy, and particle-size analysis. The data-collection phase of the project has been completed. Figure 10 shows how atrazine in the alluvial aquifer increased near the river during runoff (March 20-22, 1990) due to bank storage of the river water. Other data collected indicate a ground-water source of herbicides to the river during base-flow conditions. As a result of the research conducted during this project, two reports and eight abstracts have been published, five reports are in press, and three reports are in preparation.

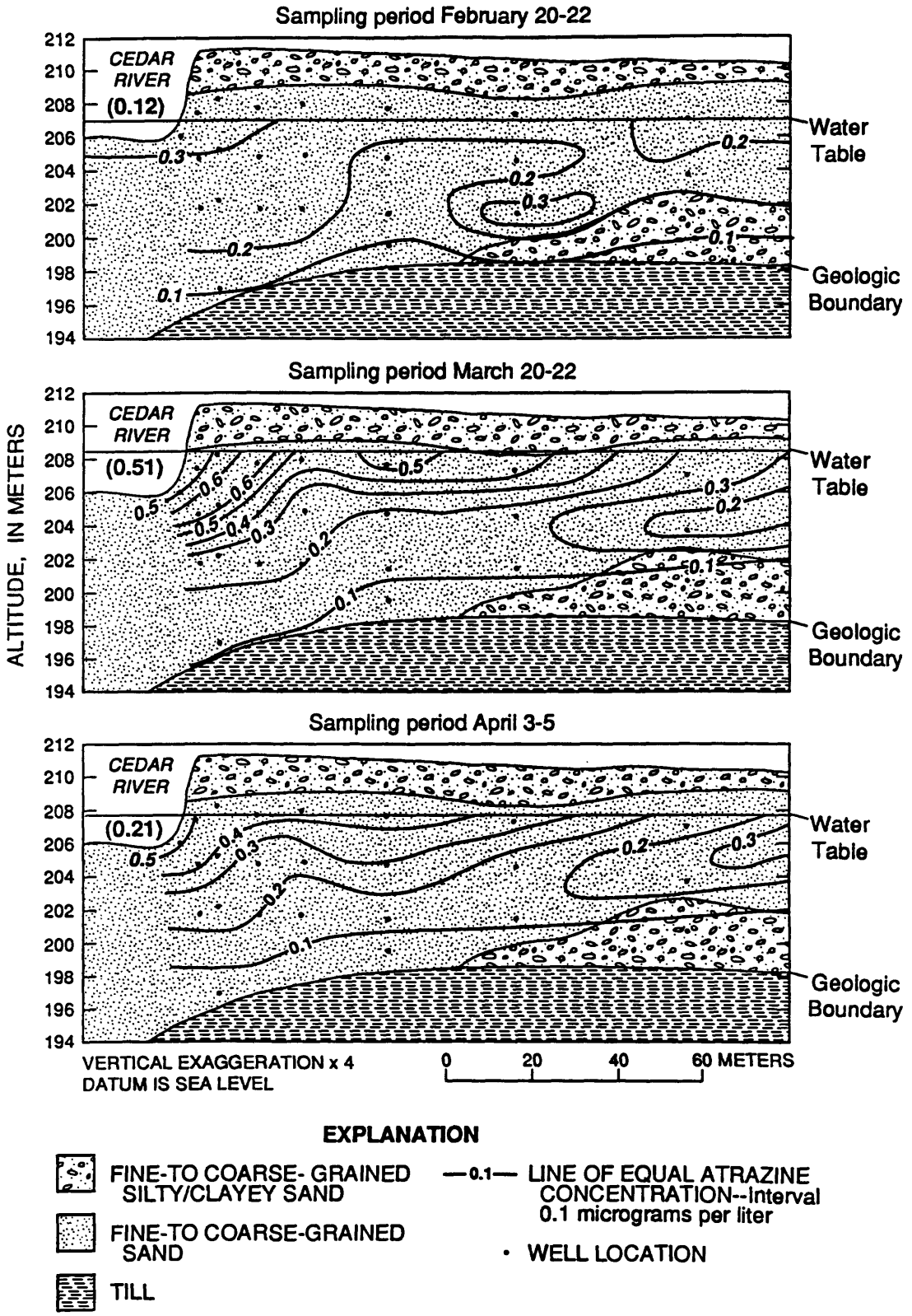
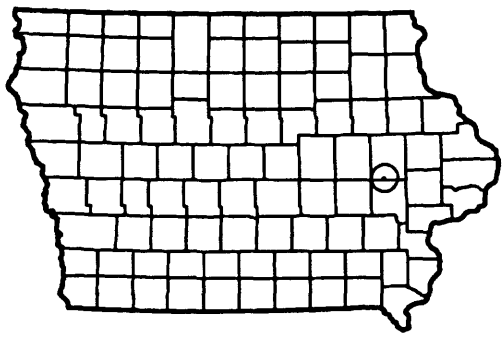


Figure 10. Cross-sectional distribution of atrazine in Cedar River alluvium near Cedar Rapids, Iowa, February through April 1990.

HYDROLOGY OF PRE-ILLINOIAN TILL IN IOWA (IA 88-063)



PERIOD OF PROJECT: 1988-92

PROJECT CHIEF: R.C. Buchmiller

STUDY AREA: Linn County

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

NEED FOR STUDY: A great deal of research on the hydrology of Wisconsin glacial till has been done during the last two decades. However, little research has been done on the hydrology of pre-Illinoian glacial till. It is unknown, therefore, whether the hydrology of Wisconsin and pre-Illinoian till differs. In general, glacial till can be divided into two distinct zones: (1) an upper, fractured, weathered zone and (2) a lower, unfractured, unweathered zone. The physics of water movement through pre-Illinoian till needs to be defined--in particular, the relation of fractures in the till to water movement. Changes in the chemistry of water as it moves through pre-Illinoian till needs to be determined, particularly as related to potential contaminants applied or disposed of on the land surface.

OBJECTIVES: The objectives of this study are to determine the physics and chemistry of ground-water movement in pre-Illinoian glacial till.

PROGRESS: Field work began in September 1989 at a site in Linn County where pre-Illinoian glacial till is present. A hydrologic data-collection network, consisting of 22 observation wells and a meteorological station, was installed to describe the hydraulic properties of the till. Continuous water-level recorders were installed in 12 observation wells to monitor water-level fluctuations. A hydrograph from one of these wells is shown in figure 11. A meteorological station consisting of a rain gage, a barometric-pressure sensor, and an air-temperature sensor were installed to monitor climatic conditions. A multiple-constituent water-quality minimonitor was installed to measure temporal changes in specific conductance, water temperature, and pH of the ground water and to measure the changes that occur due to precipitation. Ten unvented, vibrating-wire, pressure transducers were buried at specific depths in two boreholes to provide an alternate method of collecting water-level and water-temperature measurements. Hydraulic-conductivity measurements, using vented pressure transducers, were conducted in 21 observation wells to record hydraulic-conductivity values. Forty-eight nested piezometers were installed for a tracer-injection study to monitor the three-dimensional movement of solute transport in the shallow, weathered, fractured till. Selected observation wells are sampled periodically for chemical analyses. All monitoring instruments at the study site were connected to digital data loggers.

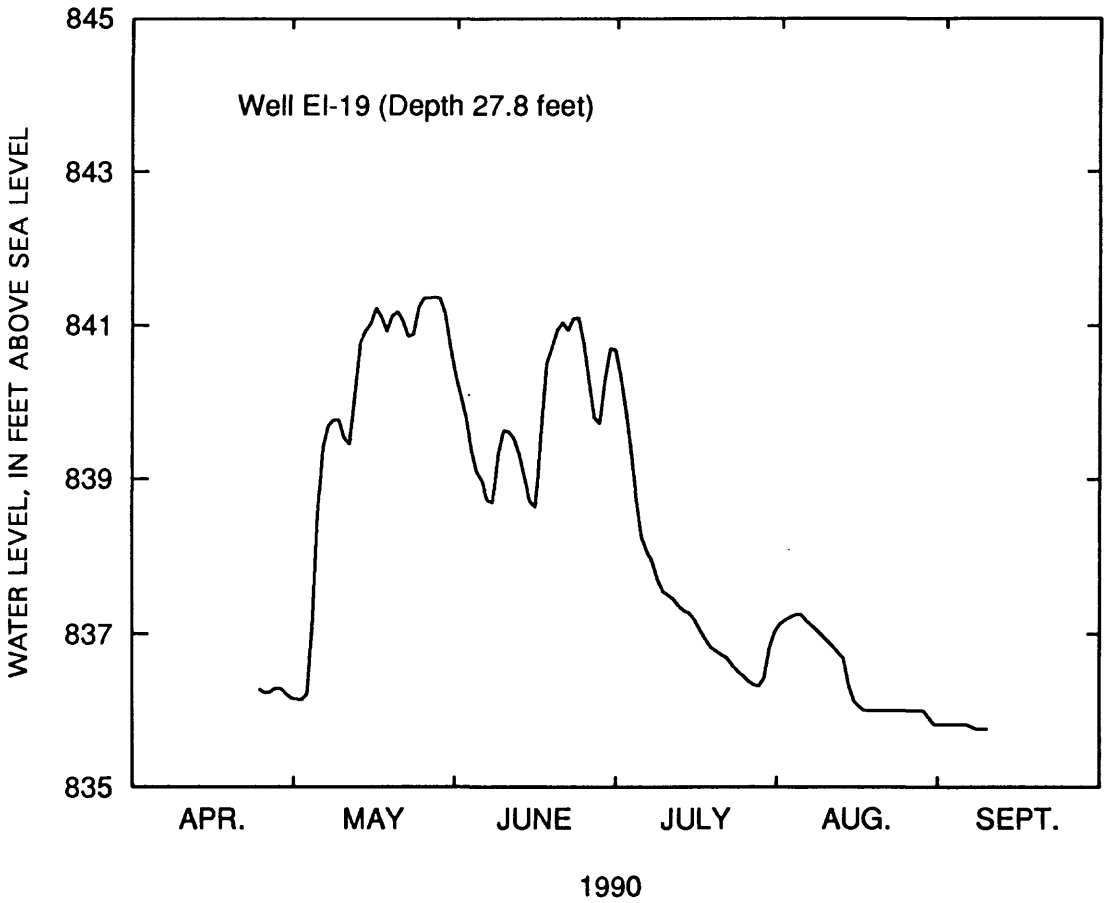
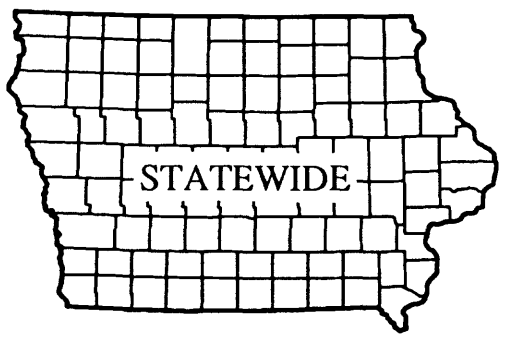


Figure 11. Daily mean water level in continuously monitored observation well El-19, April-September 1990, near Cedar Rapids, Iowa.

ESTIMATING DESIGN FLOOD DISCHARGES FOR IOWA USING DRAINAGE-BASIN AND CHANNEL-GEOMETRY CHARACTERISTICS (IA 89-064)



PERIOD OF PROJECT: 1990-92

PROJECT CHIEF: D.A. Eash

STUDY AREA: Statewide

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

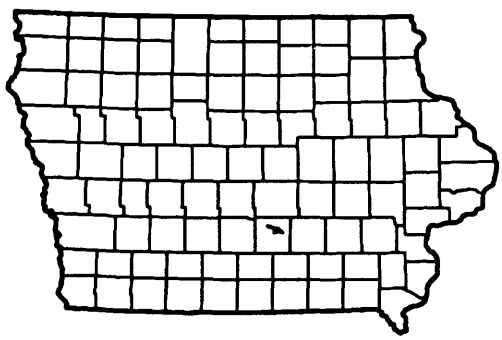
NEED FOR STUDY: Knowledge of the magnitude and frequency of floods is essential for the economical planning and safe design of bridges, culverts, levees, and for other structures located along streams in Iowa and for the efficient management of flood plains. Two problems are encountered using the current hydrologic regionalization method to estimate design flood discharges for Iowa. First, because regional borders are not well-defined lines, it is difficult to proportion flood estimates for basins located in more than one hydrologic region. Second, because hydrologic regions contain basins with anomalous physiographies, it is difficult to reclassify or to proportion the regional flood estimates.

OBJECTIVES: To further characterize the flood potential for Iowa streams using two flood-estimation methods that are independent of hydrologic regionalization. Specific objectives include: (1) Develop a single set of equations for Iowa that relate measurable basin characteristics to flood discharges of 2-, 5-, 10-, 25-, 50-, and 100-year frequencies; (2) develop a corroborative set of equations for Iowa that relate channel-geometry characteristics to flood discharges of the same frequencies; and (3) obtain an improved understanding of the effect of drainage-basin and stream-channel morphology on flood runoff in Iowa.

PROGRESS: Channel-geometry measurements have been collected, and sediment samples from 170 gaging stations in Iowa have been analyzed for percent silt-clay and median grain size. A geographic-information-system (GIS) procedure has been developed to quantify 29 drainage-basin characteristics. The GIS procedure uses ARC/INFO software to digitize basin-boundary coverages from 1:250,000-scale topographic maps, to create stream-network coverages from 1:100,000-scale digital line-graph data, and to create elevation-contour coverages from 1:250,000-scale digital-elevation model data. These three basin coverages, along with a long-term, mean annual precipitation coverage and a 2-year, 24-hour precipitation coverage, are processed using software developed by the Iowa District to quantify the 29 basin characteristics. Comparison measurements indicate that the quantification software developed by the Iowa District provides reliable results, and that 10 of 11 key basin characteristics quantified using the GIS procedure are within 10 percent of manual measurements made from the same scale of topographic maps. Basin slope appears to be consistently undermeasured due to limitations inherent in the GSI procedure. Approximately 100 of the 165 basins to

be used in the basin-characteristics data set have been processed using the GIS procedure. Flood-frequency analyses for the gaging stations being used in the study have been updated through the 1990 water year. A report presenting flood-frequency equations and summary results is planned as a U.S. Geological Survey Water-Resources Investigations Report.

ANALYSIS OF THE GROUND-WATER FLOW SYSTEM, GEOCHEMISTRY, AND UNDERSEEPAGE IN THE VICINITY OF THE RED ROCK DAM NEAR PELLA, IOWA (IA 89-065)



PEROID OF PROJECT: 1989-91

PROJECT CHIEF: K.J. Lucey

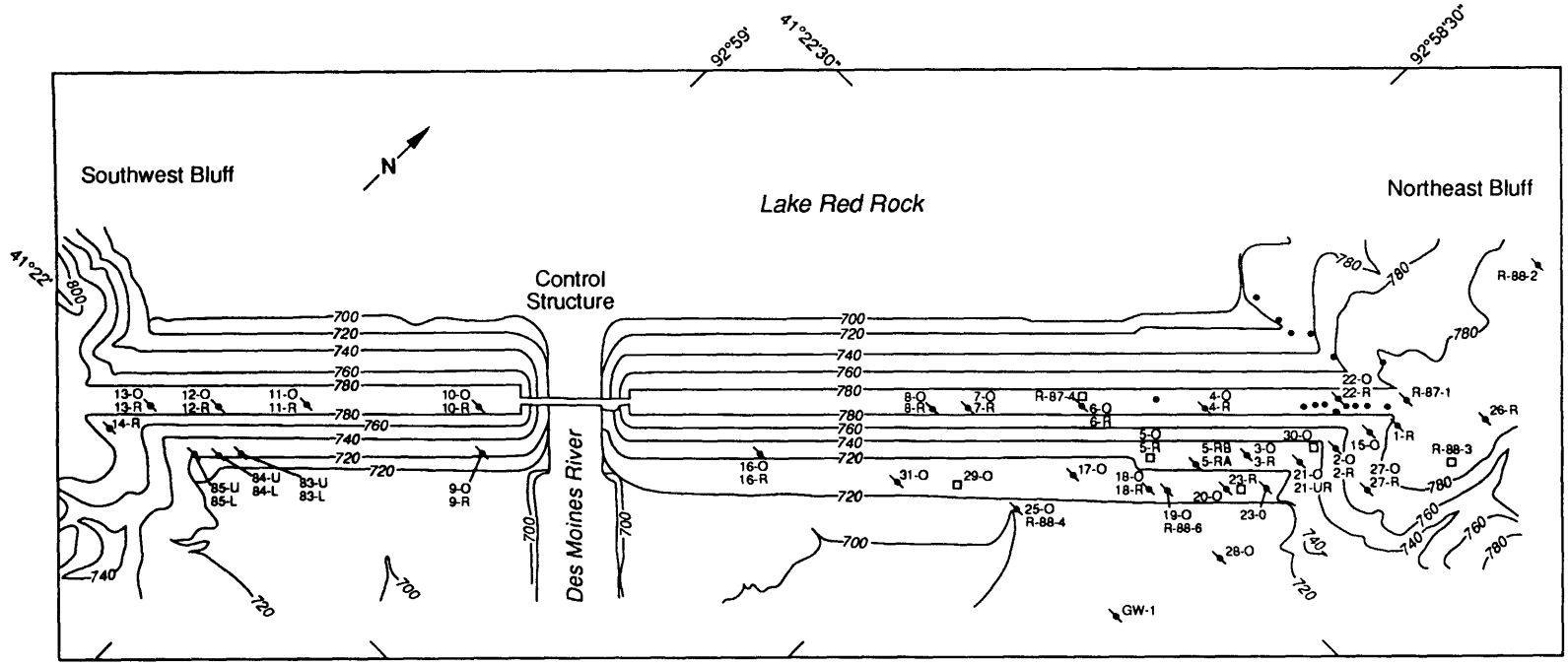
STUDY AREA: Marion County

COOPERATING AGENCY: U.S. Army Corps of Engineers.

NEED FOR STUDY: Since the completion of the Red Rock Dam on the Des Moines River in 1969, the U.S. Army Corps of Engineers has been collecting geologic and hydrologic data to monitor underseepage conditions. The bedrock foundation of the dam in the river valley is highly fractured and weathered from dissolution of a basal gypsum zone. Seepage of reservoir water could cause dissolution of the gypsum in the bedrock and threaten the integrity of the earthen structure.

OBJECTIVES: The objectives of this project are to: (1) evaluate the ground-water flow system, geochemistry, and underseepage conditions; (2) determine the flow path of any seepage; and (3) address the potential for dissolution of gypsum from the bedrock foundation.

PROGRESS: An interpretive report, "Analysis of the Ground-Water Flow System, Geochemistry, and Underseepage in the Vicinity of the Red Rock Dam near Pella, Iowa," has been published as U.S. Geological Survey Water-Resources Investigation Report 91-4092 (Lucey, 1991). The report provides an interpretation of hydrologic data collected by the U.S. Army Corps of Engineers and the U.S. Geological Survey from 70 ground-water monitoring wells at the dam site (fig. 12). Chloride-concentration data indicate a hydraulic connection between the reservoir and the ground-water system on the northeast side of the dam. Underseepage occurs through the basal evaporite zone of the St. Louis Limestone and through glacial sand in the northeast bluff.



EXPLANATION

—720— TOPOGRAPHIC CONTOUR--Shows elevation of land surface, in feet above sea level. Contour interval 20 feet

14-R OBSERVATION WELL--Number is from U.S. Army Corps of Engineers well-identification system. Letter refers to unit monitored:

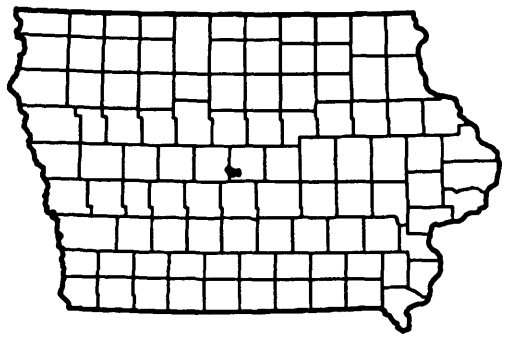
G-; -O	OVERBURDEN
R-88-2; R-88-3	PENNSYLVANIAN BEDROCK (SHALE)
U; -U; -UR	UPPER BEDROCK, ST. LOUIS LIMESTONE
-L; R-; -R; RA; -RB	LOWER BEDROCK, ST. LOUIS LIMESTONE

29-O WATER-QUALITY WELL--Observation well sampled for water-quality constituents; number is from U.S. Army Corps of Engineers well-identification system and letter refers to unit monitored and listed above

• EXPLORATORY BORING

Figure 12. Red Rock Dam site with observation wells near Pella, Iowa.

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: Parts of 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, atrazine, alachlor, 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 in cooperation 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 (fig. 13) 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 tileflow to the major flow processes.

PROGRESS: A brief workplan, with a schedule of activities was prepared. In conjunction with ARS, 65 ground-water wells, 3 surface-water gaging and sampling stations, and 1 surface-water-tileflow gaging and sampling station were installed. Since March 1991, wells have been monitored biweekly and sampled monthly, and surface water and precipitation have been monitored continuously. Approximately 590 water-quality and 350 sediment samples have been collected at surface-water stations. The ARS and AES have monitored and sampled tileflow and meteorological and agricultural contributions, and have worked on field studies. The following coverages were developed for a geographic information system of the watershed: (1) topography, (2) surface drainage, (3) transportation, (4) study sites, and (5) basin and municipal boundaries. A number of ground-water and rainfall samples were collected for oxygen-isotope analyses to help determine the origins of subsurface flow.

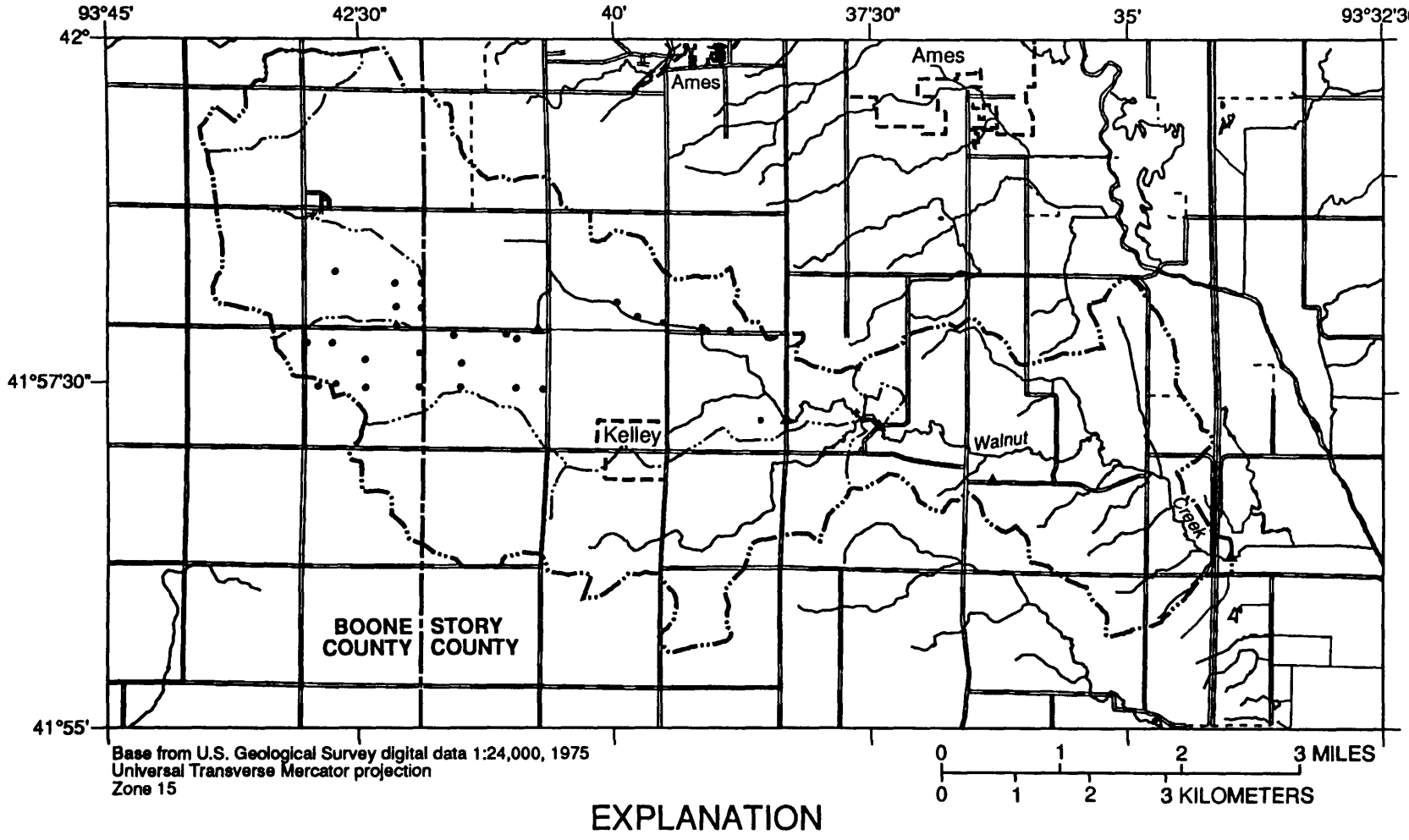
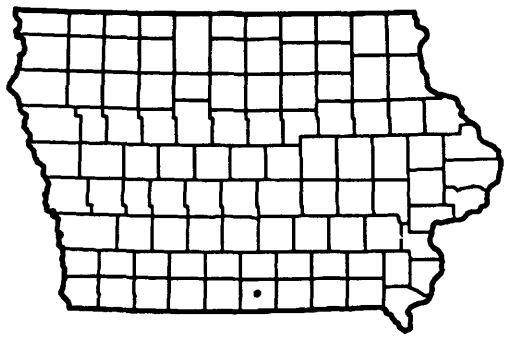


Figure 13. Walnut Creek watershed in parts of Boone and Story Counties near Ames, Iowa.

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



PERIOD OF PROJECT: 1991-92

PROJECT CHIEF: S.J. Kalkhoff

STUDY AREA: Wayne County

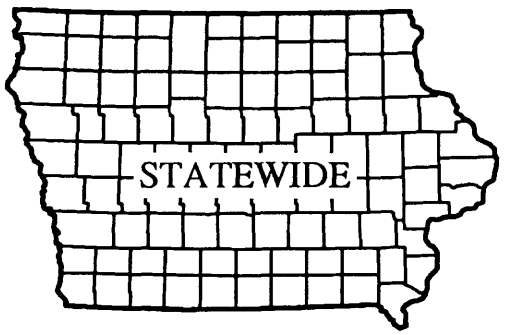
COOPERATING AGENCY: Iowa Department of Natural Resources (Geological Survey Bureau).

NEED FOR STUDY: Previous analyses of water samples 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 Federal, State, and local agencies (U.S. Environmental Protection Agency; U.S. Department of Agriculture's Soil Conservation Service and Agricultural Stabilization and 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 the landowners in the Corydon Reservoir watershed to modify their agricultural practices and to implement conservation practices. This is intended to reduce the input of nitrates, 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: An initial areal reservoir survey was completed in September 1990 to assess the variability of the water quality in the reservoir and to select representative sites for monthly sampling. The three sites selected have been sampled monthly for concentrations of nutrients, selected herbicides, total solids, bacteria, and chlorophyll. The reservoir level is recorded continuously to determine the reservoir storage and discharge from the watershed. Precipitation quality and quantity are being determined to document atmospheric input of herbicides into the watershed.

OCCURRENCE AND FLUX OF INERT PESTICIDE INGREDIENTS IN SHALLOW GROUND WATER (IA 91-069)



PERIOD OF PROJECT: 1991-92

PROJECT CHIEF: R.C. Buchmiller

STUDY AREA: Statewide

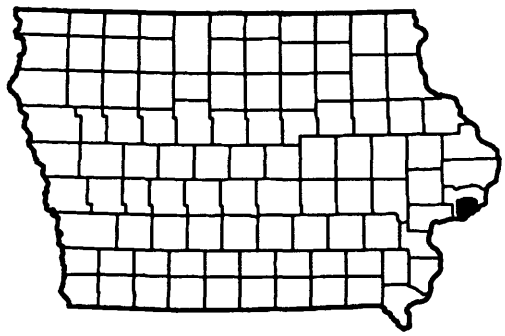
COOPERATING AGENCY: University of Iowa Hygienic Laboratory.

NEED FOR STUDY: Many of the pesticide ingredients used extensively in the corn- and soybean-growing areas of the Midwest contain ingredients referred to on product labels as inert ingredients. Testing of raw product formulations has determined that the inert ingredients may contain chemicals such as volatile organic chemicals. Many volatile organic chemicals are regulated under provisions of the Safe Drinking Water Act. Therefore, there is a need to determine the effects of volatile organic compounds contained in pesticide formulations on ground-water quality.

OBJECTIVES: The primary objectives of this project are to determine if significant quantities of volatile organic compounds are present in pesticide formulations that are being applied to Iowa corn and soybean fields and to determine if these chemicals are entering the ground-water system beneath the fields. Samples of pesticide formulations will be obtained for analysis of volatile organic compounds. Field samples from areas where monitoring equipment is in place will be obtained prior to application and after application for analysis to compare with results from the product sampling. Sites that have detectable concentrations of volatile organic compounds will be studied in greater detail.

PROGRESS: Four sites were selected for collection of field samples: Deer Creek in Clayton County; the Nashua till site in Floyd County; and the Ames till site and Walnut Creek in Story County. More than 300 samples were collected from the sites prior to application and at selected dates after application. Samples of the product formulations that were applied to the sites were obtained. Several volatile organic compounds were found in the product formulations in percent amounts. Small concentrations of several volatile organic compounds were detected in field samples both before and after application. Plans for modifying the field-sampling procedure during 1992 are underway.

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



PERIOD OF PROJECT: 1991-94

PROJECT CHIEF: K.J. Lucey

STUDY AREA: Scott County

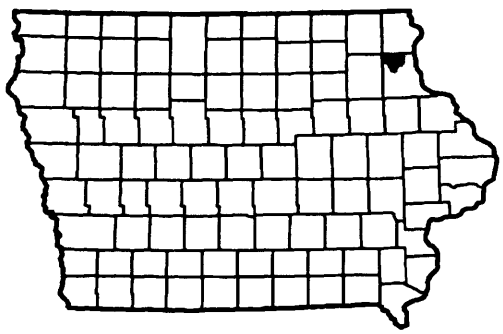
COOPERATING AGENCY: City of Davenport

NEED FOR STUDY: Cumulative constituent loads associated with urban runoff can have significant 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 storm-water 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 permit application for discharges from municipal storm-sewer systems.

OBJECTIVE: The objective of the study is to characterize the quantity and the quality of storm water in streams and channels draining five areas of specific land uses. The data will be used to determine mean concentrations and loads of selected constituents in storm-water discharges for the city of Davenport for each period of runoff.

PROGRESS: Geographic-information-system (GIS) coverages for land-use data, outfall locations, outfall drainage areas, storm-sewer network, roads, topographic contours, and streams were compiled. The coverages can be used to determine the percentages of various land-use types contributing to a drainage area. Existing hydrologic data for the streams receiving urban runoff were compiled. Five monitoring sites were selected that will characterize urban runoff from the various land uses. A surface-water gaging station and a precipitation collector will be installed and maintained for a 2-year period to gather data from three storms at each site. Water-quality sampling will be done during the first 3 hours of each storm.

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: S.J. Kalkhoff

STUDY AREA: Clayton County

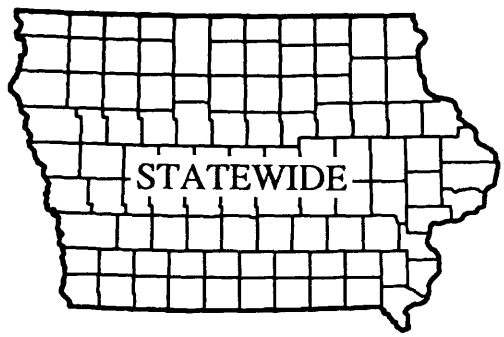
COOPERATING AGENCY: Iowa Department of Natural Resources (Geological Survey Bureau).

NEED FOR STUDY: Stream sediment continues to be a major problem in rivers and streams throughout the corn- and soybean-growing region of the midcontinental 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 best-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, monitoring of the changes in stream sediment is needed.

OBJECTIVES: The principal 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 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 project began October 1991.

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.

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 that the U.S. Geological Survey (USGS) provide an assessment of regional scour susceptibility for bridges in Iowa.

OBJECTIVE: 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 field inspection, select between 8 and 15 sites to collect data for more detailed evaluations of scour susceptibility, and make scour analyses. The USGS will attempt also to collect measurements of scour during several high-flow events.

PROGRESS: The project began October 1991.

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