Iowa Water Science Center

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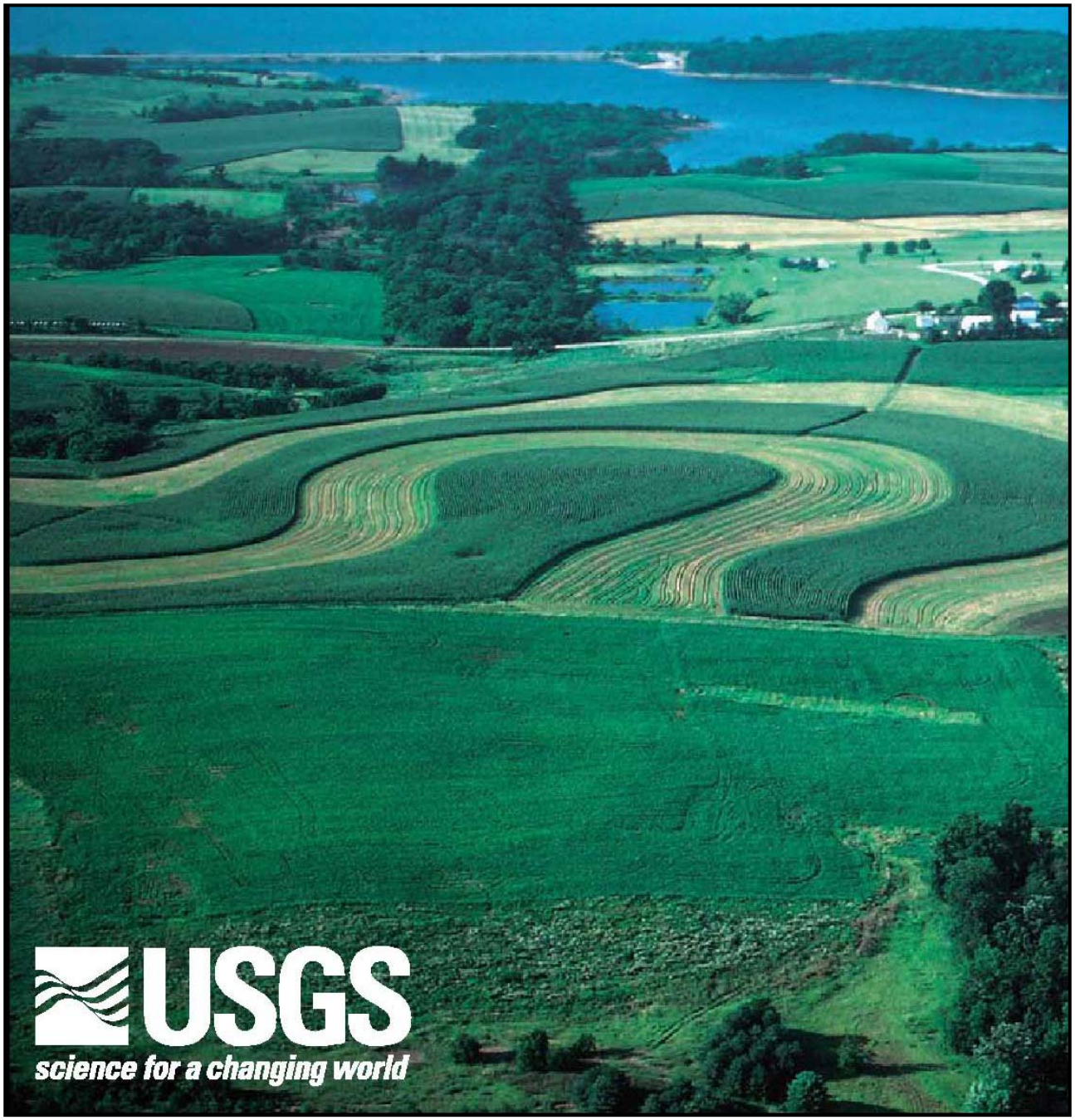
Center Science Plan



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Introduction

This Science Plan describes: (1) the U.S. Geological Survey (USGS), Iowa Water Science Center's view of the current priority water-resource issues in Iowa, (2) the Center's program related to these issues, and (3) the resources the Center needs to address these issues.

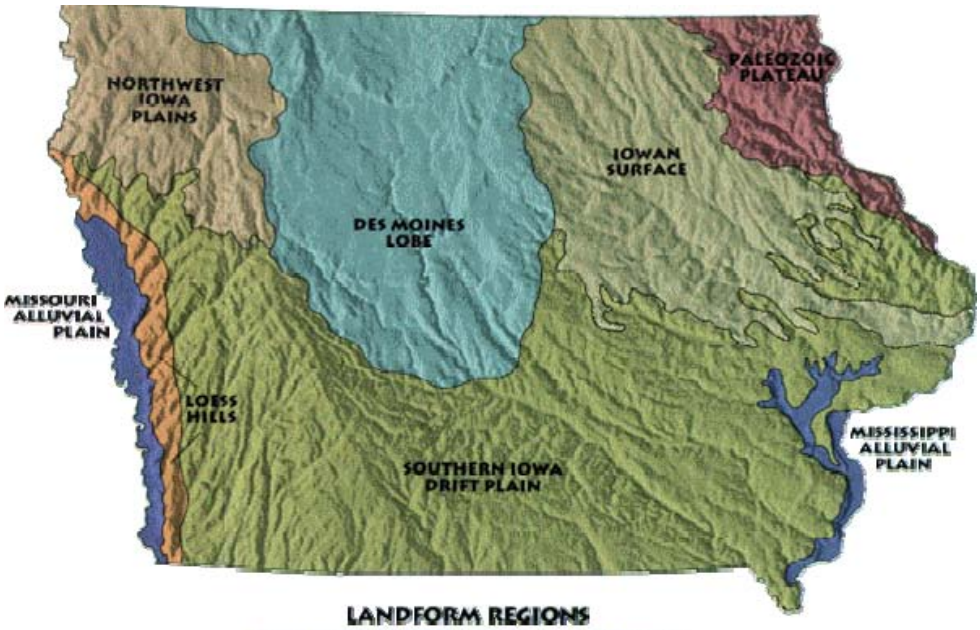
The plan presents the background information, vision, and specific goals for current and developing priority water-resource issues. Also included is an overview of the Center's future skill needs and implementation goals. This plan is intended to provide a framework for enhancing the scientific contribution of the Center to both national and local stakeholders and is viewed as a dynamic document subject to future amendments and revisions.

The plan is a revised version of the January 2006 plan. The January 2006 version was initially developed through the Center's Management Team, followed by an expanded and reformulated version resulting from several meetings of senior scientists within the Center, and discussed with input obtained from major Center program partners. This revision has been developed by the Center's senior scientists to reflect the latest water-resource issues.

Physical Setting

Iowa is located approximately equidistant from the east and west coasts of the United States. As such, it is often referred to locally as the Heartland or The Land Between Two Rivers. Iowa's geographical position results in wide variations in temperature and precipitation. In most years, there are an adequate number of frost-free days and sufficient natural precipitation to grow the primary agricultural crops of corn and soybeans throughout the State.

The landforms of Iowa have been characterized into eight primary regions. Each landform region includes a variety of glacially-derived materials mantling sedimentary bedrock of various ages. Although the differences may seem subtle compared to more dramatic differences between landforms in other states, each landform region has an effect on water resources and land use.



LANDFORM REGIONS AND SURFACE TOPOGRAPHY OF IOWA

The Northwest Iowa Plains region, covering approximately 7 percent of Iowa, was created by glaciers and is covered with loess. This land surface is gently rolling. It is the highest, driest, and most sparsely wooded landform region in the state. This region has a relatively uniform density of streams and a well-established natural drainage system. Common wetland and riparian ecological communities in the landform region include floodplain and stream-side woodlands.

The Des Moines Lobe region, covering approximately 22 percent of Iowa, was created by glacial activity that left the land surface quite level, except in a few areas called moraines, which have long ridges or bumpy terrain. There are relatively few large rivers in this landform region, and they tend to be deep and narrow because of their young age and rapid down cutting during previous swift glacial meltwaters. Much of the precipitation that falls on this region has historically drained slowly (due to little slope) over the land surface through swales, potholes, lakes, and streams. Nearly all of Iowa's natural lakes occur in this landform region.

The Iowan Surface region, covering approximately 17 percent of Iowa, is a low relief, stepped or multi-level surface. This landform region has a geologic history similar to the Northwest Iowa Plains. Before a period of accelerated erosion (16,500 to 21,000 years ago) and the Wisconsinan glacial advance into Iowa (12,000 to 14,000 years ago), this region was part of the Southern Iowa Drift Plain. The drainage networks in this landform region are well established, though stream gradients are low.

The Paleozoic Plateau region, covering approximately 4 percent of Iowa, was created by erosional processes exposing sedimentary bedrock such as limestone, dolomite, sandstone, and shale. Abundant rock outcrops, a near absence of glacial deposits, and many deep, narrow valleys create a striking contrast to the other seven landform regions in the state. Sinkholes are abundant in many areas, including beneath stream channels, providing an abrupt end to some streams. Springs and other sources of ground water provide nearly constant flow and temperature for coldwater streams, another drainage feature unique to this Iowa landform region.

The Mississippi Alluvial Plain region, covering approximately 1 percent of Iowa, was created by meltwater flow from glaciers over a period of hundreds of thousands of years. The Mississippi and other rivers established distinctive flat-floored corridors known as alluvial plains (floodplains). During periods of low streamflow, sandbars appear in stream channels. If not anchored by vegetation, sand and silt can be blown onto floodplains, terraces, and valley margins to create sand-dune habitats.

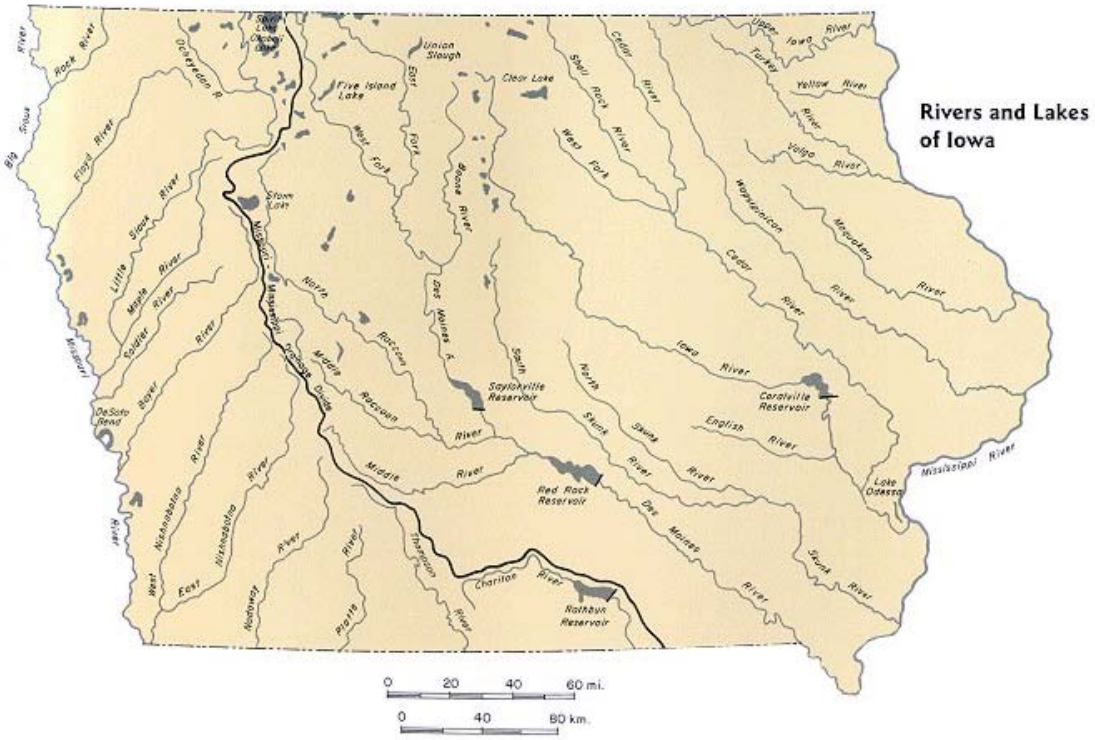
The Southern Iowa Drift Plain region, covering approximately 46 percent of Iowa, was created by a combination of several older glacial ice sheets, wind-deposited loess, and water erosion. In this older landscape, streams have had time to establish well-connected drainage systems that cut deeply into the land surface. Many finely-etched rills give way to ravines, then to creeks that flow part of the year, and eventually to perennial streams and rivers in major valleys. Glacial deposits in this region typically have a high clay content, which aids in building farm ponds and artificial lakes that have been constructed to slow soil erosion and provide sources of water supply.

The Loess Hills region, covering approximately 1 percent of Iowa, was created by strong winds which picked up silt deposited by melting glaciers, carried the material until the wind speed lessened, then dropped the material on top of glacially-deposited till. This silt was subsequently carved into unique hills by erosion. The result is a visually distinctive landscape of extremely narrow, crooked ridge tops, steep sideslopes, and narrow, small valleys. Streams and riparian areas are prone to accelerated erosion in and near stream channels.

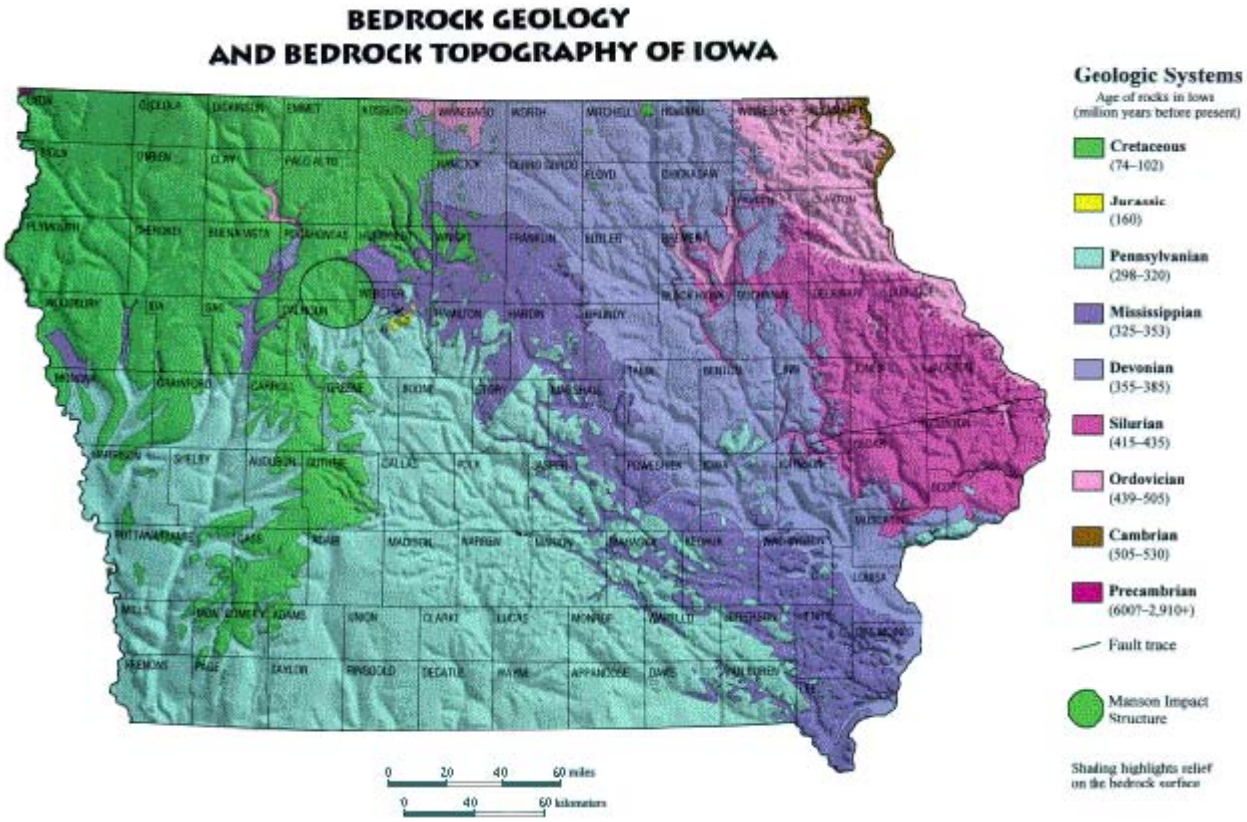
The Missouri Alluvial Plain region, covering approximately 2 percent of Iowa, was created by rivers carrying meltwater from glaciers over a period of hundreds of thousands of years. The Missouri and other rivers established distinctive flat-floored corridors known as alluvial plains (floodplains). The level of the rivers and surrounding ground water has been lowered as the rivers have been confined to a straightened channel, causing them to erode more deeply rather than meander horizontally. As the channel cuts down, it pulls the water table with it, and adjacent wetlands are left high and dry.

All streamflow from Iowa eventually discharges to the Gulf of Mexico. The Missouri River and Mississippi River that border Iowa on the west and east, respectively, are affected by flow-control structures, primarily to support commercial navigation. Some of Iowa's interior streams originate as small tributaries in southern Minnesota and some small rivers in southern Iowa flow south into Missouri before joining either the Missouri or Mississippi Rivers.

Iowa's river system is a complex hierarchy of streams ranging from small rills on hillslopes to the broad expanses of the Mississippi and Missouri Rivers on the state's eastern and western borders. These streams connect to form a drainage network across the state's landscape. The many stream valleys consist of two basic components: floodplains and terraces. The floodplain is the lowest part of the valley, and consists of the modern stream channel and that part of the valley floor covered with water when the river is at flood stage. Terraces are relatively flat remnants of former floodplains now elevated along the valley because the river downcut (eroded) to lower levels.



Iowa has a variety of ground-water resources available throughout the State. Alluvial aquifers adjacent to many mid- to large-size rivers are important surficial aquifers. In other areas, bedrock aquifers of various age are used where naturally occurring water quality is sufficient to meet the intended use. In some areas of southern and western Iowa, adequate local supplies of good quality ground water are difficult to obtain. Chemicals that are not naturally occurring, particularly where surficial and bedrock aquifers are close to the land surface, have affected ground-water quality.



Social, Political, and Economic Setting

In the 1800s, Iowans reworked the face of their new state with a speed and to an extent perhaps unparalleled in human history. At the beginning of the century, native prairie covered three-quarters of this "land between two rivers." Pothole marshes dotted the flatter north-central part of the state, while a network of streams drained the rolling hills elsewhere across Iowa. Dense forests filled some valleys in the east and groves of bur oaks formed savannas on nearby uplands. Thousands of Native Americans lived on the land, harvesting wild plants and animals, growing crops, and occasionally managing the vegetation with fire. By 1900, however, Euro-American settlers had claimed nearly all of Iowa's 36 million acres as farmland.

Euro-American settlement officially began on June 1, 1833, when pioneers first were allowed to claim new land in the 6-million-acre Black Hawk Purchase along the west side of the Mississippi River. By 1846, when Iowa became a state, census records listed 96,088 people. The population doubled to 192,914 by 1850 and topped one million before 1870. In 1900, Iowa had 2.2 million people, compared to 2.9 million people today. In 1900, most lived on the state's 200,000 farms, working land where 95 percent of the prairie, two-thirds of the woodlands, and most of the wetlands had been converted to agriculture.

To understand the priority water-resource issues in Iowa and why they are priorities, especially when compared to issues in other states, it is necessary to understand the social, political, and economic setting in Iowa. Iowa’s soil, and its ability to grow abundant crops, is arguably Iowa’s greatest resource. Over 95 percent of Iowa’s 55,986 square miles is in private ownership. Over 90 percent of the State is used for agricultural purposes. Recent statistics show Iowa to rank first in the nation in the production of corn, soybeans, and swine; third in expenditures for fertilizer and agricultural chemicals; and seventh in cattle production.

Population growth within the State of Iowa has been relatively slow. Some urban areas have high rates of growth, but other areas, such as small rural communities, are declining in population. The number of individual farms in Iowa is declining while the average size of farms is increasing. Because of Iowa’s relatively slow total population growth, estimated to grow only 3 to 6% in the next 20 years, Iowa has lost seats in Congress after each census in the last 30 years. Iowa also has one of the oldest per-capita populations in the country. Two-thirds of the land is owned by persons over 55; those over 74 own 20%.

Much of Iowa’s economy is based on agriculture and related service, support, and post-harvest processing industries. Changes in commodity supply and demand or policies that affect commodities therefore can have large impacts throughout the State. Agriculture, as the main industry and land use, has a significant influence on water resources.

Because of the predominance of agricultural land use and private ownership, Iowa has few public-land management water-resources issues, particularly in the federal sector. There is only a small representation of Department of Interior agencies in Iowa. The general abundance of both ground water and surface water coupled with the relatively slow population growth has not created high priority water-quantity issues. Water-quality issues are typically related to human health and safety, particularly as defined by federal regulations.

Priority Water-Resource Science Issues in Iowa

The Center plans to develop long-term program over the next five years that will primarily be focused on understanding the effects on water quantity and quality of Iowa's predominantly agricultural intensively-managed landscapes. The program elements will primarily be the determinations of status and trends in water quantity and quality as well as the relationship of water quantity and quality to the changes occurring in modern agricultural practices. The core program activities of the Center will continue to be within the following five broad categories:

- Collection of hydrologic data
- Water-resources investigations and assessments
- Basic and problem-oriented hydrologic research
- Acquisition of information for analysis of landscape effects on water resources
- Scientific and technical assistance in hydrologic studies

The Center's present and future research and programs will be focused on identifying and assessing the effects of landscape changes, particularly due to agriculture, on water resources in Iowa. Specifically, the Center will be developing a science-based program that assesses the occurrence and distribution of sediment, nutrients, pesticides, and emerging contaminants in collaboration and partnership with other Federal, State, and local agencies. The Center is uniquely positioned, with the ongoing NAWQA and statewide surface and ground-water monitoring projects, to partner with the Iowa Department of Natural Resources and other agencies in addressing a large scale analysis of the current status and trends in water quantity and quality of the State. The following are five specific priority water-resource issues utilizing both data-mining and new data collection efforts to determine these status and trends:

I. Trends in Surface-Water Quantity - surface-water quantity assessments to determine if and where changes in flow are occurring and whether these changes can be related to changes in landscape management practices and/or climate. This topic includes developing methods to model streamflow or estimate streamflow in ungaged watersheds. Assessments would include the effects of surface-water change on the availability and sustainability of water supplies.

II. Changes in Surface-Water Quality - surface-water quality assessments focusing on sediment, nutrients, and pesticides and whether these changes can be related to changes in landscape management practices. Surface-water quality assessments include modeling to help establish chemical loadings permissible to achieve surface water-quality classifications, quality of water for public supplies and the associated effects on human health, and the impacts of water-quality changes on flora and fauna.

III. Trends in Ground-Water Levels - ground-water quantity assessments investigating the changes in ground-water levels and water use. Assessments include the use of index wells for determining the long-term trends of aquifer system water levels and modeling of ground-water flow systems in selected areas to determine the sustainability of water supplies under future development scenarios.

IV. Changes in Ground-Water Quality - ground-water quality assessments of the changes in water chemistry due to effects of natural and anthropogenic activities. Specifically, the changes in ground-water quality as affected by changes in landscape management practices including confined animal feeding operations, land disposal of manure, and chemical application to crops.

V. Emerging Contaminants in Surface and Ground Water - Research on a diverse agenda of topics aimed at providing new knowledge and insights into varied and complex hydrologic processes that are not presently well understood. The emphasis of these research activities changes through time; reflecting the emergence of promising new areas of inquiry and the demand for new tools and techniques with which to address water-resources issues.

I. Trends in Surface-Water Quantity

Background—Agricultural land use as been a part of Iowa's landscape for over 150 years and the long-term impacts of this land use have greatly altered the surface-water drainage patterns across the State. In the landscape transformation process, the recharge and discharge character of the land, where water once had soaked into the ground and slowly discharged, has been altered. The early farmers' artificial drainage ditches began to expand, forming water courses that grew and eroded with more runoff. New tile lines diverted more water to the channels. Dredges straightened rivers to further speed the water away. In place of a flat landscape with numerous wetland areas, there developed a system of ditches, creeks, streams, and rivers. Instead of seeping gradually into the land and forming water tables close to the land surface, the excess water was sent downstream through a new network of drainage tiles and surface connections. On the more rolling land, thousands of miles of rivers and streams developed over thousands of years, as water found its way gradually downstream. If those sometimes-meandering rivers ran where people wanted to put farm fields or highways or other structures, engineers frequently used machines to straighten, channelize, or stabilize the waterways. The process started in the late 1800s but reached its peak in the early 1900s, as heavy equipment became more available. By some estimates, Iowa lost more than 3,000 miles of streams to channelization before government restrictions curtailed the practice. Iowa has lost 90 percent of its original 4.5 million acres of wetlands, especially in the north-central prairie pothole region, which became world-class cropland. Iowa has dredged and ditched rivers and adjoining sloughs and lowlands. Iowa has laid about 800,000 miles of drainage tile; the amount of tile laid is seven times the length of the State's road system.

The current and likely future change in landscape management practices due to changes in the federal Farm Bill and some urbanization may greatly affect the drainage patterns, timing, and amount of surface-water discharge, flood frequency, and surface-water supply. Recognition of the deleterious effects of excessive runoff is slowly changing the management of runoff in Iowa. Changes in urban stormwater management and agricultural drainage systems may begin to affect stream hydrology.

Vision—The Center, in developing partnerships with the Iowa Department of Natural Resources, the Iowa Department of Transportation, the U.S. Army Corps of Engineers, and other stakeholders, will focus on how changes in landscape management practices (e.g. agricultural and urbanization) affect the short-term and long-term timing and quantity of surface-water flow.

Specific Goals— The Center will address this priority water-resource issue in Iowa by the following actions:

A. Revise the streamflow quantity monitoring program to provide a better ability to quantify the amount of flow leaving the State to its border rivers.

B. Work with stakeholders to determine changes in surface-water quantity in selected watersheds where landscape management practices are altered to determine their effect on changing streamflow quantity.

C. Implement a Web-based mapping and statistics program (StreamStats) to provide streamflow estimation and basin characteristics at user selected locations

D. Document the temporal streamflow trends in Iowa with streamflow statistics; including the effects of climate and landscape management change.

II. Changes in Surface-Water Quality

Background—Water quality in Iowa is and has been adversely impacted by a combination of point and nonpoint sources. Although many different land uses contribute contaminants to Iowa's waters, agriculture is a major contributor of sediment, nutrients, bacteria, and other contaminants because of the overwhelming amount of land devoted to agricultural production (over 90%). Iowa's landscape is among the most altered by man of any of the States, and Iowa has the greatest percentage of its land used for farming. Nitrogen and phosphorus use in Iowa has remained relatively constant for the past 15 years. During the same period, crop yields have increased significantly showing that gains have been made in production efficiency. However, during the same period, the frequency of high concentrations of nitrate-N in Iowa's rivers and streams has increased and phosphorus levels remain high in Iowa's water. Observations of water quality across Iowa suggest that this problem is complex and solutions will require creativity across all sectors of the Iowa landscape, both rural and urban. There has been extensive information compiled on water-quality responses of specific agricultural management practices. These observations demonstrate that Iowa's farmers can improve water quality while maintaining, or perhaps even enhancing, average crop yields. For example, there is evidence that nitrogen rates applied to corn in a typical Iowa corn-soybean rotation system could be reduced without adverse impact on crop yield in an average year.

As changes in federal Farm Bill legislation are fully implemented with the Conservation Security Program that requires measurement of the environmental effects of landscape management practices, the quality of surface water may be affected. Additionally, recent changes in the energy industry have increased the demand and political desire for biofuels (ethanol and biodiesel). This has the potential to dramatically increase the production of crops for fuel in Iowa. This, in turn, may result in landscape changes (additional acres planted) and crop system management (introduction of alternative crops for fuels) that may affect water quality.

Vision—The Center, in developing partnerships with the Iowa Department of Natural Resources, the U.S. Environmental Protection Agency, and other stakeholders, will focus on how changes in agricultural management practices (land-use and application practices) affect the short-term and long-term quality of surface-water.

Specific Goals— The Center will address this priority water-resource issue in Iowa by the following actions:

A. Revise and implement a surface-water quality monitoring program that emphasizes the need to collect and document concentration and load data for selected contaminants discharging from hydrologic units across Iowa. This strategy may involve the use of real-time water-quality monitors and surrogate constituents to provide a cost-effective means of providing additional temporal and spatial data.

B. Work with stakeholders to determine changes in surface-water quality in selected watersheds where landscape management practices are changed.

C. Analyze and model water quality, as it is related to changes in landscape management practices, in priority watersheds for the development of Total Maximum Daily Load calculations for streams, rivers, and lakes.

D. Interpret and document the seasonal and annual trends in water-quality concentrations and loads as related to changes in landscape management practices.

III. Trends in Ground-Water Levels

Background—Iowa's ground-water resources include of four bedrock aquifer systems and a shallow surficial aquifer that consists of sand and gravel deposits that overlies the bedrock. Each of these four bedrock aquifer systems serves as a primary ground-water supply for some part of the state, or as a secondary option in some other areas. Public water supplies account for the second largest amount of water withdrawn in Iowa, the largest amount of water withdrawn is for power generation. Nearly 70 percent of the water used by public water supplies in Iowa comes from ground water. Including the rural population supplied by privately-owned wells, ground water provides nearly 80 percent of Iowans' drinking-water supplies.

Ground-water levels are affected by a number of factors including: pumping from nearby wells in larger urbanized areas, increased pumping of existing wells for public, industrial, and commercial uses, and climatic conditions. Both bedrock and surficial aquifers are affected by these factors although the surficial aquifer is more susceptible to drought.

Current activities that may impact ground-water levels and supplies in Iowa are increases in population in some urban areas and increased demand for commercial use of water due to the expanding confined animal feeding operations industry and ethanol production facilities. Ethanol production facilities are particularly noteworthy because it has been reported that these facilities require 3 gallons of water for every 1 gallon of ethanol produced. Construction of these facilities has often been in rural areas where large capacity ground-water supplies are not currently in place. Expansion of this industry may compete with municipal supplies in some areas where high capacity wells are not possible.

Vision—The Center, in developing partnerships with the Iowa Department of Natural Resources and local government agencies, will operate available and new monitoring and data analysis programs that focus on the future changes and trends in ground-water levels and supplies including well interference, increasing pumpage, and climate change.

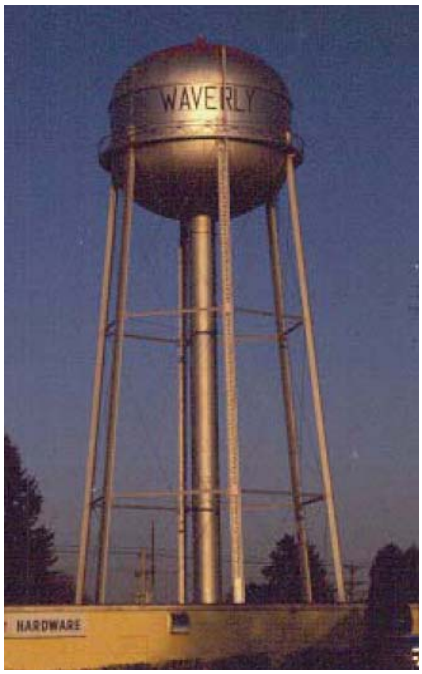
Specific Goals—The Center will address this priority water-resource issue in Iowa by the following actions:

A. Revise and implement a ground-water monitoring program specifically designed for determination of changes in ground-water levels in all major aquifers under static or ambient conditions through the use of indicator wells. Increase the use of continuous water-level monitoring technology and Internet availability of data.

B. Determine ground-water supply sustainability for specific areas and future water-supply needs as identified by changing water use.

C. Interpret and document the trends in water levels for Iowa's aquifer systems; including the effect of climate, landscape management practices, and water use.

IV. Changes in Ground-Water Quality



Background—The USGS, in partnership with the Iowa Geological Survey and the University Hygienic Laboratory, started a program in 1982 to sample between 150 and 200 wells annually for water-quality. These analyses included minerals such as calcium, magnesium, bicarbonate, sulfate, iron, and manganese; the more common nutrients such as nitrate; and radioactive compounds such as radium. As various ground-water investigations began to show the presence of agricultural and other contaminants in "vulnerable" aquifers, the program emphasis shifted towards shallow aquifers, with more nutrients, pesticides, and synthetic organic chemicals added to the list of analytes. Environmental parameters such as organic carbon and dissolved oxygen also joined the list. The number of wells sampled per year has varied throughout the term of the program. Results from this cooperative monitoring network are a key part of the State's knowledge about the state's ground-water quality. The information is used by resource managers to assess the natural and anthropogenic-affected water quality of Iowa's major aquifers to determine whether the quality will support the various intended uses.

On-going factors that may affect ground-water quality in Iowa include: continuous evolution of pesticide products used for crop production, changes in landscape management as a result of new agricultural industry opportunities (i.e. biofuels), and human and animal waste disposal systems in rural areas not served by advanced treatment processes.

Vision—The Center, in developing partnerships with the Iowa Department of Natural Resources, local government agencies, and other stakeholders, will operate available and new monitoring and data analysis programs that focuses on changes and trends in ground-water quality.

Specific Goals—The Center will address this priority water-resource issue in Iowa by the following actions:

A. Revise and implement a ground-water monitoring program specifically designed for the analysis of long-term changes and trends in ambient ground-water quality for the major aquifers in Iowa.

B. Interpret and document the trends in water quality for major aquifers as related to climate, water use, and landscape management practices.

V. Emerging Contaminants in Surface and Ground Water

Waste samples collected from a swine manure holding pond in Iowa for a study of veterinary antibiotics in the environment

Background—Activities of man have introduced contaminants into the environment at least since civilization began. Monitoring to detect contaminants has occurred for many years, starting with natural constituents that had significant health and environmental effects and that were easiest to measure. Other chemicals have been added to the list of potential contaminants as they have been developed and used. In other cases, some chemicals that have long been used and present in the environment have become more important due to other stresses in the hydrologic system. Emerging contaminants are ones that can be broadly defined as any synthetic or naturally occurring chemical or any microorganism that is not commonly monitored in the environment but has the potential to enter the environment and cause known or suspected adverse ecological and(or) human health effects. In some cases, release of emerging chemical or microbial contaminants to the environment has likely occurred for a long time, but may not have been recognized until new detection methods were developed. In other cases, synthesis of new chemicals or changes in use and disposal of existing chemicals can create new sources of emerging contaminants. New pesticides and degradation products, pharmaceuticals, household products, and toxins are of highest priority in Iowa and nationally because of increased interest and development of new laboratory methods for their detection in environmental samples by the USGS.

The Center is a national leader in the design and implementation of studies to determine the presence and transport of emerging contaminants in aquatic systems. These efforts have been funded primarily by the USGS' Toxic Substances Hydrology Program with additional support from the U.S. Environmental Protection Agency. As the methodology for determining the presence of emerging contaminants in the environment has been documented and approved, several Iowa projects have begun to utilize these methods as part of their data-collection scheme. These include the monitoring of statewide ground-water quality for the Iowa Department of Natural Resources and the study of ground- and surface-water interaction for the City of Cedar Rapids.

Vision— The Center, in partnership with the USGS Toxics Program, Iowa Department of Natural Resources, and other stakeholders, will design new monitoring and data analysis programs that focus on the future contaminants in ground- and surface-water from both agricultural and non-agricultural sources.

Specific Goals—The Center will address this priority water-resource issue in Iowa by the following actions:

A. Revise and implement a water-quality monitoring program specifically designed to include emerging contaminants among its constituents in surface- and ground-water samples.

B. Develop a program that analyzes the frequency of detection and distribution of emerging contaminants.

Future Skill Needs and Implementation Goals

Future skills needed to meet anticipated program can largely be acquired through training and by new hires. As retirements or transfers out of the Center occur, skill acquisition from new hires should be closely linked to the emerging program direction. Specifically, the following is a list of the staff technical skills that will be needed to address the science vision for the Center for each of the identified priority water-resource issues based upon the gap between the current and future workforce profiles:

Workforce Characteristics and Flexibility

- New hires through internships or student appointments to bring in recently and highly educated talent for both the Data and Studies Section; utilize community colleges and large universities, depending on position skill requirements
- Make use of student internships and future hires in agricultural-related fields from Iowa State University to develop relationships with the University's agricultural-program faculty members, research programs, and agencies on or near campus; new hires would likely be those from degree programs with environmental and agricultural backgrounds
- Utilize the higher graded hydrologists within the Studies Section to focus on the interpretive and report aspects of the priority water-resource issues
- Develop a media and public-relations specialist that focuses on highlighting the work and products of the Science Center; position would likely be part-time with the major emphasis during the field season on televised media coverage
- Cross train staff so that they have multiple skills and abilities to provide backup capabilities and career development opportunities
- Increase collaboration between the Data and Studies Sections by involving both Sections in work on the priority water-resource issues for the Science Center
- Start new Studies Section employees in field activities to understand and learn data-collection concepts as well as develop an understanding of the data collection process before moving into analysis or interpretation of data
- All Data and Studies Section personnel should be field capable for emergency situations, such as floods, so that all staff can be assigned to data collection crews if necessary
- Increase the number of advance-degreed employees through new hires and training

Location of Staff

- Primary location of Science Center staff will be at the Science Center location in Iowa City, Iowa in close proximity to a large University
- Western Field Unit staff to be located in Council Bluffs, Iowa to effectively meet the needs of the priority water-resource issues related to the Missouri River and in Ft. Dodge, Iowa to meet the needs of the NAWQA high intensity phase Agricultural Chemical Transport topical study.
- Sediment laboratory located within the Science Center office in Iowa City, Iowa

Technical Skills (related to Priority Issues I-V)

- Surface water modeler (I,II,)
- Water Quality modeler (II,IV,V)
- Ground Water modeler (III)
- Geomorphologist (I,II)
- Sedimentologist (I,II)
- Geostatistian (I,II,III,IV,V)
- Hydrologic technicians for field collection of field data (I,II,III,IV,V)

The priority water-resources issues within this Science Plan include NAWQA-related activities, the development of the state-wide water quality data monitoring and assessment, and surface-water and ground-water hydrology and hydraulics modeling to address the effects of landscape management practice changes.

Cooperator/partner program needs

- Integrated science between Water, Biology, Geology, and Geography disciplines, particularly for measuring the effects of landscape management practices on water resources
- Flood and streamflow statistics; including the estimation of flow in ungaged watersheds
- State of the science technology and leadership in hydroacoustics and hydrographic surveying
- Electronic and real-time access to water-quantity and water-quality data
- Non-advocacy science excellence for the water-resources information

Long-range business plans

- Successful transition thru the NAWQA HIP ACT topical study; working closely with the USDA ARS on the South Fork Iowa River to develop a program to measure the effects of landscape management practices on water resources
- Succession strategy to replace technical, administrative, and management personnel who will be retiring over the next 5 to 10 years.
- Expand program opportunities that focus the program on the relationship between landscape management practices effects on water resources in Iowa
- Develop an outreach program that concentrates on promoting the capabilities, services, and products of the Science Center through mass media including the Internet and Congressional contacts

Influx of new technology and equipment

- Ensure that the current workforce is provided the opportunity to acquire skills/knowledge necessary for utilizing new technology and equipment
- Continue the purchase of hydroacoustics, dataloggers, and water-quality multi-parameter equipment to increase capabilities for remote and continuous monitoring of streamflow, ground-water levels, sediment transport, and water quality
- Lower the cost of data collection through increased use of new technology whenever and wherever possible
- Develop skills and tools to mine available water-quantity and water-quality data for expansion of the status and trends assessments.

Specific Short-Term Goals for the Science Plan (0-2 years)

Program

- Maintain and expand the cooperator program to address the effects of landscape management practices on water resources by revising the surface-water quality network with the Iowa Department of Natural Resources; use the Large Rivers project started in FY2004 to be the starting point for the network revision
- Continue to explore opportunities for deployment of real-time water-quality monitors that was initiated in FY2005 at selected streamgage locations and begin development of statistical regression correlations using surrogate parameters where possible
- Develop plans within the high-intensity phase of Eastern Iowa Basins NAWQA ACT program for a close coordination with USDA-Agricultural Research Service, the Iowa Department of Agriculture and Land Stewardship, and Iowa State University to begin an effort of addressing the effects of current landscape management practices on water quality within the South Fork of the Iowa River basin.
- As a joint venture with the Iowa Department of Natural Resources, begin developing program partnerships with the Iowa Department of Agriculture and Land Stewardship, the Leopold Center for Sustainable Agriculture (located at Iowa State University) and the Iowa State Water Resources Research Institute (located at Iowa State University) for future funding of the priority water-resource issue related activities.

Workforce

- Work closely with the Dean of Agricultural and Biosystems Engineering College at Iowa State University to establish a research collaboration program and USGS internship positions for agricultural water quality and management programs; internships would be for developing staff positions with knowledge and expertise in agriculturally-related sciences.
- Provide training to existing staff on the use of real-time water-quality monitors, statistical analysis of data, data-mining techniques, landscape management practice effects on water resources, sedimentology, and geomorphology.

Capabilities

- Continue with technology upgrades to the surface- and ground-water networks; continue with the goal of a “click free” data-collection process and Internet access to water resources data.

Specific Long-Term Goals for the Science Plan (3-5 years)

Program

- Lead the monitoring and evaluation efforts for evaluating the status and trends associated with water quality at the large watershed scale; particularly in regards to the effect of landscape management practices on water resources.
- Promote integrated science in Iowa by increasing collaboration with other science centers, National Research Program, Geography, Geology, and Biology Disciplines and Department of Interior agencies to address the effects of intensively-managed landscapes on water resources
- Develop projects that address physical, chemical, and biological processes and process controls related to key questions regarding the effect of landscape management using integrated approaches and effective diagnostic and prescriptive tools
- Establish a cooperative program with the Iowa Department of Agriculture and Land Stewardship to develop the state-wide large watershed water-quality assessment program with special emphasis on the effects of agriculture on water quality
- Cultivate a partnership program with USDA agencies (NRCS and ARS) to support efforts at data collection and assessment for the CEAP (Conservation Effects Assessment Program)
- Utilize information and findings from other Center's science activities and programs, such as RCRA, DODEC, and other specific-topic projects, to improve understanding of intensively-managed landscape effects on water resources

Workforce

- Ensure that the current workforce is provided the opportunity to acquire skills/knowledge necessary for utilizing new technology and equipment
- Develop skills, expertise, and technical knowledge in the following areas:
    - Landscape management practices and their effects on water resources
    - Hydraulics in respect to floods, droughts, channel morphology
    - Water-quality assessment and simulation modeling
    - Ground-water level and water-supply assessment
    - Sediment analysis, yield estimation, and assessment
    - Status and trends analysis
    - Drainage hydraulics and hydrology
    - Emerging issues research in regards to water quality from an intensively managed landscape
    - Statistics

Capabilities

- Develop surface-water and water-quality modeling capabilities to enhance the ability to simulate and predict water-resource responses to landscape management changes
- Continue the purchase of hydroacoustic, datalogger, and water-quality multi-parameter equipment to increase capabilities for remote and continuous monitoring of streamflow, water levels, sediment transport, and water quality
- Lower the cost of data collection through increased use of new technology whenever and wherever possible
- Develop skills and tools to mine available water-quantity and water-quality data for expansion of the status and trends analysis