

***ILLINOIS STATE WATER SURVEY***

**STRATEGIC PLAN**

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## BACKGROUND

Water always has been and will continue to be an essential natural resource in the development of Illinois and the nation. Ensuring the long-term availability of adequate supplies of clean water at a reasonable price is one of the greatest challenges facing Illinois and the nation. Clean drinking water is essential for human health, and large volumes of water are also needed for sanitation, agriculture, industry, power production, recreation, navigation, and countless other human activities. In addition, there is increasing recognition of the importance of maintaining surface waters to meet ecosystem needs.

Watersheds, aquifers, and ecosystems are recognized as units for resource management, complementing the more traditional political units, such as counties and municipalities. Still, water resource management in Illinois is conducted largely in a decentralized manner by a large number of private companies, municipalities, water authorities, and individuals.

Sound resource management practices must be based on many factors, including appropriate laws, regulations, and science. As concerns about water resources increase, new federal laws and regulations that impact Illinois are being formulated and implemented, and the possibility of new state water laws and management schemes in Illinois is being discussed.

The Illinois State Water Survey ([www.sws.uiuc.edu](http://www.sws.uiuc.edu)) provides sound scientific and engineering data that are a necessary foundation for making wise decisions related to water resource issues and other issues such as climate change, severe weather, and air quality. The Water Survey also provides scientific and engineering data to researchers and the public.

This strategic plan provides a guide for resource planning within the Water Survey and is a source of information for those outside the Water Survey who have an interest in the organization's current and future activities. As a strategic plan, it focuses on future direction and the changes needed to achieve specified goals. It does not include explicitly the continuation of the many base programs. Therefore, the plan cannot be used as a comprehensive basis for budgeting and performance evaluation. The action items identified in the plan are included in staff job descriptions and provide a basis for performance evaluation.

The Water Survey has a long history of conducting objective scientific research and providing products and services to the citizens of Illinois and the nation. Over time, the mission has changed in response to evolving needs and opportunities. It is anticipated that this flexibility and responsiveness will continue to be a hallmark of the Water Survey.

The Water Survey is headquartered on the campus of the University of Illinois in Urbana-Champaign, and additional facilities are located in Champaign at Willard Airport, Peoria, and Carbondale. The current staff of about 200 employees includes professional scientists and engineers, technical and support staff, and university students and hourly employees.

The Water Survey has four sister agencies in the Illinois Department of Natural Resources (IDNR): the Illinois Natural History Survey ([www.inhs.uiuc.edu](http://www.inhs.uiuc.edu)); the Illinois State Geological Survey ([www.isgs.uiuc.edu](http://www.isgs.uiuc.edu)); the Waste Management and Research Center ([www.wmrc.uiuc.edu](http://www.wmrc.uiuc.edu)); and the Illinois State Museum ([www.museum.state.il.us](http://www.museum.state.il.us)). These institutions provide Illinois with a level of scientific expertise and capabilities that is unique in the nation.

The Water Survey was founded in 1895 as a unit of the University of Illinois ([www.uiuc.edu](http://www.uiuc.edu)). Department of Chemistry. Its original mission was to survey the waters of Illinois to trace the spread of waterborne disease, particularly typhoid. From these early times, the Water Survey also addressed the health and safety of public water supplies, water and wastewater treatment, and the establishment of sanitary standards for drinking water.

In 1917, the Scientific Surveys were transferred to the Illinois Department of Registration and Education, to be administered at the University of Illinois. At this time, the Board of Natural Resources and Conservation (the Board) was formed to guide Survey activities. The Board, composed of eminent scientists and professionals, continues to govern the Surveys today.

Scientific activities at the Water Survey have expanded greatly over time to include the development of an electronic dropline for measuring water levels, well and aquifer testing, and assessments of the state's surface and groundwaters. In 1933, the Water Survey accepted primary responsibility for the operation of the U.S. Geological Survey's stream-gaging program in Illinois. Water Survey chemists cooperated with the University and the federal government during World War II in studies to detect chemical-warfare agents in water and develop methods for their removal. Meteorological efforts further expanded in the post-war years to include the use of radar to measure rainfall and to track severe storms. In 1953, Water Survey scientists were the first in the world to identify and photograph the radar image of the development, growth, and partial disintegration of a severe tornado. Today, radar is used worldwide to detect and track tornados.

In 1978, the Surveys were incorporated into the new Illinois Institute of Natural Resources, which became the Department of Energy and Natural Resources in 1981. The Hazardous Waste Research and Information Center was originally organized as part of the Water Survey in 1984, but three years later it was authorized as a separate entity (its name was changed to the Waste Management Research Center in 1996). In 1995, the Surveys became divisions in the Office of Scientific Research and Analysis in the IDNR ([www.dnr.state.il.us](http://www.dnr.state.il.us)).

The Water Survey is supported by a combination of an annual appropriation from the General Assembly and by grants and contracts, which are funded by a wide range of sponsors in Illinois and the nation. The grants and contracts are awarded to and managed through the Board of Trustees of the University of Illinois. The Water Survey is also an Affiliated Member of the University of Illinois at Urbana-Champaign.

## Mission

The mission of the Water Survey is based on a number of legal mandates and evolving priorities and is as follows:

**The Illinois State Water Survey is the primary agency in Illinois for research and information on surface water, groundwater, and the atmosphere. Its mission is to characterize and evaluate the quality, quantity, and use of these resources. The mission is achieved through basic and applied research; by collecting, analyzing, archiving, and disseminating objective scientific and engineering data and information; and through service and outreach programs. This information provides a sound technical basis for the citizens and policymakers of Illinois and the nation to make wise social, economic, and environmental decisions.**

## Considerations in Developing the Strategic Plan

This strategic plan for the Water Survey has been developed in the context of current conditions and emerging trends. The following findings were important considerations in developing the strategic plan:

- Data collected and scientific expertise within the Water Survey will continue to be needed to contribute to a high quality of life, economic development, and the protection and restoration of natural resources in Illinois.
- The organization of the Water Survey and the breadth of scientific and engineering expertise are suitable for studying water as a complex system.
- In general, there is an inadequate understanding of the environmental implications of a variety of economic and societal decisions and activities.
- Populations are shifting and expanding rapidly in some parts of the state. This puts increased demands on water resources and ecosystems and on the science-based management of these resources. Water shortages

have been projected for parts of the Chicago Metropolitan area by 2020. The scientific basis for improved management of water supplies is detailed in the October 2001 “A Plan for Scientific Assessment of Water Supplies in Illinois” (ISWS Information/Educational Material 2001-03).

- There is increasing concern about non-point source pollution, especially from nutrients, agrochemicals, and sediment. The accumulation and fate of nutrients, agrochemicals, and their associated products in soils and aquifers needs to be addressed. Data collection and scientific analysis will enhance evaluation of the needs for and the development of possible further voluntary and regulatory controls of pollutants.
- With a new federal standard to limit the concentration of arsenic in drinking water, the demand for reliable scientific data on arsenic sources, arsenic concentrations, and arsenic removal is increasing.
- Watersheds provide well-defined geographic units for studying surface waters and wetlands, connections between surface water and groundwater, and water quality. It is recognized that each watershed is unique and the management or restoration of any watershed should reflect all of the components that interact in the watershed to influence water quantity, quality, and use. Watershed issues will increase in complexity.
- The state and several federal agencies have made major commitments toward the restoration of the Illinois River Watersheds, as demonstrated by the development of the Integrated Management Plan for the Illinois River Watershed, the creation of the Illinois River Coordinating Council, and the success of the State in obtaining funding for the Illinois River Conservation Reserve Enhancement Program (CREP), and the Illinois Rivers 2020 initiative.
- There has been substantial grassroots interest in watershed restoration that includes stream, streambank, and lakeshore stabilization; wetland creation and restoration; and the implementation of different best management practices (BMPs) such as buffer strips and conservation tillage.
- Illinois continues to play a leading role in regional water-resource issues, including issues related to management of the Upper Mississippi River, Lake Michigan, non-point source chemicals, sediment, and nutrients.
- There is an increasing need to interpret and communicate the results of complex scientific research in non-technical terms for use by resource managers, policymakers, and the public.
- Illinois is increasingly influenced by environmental, economic, and energy issues outside of the state (e.g., hypoxia in the Gulf of Mexico; global climate change; and energy restructuring), as well as within Illinois. Addressing these issues will necessitate the development of regional, national, and global analytical capabilities to evaluate potential implications for Illinois. Increasingly complex state, regional, and national environmental, social, and economic issues pose greater challenges to define the issues, to communicate them to legislators and the public, and to identify possible solutions.
- Climate variability and air quality have great impacts on the environment, society, and economy in Illinois. Human activities in Illinois and the rest of the world also affect climate and air quality. Hence, there is a need to improve our understanding and prediction of the atmospheric system.
- The interconnectedness and complexity of issues means that computer models are needed to address them.
- More human and financial resources will be needed to address the issues. The Water Survey cannot continue to provide the current suite of public services, expand these services and address new issues with the existing financial resources.
- Public demand for short-term benefits, quicker responsiveness, and less expensive and more efficient government programs are likely to continue at the expense of longer-term research and planning efforts.

- The Water Survey is operating in an environment of increasing focus on quality management.
- The state has potentially competing interests in promoting economic development, while also supporting environmental stewardship, restoration, and protection. The Water Survey conducts research and provides services that can help harmonize these demands in the best interests of the citizens of Illinois.
- New technologies are rapidly changing our ability to communicate with large audiences and to archive, transmit, receive, and analyze large amounts of data. The Water Survey is challenged to stay abreast of these developments and utilize them.
- State government is strengthening its efforts in strategic planning, performance evaluation, and performance-based budgeting in order to demonstrate the efficient and effective use of public resources.

## **Vision to 2010**

The following vision statement depicts the desired evolution of the Water Survey:

The Water Survey Research Center will be a center of scientific excellence with facilities adequate to house its expanding programs and staff. The number of Survey staff, the Survey budget, and the number of people served by the Survey will increase by 25 percent. Scientists, engineers, and administrators from Illinois, other states, and other countries will want to work at the Water Survey, and current Water Survey employees will want to stay to take advantage of a competitive benefits package; education and training opportunities; safe, clean, and modern facilities; state-of-the-art technologies; and increased opportunities for creative research, public service, and promotion.

A fully electronic data system will provide Internet access to extensive scientific databases and to full text of all new and many historical Water Survey reports. Administrative functions will be conducted via secure, electronic communication systems. Outreach and education efforts will be expanded. The resulting management of water and atmospheric resources, economic development, protection of the environment and human health, and the education system will strengthen in Illinois and nationwide based on increased use of quality data and information produced and disseminated by the Water Survey. In particular, planning and management of water resources in Illinois will improve when based on a foundation of sound science provided by the Water Survey.

# **OFFICE OF THE CHIEF**

## **Mission**

The Office of the Chief provides the scientific leadership and management of the Water Survey. The administrative functions within this office provide Survey-wide support of the research/service activities in the areas of human resources, financial management, publications services, library service, education and outreach, data management, quality management, information systems, equipment, and facilities.

## **Vision to 2010**

The Office of the Chief will provide scientific leadership to continue and strengthen existing Water Survey programs that are important to the state, while terminating lower priority programs, and stimulating the development of new programs to address emerging priority issues. Cross-disciplinary studies among the sections and with external

scientists will be strengthened. Efficient central management of human resources, finance, equipment purchases, publication services, library services, geographical information systems, and web development will continue. The Office of the Chief will continue to coordinate education and outreach and quality management activities of the Water Survey. Plans will be prepared for the Water Survey to occupy new facilities on the Survey Campus of the South Research Park.

## Goals

- Provide leadership for high-quality program of research, data collection, analysis, and dissemination, and public service.
- Maintain a strategic plan for the management of programs and resources, leading to the identification of activity measures and performance indicators.
- Lead the expansion of scientific capabilities to address existing and emerging water and atmospheric resource issues.
- Strengthen and broaden the scientific basis for studying hydrological and biogeochemical cycles.
- Provide effective and efficient administrative support to staff.
- Provide state-of-the-art facilities.
- Provide state-of-the-art equipment.

## Strategies

The Office of the Chief will lead Survey-wide collaborative efforts to implement the following strategies.

- Collaboration among the Scientific Surveys ([www.sws.uiuc.edu/docs/JSPlan/](http://www.sws.uiuc.edu/docs/JSPlan/)). The Water Survey will function as a member of a shared pool of multi-disciplinary research and technical expertise provided by the Scientific Surveys and the State Museum. The diverse capabilities will focus on scientific, economic, environmental, and social issues of interest to Illinois. These institutions will act collectively to continue to be recognized as the prime source of objective scientific analyses in Illinois on natural resource-related issues affecting Illinois, the Midwest, and the nation. They will also expand their capabilities to address emerging natural resource-related issues in specific watersheds.
- Dovetailing with Other IDNR Offices. Science is an important basis for the management of natural resources, which is the prime function of IDNR. The Water Survey will continue to be an active player in the development and implementation of the Strategic Plan and Annual Management Plan for IDNR,” especially in enhancing the capabilities of the Department to provide Illinois with scientific expertise, data, and information to meet societal needs in the 21st century. In particular, the Water Survey will help build scientific capabilities to manage watersheds, water supplies, atmospheric resources, ecosystems, and state land.
- Partnerships. The history of the Scientific Surveys is intertwined with that of the University of Illinois, and there are ongoing discussions of new facilities on campus and enhanced program planning between the Scientific Surveys and the University. The Water Survey will participate actively to foster and strengthen this partnership in areas of research, data collection and access, public service, and new facilities. Partnerships with scientists and students at other universities and government laboratories also will be pursued to enhance the Water Survey’s and other organizations’ scientific activities and capabilities.



- Relations with State and Federal Agencies. Some relationships between the Water Survey and state agencies are legally mandated. These relationships will be fostered, and relationships between the Water Survey and other state and federal agencies will be enhanced as appropriate.
- Constituent Relations. The mission of the Water Survey is to serve the citizens of Illinois. In order to better serve the priority needs of multiple constituents, the Water Survey will enhance its education and outreach programs to identify information needs, to distribute information, and to provide leadership and advice to constituents in the use of this information.
- Effective Use of Resources. In order to ensure that scarce resources are used to meet priority needs in an effective manner, the Water Survey will evaluate the current use of state resources and ensure that these resources are applied in ways that best meet the state demands for information. Strategies for maximizing the use of grant and contract funds will be evaluated. Overall, an administrative structure will be continued that maximizes efficiency and keeps overhead costs to a minimum, while providing the highest level of service.
- Facilities. Survey facilities will be maintained in order to address health and safety issues. Capital Development funding will be pursued to provide for major renovations and/or new facilities to accommodate future needs.
- Financial Support. The Water Survey will seek to increase state appropriations to cover core operations and to secure additional support through grants, contracts, and nontraditional sources of financing. Competitive salaries and benefits will be sought and maintained.
- Hydrologic and Biogeochemical Cycles. The hydrologic and biogeochemical cycles will provide a systems framework for Water Survey projects. The major components of these cycles - atmosphere, hydrosphere, geosphere, and biosphere - will provide a basis for organization and program management at the Water Survey. Just as all the major components of the hydrologic and biogeochemical cycles are interconnected, so too will many of the major programs at the Water Survey be linked in a systems approach.
- The nitrogen cycle web site will be complemented with development of a water cycle web site and sites for biogeochemical cycles of oxygen, carbon, phosphorus, hydrogen, and sulfur. These will provide an educational tool accessible via the Internet to promote environmental studies of interconnections between major elements in the atmosphere, hydrosphere, biosphere, and geosphere. Such studies will result in more comprehensive research, education, and understanding of complex biogeochemical cycles and processes and human modifications of these cycles and processes.
- Watersheds. The Water Survey will use watersheds and basins as focal units of scientific investigation, data collection, and public service on the surface water resources of the State of Illinois.
- Groundwater. Aquifers are not coincident with watersheds or basins. The Water Survey will study the hydrology, hydraulics, and water quality of local and regional aquifers and their connections to surface waters.
- Analytical, Simulation, and Presentation Tools. Consistent with a systems approach, greater emphasis will be placed on the development, calibration, testing, and application of mathematical, computer-based models as tools to better understand systems and to simulate the state of the environment in the future.
- Data Collection and Analysis. To understand environmental processes, to document the variations of important variables over space and time, to evaluate the impacts of human activities on the environment, and to provide data for model development and testing, the Water Survey will review and, as necessary and according to resource availability, regenerate its data collection and analysis capabilities.
- Information Management. To ensure high-quality, distribution, access, and archiving of data and information, the Water Survey will implement an information management plan. Modern mathematical, computer-based tools will be used to handle, present, and distribute data and information. New databases will be created, when

needed, and existing databases will be maintained and improved and made Web- and GIS-compatible. Access to stored data through user-friendly interfaces will be improved. A systematic approach to the archival of data will be made. Data contained within the Water Survey's historical records will be digitized and made available electronically.

- **Quality Management.** The Water Survey quality management plan (QMP) will serve as a primary guidance document for all environmental data collection programs to ensure adequate management and quality controls. The QMP will be reviewed and revised on an annual basis to ensure that it meets the needs and requirements of internal staff and external funding agencies.
- **Scientific Outreach and Communication.** Scientific staff will continue to communicate their findings to the scientific community through peer-reviewed journal articles and presentations at professional and public meetings. These activities will ensure that the scientific output is of high quality, relevant, and a significant contribution to science.
- **Mentoring.** Active mentoring of new staff by senior staff will promote professional development and participation in Survey programs.
- **Recruiting and Training.** To ensure the continued provision of quality research and services; to improve efficiency, productivity, and accountability; and to promote professional development, professional training and staff development will continue to be offered to all salaried staff at the Water Survey. Internal staff expertise on issues of importance to Illinois will be maintained through literature review and attendance at relevant professional meetings. Competitive compensation will be emphasized in order to attract and retain staff with high levels of scientific and engineering expertise, and administrative and management skills. As programs grow and additional expertise is needed, new staff will be hired.
- **Computer Security** will continue to be a high priority. Software firewalls are required and will be installed. Other means of physical and logical security also will continue to be investigated.

### **Action Items: April 2004 - March 2005**

#### **Education/Outreach**

- Coordinate education and outreach programs Survey wide.
- Scan and digitize historical reports and make these available on the Internet.
- Promote ISWS Outreach activities by establishing web page on the ISWS site.
- Continue to publicize the Rain Check Network (RCN) and distribute rain gages.
- Utilize funding from a national organization to incorporate an aspect of chemistry-of-rain with the rain gages.
- Publicize ISWS Educational Outreach activities on DNR web site.
- Participate in the national American Chemical Society Earth Day program by providing the central activity.
- Participate in the State Fair by providing hands-on activities for children and parents.
- Collaborate with national professional organizations to promote science and science education.
- Inform the public of current projects and programs through listings on the web.

- Host student field trips that are educations, hands-on and fun.
- Attend in-house and campus seminars.

#### **Facilities**

- Complete the construction of the new Building 11.
- Complete replacement of the central boilers, chiller, and Building 3 make-up air system.
- Contribute to the South Campus Planning process.
- Contribute to the planning process regarding a new facility for the Water Survey Research Center.
- Monitor and support the need for traffic signal controls at Gerty/First Street; Hazelwood/First Street; and St. Mary's/First Street.

#### **Web**

- Continue to develop and improve overall web presence.
- Create "Education/Outreach" web page/section.
- Continue to apply security updates as released and monitor the web server logs.
- Expand online climate data.

#### **GIS**

- Implement action items listed in the ISWS GIS Plan.

#### **Data & Information Management**

- Continue to implement Information Management Plan.
- Work with ISGS and computer staff to upgrade existing database software to a Web-based version, and to enhance and maintain the library Catalog databases to provide public access.
- Continue to evaluate and develop "point and click" interface for accessing ISWS scientific data.
- Identify data to be converted to SQL Server.
- Develop Prototype "Green Sheet" applications.
- Continue to move data to SQL server from other databases.
- Develop reports for banner.
- Implement internal Departmental Accounting System.

#### **Quality Assurance/Quality Control (QA/QC)**

- Complete annual, internal review of PSL and Analytical Services group.
- Initiate committee discussion regarding the feasibility of continuing the external review of PSL and Analytical Services group. Explore costs if review is done by outside agency or likelihood of creating a volunteer review team from outside professionals.
- Complete annual review of Laboratory Quality Assurance Plan.

### **Professional Development**

- Provide seminars, training, and electronic documents where possible for computer use, software use, security, and GIS.

### **Research**

- Finalize and coordinate the implementation of ISWS Water Quality Plan.
- Work with IDNR/OWR to implement the IDNR water supply plan.
- Develop ISWS Hydrologic Cycle website.
- Complete Gulf hypoxia ISWS website.
- Publish an article on Gulf hypoxia in the peer-reviewed literature.
- Conduct research to enhance SWAT surface water modeling.
- Publish an article on surface water modeling in the peer-review literature.
- Help develop a plan for the Southern Lake Michigan Water Supply Consortium.
- Produce a report on drought planning.

## **Atmospheric Environment Section Strategic Plan**

### **Mission**

The mission of the Atmospheric Environment Section is to advance the use of atmospheric information for applications of benefit to the environment, the economy, and society of Illinois, the Midwest, and the nation through the performance of basic and applied research, the collection and analysis of relevant data, and the provision of scientifically sound and credible information to the citizens and policy makers.

### **Vision to 2010**

The programs will enhance the state's scientists', analysts', and decision makers' abilities to understand complex air-quality, weather and climate issues, to assess water-resources issues related to the atmosphere, and to evaluate resource-management and policy options. Key decisions in Illinois relating to the development and management of natural resources and environmental protection in Illinois, the Midwest, and the nation increasingly will be made on the basis of scientific information provided by the AES. The programs also will be prominent internationally.

The programs will reduce uncertainties about the magnitude and direction of future climate variability and change, will provide a scientific basis for addressing air-quality problems particularly related to PM2.5 and ozone, and will produce information of substantial value needed to protect human health and well-being, improve water-resources management, and support agriculture and other weather-sensitive industries/sectors, including energy and transportation. Modeling on many scales will play an increasingly important role in focusing and integrating the research of the Section.

## Goals

- To achieve a better understanding and greater predictability of climate and air quality variability and change in Illinois and the Midwest through data analysis and regional models. Conduct basic research to improve these models on topics including cloud-radiation interactions, cloud physics and dynamics, land-atmosphere interactions, aerosol physics and chemistry, and air/precipitation quality.
- To expand the extensive services program through the State Climatologist program and the Midwestern Regional Climate Center.
- To advance our understanding of severe and hazardous weather processes and events and their impacts in Illinois, including droughts, floods, heat and cold waves, intense lake-effect snow storms, lightning hazards, freezing rain, fog, and severe summer and winter storms.
- To provide the basis for improved understanding of atmospheric resources through experimental investigations to include focused field studies, laboratory investigations, and extended environmental monitoring programs.
- To improve our understanding of and capability to predict the impacts of weather, climate, and air pollutants on society (including health, economics, and quality of life), agriculture, and on water resources and other environmental conditions.

## Strategies

- The modeling capabilities of the section will be developed through the continued implementation of the CAQIMS program. The modeling of cloud and weather systems will be continued and enhanced. Internal computer facilities and external computer resources will be expanded in order to provide the capabilities to perform key aspects of the modeling. RCM integrations will be conducted to generate a comprehensive and realistic database and, through detailed diagnoses, to evaluate the RCM capability to reproduce observations and to better understand the physical processes and underlying mechanisms that cause interannual climate (especially precipitation and surface air temperature) variations in Illinois and the Midwest.
- The laboratory and field experimental capabilities and data collection activities of the section will be expanded. This may include the use of Geographic Information Systems (GIS) and other state-of-the-art visualization tools, expanded access to data from satellites, aircraft, radar, wind profilers and lidars. Energy flux measurement capability will be enhanced to include carbon fluxes. Emphasis will continue to be placed on cloud and aerosol microphysics and on laboratory chemical analysis and techniques.
- Proposals to seek funds will be developed in response to selected opportunities in order to expand programs in mesoscale meteorology, boundary layer meteorology, aerobiology, air quality, geochemical cycles, aerosol physics and chemistry, regional climate and impacts modeling, agricultural climatology, hydrometeorology/climatology, climate change studies, and the effects on society of such problems as animal odor, airborne pests, and climate extremes.
- External support for the activities of the section will be enhanced by increasing our interactions with key Illinois user groups including state and local government agencies, business groups, private sector, and other organizations. Federal agency support will be increased by working closely with NOAA to establish a clear vision for the role of the RCCs.
- Partnerships with scientists at other organizations such as the University of Illinois, National Center for Atmospheric Research (NCAR), government laboratories, other universities, and the National Weather Service, etc., will be pursued to enhance the section's scientific activities and capabilities.

- Scientific staff will enhance communication of their findings to the scientific community through peer-reviewed journal articles and presentations at professional meetings. This activity will ensure that the research output of the section is scientifically defensible and a significant contribution to science.
- Scientific staff will translate their findings for communication to the non-scientific community through more press releases, popular articles, and items for the ISWS web page.
- The efficiency and value of the data collection and services program of the Office of State Climatologist and the Midwest Regional Climate Center will be improved by enhancing the quality and quantity of information available on the Web.
- Participation in national field programs and research initiatives will be pursued in order to leverage the Section's expertise and equipment, allowing a more comprehensive investigation of issues that relate to Illinois.
- Assessments of major climate anomalies that impact Illinois and the Midwest will be performed when they occur.
- Internal staff expertise on atmospheric environment issues of importance to Illinois will be enhanced through literature review and attendance at relevant scientific meetings.
- More active mentoring of younger staff by senior scientists will promote their more rapid advancement and participation in their scientific fields and the Section's programs.
- Staff will participate in the education of graduate and undergraduate students to encourage growth of knowledge in scientific areas relevant to the state.
- Scientific staff will be more involved in the review of scientific papers and proposals which reflects our staff's scientific importance, responsiveness to national needs, and the potential for learning new insights.

### **Action Items: April 2004 - March 2005**

- Construct a mobile flux tower and install it in the no-till field north of the Ameriflux tower.
- Publish a paper comparing the effects of 2003 weather on soybean yields to weather in 1998, 2000, and 2002.
- Publish a paper describing the diurnal CO<sub>2</sub> profile changes in a corn field throughout the growing season.
- Promote the Illinois Climate Atlas.
- Investigate temporal aspects of various climate conditions and those conditions affected by climate.
- Investigate inadvertent modification of various atmospheric conditions.
- Assess impacts of major climate anomalies that develop.
- Assist in the development of special materials for the Survey's web site.
- Complete redesign and upgrade of the Midwest Climate Information System (MICIS).
- Look for opportunities to expand interactions with NCDC and the other RCCs through participation in cooperative projects.

- Work with the other RCCs on the development and deployment of the Applied Climate Information System (ACIS).
- Visit additional NWS offices in the Midwest to familiarize NWS staff with the RCC and State Climatologist program, and to explore partnerships with the NWS Climate Services program.
- Complete development of pages on the Midwestern Regional Climate Center web sites that document 19th and 20th Century climate trends and variability for the Midwest.
- Publish paper on air quality and emissions modeling.
- Prepare and install equipment at Northbrook for PM2-5 speciation monitoring.
- Complete a proposal, as part of a team effort, for DOE atmospheric science program funding to support basic research on aerosols.
- Publish a journal article on the linear trends for sulfur dioxide, particulate sulfate, and precipitation sulfate deposition at approximately 40 sites, mostly in the eastern USA, that began data collection in late 1980's.
- Complete final report for the IDOT funded road salt study. Remove equipment and fences from the five Lemont sampling sites.
- Complete a revision of chapter on acid rain for the fifth edition of the Encyclopedia of Environmental Science and Engineering, Gordon and Breach Science Publishers.
- Initiate a study of gridded radar and multi-sensor rainfall estimates (4-km resolution), and Cook County rain gage data to attempt to distinguish radar range biases and possible raingage siting biases from urban and lake influences on precipitation
- Complete study of dense fog events.
- Obtain data for 21<sup>st</sup> Century simulations of the HadCM3 model for use in the modeling program
- If data become available during this year, begin an analysis of CMIP simulations of the 20<sup>th</sup> Century climate.
- Publish a paper on CWRF.
- Publish a journal article on the analysis of CMIP and AMIP GCMs.
- Complete the coupling of CWRF with interactive sea-ice and ocean models.
- Explore opportunities to closely collaborate with terrestrial hydrology and water quality modeling scientists.
- Submit a proposal to the National Science Foundation to continue studies of Great Lakes weather systems.
- Publish a paper on the diurnal evolution of lake-effect precipitation in the vicinity of Lake Michigan to a scientific journal.
- Begin analyses of data collected during the Great Lakes Ice Concentration - Atmospheric Flux (GLICAF) field experiment.
- Expand upon research efforts of relevance to the Great Lakes mesoscale weather systems by participating in guidance of graduate students (as graduate research advisor, member of advisory committees).

- Publish a journal article on mesoscale vortices forming along an intense lake-effect snowband over Lake Michigan.
- Assist IEMA in developing an updated hazard mitigation plan, providing data on climate-related hazards such as droughts, tornadoes, hail, and winter storms.

## **ANALYTICAL CHEMISTRY AND TECHNOLOGY UNIT**

### **Mission**

The Analytical Chemistry and Technology Unit (ACTU) provides analytical chemistry and technological services and consultation to state institutions, communities, and private citizens in Illinois and the Midwest, including Water Survey scientists. The Institutional Water Treatment Program (IWTP) provides advice to state facilities on the purchasing, specification, and implementation of chemical treatment for all of their water-using systems. The Public Service Laboratory (PSL) provides analytical testing and consultation to a wide range of users throughout Illinois. The Analytical Services group provides chemical analyses in support of the research activities of Water Survey staff and external researchers. The Midwest Technology Assistance Center (MTAC) provides technological support for small public water supplies and Native American Indian water supplies throughout the Midwest.

### **Vision to 2010**

The *Public Service Laboratory* (PSL) will be recognized as the premier information resource on water quality for private well owners. The PSL will continually expand the suite of analytes and broaden outreach efforts. This expanded suite of analytes and increased sensitivity will enable the *Analytical Services Laboratory* (ASL) to provide Water Survey scientists with access to data on a wider range of pollutants and naturally occurring chemicals at lower concentrations for research and monitoring studies. Adherence to stringent procedures for quality control and safety, state-of-the-art instrumentation in modern laboratories, and efficient systems for data storage and retrieval will make the PSL one of the highest quality and safest laboratories in the state. The *Institutional Water Treatment Program* (IWTP) will provide all state facilities and community colleges with state-of-the-art advice on water treatment and corrosion control, saving millions of dollars in reduced chemical and water usage and maintenance needs. The IWTP will lead the way in protecting the natural ecosystems of Illinois by promoting the use of environmentally friendly “green” chemical inhibitors for corrosion and scale control. The *Midwest Technology Assistance Center* (MTAC) will achieve national prominence in providing technical assistance for small public water systems, enabling them to provide secure, reliable, and safe supplies of water to the consumer at reasonable cost.

### **Goals**

- Maximize the benefits that the ACTU provides to Illinois citizens and the Water Survey. Increase the efficiency, productivity, and accountability of the Analytical Services and Public Service laboratory groups.
- Maintain and strengthen existing quality-management practices and documentation to ensure the highest quality data and information is produced.
- Maintain and expand the level of participation by state agencies in the Institutional Water Treatment Program. Explore nontraditional sources of support.



- Maintain a viable, productive Analytical Services Laboratory to support the analytical needs of other Water Survey scientists in a cost-effective manner.
- Establish the reputation of the Midwest Technology Assistance Center as a valuable resource for small public-water systems.

## **Strategies**

- Purchase analytical instruments with a combination of state and contractual money (as appropriate) that are needed to maintain, expand, and automate the analytical and data archival capabilities of the Analytical Services and PSL groups. Implement a depreciation account for all instruments purchased with contractual money, to allow replacement of the instruments on a regular basis without incurring undo expense to the service account.
- Conduct annual internal and periodic external reviews of the PSL (under the supervision of the ISWS Quality Assurance Officer) to assure compliance with good laboratory operating procedures and the laboratory Quality Assurance Plan.
- Fund competitive grants at universities or other technical assistance providers (utilizing a peer-review process) within the Midwest region through MTAC to address critical issues for small public water supplies.
- Develop MTAC training and education programs and/or tools (such as interactive CD's) in partnership with other groups such as the Illinois Section American Water Works Association (ISAWWA), the Illinois Rural Water Association (IRWA), and the Environmental Resources Training Center at SIU-E to use their expertise and established relationships with the small utilities.
- Maximize the Unit's benefit to Illinois citizens and the Water Survey by increasing public awareness among private citizens, government officials, and the news media. This will be accomplished by an increase in outreach activities.
- Continue to enhance Web presence for all ACTU programs.
- Continue to provide expert consultation to state facilities on water treatment and corrosion control, maintain current enrollment in the program, and expand participation from new or existing institutions in the IWTP.
- Maintain the highest standards in productivity and quality for laboratory activities while supporting the analytical needs of internal research staff, basing charges for analysis upon full-cost recovery of expenditures for supplies, staff, quality assurance requirements, data archival, and instrument maintenance costs. Encourage Principal Investigators in other Survey sections requiring analytical services to discuss their needs when preparing proposals. Encourage PI's to utilize available QA/QC data for reported measurements.
- Encourage staff to remain active in professional societies in a manner beneficial to their continued professional development when related to their job duties; encourage staff participation in conferences, technical symposia, technical committee meetings, and workshops as permitted by time and resources.
- Facilitate improvement and growth in job expertise and professionalism of junior staff through mentoring by senior staff, particularly of those individuals who senior staff envision may have increased responsibilities in the future (staff supervision or PI status). Encourage all staff to continue their

professional growth by taking advantage of the available staff development courses sponsored by the University of Illinois, the State Water Survey, IDNR, or other sources as appropriate.

### **Action Items: April 2004 - March 2005**

- Contact a minimum of twelve additional Community Colleges around the state annually to encourage their participation in the IWT program. Seek out nontraditional sources for additional IWT agreements to broaden program support base. Encourage attendance at the Annual Illinois Institutional Chief Engineers Conference to familiarize them with the IWTP program.
- Comply fully with laboratory Quality Assurance Plan (QAP), including standards for sample tracking, quality assurance, and general laboratory practices.
- Cooperate fully with the Laboratory Quality Assurance Officer as needed to comply with the laboratory QAP.
- Cooperative with QA officer as required to complete external or internal reviews of PSL and Analytical Services group.
- Participate in outreach activities to enhance ACTU program visibility. This will be done by participating in some, or all, of the following activities: Science Olympiad, Natural Resources Quiz Bowl, Regional Science Fairs, County Fairs, and the State Fair.
- Disseminate MTAC products and information regionally and nationally through a partnership with the National Drinking Water Clearinghouse and/or TacNet.
- Update Unit web sites for design and content as needed. Web sites will be checked a minimum of twice per month to ensure links are current and to update.
- Select proposals for funding from MTAC through a peer-review process in cooperation with John Braden, and oversee the progress and compliance of the PI's.
- Oversee development and progress of all directly funded MTAC cooperative projects.
- Submit quarterly progress reports to USEPA for MTAC.
- Work towards the implementation of, in cooperation with the Scientific Sections, of a water-quality plan for the Water Survey.
- Organize annual planning meeting for MTAC with other technical assistance providers and regulatory agencies in the State.
- Maintain contact with USEPA regional small system and capacity development staff to promote work of MTAC and foster closer relationships with USEPA.
- Work with Groundwater Section on PSL sample entry and integration with the groundwater database.
- Complete an updated PSL brochure.
- Complete an updated MTAC and/or TacNet brochure.

# **WATERSHED SCIENCE SECTION**

## **Mission**

The mission of the Watershed Science Section is to characterize and evaluate the quantity, quality, and use of the surface-water resources important to the State, with emphasis on integrated watershed-based approaches. The mission is achieved by collecting, analyzing, archiving, and disseminating objective scientific and engineering data and information; and developing modeling and assessment tools. These data and tools, generated through state-of-the-art scientific methods and research, provide a sound technical basis for the citizens, resource managers, planners, and policymakers of Illinois to make informed resource-management decisions.

## **Vision to 2010**

The Watershed Science Section (WSS) envisions providing state-of-the-art scientific analyses for managing surface-water resources to meet societal and ecosystem demands with minimum conflict and at reasonable cost. The Section will continue to be recognized as a center of excellence for studies on floods, droughts, water quality, erosion and sedimentation, and watershed restoration. Collaborations with local, state, and federal agencies and universities will be strengthened.

## **Goals**

- Conduct research to improve our understanding of the hydrologic and biogeochemical cycles as they relate to Illinois watersheds, including rivers, streams, lakes, and wetlands and their interaction and influence on the Mississippi River, the Gulf of Mexico, and Lake Michigan.
- Improve our capabilities to develop, apply, and test existing and new mathematical models that simulate hydrologic and biogeochemical processes based on theory, and field and laboratory data.
- Conduct research to advance our knowledge of the temporal and spatial variability of streamflows in Illinois to address water supply, flood, drought, water quality, instream-flow needs, and watershed-management issues.
- Develop, maintain, and distribute databases on Illinois surface-water resources including water supply and use, low flow and drought impacts, floods and floodplains, streamflow, water quality, lake sedimentation, and stream geomorphology.
- Improve and expand watershed, stream, wetland, and lake monitoring capabilities related to water quantity, water quality, sediment, and geomorphic characteristics and variations.
- Lead the development of the Illinois Rivers Decision Support System (ILRDSS), including coordination among the Scientific Surveys and constituents and the development and integration of models and databases related to climate, hydrologic, hydraulic, and water quality characteristics of the Illinois River watershed.
- Maintain core capabilities to provide technical assistance and information to state agencies, municipalities, professionals, and the general public on water resources issues.
- Effectively convey scientific results to the public in ways that are useful and easy to understand.

## **Strategies**

- Improve our ability to predict the outcome of physical, chemical, and biological processes as they impact water quality.
- Identify, apply, and test new and existing mathematical models to simulate hydrologic and hydraulic processes such as the rainfall-runoff process; seepage into the unsaturated zone; surface water and Groundwater interactions; soil erosion; transport of sediment; fate and transport of nutrients and contaminants; and the hydrodynamic character of rivers and lakes.
- Develop proposals, in cooperation with the Groundwater and Atmospheric Environment Sections, the other Scientific Surveys/Center, and the University of Illinois, to develop mathematical models and monitoring programs to study the physical, chemical, and biological interactions between the atmosphere, surface water, and Groundwater.
- Propose, conduct, interpret, and disseminate results of field and laboratory studies designed to advance our fundamental understanding of the fate and transport of nutrients and contaminants.
- Develop proposals and work to establish programs to monitor hydrologic and sediment budgets for reservoirs, point and non-point pollutant sources, and the impact of watershed and ecosystem management efforts.
- Give increased emphasis to data collection and the application of new data-management and data-archival technologies, as driven by the expanded database needs for numerical modeling and other forms of analyses.
- Seek state funding to develop and sustain core capabilities to provide technical assistance to state and local agencies, municipalities, and the general public on water-quantity and water-quality issues.
- Communicate and disseminate the Section's products by relying upon traditional forms of publication, presentation, and public service, but with increasing emphasis on electronic communications.
- Strengthen collaborative partnerships with other Sections and Units within the Water Survey, other Scientific Surveys, universities, state and federal agencies, and local and regional organizations in recognition of the multi-disciplinary nature of watershed science; and enhance our public outreach activities on watershed issues.
- Support efforts to improve floodplain mapping and its use in Illinois.

## **Action Items: April 2004 - March 2005**

- In coordination with other Sections, continue to apply hydrologic models and other analyses to evaluate the effect of potential climate change on Illinois water resources, including assessment of the water resource impacts of worst-case drought scenarios.
- Contribute to the development of plans for regional, county, and statewide water-resources studies.
- Continue developing, with other Sections, a water-quality plan for the Survey.
- Continue working with the water quality focus group within the Section and identify potential research areas.

- As part of the Water and Atmospheric Resource Monitoring Program, continue to monitor month-end reservoir water levels; compile supplementary reservoir water level data from cooperating operators; continue to update web site with provisional monthly flow data at 26 sites; continue to update suspended sediment data web site; and continue to provide surface water conditions monthly review for the *Illinois Water and Climate Summary*.
- Complete analysis of data and publish project reports for IDNR Pilot Watershed studies: Sugar Creek Watershed; Big/Cypress Creek Watershed; Hurricane/Kickapoo Creek Watershed.
- Complete project report for Lake Decatur Watershed, 2000-2003 monitoring period.
- Prepare and submit a Water Survey report on Solar-Driven Ammonia Production in Illinois Waters.
- Complete the final report on the watershed assessment of Hickory Creek for the IDNR/OWR.
- Complete the final report for hydrologic, sediment and nutrient monitoring in the CREP watersheds.
- Complete a publication on an inventory of sedimentation surveys for Illinois reservoirs.
- Continue literature review of water quality issues in the Illinois River Basin and prepare a Water Survey report.
- Complete the development of the Illinois Streamflow Assessment Model (ILSAM) for the LaMoine River basin.
- Prepare a draft research report summarizing applications of ILSAM for all Illinois watersheds and documenting the concepts and analytical methods used in its preparation.
- Prepare ISWS Research Report on “Dependence of Photochemical Transformation Rates on Water Quality in the Calumet River Watershed.”
- Prepare and deliver to the IEPA the Final Report and video material on in-stream habitat and urban fisheries for the Waukegan River National Monitoring Program.
- Continue to collect and analyze data and prepare and deliver to the IEPA the Lake Pittsfield National Monitoring Program Final Report and video documentation on in-stream habitat and rural fisheries.
- Conduct research on hydrologic drought, low flows, and water supply in Illinois and provide relevant information to IDNR, other state agencies, and the public.
- Begin analysis related to the adequacy of public water supply systems during drought, including a general overview of the levels of error/uncertainty in estimates of reservoir volume, lake evaporation, and drought inflow, and identifying the potential impact of these uncertainties on water supply yield estimates.
- As needs arise, conduct analyses on emerging water supply issues and assess yields for new and potential major users of water in Illinois, providing relevant information to IDNR, other state agencies, and the public.
- Continue to maintain, improve, and expand the Illinois Rivers Decision Support System (ILRDSS).
- Initiate analysis of impacts and influences of land-use changes, climate changes, urbanization, hydraulic modifications on low flow and flood frequency.
- Continue to develop the Illinois Watershed Atlas.

- Perform research on Rapid Solar Phototransformation of Nutrients in Natural Waters currently funded by Illinois Water Resources Center.
- Perform research on “Development of Low-Cost Treatment Options for Arsenic Removal in Water Treatment Facilities” currently funded by Midwest Technology Assistance Center.
- Perform research on the ion adsorption properties of mineral surfaces.
- Develop a relational database for public water supply surface water reservoirs compiling historical and contemporary data and information from Watershed Science Section files.
- Complete the development of the Illinois River Sediment Chemistry database for posting on ILRDSS.
- Complete part 2 of Phase II of the Fox River Watershed Investigation project.
- Develop a plan for a database for archiving of video and 35mm slides of past projects and ongoing projects.
- Conduct a GIS Data Needs Assessment of the Watershed Science Section. The goal is to identify data gaps, improve GIS data management, and identify potential GIS applications within the Section. An inventory of existing data sets would also be compiled.
- Continue to review and enhance an existing water quality database for the Illinois Waterway and analyze dissolved oxygen data for historical trends and identify potential water quality problems.
- Maintain and update the agricultural land use database for all counties in the state.
- Work with federal agencies on using and enhancing existing models.
- Develop the Lower Illinois River System hydraulic model for Flood Protection for use by the Office of Water Resources, IDNR, for planning and flood management.
- Model the entire Illinois River hydraulics. Construct a UNET model for the entire Illinois River from Dresden Island to Grafton for current condition. This model will be integrated with the regional scale HSPF model for the Illinois River Basin.
- Develop a UNET model for the entire Illinois River with geometry data derived from Woermann maps and simulate flow conditions of the Illinois River prior to 1900.
- Develop a window-based interface to link a hydraulic model such as UNET to the hydrological model HSPF.
- Model the flow hydraulics in the La Grange Pool of Lower Illinois River with 1-D and 2-D unsteady flow hydraulic flow models as part of a multi-disciplinary research team on large river ecosystem restoration.
- Modeling the Lower Wabash River watershed using BASIN's SWAT model and enhancing it with a storm event component to evaluate water quality at intakes of small drinking water system.
- Complete hydrologic modeling of the Embarras River watershed using BASIN's SWAT model.
- Develop a BASINS-HSPF hydrological simulation model for the Fox River watershed from the Stratton Dam to the confluence with the Illinois River, if the Fox River Phase II project is funded.
- Develop a watershed loading model for simulating fate and transport of suspended sediment and nutrients in Illinois River watersheds.

- Prepare a hydrologic and hydraulic model for the Peoria Pool and for one tributary that drains directly into Peoria Lake.
- Maintain and improve long-term, instream sediment-transport data collection under the Benchmark Sediment Monitoring Network of the WARM Program.
- Develop constituent load estimation/calculation methods by incorporating statistical analysis for reliability and uncertainty. Submit a manuscript by April 2005 for peer reviewed journal publication.
- Develop baseline loadings estimates for nutrients in the Illinois River Basin
- Conduct research to quantifying the impact of land cover change and of climate change on floods in northeastern Illinois when funding from the Illinois/Indiana Sea Grant is made available.
- Analyze spatial and temporal variations in sediment transport in Illinois and the Upper Midwest and examine potential relationships to climate variability and land use, and stream management.
- Complete development of a stream classification system to assist nutrient criteria development in Illinois, currently funded by USEPA.
- Study the effects of land-use changes on water quality from watersheds in the Illinois River Basin and explore possibility of implementing an optimization approach for selection and evaluation of Best Management Practices for improving water quality.
- Continue to monitor water quality of the Waukegan River using YSI Sondes (as funding is made available – being negotiated).
- Conduct aerial reconnaissance of streams in Illinois River watershed using video and GPS to make geomorphic and other watershed assessments used to prioritize critical projects to be restored.
- Conduct field assessment of watersheds, stream segments and sites targeted from the aerial flyovers.
- Design and oversee installation of at least ten (total) stream restoration structures in the upper Cache River by December 2004. Complete the analysis and preparation of the final report on in-stream restoration structures in the Cache River.
- Conduct a geomorphic watershed assessment and prepare a paper for one Illinois River tributary watershed.
- Provide specialized sediment sampling capabilities to support Illinois State Water Survey (ISWS) and other federal, state and private entities in their research efforts, if funding is available.
- Enhance Section's abilities to collect 3-D acoustic discharge and velocity data to support ISWS research efforts in water supply, flood measurement, and other hydrologic/hydraulic research and modeling efforts, if funding becomes available.
- Operate 31 Ambient Water Quality Monitoring Network stations for the Illinois Environmental Protection Agency's stream monitoring program.
- Continue to collect, reduce, and analyze data from five monitoring stations in support of the Conservation Reserve Enhancement Program, if funding for the project from DNR continues.
- Continue to provide technical assistance to DNR's Illinois River Basin Restoration Project through the program's Technical Advisory Group and the Middle Illinois and Kankakee Regional Teams.

- Help design an integrated monitoring plan for the Illinois River Basin Restoration Program.
- Improve our data collection capability for detailed chemical analysis of sediments.
- Continue to enhance the credibility of the ISWS Sediment Laboratories at Champaign and Peoria by continued participation in external/internal quality control audits, completion of a laboratory quality assurance plan, and documenting appropriate standard operational procedures.
- Build and foster relationships with the Illinois Association of Floodplain Managers (IAFSM) and the national Association of State Floodplain Managers (ASFPM) by serving as an elected officer.
- Continue to monitor developments in the Federal Emergency Management Agency, Map Modernization Program for information dissemination and funding opportunities.
- Should the Federal Emergency Agency accept and fund the State Business Plan submitted by IDNR, the ISWS will be responsible for statewide conversion of Flood Insurance Rate Map information into Geographic Information Systems (GIS) database format.
- Continue to serve on Editorial Board of the *Journal of Advanced Oxidation Technologies*.
- Continue to serve as Associate Editor for journal, *Geochimica et Cosmochimica Acta*.
- Continue to investigate serving as the Illinois designated Nation Hydrography Dataset (NHD) high-resolution data steward in the USGS NHD Stewardship Program.
- Prepare and submit a journal article on “Variation of Photogeneration Rates of Reactive Aquatic Transient Species within a Small Watershed” to *Environmental Science and Technology*.
- Prepare and submit at least one peer-reviewed manuscript concerning fundamental studies of ion adsorption by mineral surfaces.
- Complete a journal article entitled “Sensitivity of Parameters with Spillway Option in the UNET to Peak Flood Stage Reduction”, which will be submitted to the *Journal of Hydrology* or *ASCE’s Journal of Hydraulic Engineering*.
- Prepare and submit a journal article on the Mechanism of Solar Photoammonification.
- Submit peer-reviewed journal paper to *Geomorphology* on the hydrologic, sediment, and geomorphic evaluation of Big Creek
- Prepare and submit a journal paper on differentiating effects of pollution processes on water quality in receiving waters using modeling approach.
- Prepare a journal article on *Impacts of Boundary Condition on Unsteady Flow Modeling in Using the UNET Model*, which will be submitted to the *Journal of Hydrology* or *ASCE’s Journal of Hydraulic Engineering*.
- Prepare a proceedings paper entitled *Real-Time Simulation of Floods in the Lower Illinois River with UNET Model* to IAHR annual meeting.
- Conduct CFAR funded research on the Impact of Sediments on Phosphorus Cycling and Potential Bioavailability in Illinois Streams.



- Prepare a proposal for Phase II of the Fox River Watershed Investigation – Stratton Dam to the Illinois River for watershed hydrology and water quality modeling.
- Submit proposal to IDNR for hydrologic, sediment, and geomorphic monitoring for Big Creek watershed.
- Submit two research grant proposals to federal agencies (USDA-CSREES and USDA-NRI).
- Submit two research grant proposals to state funding agencies (IDNR, IEPA, IDOA, and C-FAR) on enhancements of watershed models and applications to Illinois watersheds for hydrologic and water quality investigations.
- Prepare a proposal on understanding thresholds in aquatic systems through retrospective analysis and submit to USEPA (STAR Program).
- Prepare a proposal to the Office of Water Resources Management, IDNR, on the enhancement of the windows-based real-time simulation program for the lower Illinois River for flood protection.
- Prepare a Phase II proposal to IDNR to continue to conduct geomorphic and other watershed assessments used to prioritize critical project sites to be restored for the Illinois River Ecosystem Restoration project.
- Prepare and submit a proposal to NSF on “Solar Transformation of Nitrogen and Organic Species in Water – Effect on Nutrients and Water Quality.”
- Develop proposals and submit to the USACOE and IDNR to continue the development of hydrologic, hydraulic, and water quality model development for the Illinois River as part of the ILRDSS.
- Seek sufficient support from new or existing contracts to obtain, integrate, and develop procedures for the digital integration and graphical representation of spatial, hydrologic, and bathymetric data in order to better support ISWS research activities.
- Continue to update the Section’s modeling plan as needed.

## **GROUNDWATER SECTION**

### **Mission**

The mission of the Groundwater Section is to help protect public health and natural resources and support development by providing a scientific basis for planning and decision making on critical groundwater issues in Illinois. This is achieved by conducting research, collecting and analyzing data, responding to public needs, and serving as the state’s primary repository of groundwater records and data. The Section develops and applies appropriate scientific methods and techniques to improve the understanding of the occurrence, quantity, quality, treatment, and use of the state’s groundwater resources. The Section also interacts with other programs and agencies in the study of larger hydrological and biogeochemical systems. Results of all data collection efforts and investigations are disseminated to the public in a timely manner through a wide variety of formats.

### **Vision to 2010**

The public, state, local, and regional officials, and industry will rely on Groundwater Section (GWS) experts for technical data and assistance to help solve complex groundwater problems. Interagency cooperation will increase, especially with the Geological Survey. Assessments of water quality and groundwater resources using

state-of-the-art science and technology, including the creation and use of models of the state's major aquifer systems, will contribute to wise consumption and protection of groundwater resources in Illinois. As a result, the GWS will achieve national recognition as a center for excellence in groundwater data collection, research, and public service.

## **Goals**

- Increase the number of articles published in the open peer-reviewed literature and the number of presentations at professional meetings.
- Integrate existing statewide data bases with project and external data bases.
- Enhance and expand the Section's groundwater information services to meet customer requirements, and to increase the use of the Section's data and expertise.
- Improve the characterization of groundwater resources in Illinois.
- Expand the use of state-of-the-art water well design, well field optimization, and well maintenance and rehabilitation techniques.
- Increase staff training and personnel resources.
- Strengthen relationships with other scientific programs and agencies to foster multi-disciplinary collaboration.
- Expand program activities and improve its ability to identify and respond to emerging issues.
- Strengthen collaboration with other sections within the Water Survey.
- Strengthen an active research program in contaminant hydrology for the advancement of techniques and methodologies in site characterization, and fate, transport, and treatment assessments of point and nonpoint sources.
- Encourage presentation of material through a wide variety of formats, including Web pages, oral presentations to stakeholders, and development of short, readily understandable project summaries for wide distribution.
- Develop a groundwater data access and display system.
- Obtain funding for improved characterization of aquifers state-wide.

## **Strategies**

- Improve data entry and service capabilities, including securing stable funding for "file-room" staff and archiving and scanning of well records.
- Update paper records and, where appropriate, use these data to update computer files.
- Continue mapping potentiometric surfaces within major aquifers such as the Cambrian-Ordovician aquifer system in northeastern Illinois, the American Bottoms of Metro-East, and the Mahomet Aquifer.

- Enhance an active research program on the distribution, fate, transport, and treatment of natural chemicals and contaminants in Illinois groundwater.
- Improve and expand the use of computer technologies in groundwater flow, transport, and geochemical modeling, data archiving, data mining, and data dissemination.
- Improve estimates of sustainable yield of the state's major aquifer systems and predictions of the effects of changing demands and climate.
- Enhance the water-use inventory program.
- Update the aquifer hydraulic properties data base with information from the Section's historic files, assess gaps in the spatial distribution of the data, and initiate a program to collect new data where gaps exist.
- Conduct studies of the state's major aquifer systems and create calibrated models starting with the Mahomet buried valley aquifer and the Cambrian-Ordovician aquifer systems, including collaboration with the ISGS geological mapping initiative.
- Conduct studies to estimate groundwater recharge to our aquifers.
- Expand and improve groundwater and geochemical modeling capabilities and presentation of results.
- Foster improved relationships with Illinois Environmental Protection Agency, Illinois Department of Public Health, Illinois Department of Agriculture, Illinois State Geological Survey, U.S. Geological Survey, U.S. Environmental Protection Agency, Illinois Association of Groundwater Professionals, academic institutions, and regional and local stakeholders.
- Aggressively seek additional funding through new state initiatives, external grants and contracts, and cost-recovery mechanisms.

### **Action Items: April 2004 - March 2005**

- Complete the following activities related to arsenic in Illinois groundwater:
  - Finalize WMRC arsenic report
  - Review recent arsenic PSL data and work with IDPH on press release
  - Conduct research on manipulation of geochemical conditions to reduce the solubility and mobility of arsenic in groundwater
  - Pursue and initiate arsenic-related research through MTAC.
- Complete the following activities related to nutrients in Illinois waters:
  - Characterize temporal variations of nitrogen species (nitrate, ammonia, organic nitrogen) in shallow groundwater in agricultural watersheds
  - Characterize the bioavailability of phosphorus in streams and the chemical form of phosphorus in stream sediment
  - Measure nitrogen isotopes in the Illinois River basin to estimate sources of nitrate and degree of denitrification.
- Review and coordinate updating of the Section web pages.

- Provide new input to the Water Supply web-site on:
  - Groundwater quality
  - Groundwater quantity
  - General groundwater hydrology and well hydraulics
  - General hydrologic cycle
  - Groundwater modeling
  - Well and aquifer testing procedures.
- Continue contributions to a point-and-click data interface using a system compatible with IEPA's ArcIMS Source Water Assessment Program (SWAP) site:
  - Develop an interface for updating and querying the Aquifer Properties database and create a "data-quality indicator" map of test locations.
- Initiate inventory of projects, data bases, and field networks as a basis for integrating and archiving data. Limit to the past 3 fiscal years as a start. Test and refine the integration of project water chemistry data into the water quality database.
- Complete these tasks related to the Groundwater Level Monitoring program:
  - Create water level database interface for entry and query of water level data
  - Work with Bob Scott to incorporate groundwater level data into the WARM web-site
  - Review WARM ICN groundwater level data
  - Review and recommend potential additions to the ob-well network.
- Conduct the following activities related to the Mahomet Aquifer, including the Mahomet Aquifer Consortium and the Imperial Valley Water Authority:
  - Complete preliminary aquifer-wide flow model; expand the extent of Glasford aquifers in the model
  - Work with MAC Data and Scientific Assessment Committee (DSAC) to prepare an updated MAC proposal task outline and budget
  - Work with MAC DSAC to prepare a bibliographic reference list
  - Work with MAC Education and Public Relations Committee (EPRC) to update the MAC poster
  - Work with MAC DSAC and EPRC to prepare contributions to the MAC web-page or the GWS web-page for linkage to the MAC web-page
  - Pending availability of funds, construct additional observation wells in the Mahomet Aquifer
  - Inventory and measure water levels in rural wells located north/east of the Champaign cone of depression
  - Sample observation wells in Iroquois County.
- Review Route 25 Mine (near Elgin) Groundwater Model (version 2) and conduct water level monitoring at three nature preserves.
- Complete report to the Nature Preserves Commission on methodology for delineating areas of groundwater contribution to designated nature preserves.
- Complete a Standard Operating Procedure for aquifer testing and analysis and water level measurement using datalogging devices.
- Continue working with the ISGS toward a common water well database, including preparation of an issue paper.
- Prepare new proposal and conduct field work on isolating areas of groundwater seepage into the Emiquon.

- Complete these specific groundwater investigations in Kane County:
  - Compile water level and aquifer test analysis data for NE Illinois aquifers
  - Complete data compilation for regional NE Illinois groundwater model
  - Calibrate the regional NE Illinois groundwater model and run selected pumping scenarios
  - Complete interim report on shallow aquifer potentiometric surfaces
  - Complete interim report on deep bedrock groundwater quality
  - Complete shallow groundwater quality report
  - Provide and/or undertake training in groundwater flow modeling using GW Vistas
  - Initiate groundwater flow modeling of selected shallow aquifers - identify aquifers, superimpose modeling grids, import geological information onto grids.
  
- In addition to work in Kane County, complete these tasks related to Northeast Illinois:
  - Complete northeastern groundwater quality study
  - Complete the literature review of the hydrogeology of northeastern Illinois
  - Complete technical review of the literature review
  - Complete mass measurement of Silurian dolomite wells in northeastern Illinois and mapping of potentiometric surface and complete report
  - Conduct field reconnaissance to find “missing” deep aquifer wells in NE Illinois
  - Cooperate with Northeastern Illinois Planning Commission on water resources planning issues for NE Illinois and ICCG on statewide issues
  - Work with the South Lake Michigan Water Supply Consortium and NIPC in coordinating a regional water supply conference, including identification of speakers and presentation materials
  - Cooperate and provide assistance to the Barrington Area Council of Governments
  - Work with other Lake County entities and the County to establish a groundwater research and/or data collection program in the County.
  
- Update Policies and Procedures and charging policy for all groundwater data, to include mailing and e-mailing of digital data.
  
- Create new Policies and Procedures and charging policy for groundwater service activities, especially as they relate to collection of field data and interpretive reports.
  
- Coordinate creation of a database of ISWS groundwater model results.
  
- Prepare new proposal and conduct aquifer test for new Paris well field in Indiana.
  
- Work with the City of Martinsville in preparation for a proposal to conduct an aquifer test for a supplemental supply for the City.
  
- Visit wells completed for Russell-Allison Water Authority in Lawrence County and possibly survey and sample wells.
  
- Present seminar to ISGS on groundwater modeling.
  
- Work with DNR Office of Water Resources on issue paper for best management practices on water well construction and minimizing the effects of well interference.
  
- Work with GIS Group on creation of new aquifer and well yield maps and interpreted groundwater data.
  
- Review, update, and complete Groundwater Section modeling plan.
  
- Conduct research on heterogenous flow in aquifer systems.
  
- Cooperate with ISGS and provide solute transport models for selected livestock waste sites.

- Pending on availability of funding, construct new observation well nest(s) in the recharge area of eastern DeKalb County to examine vertical hydraulic gradients in the deposits overlying the deep bedrock.
- Work with Illinois Department of Public Health regarding the linking of environmental data to health data.
- Contribute to Survey-wide studies of Illinois' hydrologic budget, including impacts to the recharge and groundwater components due to climate change and drought.
- Prepare booklet on planning a community groundwater supply.
- Publish more articles in the peer-reviewed literature.

## **NATIONAL ATMOSPHERIC DEPOSITION PROGRAM**

### **Mission**

The National Atmospheric Deposition Program (NADP) provides quality-assured data and information in support of research on the exposure of managed and natural ecosystems and cultural resources to acidic compounds, nutrients, mercury, and base cations in precipitation and evaluates improvements in its measurement systems, including the addition of other chemical and biological species.

### **Vision to 2010**

The NADP will remain one of the nation's premier research support projects serving science and education and supporting informed decisions on air quality issues related to precipitation chemistry, especially acidic compounds, nutrients, base cations, and mercury. The NADP will be responsive to emerging issues requiring new or expanded measurements. Its measurement system will be efficient, its data will meet pre-defined data quality objectives, and its reports and products will meet user needs.

### **Goals**

- Increase the completeness and improve the accuracy and representativeness of valid wet-only deposition data.
- Increase the completeness and improve the data capture efficiency of valid precipitation depth measurements.
- Provide analytical laboratory, data management, and site support services that are cost-effective and meet work statement requirements and delivery schedules.
- Evaluate alternative methods and new measurements that meet user needs for atmospheric deposition data.
- Maintain up-to-date quality system documentation and ensure that NADP data meet data quality objectives.
- Enhance data usage by offering on-line products and presentations that support research activities related to ecosystem exposure to atmospheric chemical deposition.

- Facilitate NADP data usage in the Illinois River Decision Support system.
- Market data and reports to support scientific research, public decision-making, and education.

## **Strategies**

- Replace the NADP-approved wet deposition collector, designed by the Aerochem Metrics company in the mid 1970s, with a reliable new collector that has up-to-date mechanical and electrical components, greater snow retention capacity, and improved catch efficiency in light rain and snow.
- Replace the NADP-approved Belfort 5-780 Recording Precipitation Gage with a gage that measures all precipitation types reliably and accurately (i.e., no significant biases relative to the National Weather Service Standard Gage) and is equipped to produce precipitation measurements as a remotely accessible, digital, electronic signal.
- Ensure service-providers (Central Analytical Laboratory, Mercury Analytical Laboratory, etc.) have appropriate facilities, efficient and accurate instrumentation, and trained and adequate staff for routine measurements.
- Investigate sample collection and measurement methods for analytes that data users want or need but are not routinely measured.
- Maintain and revise as appropriate NADP quality system documentation, including the NADP Quality Management Plan, quality assurance plans, and standard operational procedures.
- Develop on-line products that present NADP data in ways that facilitate research on atmospheric deposition effects in watersheds, ecoregions, estuaries, and other potentially sensitive environments or research on the relationships of atmospheric deposition with point and area pollutant emissions, census information, road and highway distributions, topography, etc.
- Develop data summaries that describe the trends and geographic distributions of wet deposition in the Illinois River watershed.
- Ensure that NADP remains sensitive to the needs of its sponsors, scientists, the public, and decision makers who need information on the exposure of managed and natural ecosystems and cultural resources to chemical deposition in precipitation.

## **Action Items: April 2004 - March 2005**

- Evaluate the operational reliability, catch efficiency, sample chemistry, and overall performance of the N-Con Systems and Yankee Environmental Systems wet-only deposition collectors against the currently used Aerochem Metrics (ACM) collector. Ensure that potential ACM replacements meet NADP specifications. Present summaries of field and laboratory tests at NADP meetings.
- Explore alternative sample collection containers that can accommodate plastic bag inserts and evaluate handling procedures, system blanks, and costs of using this alternative protocol relative to the current sample collection procedures. Present results to the Network Operations Subcommittee (NOS).
- Field test the ETI Systems NOAH III and new NOAH IV (when available) precipitation gages and the new Ott-Pluvio gage and evaluate these gages against the NOS-approved precipitation gage performance criteria. Present results to the NADP NOS.

- Develop a space utilization plan for the office and utility areas available for Central Analytical Laboratory use as a result of construction of the new shop building (Building 11).
- Test the feasibility of measuring total phosphorus in NTN and AIRMoN samples using Inductively Coupled Plasma - Atomic Emission Spectrometry. Report preliminary findings to the NADP NOS.
- Measure total nitrogen in NTN and AIRMoN samples and assess the cost and practicality of adding these measurements to the routine set of analytes. Report findings to the NADP NOS.
- Evaluate the new Dionex ion chromatograph, which reportedly has improved baseline stability and increased sensitivity.
- Prepare an NADP Quality Assurance Plan that updates and replaces the three existing plans for the individual NADP networks (National Trends Network, Atmospheric Integrated Research and Monitoring Network, and Mercury Deposition Network). Present a complete draft for review at the September 2004 subcommittee meetings and a final plan for publication by the spring 2005 subcommittee meetings.
- Update and prepare standard operational procedures documentation for NADP Program Office operations.
- Draft new NTN and MDN design plans in cooperation with a task group appointed by the NADP Executive Committee.
- Implement an on-line application that enables data users to access NADP site classifications and related site characterization information, such as population, SO<sub>x</sub> and NO<sub>x</sub> emissions, and roadway density.
- Develop computer programs that enable site operators to enter precipitation gage measurements and other field data and information using a handheld computer.
- Prepare 2003 color concentration and deposition maps for the Illinois River Decision Support System Internet site.
- Solicit ideas on new data products, including Web-based presentations, new brochures, etc. from the NADP Executive Committee and Environmental Effects Subcommittee.

## **WATER AND ATMOSPHERIC RESOURCES MONITORING PROGRAM**

### **Mission**

The mission of the Water and Atmospheric Resources Monitoring (WARM) Program is to provide a long-term continuous record of the quality and quantity of the state's water and atmospheric resources in cooperation with local, state, and federal agencies, and to provide this information on a timely basis for research and analyses to better understand and manage the interactions of the various water and atmospheric resources and their impacts on Illinois' natural resources and economy.

### **Vision to 2010**

Continuous records for up to 27 years will be available from statewide monitoring of climate, wind, solar radiation, sediment, groundwater, and soil moisture at WARM sites. Increasingly, these data will be collected and



disseminated electronically, quality managed, and used for effective management of resources, development of alternative energy sources in Illinois, and research throughout the world.

## **Goals**

- Ensure continuous, long-term collection, archival, and dissemination of high-quality data on the water and atmospheric resources of Illinois.
- Enhance and extend the physical measurements of our water and atmospheric resources across all parts of the state.
- Analyze and present the temporal and spatial variations in the data and participate in the determination of how these trends may alter the state's current water and atmospheric resources.
- Participate in inter-Survey collaborations in accordance with the joint Surveys Strategic Plan, particularly in activities related to restoration of the Illinois River watershed.
- Collaborate with other environmental monitoring agencies inside and outside of Illinois in order to share information and minimize duplication of effort.
- Assure that future long-term monitoring activities of the state remain consistent with monitoring needs.

## **Strategies**

- Establish procedures and guideline criteria to determine how and under what conditions long-term monitoring activities will be continued or added to the WARM Program.
- Scrutinize current WARM Program networks to develop procedures to alter data collections where the present design is determined as inadequate.
- Develop and implement quality-assurance and quality-control procedures.
- Construct an interactive WARM Program home page to display the water and atmospheric data monitoring activities in Illinois with links to other home pages or sources of similar data.
- Develop working relationships with other Illinois agencies that monitor water and atmospheric resources of the state to foster two-way sharing of collection procedures and analyses of data in order to maximize data collection efficiencies and the number and quality of variables monitored within the state.
- Improve data quality and delivery by adopting advances in instrumentation and data downloading technologies.
- Submit data analyses and findings using WARM Program data for publication in refereed journals and for presentations at professional meetings.
- Participate in regional and national field programs. (The baseline nature of the current WARM networks allow data to be used in assessing event frequencies and background trends upon which short-term data sets are superimposed.)
- Seek internal and external funding to enhance water and atmospheric resource monitoring.
- Improve public awareness.

## **Action Items: April 2004 - March 2005**

- Maintain ICN, soil moisture, reservoir water level, streamflow, suspended sediment, and shallow groundwater data collections and archives, and the reporting structures of the WARM web pages and the *Illinois Water and Climate Summary*.
- Finalize criteria for new WARM site selection. Develop minimal acceptance thresholds for each measured variable. Use new criteria to evaluate variables collected at existing WARM sites. Document ratings for display to Internet users of WARM data.
- Move the ICN site at Wildlife Prairie Park to a qualified location in northwestern Illinois.
- Update the site descriptions at existing ICN sites. Include digital surface photography, digital orthoquads, locations of adjacent impediments to flow, and a schematic of the site sensor array. Produce a new manual to replace ISWS Circular 178. Provide access to this information on the Internet.
- Assess the comparative analyses between neutron probe and dielectric constant soil moisture data, leading to the retirement of neutron probe data collection.
- Conduct gravimetric soil moisture analyses at ICN sites where neutron probe data are at a distance or not performed. Correlate results to new continuous soil moisture sensor data.
- Quantify the horizontal soil moisture gradient between an ICN site and an adjacent agricultural field.
- Submit appropriate articles on the soil moisture assessments to refereed journals.
- Finalize and implement the enhanced automated quality control procedures of daily ICN data on the Internet.
- Work with Groundwater Section staff to produce Internet display of WARM shallow groundwater monitoring network data as well as daily data from ICN monitoring wells.
- Announce WARM Program and web site in appropriate fora. Expand WARM visibility. Conduct seminars.
- Construct a WARM brochure.
- Provide assistance to Watershed Science Section staff to maintain and improve long-term, instream sediment-transport data collection under the Benchmark Sediment Monitoring Network of the WARM Program.
- Support development of a relational database for public water supply surface water reservoirs compiling historical and contemporary data and information from Watershed Science Section files.
- Work with Atmospheric Environment Section staff to assess potential evapotranspiration data in Illinois in coordination with Integrated Water Cycle Modeling.
- Participate with the Information Management Committee ISWS in developing the Survey metadata repository.
- Provide input into the continued development of the Illinois River Decision Support System.

# OUTCOMES

The Water Survey disseminates data and information either because they are of broad general interest, or because specific clients have requested specific data and information. The Water Survey has no control over the use of data and information once they are disseminated. However, it is use of data and information by customers and constituents that determines the outcomes of all the work done by the Water Survey. The Water Survey does not specifically track and analyze the outcomes of its work, but knowledge of issues and problems and frequent customer interactions allow the Water Survey to make the following reasonable estimates of outcomes:

## A. WITHIN THE WATER SURVEY

- Mission accomplishment.
- Safe work environment.
- Merit performance.
- Efficient and effective use of resources.
- Quality products, research, service, data dissemination, and outreach.

## B. OUTSIDE THE WATER SURVEY

- Restoration and protection of the environment.
- Improved public health.
- Adequate and safe water supplies.
- Swimmable, fishable, and navigable waters.
- Economic development.
- Reliable and safe energy production and distribution.

All these outcomes have significant environmental, social, and economic benefits for Illinois and the nation.